Omterra - subsea

SpecTRON5

IOM Rev14

Unrestricted

Foreword

Thank you for purchasing a Siemens Subsea SpecTRON 5 product. The information that follows is an overview of the protection, storage, shipment, unpacking, deployment, and maintenance instructions for Siemens Subsea SpecTRON products.

Siemens Subsea recommends the termination 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	N. Knight	W. Barrett	06/10/2009	• First Issue
1 - 10	See TC for Revision History			
11	N. Smith	S. Kelly	10/08/2022	• Section 7.1.4 added • Additional Caution box added on Section 7 • Added to Section 10.1 first paragraph.
12	M Brereton	N. Williamson	17/10/2024	• Added Test connector Maintenance Section 9.1.7
13	T. Edwards	D. O'Donnell	18/12/2025	• Section 9.1.1 Added instruction regarding IR,HV,PD Testing
14	C. Taylor	T. Edwards	30/07/2026	• Section 7 updated to include images and information from internal inspection quality document relating to coatings and scuffing.

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1 PRODUCT SCOPE

This procedure includes information on the following connector types

- SpecTRON 5 ROV Plugs
- SpecTRON 5 ROV Receptacles
- SpecTRON 5 Penetrators
- SpecTRON 5 ROV Dummy Connectors (Plugs & Receptacles)
- SpecTRON 5 ROV Parking Receptacle
- SpecTRON 5 Junction Box

Any information, records or Health and Safety feedback that needs to be detailed, can be recorded in the punch list at the rear of the document.

1.1 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 1 - Contact Details

1.2 Product advice label

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

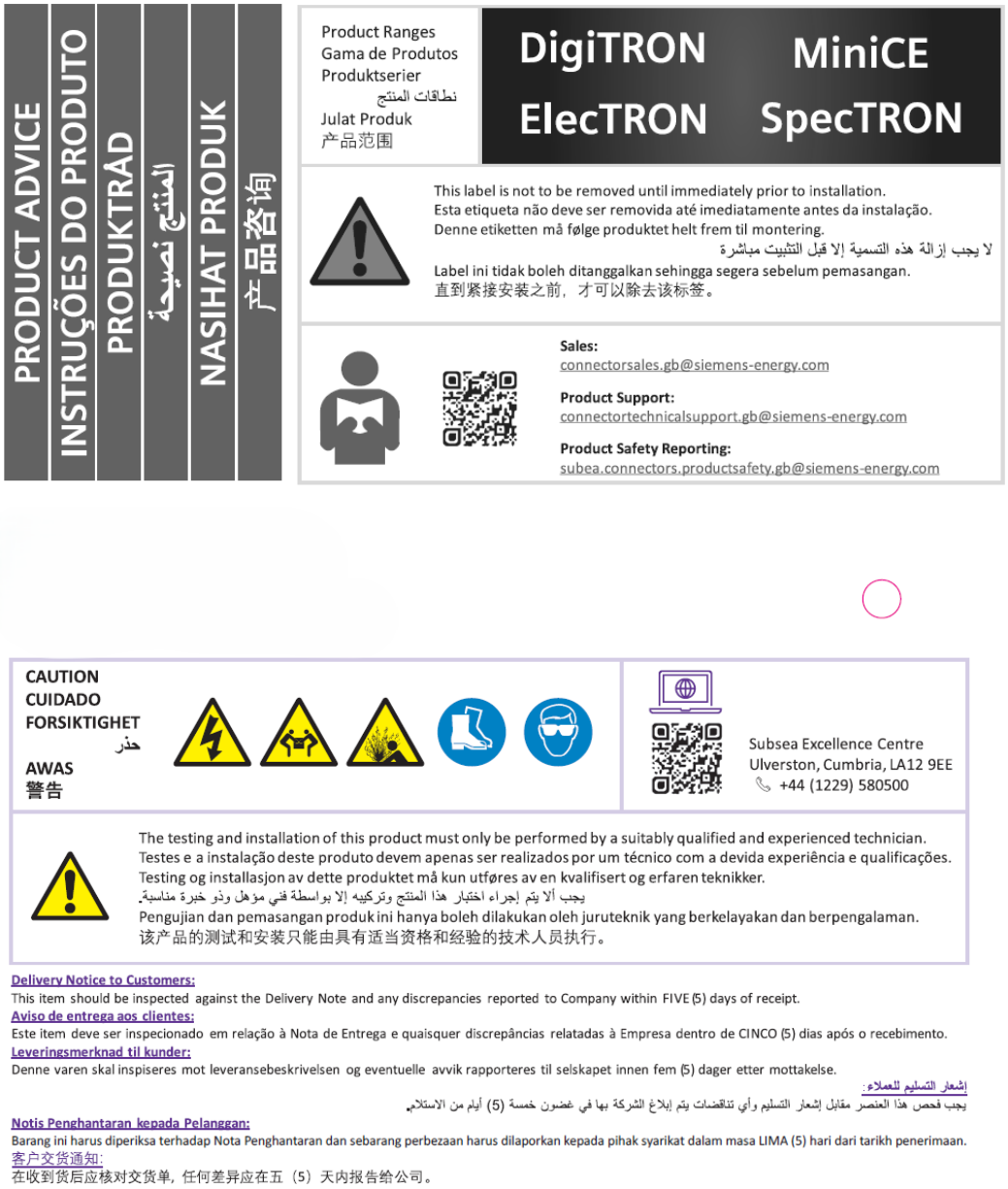


Figure 1 - Product Advice Label

1.3 Product marking

1.3.1 Connectors and Penetrators

Siemens Subsea Connectors, Junction Box and Penetrators are marked with the Siemens Subsea part number and unique serial number. Marking locations are typically on the Plug Nose, Receptacle and Penetrators gland body for Wet Mate Connectors and Housing for the Junction Box Figure 2 and Figure 3 shows the typical marking locations for a Plug, Receptacle and Junction Box. Marking is typically by laser etching.

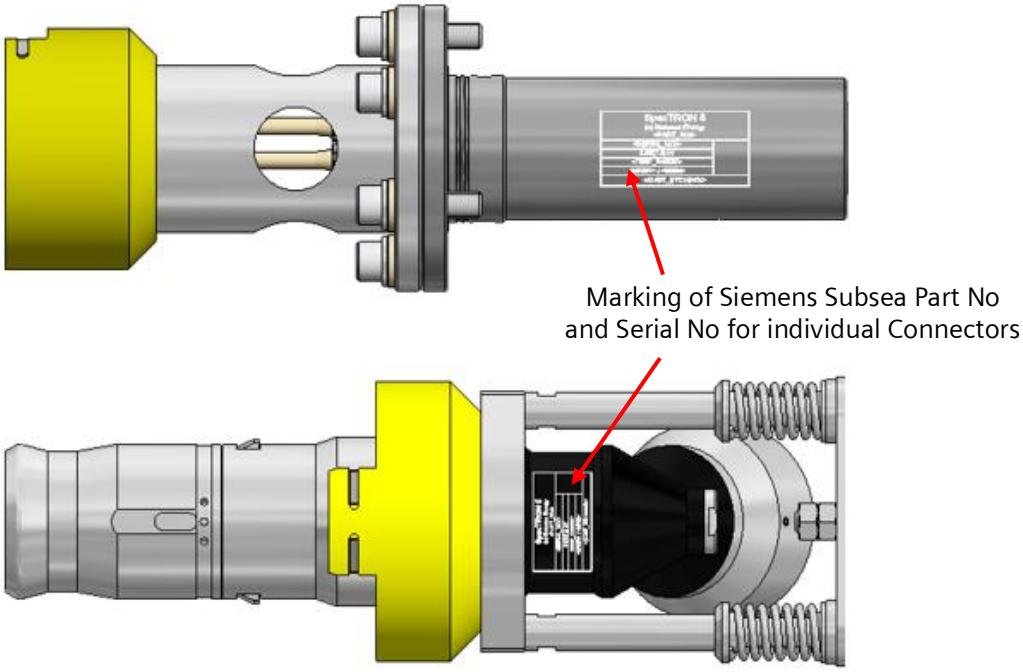


Figure 2 – Marking of Connectors



Figure 3 – Example Etching for Junction Box

1.3.2 Harnesses

Harnesses are also marked with the Omterra part number and unique serial number as shown in Figure 4. 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 4 - Example harness marking

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 12). 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 unused cores and metalwork are earthed.
- 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 5 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).



Danger! Risk of imminent danger to life, risk of severe personal injury caused by released pressure and or projectile due to depth pressure , e.g. for area with extreme marine growth pay special attention to connector free flooding ports and ensure that they are unblocked. Refer to Section 9.1.4 for cleaning restriction.

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



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 the largest contributors to occupational ill-health. Ensure that mechanical handling aids are used whenever 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 12. 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
API	American Petroleum Institute
°C	Degree Celsius
CE	Controlled Environment
COSHH	Control of substances hazardous to health
CP	Cathodic Protection
dc	Direct Current
EMI	Electromagnetic Interference
IR	Insulation Resistance
ICDS	Implantable Cardioverter-Defibrillators
K	Kelvin
M	Metres
Max.	Maximum
Min.	Minimum
No.	Number
PPE	Personal Protective Equipment
ROV	Remotely Operated Vehicle
SIT	Site Installation Test
SPO	Steel Product Offshore
UNS	Unified Numbering System for Metals and Alloys
V	Volt

4 SPECIFICATION

The following is a basic specification for SpecTRON 5 connectors. Actual product may vary. Please refer to product specific data sheet or Project specific Design Input Document for more detailed information.

4.1 Electrical

Rated Voltage:	2.9/5(5.8)kV or 3.6/6(7.2)kV
Rated Frequency:	1-100Hz
Rated Current:	150A

4.2 Environmental

Storage Temperature:	-40°C to + 70°C
Handling Temperature:	-25°C to +70°C
Operating temperature:	-4°C to + 20°C
Max Deployment Rate:	20bar / min
Max Water Depth:	1330 m

4.3 Hose & Cable

4.3.1 AquaTRON 200 (2" bore)

Outside Diameter:	66 mm
Minimum Bend Radius (dynamic):	375 mm
Minimum Bend Radius (static):	375 mm
Weight in Air (Inc cable and oil):	4.3 kg/m
Weight in Water (Inc cable and oil):	0.79 kg/m
Storage Temperature:	-40°C to + 70°C
Max. allowable hose twist (lengths >5m only):	180° (spread over a length of hose >5m long)

4.3.2 Gorilla (1.5" bore)

Outside Diameter:	51.8 mm
Minimum Bend Radius (dynamic):	375 mm
Minimum Bend Radius (static):	250 mm
Weight in Air (Inc cable and oil):	2.8 kg/m
Weight in Water (Inc cable and oil):	0.64 kg/m
Storage Temperature:	-25°C to + 70°C
Max. allowable hose twist (lengths >5m only):	180° (spread over a length of hose >5m long)

4.4 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 5 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 PROTECTION, HANDLING AND SHIPMENT

Siemens Subsea electrical connectors are manufactured primarily from materials such as 316L stainless steel (UNS S31603), and Super Duplex stainless steel (UNS S32550). Stainless steel 316L (UNS S31603) connectors and penetrators must be connected to a CP system at all times in order to withstand harsh saliferous environments. Super Duplex stainless steel (UNS S32550) connectors, penetrators and Junction Boxes have no need to be connected to a CP system in order to withstand harsh saliferous environments. Siemens recommends that such connectors and penetrators are not connected to a CP system in order to avoid the risk of introducing HISC (Hydrogen Induced Stress Cracking).



Caution. Risk of material damage.

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

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

If storage is carried out in saline conditions, e.g., on a ship's deck or hold, then full dummy connectors should be used.

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

If the connectors are assembled onto hoses these must be suitably coiled and secured with tape to prevent uncoiling during transit. The following bend radii are recommended for storage/transport of hoses.

- Gorilla 1.5" NB – (Static) Minimum Bend Radii – 250mm
- AquaTRON 2" NB (AquaTRON 200) – Minimum Bend Radii - 375mm

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

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



Figure 5 – Packaging

6.1 Lifting of Jumpers & Connectors

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

- Connectors/Penetrator/Junction Box must only be lifted at the locations specified below.
- Connectors/Penetrators/Junction Box should never be lifted by the hose or cable, as this places unnecessary strain on the connector internals and may result in loss of continuity.
- All lifting operations should be performed by suitably qualified personnel, in accordance with applicable regulations where and when the lift is performed.

SpecTRON 5 harnesses typically weigh in excess of 30 kg and hence should not be manually handled. Refer to the specific harness drawing for weight and length details. The centre of gravity for the Connector or Penetrator is usually marked on the outline drawing (supplied in documentation pack) but must be verified at low level before commencing any lift.

For SPO or API flange penetrators, lifting eye mounting holes are provided on the flange at 12 and 6 o'clock positions.

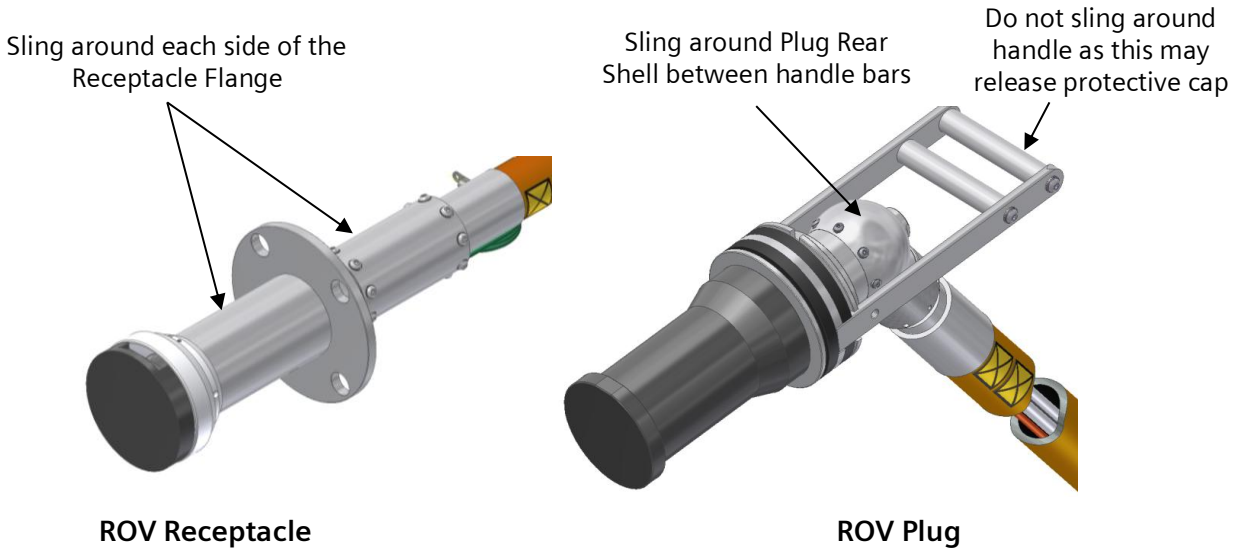
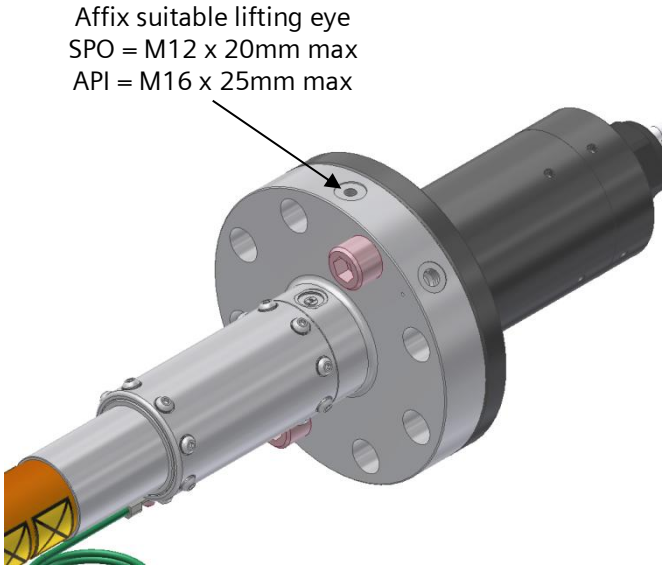


Figure 6 - Recommended lift positions – Plug & Receptacle



API or SPO Penetrators

Figure 7 - Recommended lift positions – Penetrators

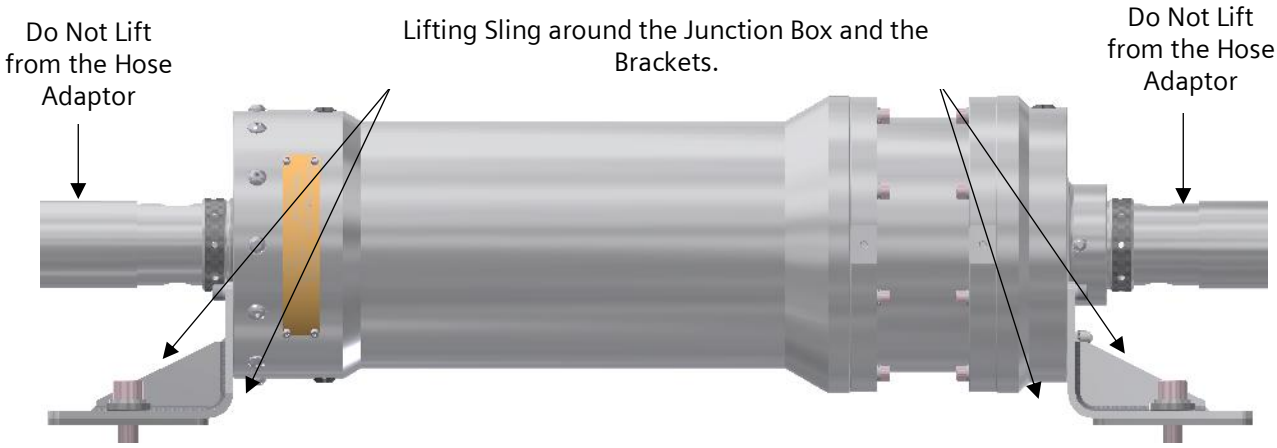


Figure 8 - Recommended lift positions – Junction Box

Dummy, or parking connectors weigh less than 15 kg and can be lifted by hand, however correct lifting practice should be observed at all times.

On harnesses, the cable or hose should be supported during lifts to minimise strain on the Connector/Penetrator/Junction Box. The maximum recommended length of hose which can be unsupported during a lifting operation is **5 meters**.

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.

7 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.

Caution. Risk of product damage.

- When mating for testing purposes, all items are to be removed from packaging completely and oriented such that no weight bearing, and product follows a natural lie to avoid kinking.

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, 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 9 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 9 – Scuffing examples

7.1 Protective Caps

All SpecTRON 5 Connectors/Penetrators come supplied with a protective cap. These can either be dust caps, protective caps or IP caps (Ingress Protection caps). Dust caps (typically yellow in colour) can be simply removed by twisting or pulling them off. Protective caps and IP caps (typically black in colour) can be removed as detailed below.

7.1.1 ROV Plug Cap

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

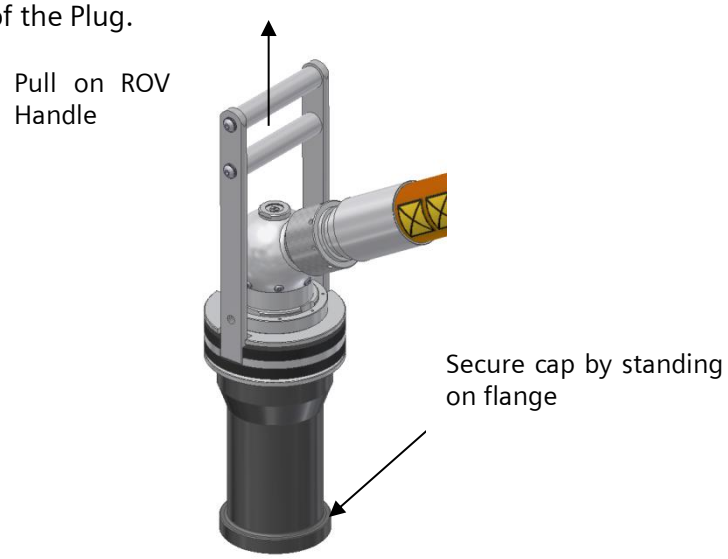


Figure 10 - ROV Plug Cap

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

7.1.2 ROV Receptacle Cap

The ROV Receptacle Cap can be removed by simply securing the Receptacle via suitable means (if not already mounted to the structure) and then pulling on the cap. Slots are provided on each side of the cap to allow finger access and easy removal.

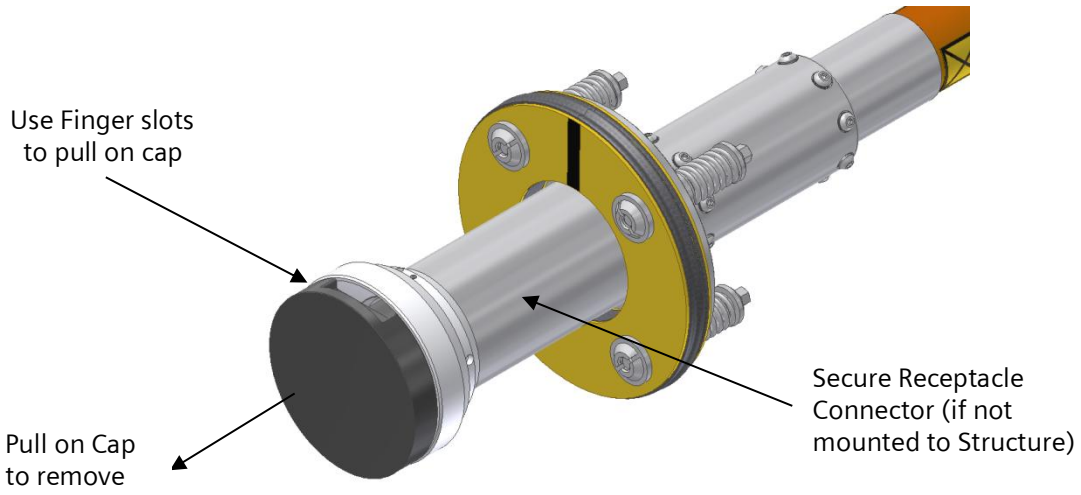


Figure 11 - ROV Receptacle Cap

Refitting the Receptacle cap can be done by simply pushing the cap back into the Receptacle shroud until the spring plungers engage, locking the cap into place.

7.1.3 Penetrator Cap

Penetrator caps would usually be removed by Siemens Subsea site engineers during the termination of the Penetrator to the module. It is recommended that only trained personnel remove Penetrator caps though details are provided here for information only. Penetrators may be supplied with pre-terminated tails which are sealed with a cable gland. This should be slackened off prior to removal of the cap. To remove the cap, unfasten the 2 cap head screws using a suitable Allen key and then simply slide the cap off the internal termination of the Penetrator, over the tails.

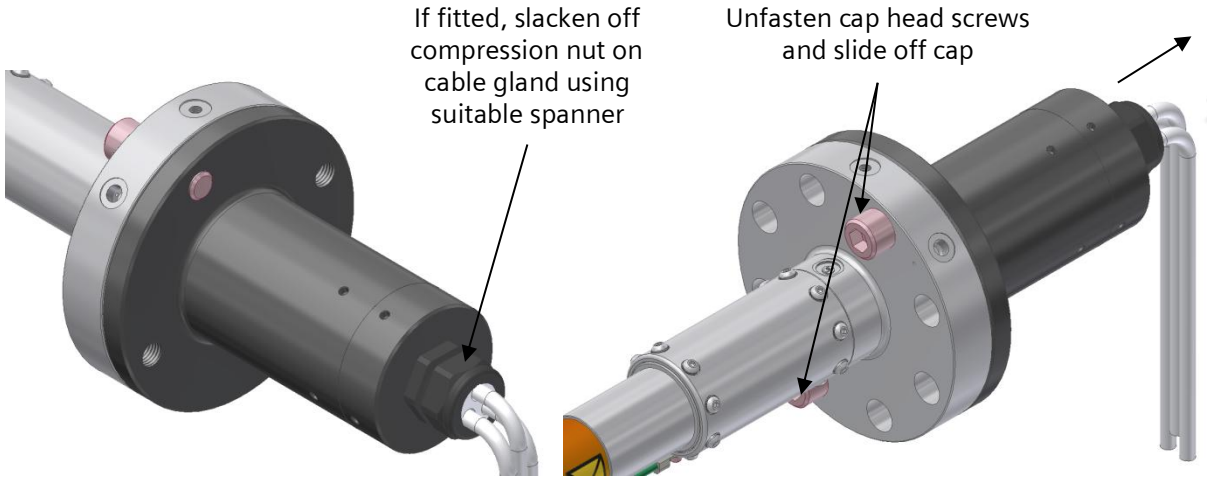


Figure 12 - Penetrator Cap

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

7.1.4 Preparation for Testing of Newly Delivered Jumpers

When unpacking any jumper, it should be coiled in a way as to prevent kinks or unnatural bends as shown on Figure 13. DO NOT manoeuvre the Jumper / legs so that test connectors can be attached and perform electrical test in the packaging. This may result in Jumpers / connector legs being bent

in awkward directions and cause kinking or straining which will damage the jumper. Instead, the product must be fully removed from the crate and oriented such that there is no weight bearing and the Jumper / legs follow a natural lie. The protective caps can then be removed before test connectors are attached and testing can be performed.



Figure 13 – Correctly coiled jumper to prevent kinks / unnatural bends

8 STORAGE



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 8.1.3)
- 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.

8.1.1 Short Term 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. Protective caps must be fitted.

8.1.2 Long Term 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. Protective caps must be fitted.

Connectors must be stored in a clean dry area. Suitable protection caps must be fitted (instrumentation connectors require sealed caps), and the storage temperature may vary for Project Specific Connectors, refer to datasheet. Humidity of the store room should be below 75%. Very moist or very dry conditions should be avoided. The equipment should be protected from ozone, strong sunlight and strong artificial light with a high ultraviolet content. Moulded connectors should be placed within black bags to avoid direct sunlight.

8.1.3 Storage of 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.

8.1.4 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.

8.2 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.

9 DEPLOYMENT & MAINTENANCE

The following section details deployment and maintenance instructions for SpecTRON 5 connectors & hose.

All information contained within this section is generic. Where customer or project-specific information is required, please refer to the relevant project specification or scope of supply.

Caution. Risk of corrosion to electrical contacts.

- It is important to isolate and earth prior to disconnect in order to remove any stray charges in the system. If left, this can induce corrosion on the exposed pins once the plug is removed.

9.1 SpecTRON 5



Figure 14 – SpecTRON 5 Power Connectors.

9.1.1 General SpecTRON 5

The SpecTRON 5 range of Power connectors has been developed for long term reliable high power control system applications associated with offshore installations. The underwater mateable capacity of these connectors is achieved using pressure compensated electrical inserts employing the CE principle.

Connectors are usually supplied with protective caps. The protective caps must be removed prior to mating the connectors. Refer to section 7.1for instructions for removal of protective caps.

Junction boxes are supplied with earth lead which are used for topside testing, which should be removed before deployment as is not required subsea. The junction box is super duplex and supplied with isolation plate and isolation bushes.

All mild steel sealing interfaces shall be inlayed with Inconel 625, or similar, where no additional protection (e.g. CP, Paint etc.) can be provided. This is to prevent localised pitting of the interface.

Plug connectors may be left unmated, in seawater, for an indefinite period of time. However, it is recommended that the Plug connectors are mated into a Parking Receptacle during this time in order to protect the socket contacts and latching mechanism.

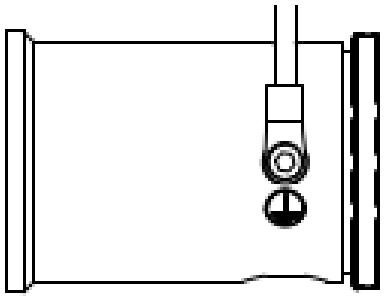
It is good practice to always fit the protective cap when a connector is unmated topside prior to deployment to provide mechanical protection.

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.

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.
- 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 metal work is earthed using a 'bleep' tester or similar.



Example of earth connection

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.
- 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 warranty of the connector.
- Guide pins must never be removed from test connectors as this can lead to damage and will invalidate the connector warranty.

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



Danger! Risk of death from electric shock if user dismantles/incorrectly re-assembles/incorrectly re-terminates product (foreseeable misuse). Apart from the removal of protective caps, since there are no user serviceable parts inside.

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

9.1.2 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.

9.1.3 Over current Capacity

Over current capacity varies for each product. Please refer to the product datasheet.

9.1.4 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.



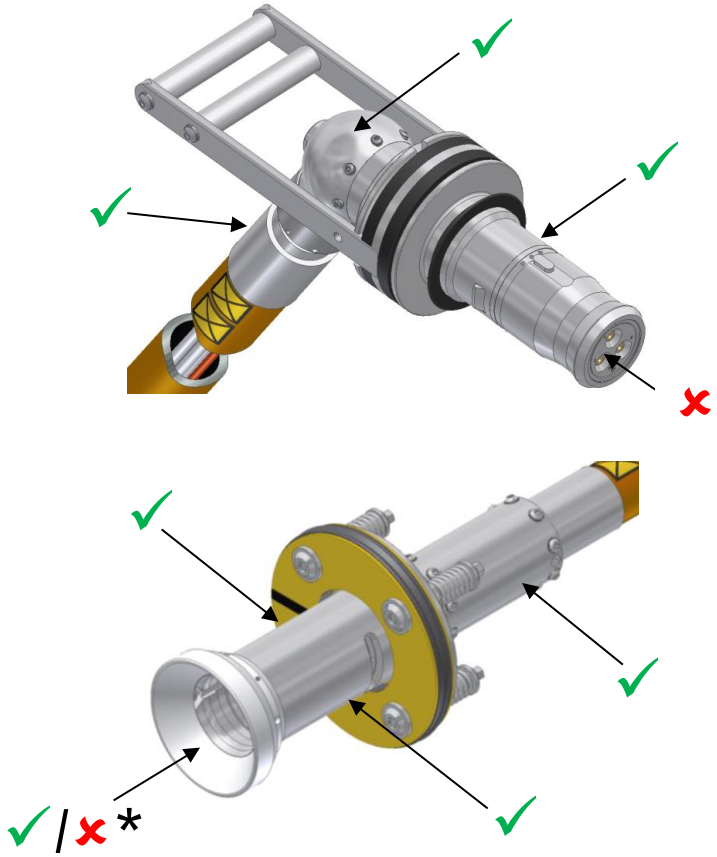
- Other acid cleaners, such as 50% Acetic Acid, should not be used as they may cause deterioration of the elastomeric materials.
- Chiselling and abrasive methods are not recommended. Wiping with a soft, clean cloth is acceptable providing care is taken inside the Receptacle shroud to avoid disturbing the earth continuity contact (i.e., Multilam or Bal spring type), or to impart a bending load on

the power pin/s. Use of water jetting for the removal of sand/silt is acceptable given the following limitations:

- All forms of water jet cleaning of connectors in air must be avoided. The likelihood of damage to connectors is great, given the high localised impact velocities of the water jet.
- Submerged water jet cleaning of connectors is acceptable, providing the critical areas identified in Figure 15 are avoided. Particularly, the jet should not be directed at the Plug shuttle pins as this could result in a risk of water being forced through the primary seals and/or front seal. Remaining areas indicated below are suitable for submerged water jet cleaning.
- The water jet should not be directed into the mouth of the Receptacle shroud if the connector is fitted with an earth continuity contact (i.e. Multilam or Bal spring) as this could be displaced.

- Submerged water jet cleaning for the Junction Box is acceptable all around.
- Ensure free flooding ports are clear of debris before recovery due to risk of trapped pressure if blocked (Refer to section 2.3.4).
- If performing this operation topside, rinse the connector with water when complete.

To remove calcite growth from Siemens Subsea connectors, a solution of 50% Citric Acid is recommended. All Seawater exposed elastomeric materials in Siemens 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 good resistance to Citric Acid.



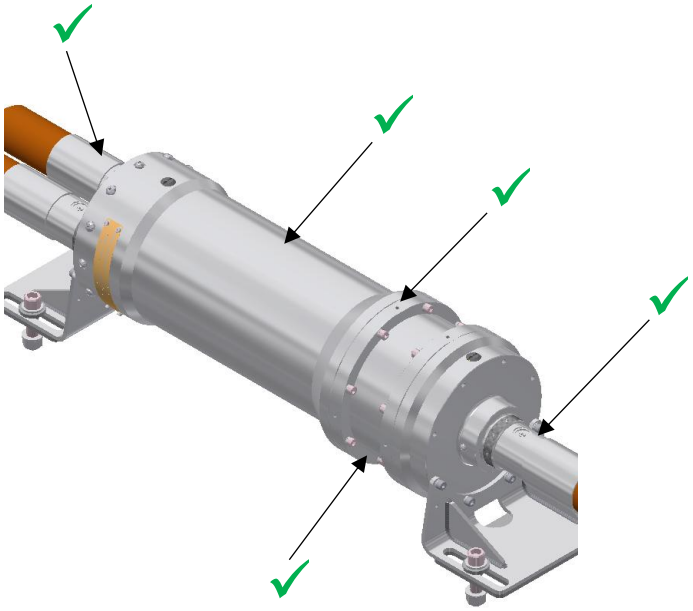


Figure 15 – Connector power washing precautions

9.1.5 Stab Plate Connectors

- **Compliance**

  One half of a stab mate connector pair must be allowed to float so that misalignment tolerances can be accommodated.

- **Mate/De-Mate Speed**

  The connectors have been designed to operate across a wide range of mate / de-mate speeds with POWER OFF. There is no practical limit to the speed at which the connectors maybe mated or de-mated, however as a guide:

  a) Mating speed should not exceed 1 m/s.

  b) De-mating speed should not exceed 5 m/s

- **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.

- **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.

- **Interrupted Connection**

Interrupted connection (i.e. Partial mate to full de-mate) can be carried out without any adverse affect to connectors, as long as the power is off.

- **Cathodic Protection:**

  Stainless steel 316L (UNS S31603) connectors must be connected to the CP system at all times. Siemens recommends that Super Duplex stainless steel (UNS S32550) connectors are isolated from the CP system to reduce the possibility of hydrogen embrittlement.

9.1.6 ROV Connectors

- **Alignment and Mating Technique**

  These connectors have been designed to self align during mating. The connectors must be roughly aligned using the alignment marks on the connector body / alignment flange. The compliance within the connector handle, and the mating half, has sufficient compliance to accommodate fine adjustments during the final approach prior to connector engagement. The mating stroke should be as close as possible to one smooth movement, i.e. avoid 'pumping'.

- **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.

- **Mechanical Forces & Misalignment During Mating / De-Mating**

  If mate / demate forces, maximum misalignment or overstroking forces have been defined, these will be specified in the product datasheet or design input document.

- **De-Mating**

  De-mating is achieved by a straight pull on the ROV handle sufficient to release the latching mechanism. Do not pull on the gland or hose.

- **Cathodic Protection**

  ROV connectors are designed to operate isolated from the CP system. ROV connectors will not suffer damage by being connected to the CP system, however there will be a tendency for increased calcareous deposits on metal surfaces, and the possibility of hydrogen embrittlement.

- **Mating / De-Mating of ROV connectors by Operator**

  Refer to Section 10.1 for procedure for operator mating of the ROV connectors.

- **Post-Mating checks**

  Determining a correct mating of the connectors must be done by visual inspection only. A pull-check on the handle should never be made as this will release the latching mechanism causing the connectors to separate.

  There are two types of mating indicator employed on the SpecTRON 5 ROV connectors. Refer to connector datasheet or outline drawing in the documentation pack to determine which connector type you have. The connectors are fundamentally the same, employing the same

CE principle. The main difference is that they have differing mating indicators as shown in the following figures.

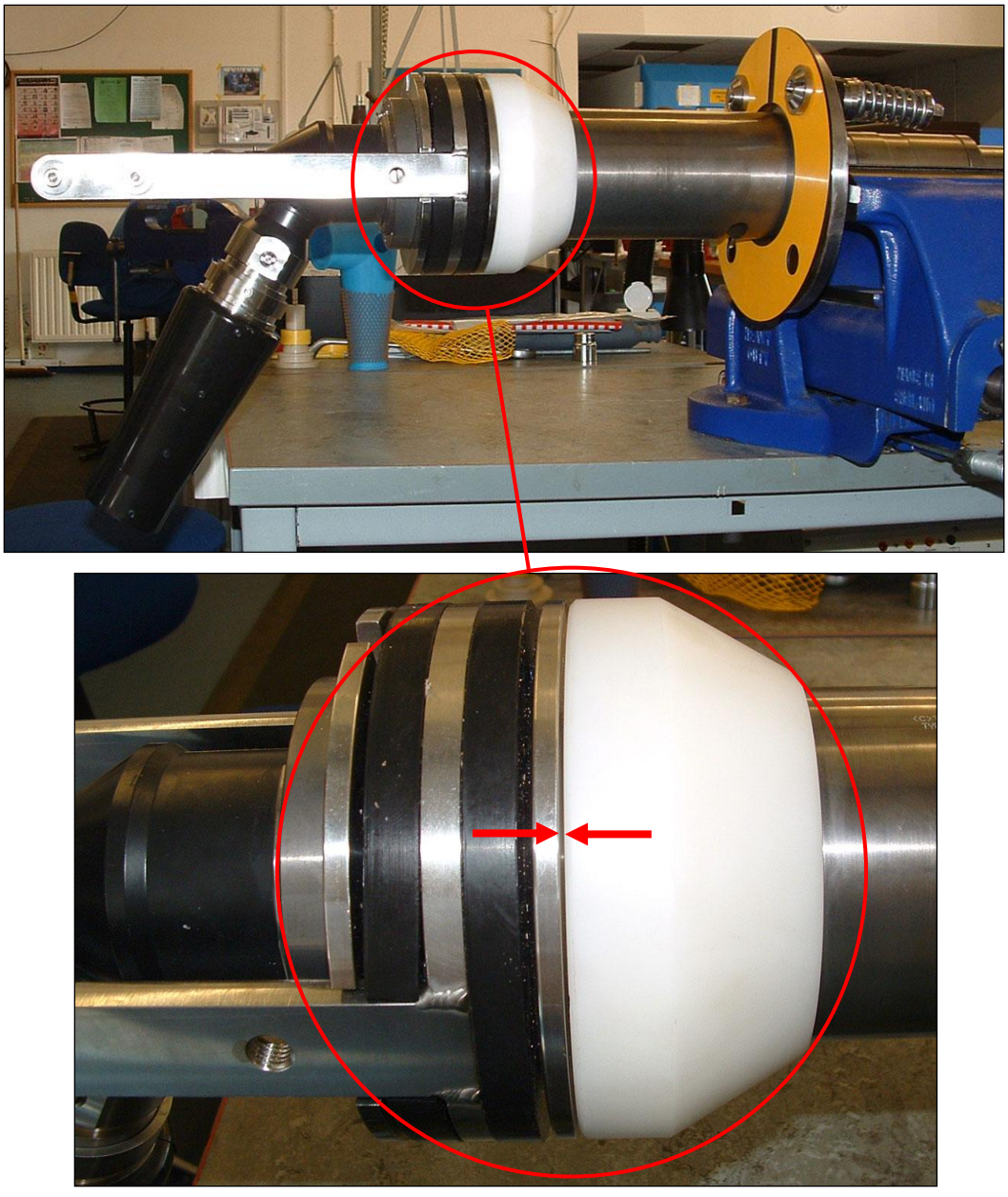


Figure 16 – Type 1 Mating check - Connectors fully mated. Note small gap between flanges.

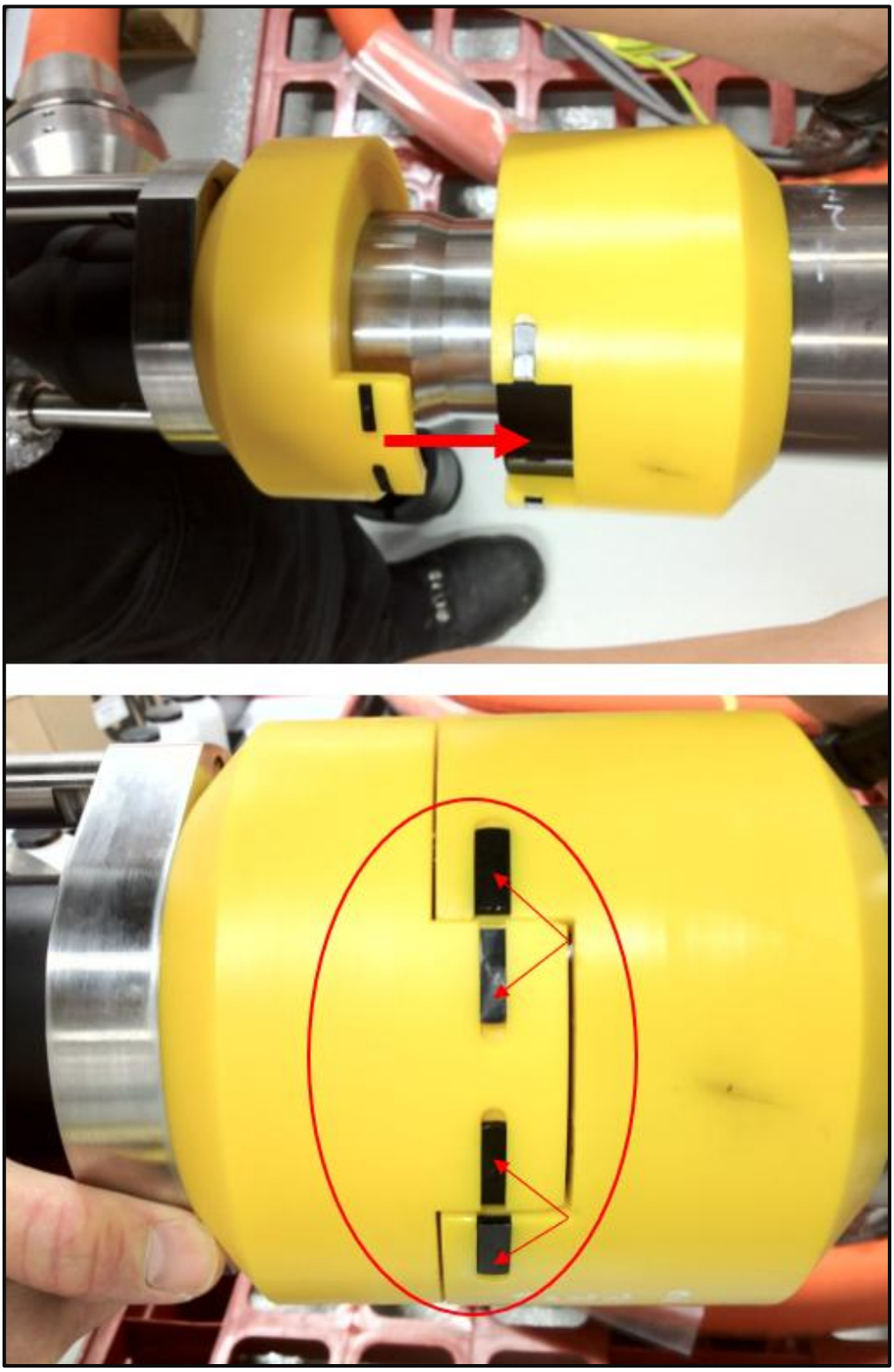


Figure 17 - Type 2 Mating check - Connectors fully mated. Note alignment of black markers on Plug & Receptacle. The thinner marker of the Plug should fall within the wider marker on the Receptacle Cone.

9.1.7 Test Connector Maintenance

- Test harnesses with exposed cables should have the cable core wiped and dried before use using Isopropyl alcohol wipes.
- Test harnesses which utilise empty hose (i.e. no oil in hose, just cable) are prone to the hose collapsing if unsupported therefore we recommend the hose being supported every 0.5m to avoid this.

10 MANUALLY MATING/ DE-MATING ROV CONNECTORS

This section summarises the procedure that a diver would need to follow in order to mate/de-mate the ROV connectors manually (as opposed to mating/de-mating using an ROV).

10.1 Mating Procedure

Prior to commencing the mating of the connector pair, it is assumed that the Receptacle connector is mounted in its associated mounting plate, and that the Plug connector is in the near vicinity. Grab bars or other interfaces should be present on the Receptacle mounting structure, in order to provide the diver with purchase and allow him to address the connector square-on, with the connector at chest height. It is also assumed that the connector has been removed from any packaging completely, and that there are no twists or kinks in the Hose / Cable. There should be no weight bearing and the product should follow a natural lie to prevent the aforementioned kinking. See Section 7.1.4 for more.

1. Remove protective cap from Plug connector, or if Plug connector is mated to a Parking/Dummy Receptacle remove as detailed in De-Mating procedure below.

2. If a Dummy Plug connector is mated to the Receptacle, remove using the de-mating procedure detailed below.

3. Inspect Receptacle pins and shroud and ensure they are clean and free from debris, etc. If any debris is present remove using a water jet.

4. Show the Plug connector nose into the shroud of Receptacle and initially locate the key on the Plug nose into the slot of the Receptacle shroud, as shown below in Figure 18.

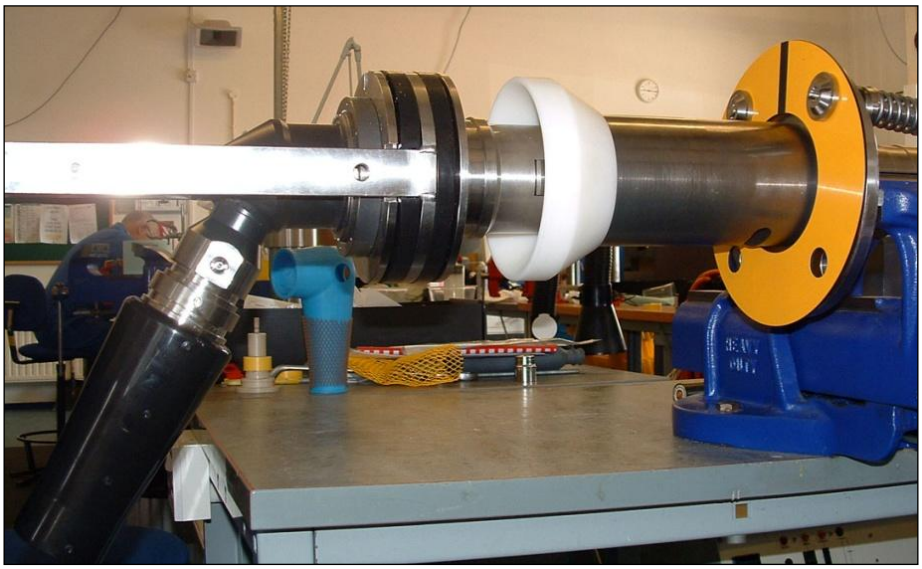


Figure 18 - Key on Plug locating into slot in Receptacle.

5. The operator should now get into a comfortable position, square on, ready to fully mate the connectors. In position, the connector should be at chest height, with grab bars or other provided interfaces on the mounting structure being within easy reach. Whilst using the grab bars or other mechanism to brace himself (i.e. tied to structure), the connector should be mated by holding the ROV handle on the back of the Plug connector (see Figure 19), and use *one smooth single stroke* to push the Plug connector along its axis until it butts up against the Receptacle. A force of 60kgf (588N) will be required to mate the connectors. Ensure the stroke is level, and the operator is able to complete the stroke in one smooth consistent movement. Also ensure that no bounce-back and failure to latch home has occurred. *When mated, under no circumstances should the Plug connector be pulled using the ROV handle to check it is correctly mated; this will de-mate the connector.* [When the plug connector end stops abut to the receptacle this activates a spring loaded latch, which stops the connectors de-mating. Pulling on the ROV Handle will de-activate this latch and hence will de-mate the connector.]

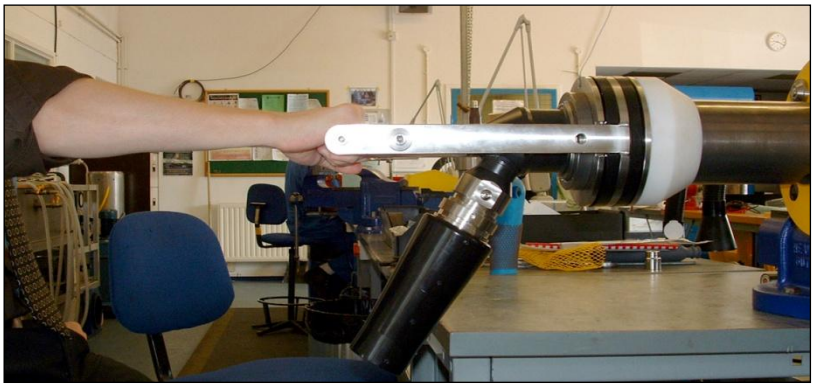


Figure 19 - Mate using ROV Handle

(*DO NOT pull this handle to check if mated*).

6. To check if connectors are fully mated and Plug is correctly latched home, pull the Plug connector by holding the angled downward section of the plug body near to the hose termination (*DO NOT use the ROV handle*), as shown in Figure 20. If the connectors are correctly latched and mated no axial movement in the Plug connector should be present. As a visual inspection, the shoulder on the Plug should butt up against the shroud of the Receptacle. However, when relaxed there may be a *small* gap between the two (due to the springs in the Plug pushing against the Receptacle pins), as shown in Figure 21.

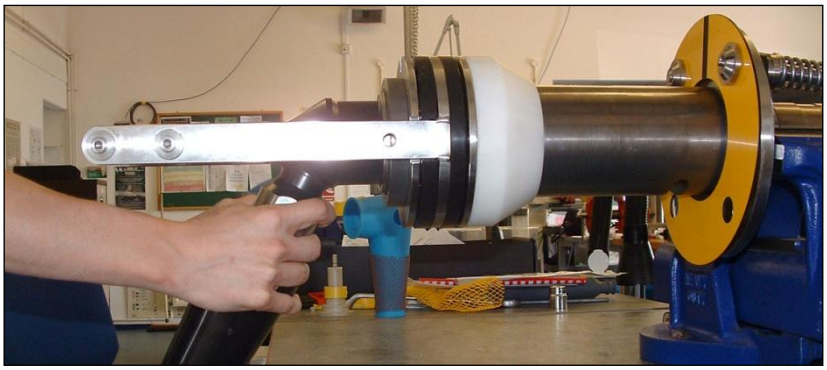


Figure 20 - Connectors mated. Pull angled downward section of body to check if Plug is correctly latched home.

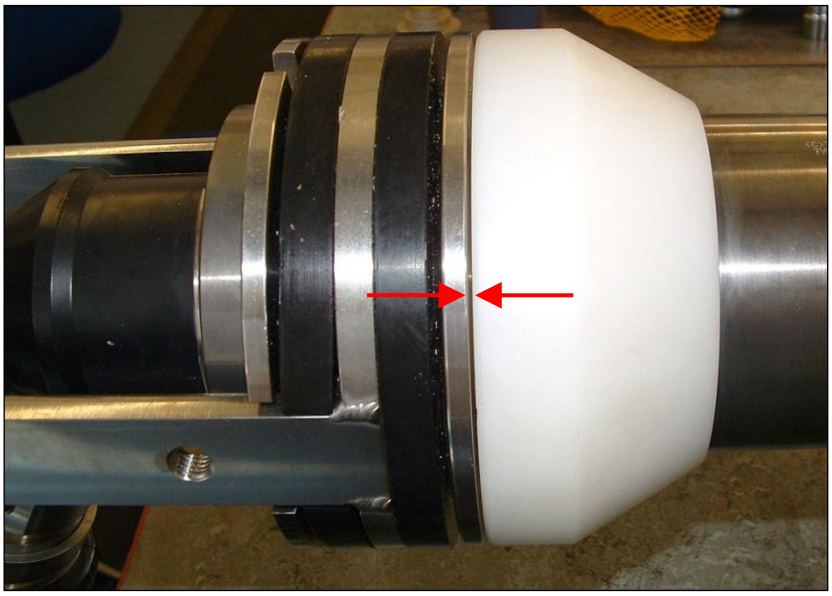


Figure 21 - Connectors fully mated.
Note small gap between flanges when fully mated.

10.2 De-mating Procedure

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

1. The operator should brace himself using the grab bars or other provided interfaces, and ensure the connector is at chest height.

2. By gripping the ROV handle (as shown in Figure 17), the connector should be de-mated from the Receptacle using one smooth pulling movement along the axes of the connectors. A force of 40kgf (392N) will be required to de-mate the connectors.
   Note: the connector latch is automatically depressed by pulling the ROV handle.

3. When the Plug connector is fully separated from the receptacle connector, if appropriate it can then be mated to the parking Receptacle, using the steps mentioned in the mating procedure above. A dummy plug should also be mated to the remaining receptacle, again using the procedure above.

11 INSTALLATION

11.1 Connector & Penetrator Installation

It is recommended that the installation of all SpecTRON Penetrators and Mounted Connectors is undertaken by Siemens Subsea site engineers or trained personnel.

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.

11.2 Hose Compensation

The hose within a pressure balanced oil filled (PBOF) jumper performs two functions:

mechanical protection to the cables inside and forming a primary barrier between the

electrical insulation and seawater. The cable is not fixed and can move within the hose volume, testing by Omterra has shown that the three conductors lay next to each other at the bottom of the hose in direct contact with the hose inside diameter.

The oil volume within a hose is compensated through changes in the cross-sectional profile of the hose.

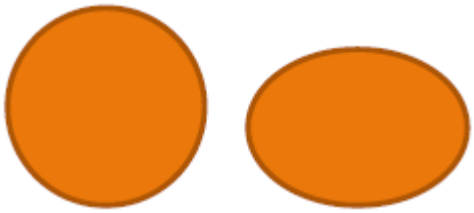


Figure 22 - Hose Profile, (left to right), as filled, and when compensating

AquaTRON 200 harnesses (Orange Hose) are provided from factory with a 10bar internal overpressure, however due to the flexible nature of the materials involved it is possible that some over pressure may be lost during shipping and storage. This is dependant on a no. of factors including length and temperature. However, a positive pressure will always be maintained and no flattening of hose should be observable topside.

Note: 1.5" Gorilla Harnesses (Yellow Hose) and Junction Box harnesses AquaTRON 200 (Orange Hose) are not provided with an internal over pressure, this is not required at their rated depth of deployment. However, the guidance below should still be followed.

Once deployed a certain amount of flattening is expected (dependant on deployment depth), this is an ordinary occurrence related to the compensation system of the harness. Harness is designed to equalise the pressure between the external seawater depth pressure and the internal oil filled hose.

The amount of compression is directly related to depth pressure, but all depth extremes have been considered. As long as harness is routed to MBR there shall be no adverse effects to electrical conductors within hose (see section 11.3 for guidance on routing).

Should any kinking (abrupt change in direction below MBR) of the hose be observed, the harness should be re-routed/deployed to try and remove the feature. If this continues it could indicate a lack of internal pressure. In which case the harness should be recovered for further inspection topside, including:

- Thorough visual inspection of the retrieved jumper for damage and correct shape, indicating the hose pre-charge pressure remains acceptable.
- IR measurement to validate the electrical performance of the jumper.

11.3 Hose Management, Routing and Support

Caution. Risk of material damage.

- Maximum unsupported horizontal hose length in air and water for SpecTRON 5 harnesses is 2m.
- Maximum unsupported vertical hose length in air and water for SpecTRON 5 harnesses is 5m.
- Hose should be routed in a manner to avoid bending beyond the MBR or kinking of the hose under any circumstances (refer to section 4.3 for Minimum Bend Radius of Hose). 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). Although in water the hose is practically buoyant (<1kg/m), topside the weights can be significant and efforts should be made to avoid application of excessive weight to avoid exceeding the MBR or causing kinking.

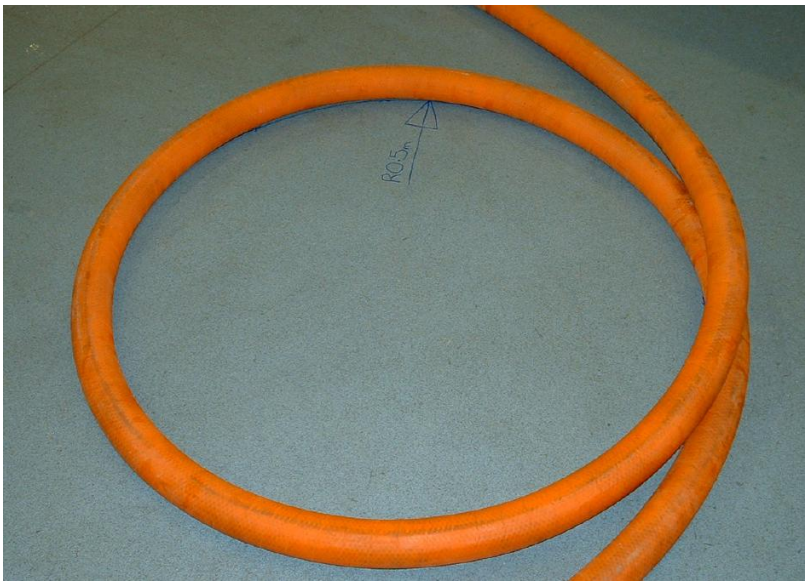


Figure 23 - MBR being maintained (AquaTRON 200 Hose)



Figure 24 - MBR being maintained (Gorilla 1.5" Hose)

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 25 - Incorrect routing (hose deformed over "sharp" edge- AquaTRON 200 Hose)

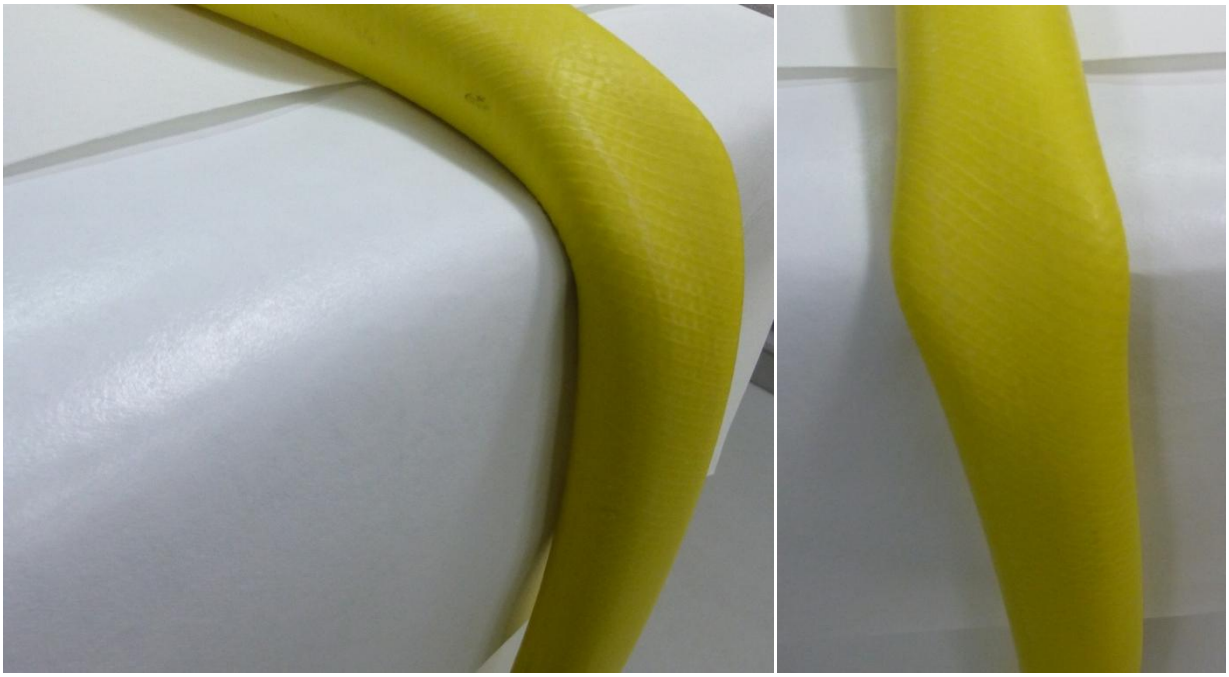


Figure 26 - Incorrect routing (hose deformed over "sharp" edge- Gorilla 1.5" Hose)

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 U shape routing – see Figures below).



Figure 27 - Immediate U shape routing

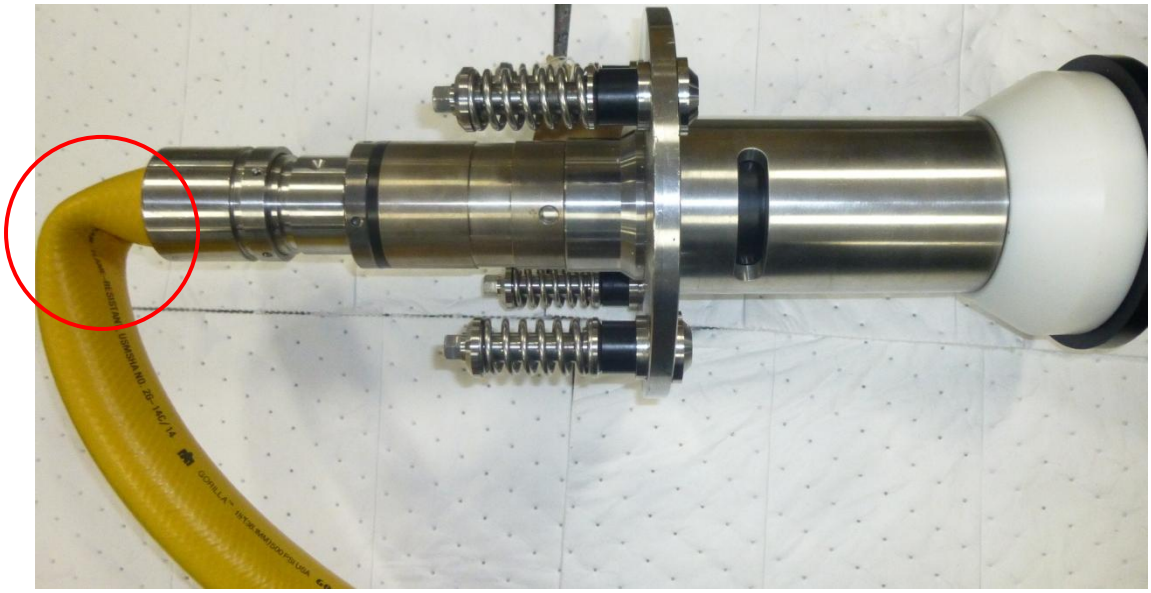


Figure 28 - Hose kink due to acute angle and weight application

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).

11.3.1 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).

RECOMMENDED FORMER DESIGN

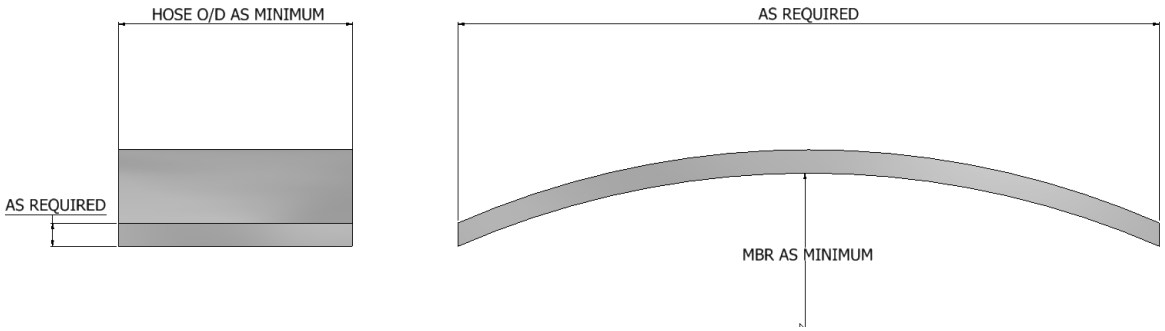


Figure 29- Plate Former

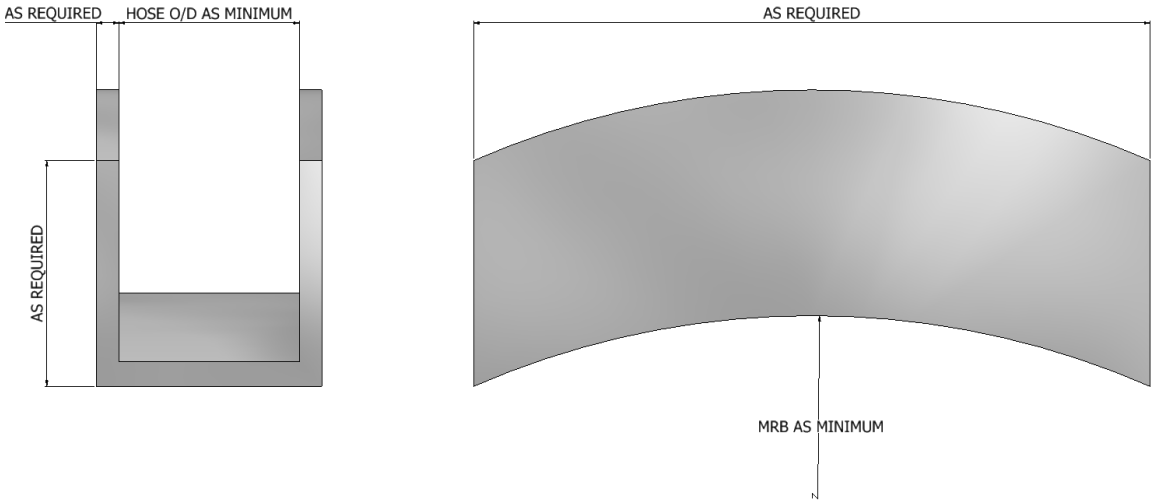


Figure 30 - 'U' Former

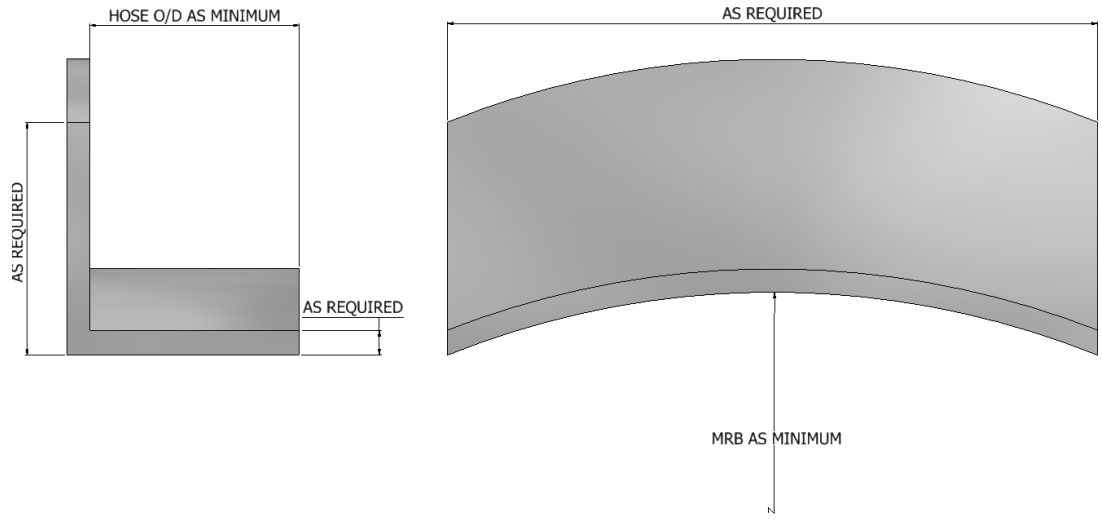


Figure 31 - 'L' Former

11.3.2 Fixed Installations

Hose management should be considered in fixed installations, where more permanent solutions are acceptable.

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 11.2) or to client specific design, and permanently fixed to the client's structure via welding or bolt pattern.

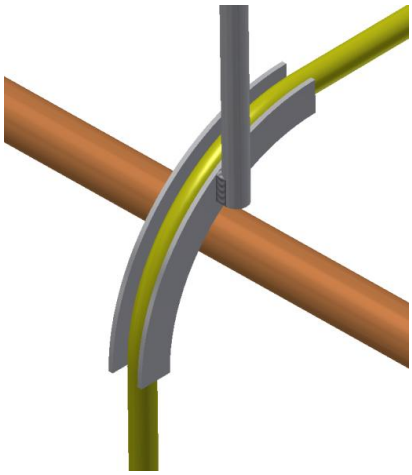


Figure 32 - Permanent fixed 'U' former

Clamping

Siemens Subsea recommends that rubber inlayed plastic clamps 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 33is utilised to take up the potential movement of the connector.

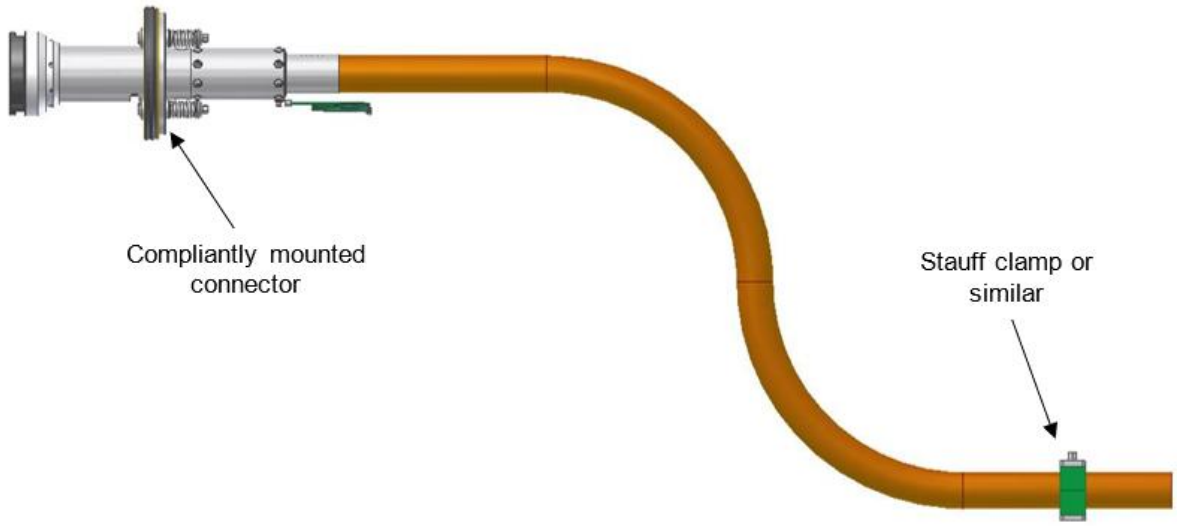


Figure 33 – Potential clamping of hose on compliant connector

11.3.3 Dynamic Installations (SIT layouts)

To aid the support of hose during SIT testing, formers can be produced to Siemens recommended design (See section 11.3.1) or to client specific design, and temporarily fixed to the client's structures via the use of tie wraps or clamps.

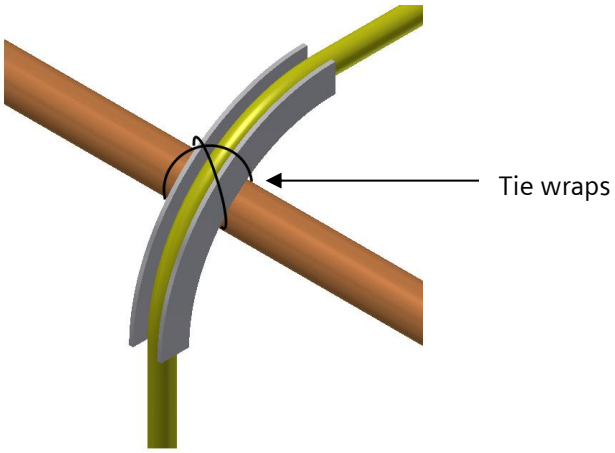


Figure 34 - Example of temporary hose support during SIT

The maximum recommended length of hose which can be unsupported is 5 meters, however the MBR of the hose must still be observed at the hose exit of a connector before allowing 5m of hose to hang freely.

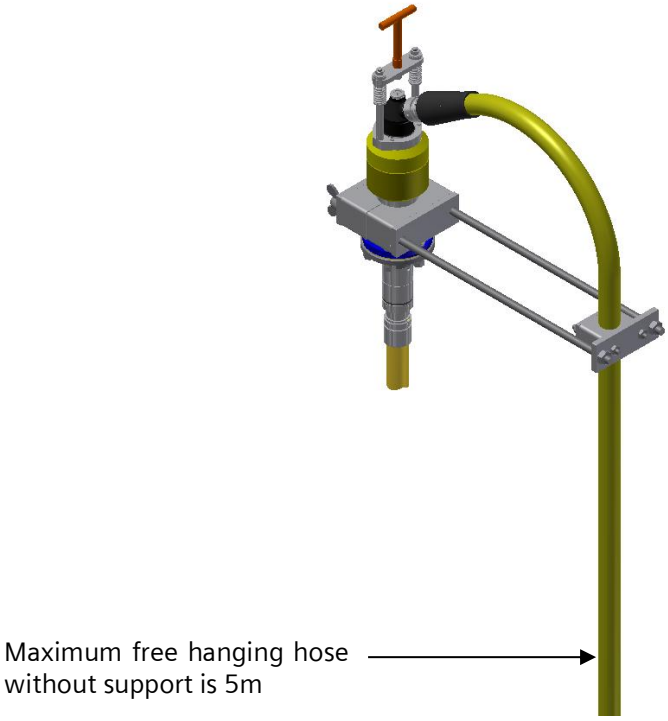


Figure 35 - Example of support for immediate fall in hose routing

Figure 35 shows an example of a vertically mounted plug and receptacle with correct hose routing. The image shows how the hose may be self supported by the use of Stauff clamps mounted to the connector body. If a system similar to Figure 35 is to be employed, 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 36.

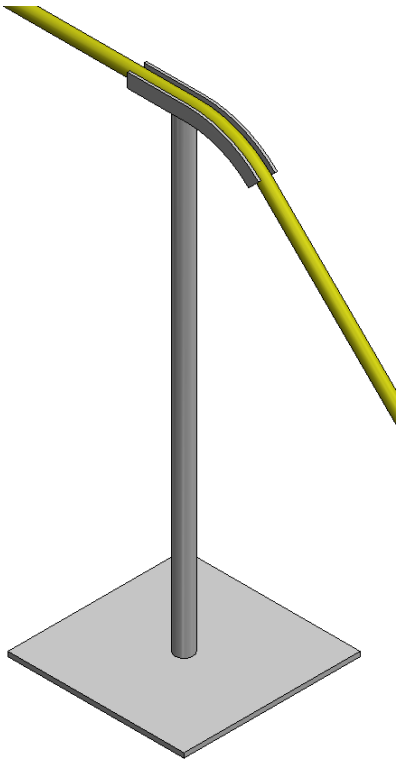


Figure 36 - Fabricated stand with former used for hose support

12 INFORMATION & NOTES / HEALTH & SAFETY FEEDBACK

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