SIEMENS energy

DigiTRONf

Installation, Operations and Maintenance Manual

IOM-008 Rev 5



DigiTRONf EFL's, Jumpers and Harness Assemblies
Protection, Storage, Shipment, Unpacking, Deployment and Maintenance Instructions

siemens-energy.com



DigiTRONf EFL's, Jumpers and Harness Assemblies Protection, Storage, Shipment, Unpacking, Deployment and Maintenance Instructions

Thank you for purchasing a Siemens Energy Subsea product. The information contained in this document is an overview including the protection, storage, shipment, unpacking, deployment and maintenance for DigiTRON connector product range.

IMPORTANT

READ CAREFULLY BEFORE USE

KEEP FOR FUTURE REFERENCE

Rev	Compiled by	Date	Approved by	Issue Date	Page(s) Affected/Remarks
01	M Tucker	09.11.2020	R Wyatt	09.11.2020	First issue
02	J.Pridmore	23/08/2021	M.Tucker	23/08/2021	Etching detail updated Connector Specification updated with Physical Contact type and No. of ways Extra abbreviations added to section 4 Images updated to show latest paddle handle Storage Temperature range added for Mate/De-mate tool
03	J.Pridmore	31/08/2021	M.Tucker	31/08/2021	Junction Box interface drawing changed to 10199114
04	R Wyatt	27/06/2022	R Wyatt	27/06/2022	Sections affected: 2.4 3.3.5 5.1 5.2 6.3 6.4.1 6.4.2 6.4.3 7.3.2 7.3.3 Siemens Energy front and back cover pages added.
05	R Wyatt	17/03/2023	JP Smith	17/03/2023	Sections affected: 2.2, 6.1, 6.2, 6.4, 7.4, 8.2, 9.5 9.7, 9.8. Information added or changed: temperature limits for storage 50°C air temp. Outdoor storage of wooden crates. Bend radius guage and protection from crate edges. Check for test connectors, incl gauge for bent pins. Inspection for corrosion, damage to front seals added. Cleaning with IPA added. Visibility of lipseal indicator from side view.

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1 PRODUCTS COVERED BY THIS MANUAL

This manual includes information on DigiTRON**f** product range of optical flying leads (OFL), jumper and harnesses, including connectors that are part thereof, their optical and mechanical specification.

Also this manual provides details of installing the DigiTRON product range of connectors that are fitted as part of an oil filled hose or cable assembly.

Installation, Operation and Maintenance manuals for other DigiTRON products not covered by this document can be found on Siemens Energy Subsea website www.siemens-energy.com /search Subsea, as listed in Table 1.

If a non-Siemens connector is fitted as part of the OFL or harness, then the manufacturer of that product should be contacted for the IOM manual.

DOC. No.	PRODUCT
IOM-002	DigiTRON single connectors
IOM-003	Obsoleted, replaced by IOM-002.
IOM-004	Not used
IOM-005	Retrievable Electrical Distribution unit (REDU), 2nd generation
IOM-006	Retrievable Electrical Distribution unit (REDU), 1st generation
IOM-007	Disconnectable junction boxes type TC3A-107 and similar Electrical Distribution Units (EDUs).
IOM-009	DigiTRONf single connectors
00003075	Subsea PT/TT sensors
00007464	Differential Pressure sensors SDP-6 / SDP-8

Table 1 List of other Installation, Operation and Maintenance manuals related to DigiTRON product range

2 BASIC INFORMATION & QUICK REFERENCE

2.1 Product overview

DigiTRON**f** connectors, optical flying leads (OFLs), jumpers and harness assemblies intended use is to provide communications and optical data links between pieces of optical equipment that are submerged in water, e.g. subsea.

The DigiTRON**f** range of connectors have been developed for long term reliable optical communications in subsea applications. The underwater mateable capacity of these connectors is achieved using pressure compensated optical inserts employing the 'controlled environment' CE principle.

An OFL is completely independent of other equipment, and is fitted with ROV or Diver installable connectors at each end. All OFL's are oil filled pressure compensated hose assemblies and are supplied as complete finished product from the factory.

All OFL's should be retrievable and when installed should not cross-over each other.

Some illustrations are shown in section 2.6 to help identify an OFL and jumper (harness).

Table 2 below identifies each product type in the DigiTRONf product range.

The products look very similar, so it is important to note the identifier for each product type.

Product range	Description	Typical part number (etched on the connector)
DigiTRON**f**	12-way fibre optic wet-mate connector	DFRV-…….. DFST-…….. DFDV- .....

Table 2 DigiTRONf product range identification

2.2 Product specification and certification

Basic specifications relating to all products covered by this manual are below in Table 3. Additional specifications can be found in section 5.

Design Life:	30 years in subsea environment
Optical Performance 1550nm and 1625nm	Insertion loss - typically ≤0.2dB [max 0.5dB, 75% ≤0.4dB] Return loss - typically ≥70dB [min 45dB, 75% ≥55dB] Cross-talk ≤ -60dB
Rated number of operations	1000 (750dry/250wet) mate / de-mate cycles
Water depth	4,000 m (13,123ft)
Storage temperature	-40°C +70°C (-40°F +158°F) (upper limit is surface temperature of the product and includes solar gain from bright sunlight) Recommended maximum ambient air temperature +50°C (122°F).
Operational temp	Subsea: -5°C +50°C (+23°F +122°F) In air: -20°C +50°C (-4°F +122°F)
Product Certification:	
Standard	**Description**
API-17F	Standard for Subsea Production Control Systems

Note: Self-certified via in-house testing.

Table 3 DigiTRONf product specification and certification

2.3 Contact details and feedback

For additional information or questions regards the products visit the Siemens Energy Subsea website https://www.siemens-energy.com /search 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 4 DigiTRON product contact details

Any information, records, or Health and Safety feedback that needs to be detailed can be recorded in section 10 of this document and sent to the relevant department in Table 4

2.4 Product advice label

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





Figure 1 Product advice label

2.5 Product marking

Siemens Energy Subsea DigiTRON products are marked with the Siemens Energy part number and unique serial number. Also, the voltage, temperature and water depth ratings are indicated. Marking locations are typically on the metal bodies of the connectors. Refer to Figure 2.

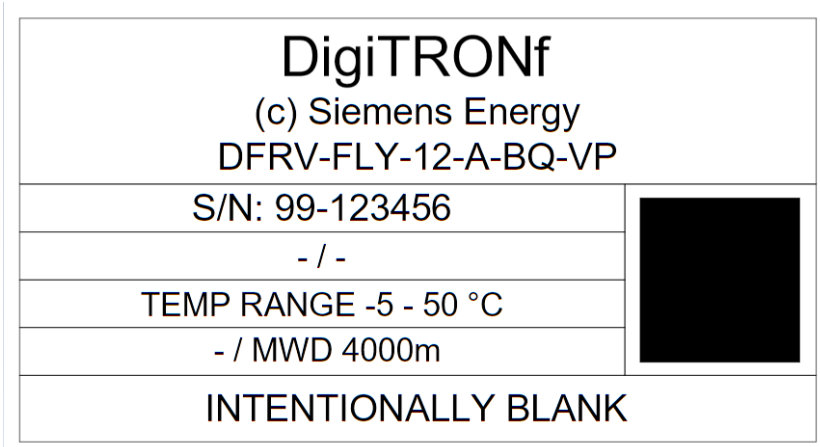


Figure 2 Product marking on DigiTRON product

Harnesses are also marked with the Siemens Energy Subsea unique serial number. Labels are typically black text on a yellow background underneath a clear protective wrap and are typically located at each end of the harness and centrally. Often client's own information is added to these labels.

2.6 Product examples

An OFL shown in Figure 3 and Figure 4 always has at least on splice unit, which could be located at different positions along the hose. Two splice units are needed for lengths in excess of 45m (150 ft).

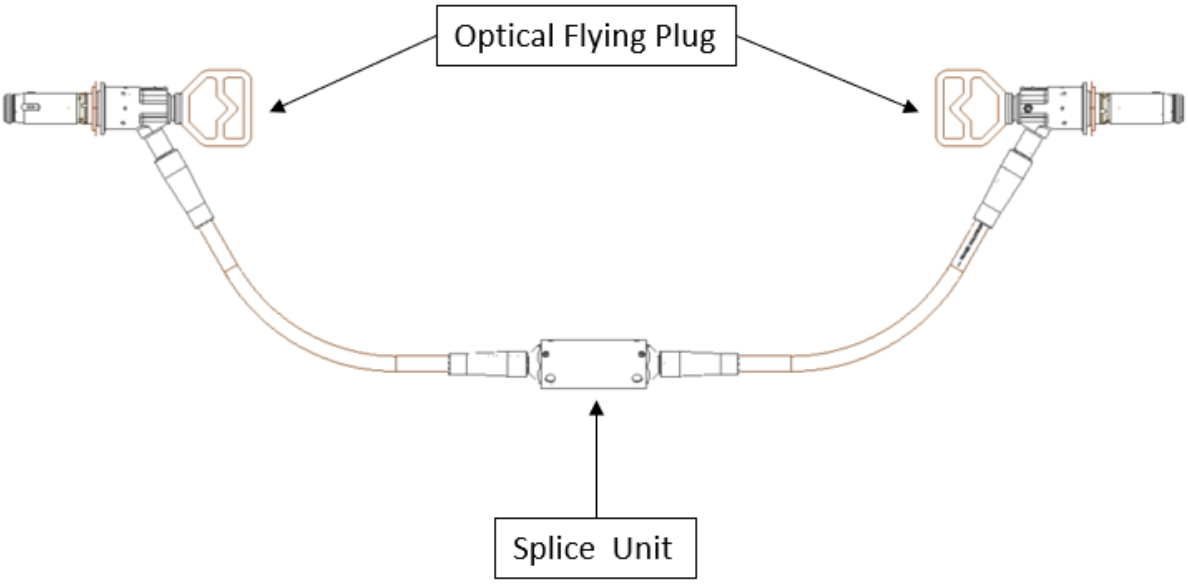


Figure 3 Typical OFL (Optical Flying Lead)



Figure 4 Example of OFL

Multi-legged harness is shown in Figure 5. There can be up to four legs on each side of the Fiber Marshalling Unit (FMU). Each hose can be fitted with a flying plug or a flange-mounted receptacle.

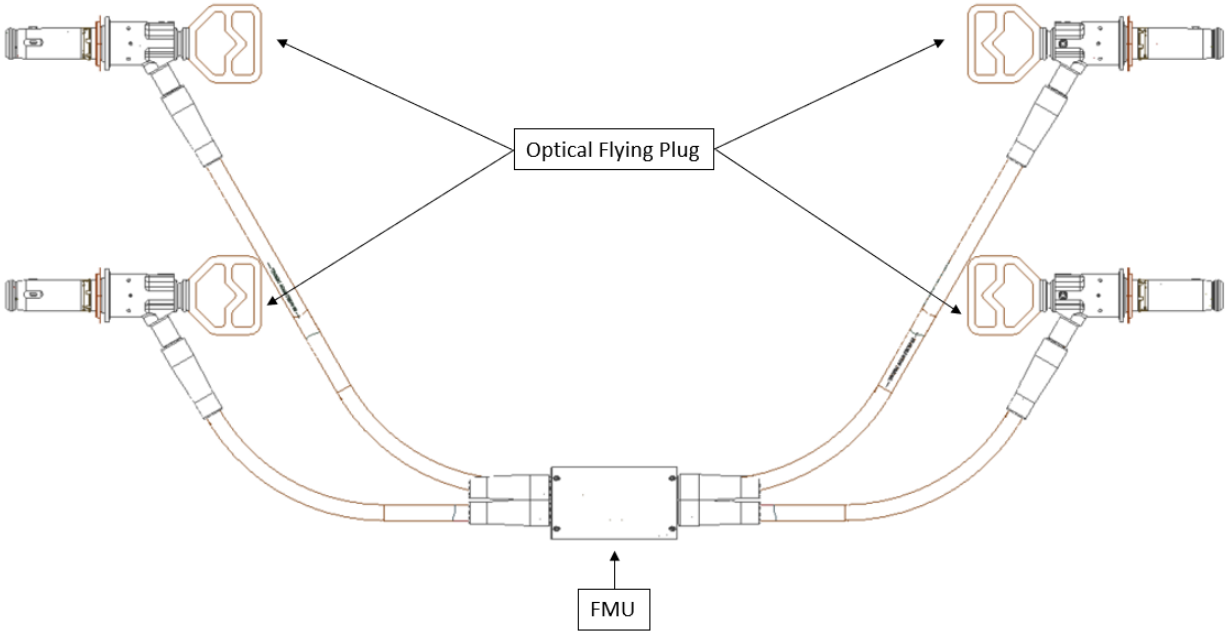


Figure 5 Typical multi-leg OFL or harness assembly

To terminate FO cables laid up in an umbilical cable (e.g. steel or copper tubes containing the optical fibers) an Advanced Fiber Termination Unit (AFT) is used. This crosses over from the umbilical cable to the oil-filled hose system. The AFT can have up to 4 hose outputs. Single output example is shown in Figure 6

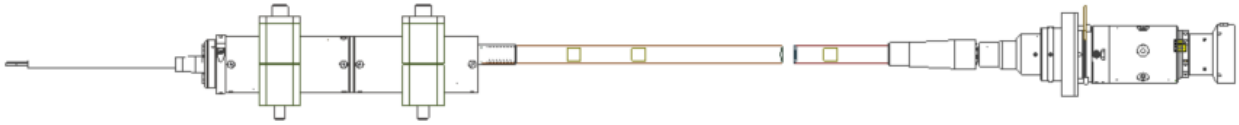


Figure 6 Typical AFT to Receptacle (1out harness) assembly

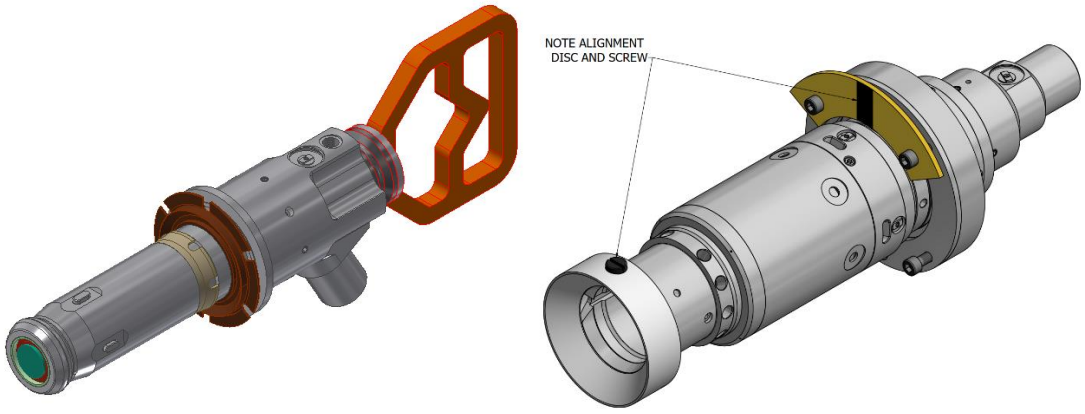


Figure 7 Examples of DigiTRONf oil hose connectors

3 PRODUCT SAFETY

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

Following installation, commissioning or deployment of product, if you have any feedback please complete and return the Customer Comments/Feedback form (Section 10). Please e-mail completed form to the Product Safety Officer at subsea.connectors.productsafety.gb@siemens-energy.com

3.1 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
	**Warning.** Risk of minor personal injury
	**Caution.** Risk of material or environmental damage

3.2 Intended use

The product is intended as a Low fibre optic connection system for subsea use

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.

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 3.3.1 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.

	**Danger!** Risk of imminent danger to life or risk of severe personal injury. Sudden release of stored pressure. DigiTRON products are not intended for use as a penetration for fixed top-side or land-based pressure vessels. They are not designed to comply with the requirements of the Pressure Equipment Directive (2014/68/EU). They are intended for integration into subsea equipment only. All pressure testing of DigiTRON product must be undertaken by a competent person.
	**Caution.** Risk of material or environmental damage, improper use of any kind is prohibited.

3.3 General safety information

3.3.1 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 Siemens Energy Lifecycle Management (Site Team) susultlcmsupport.gb@siemens-energy.com

3.3.2 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.

Wear appropriate PPE according to the product safety advice given in this document

3.3.3 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 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.

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

The oil-filled hoses and connectors are non-serviceable by the user. In case of suspected faults with the product (refer to section 8.2), do not use the product and contact Siemens Energy Technical Support or Siemens Energy Product Safety for advice. Never attempt to carry out maintenance work or repairs on the product yourself.

	**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.bulk-head connector or penetrator) during system pressure test, or the rated differential pressure of the product is exceeded - Ensure all product assembly and testing activities are completed by competent persons. - Do not exceed the maximum differential pressure rating of the product installed. - Individual products have different differential pressure ratings, refer to the specific product datasheet or contact Siemens Energy Technical Support
	**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.

3.3.5 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 or de-mating connectors. - Referring to the mate / demate forces specified herein, ensure suitable manual handling precautions are taken. It is recommended to use the mate/demate tool designed for this purpose (refer to section **9.9**). - Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.
	**Warning.** Risk of musculoskeletal injury from manual handling of heavy products. Refer to shipping information or product datasheet for weights of the product. - 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. - Local regulations for mechanically-aided lifting operations and lifting equipment must be adhered to, e.g. 'LOLER' in the UK.
	**Warning.** Risk of minor personal injury to persons with sensitivities to silicone or mineral based oils. - There is a small risk that oil could leak from the product if faulty. Wear appropriate hand protection when handling products or mineral or synthetic based oils in case oils leak from the connector due to a fault.
	**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.

3.4 Related documents

Installers shall carryout a full site risk assessment and put into place all necessary steps and procedures to comply with applicable area, regional, national or 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.

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

3.5 Control of substances hazardous to health (COSHH)

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

4 ABBREVIATIONS

AFT	Advanced Fibre Termination
APC	Angled Physical Contact
Assy	Assembly
API	American Petroleum Institute
°C	Degree Celsius
°F	Degree Fahrenheit
CE	Community European
COSHH	Control of substances hazardous to health
CP	Cathodic Protection
DWG	Drawing
FAT	Factory Acceptance Test
FMU	Fibre Management Unit
FO	Fibreoptic
HASAWA	Health and Safety at Work Act
HSE	Health and Safety Executive
IL	Insertion Loss
LBF	Pound Force
In	Inch
ISO	International Organization for Standardization
ITP	Inspection Test Plan
LB	Pound
LTC	Long Term Cover/Cap
m	Metres
Max.	Maximum
Min.	Minimum
No.	Number
OFL	Optical Flying Leads
PPE	Personal Protective Equipment
RL	Return Loss
ROV	Remotely Operated Vehicle
SI	Standard International
SIT	Site Installation Test
SQEP	Suitably Qualified Experienced Persons
SRT	Site Received Test
SST	Stainless Steel
TBD	To Be Defined
UNS	Unified Numbering System for Metals and Alloys

5 SPECIFICATIONS

The following is a basic specification for DigiTRON products. Actual product may vary. Please refer to product specific data sheet(s), website https://www.siemens-energy.com /search Subsea, or contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com for more detailed information.

General specification of the product is listed in section 2.2. Additional specifications are as follows.

5.1 Connector Specification

	ROV operated
Misalignment (Compliant mounted receptacle):	
Rotational (0º)	±12º
Radial	±20mm (0.787”)
Angular	±5º
Misalignment (Bulkhead-mounted receptacle):	
Rotational (0º)	±9 º
Radial	±8mm (0.315”)
Angular	±6º
Mate force	<800N (179 lbs)
Demate force	<800N (179 lbs)
Overload withstand:	
Axial load	<5000N (1124 lb)
Bending load	<1250N (281 lbs)
Maximum mate speed Maximum de-mate speed	0.5m/s (1.6ft/s) 1m/s (3.3ft/s)
Deployment rate	350m/min (1149ft/min)
Physical Contact Type	APC
Maximum No. of lines	12

5.2 Siemens Energy *AquaTRON* pressure-balanced oil-filled hose specification

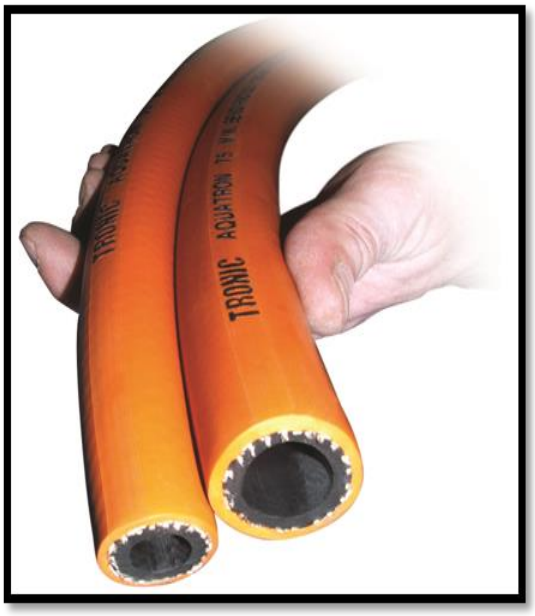


Figure 8 AquaTRON hose, size 50 (1/2" bore), and size 75 (3/4" bore)

Hose type	AquaTRON 50
Diameter	Ø50mm OD, ½" bore
Min bend radius (static and dynamic)	125mm (4.9")
Maximum axial load	5,000N (1,121 lb)
Maximum twisting	180° per 5m (16.4ft) length
Mass (air)	0.66kg/m (0.44lb/ft)
Mass (water)	0.14kg/m (0.09lb/ft)
Max water depth	4,000m (13,123ft)
Oil fill pressure	15 bar (218 psi)
Filling Medium	Dow Corning 200 Silicone Oil
Deployment rate	350m/min (1149ft/min)

Table 5 AquaTRON oil-filled hose specification

6 PREPARING PRODUCT FOR USE OR STORAGE

6.1 Product protection and packaging

Siemens Energy Subsea optical connectors are manufactured primarily from Super Duplex stainless steel, and as such are designed to withstand harsh saliferous environments. However, the connector exposed parts are susceptible to mechanical damage if not protected. Transport caps or Acetal protective caps must be fitted to all Siemens Energy Subsea connectors before transport.

⚠	**Caution.** Risk of material damage. Transport caps or protection caps must always be fitted to an unmated connector during transport, and should remain in place while topside before deployment

Products may be stored in their original packing crates or boxes indefinitely.

Wooden packaging crates supplied with Siemens Energy products are not weatherproof.
As a guide, outdoor storage should be limited to 3 months with protection from direct sunlight and wet weather. Actual duration will depend on the environmental conditions, e.g. in temperate dry conditions more than 3 months may be acceptable, in inclement conditions or use offshore it may be less than 3 months. It is recommended to inspect the crates periodically during outdoor storage to assess their suitability to protect the products from the external environment and to withstand handling.

Be very careful if fitting additional screws, nails or staples to the crate, such that they do not protrude on the inside of the crates. This can very easily damage the hoses within.

Connectors can be shipped singularly or in multiples. Care should be taken to protect the connector(s) with ‘Instapack’, bubble wrap or similar wrapping materials to avoid surface damage during transit. If large numbers are shipped in one consignment suitably reinforced transport box will be necessary to withstand the weight. See Figure 9 and Figure 10.

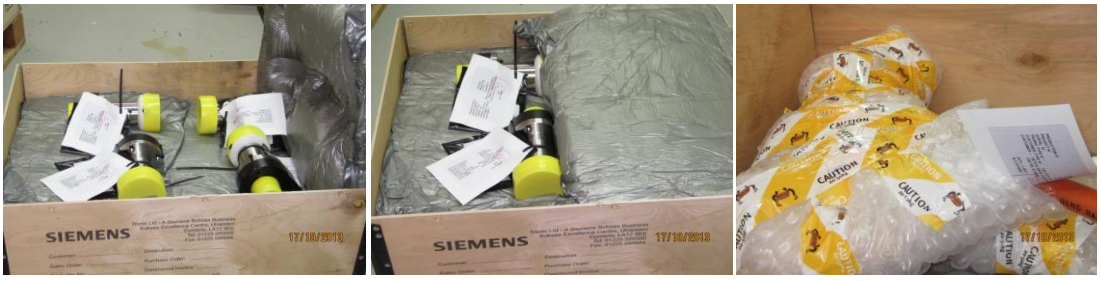


Figure 9 Acceptable packaging for shipment



Figure 10 Unacceptable packaging and storage

Bulkhead type connectors with exposed optical fibers should be packed and shipped in a suitably sized box to allow adequate space and protection of the fibers without bending or kinking.

Connectors are designed to withstand vibration that occurs during transportation and to withstand being dropped from a height of 1m (3.3 ft) whilst in packaging.

If the connectors are assembled onto hoses these must be suitably coiled and secured with tape to prevent uncoiling during transit. Respect the hose minimum bend radius (refer to section **5.2**). A minimum band radius gauge can be used when re-packing assemblies into a crate, Figure 11, 3d model available from Siemens Energy, which can be used to a 3d print the gauge.



Figure 11 Minimum bend radius gauge

6.2 Unpacking

Remove wrapping material taking care to inspect for any surface damage or items that may have become separated from the connector, such as ‘O' seals. 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 protective caps until connectors are ready for installation.

On removal of hose assemblies from packing crates, do not allow the hoses to drag over the edges of the crate. If necessary, cover the edge of the crate with something non-abrasive to protect the hose, and take care to respect the minimum bend radius of the hose.

6.3 Lifting of harnesses and OFLs

Avoid lifting hose assemblies (OFLs, harnesses) by the connector. The recommended practice to manoeuvre assemblies in or out of shipping crates and deployment baskets is to lift the entire assembly equally.

It is recommended to neatly coil into a circle or figure-of-eight (respecting bend radius of hose, section 5.2)

Slings should then be used at minimum 3 equidistant places around the circle (or more if the hose is coiled in a large diameter) to prevent the hose from kinking, plus additional point at the cross-over for a figure-of-eight layup. Ensure the slings are placed beneath the bottom coil and capture all the coils up to the uppermost coil (Figure 12).

If there is heavy equipment terminated to the hose (e.g. sensor or other instrument, or large junction boxes) weighing >5kg then additional appropriate securing and/or slinging should be employed.

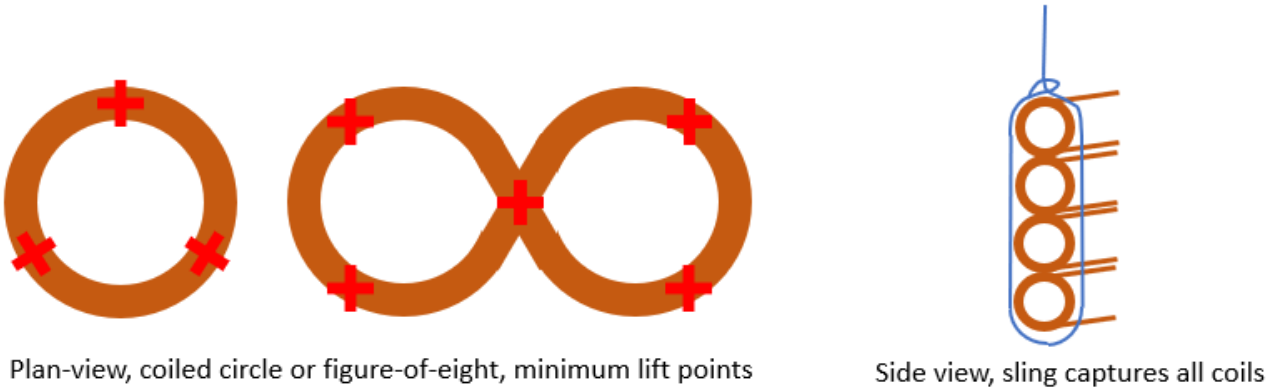


Figure 12 Illustration of strapping points for lifting hose assemblies

6.4 Storage, protection and end of life

Connectors are sensitive to environments where grit and dirt are present. All connectors come supplied with a transport cap. It is recommended to leave the caps on whenever possible. The caps must be removed before subsea deployment.

Connector may be fitted with a back plastic Protective Cap (Figure 19), which is available to purchase separately (customer preference). These caps provide a higher degree of mechanical protection to the connector than the transport caps.

Refer to section 9.3 for details on the types of caps and dummy connectors available for protection during storage.

	**Caution.** Risk of material damage. If storage is carried out in saline conditions, e.g. on a ship's deck or hold, then a Subsea Environment Cap or Dummy Plug connector should be used to protect the receptacle pins from corrosion.

Connectors and hose / cable assemblies must be stored in a clean dry area and be protected by bubble wrap or similar.

It is recommended to store products in their original packaging (e.g. wooded crates or boxes, noting outdoor storage of crates per section 6.1**Error! Reference source not found.**).

Carbon steel must not be present in the storage of the products, to avoid contamination of the stainless steel products.

If product has been recovered from subsea use, it should be cleaned before storage. Clean only with fresh water or 50% citric acid solution. If 50% citric acid wash is not performed, as a minimum, wash with clean water to remove any salt water on the products.

6.4.1 Short term storage

Storage where temperature and humidity are not controlled should be limited to 4 weeks Storage temperature range: -40°C to +50°C air temperature (-40 to 122°F). Storage humidity below 75%. Maximum skin temperature of the product should not exceed 70°C (158°F), including solar gain due to exposure to sunlight radiation.

6.4.2 Long term connector storage

These recommendations apply to products both prior to and after assembly to other equipment (e.g. XT, manifolds, SCM).

Ambient air temperature should be between -40°C and +50°C (-40 to 122°F). Storage humidity below 75%. Very moist or very dry conditions should be avoided. The equipment should be protected from strong sunlight and strong artificial light with a high ultraviolet content.

Maximum skin temperature of the product should not exceed 70°C (158°F), including solar gain due to exposure to sunlight radiation.

After 5 years storage it is recommended to perform a visual examination and optical tests to confirm the product is still fit for purpose and within specification. Check for any oil-leaks or obvious signs of damage to the connectors. Refer to 'Site Receiving Test' document SRT-004, available on the Siemens-Energy/subsea website for optical test requirements.

For product already assembled onto other equipment, the test regime of that piece of equipment shall take precedence over the SRT document, e.g. IR tests may not be allowable; function test may applicable.

Beyond 5 years storage, re-inspection and test is recommended every 2 years and before the product is put into service.

For products stored at air temperatures continually above 25°C it is recommended to perform re-inspection and test every 12 months.

	**Caution.** Risk of material damage. Maximum storage temperature accounts for solar gain. Skin temperature must not exceed 70°C (158°F). Suitable protection must be used to ensure maximum storage temperature is not exceeded.
	**Caution.** Risk of material damage. Connectors should not be allowed to encounter solvents, oil, grease or other semi-solid materials.

6.4.3 Siemens Energy pressure balanced oil filled hose storage

Recommend hose and junction box assemblies be stored in original packing crates. If not, protected from direct sunlight or strong artificial light with tarpaulin sheet or equivalent.

Maximum initial storage period: 2 years stored in accordance with ISO 2230 (pressurised), and noting the storage requirements in section 6.4.2.

After this perform visual checks and optical tests. Refer to 'Site Receiving Test' document SRT-003, available on the Siemens-Energy/subsea website for optical test requirements.

Pressurised hose assemblies must be visibly inspected for:

- Permanent distortions, such as creases or flats
- Mechanical damage, such as cuts, tears, abraded areas or delaminated plies
- Surface cracking
- Changes in surface condition, such as hardening, softness or tackiness.

After the inspection is completed and data recorded the assembly can be stored for a further 2 years, rolling program. For products stored at air temperatures continually above 25°C it is recommended to perform re-inspection and test every 12 months.

6.4.4 Long term storage of elastomers

For the recommended storage of elastomeric components e.g. termination sleeves and cable boots, please refer to Siemens Energy Subsea Document MH006 – Procedure for Storage and Handling of Elastomeric Materials, available from Siemens Energy Technical Support.

6.4.5 Repackaging to prevent damage in transport

In the event of a requirement to return any product back to the manufacturer (Siemens Energy Subsea Connectors), it is recommended that the transport cap, protective cap, or suitable dust cap is fitted to the connector(s) and care should be taken to protect the connector(s) with bubble wrap or similar wrapping materials to avoid any surface damage

If there are multiple connectors to be returned, it is recommended that a suitably reinforced box be used to withstand the weight and allow shipping in one consignment. Contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com to discuss details of typical boxes.

Refer to section 6.1**Error! Reference source not found.** for more information and re-packing of h ose and cable assemblies.

Carbon steel must not be present in the storage of the products, to avoid contamination of the stainless steel products.

6.4.6 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 .

7 INSTALLATION AND ASSEMBLY

If in doubt contact Siemens Energy Technical Support connectortechnicalsupport.gb@siemens-energy.com for more detailed information.

	Caution. Risk of material damage. Optical fibres are easily damaged and are vulnerable when not kept in the original packaging supplied with the connector. Observe the minimum bend radius of the fiber. Under no circumstance should the fibres be used to lift the product.

7.1 Pre-installation checks for OFL's

- Check hose tagging information is correct according to drawing/tag schedule.
- Ensure Flying Lead has passed Site Received Test (refer to Siemens Energy document SRT-005, available on Siemens Energy Subsea website).
- Make sure prior to installation a final visual inspection of the Flying Lead is completed.
- No part of the connectors should be dismantled prior to or during deployment, apart from the removal of protective caps since there are no user serviceable parts inside.
- Any defects need to be recorded on the form in section 10 of this document and where possible take photos of any issues that need to be recorded and inform Siemens Energy Technical Department.

7.2 Cathodic protection

ROV Connectors are manufactured in super duplex stainless steel and are designed to operate isolated from the CP (Cathodic Protection) system. Such connectors are supplied with all hardware needed to isolate the connector from the structure to which it will be mounted.

ROV connectors that do get connected to the CP system will not be immediately damaged, but there is an increased risk of hydrogen embrittlement of the metal (possible cracking under high mechanical stresses), and increased rate of calcareous deposits on the product (which may cause problems de-mating the connectors).

Do not fit 'bracelet' anodes around hose or cable as part of CP protection. These can easily damage the hose or cable as the anodes corrode.

7.3 Installation of harnesses with flanged connectors and / or Fiber Marshalling Unit

Tooling required

- ¼ inch drive torque wrench 0-25 Nm (18.4 lbf.ft) 4mm Allan key drive
- Loctite 243

If cable ties are used to secure harnesses to structures, leave loose on the hose. Do not compress.

7.3.1 ROV connectors

Referring to Figure 13 and Figure 14, remove M6 mounting screws and orientation disc, pass the front of the connector through the interface, install 4 off M6 mounting screws and alignment disc, secure screws with a spot of Loctite 243 on the threads and torque to 10-12 Nm (7.38 – 8.85 lbf.ft).

NOTE:

The alignment cone on the receptacle may require removal in order to install the connector, and re-fitting once installed. Ensure correct orientation to the internal key-way.

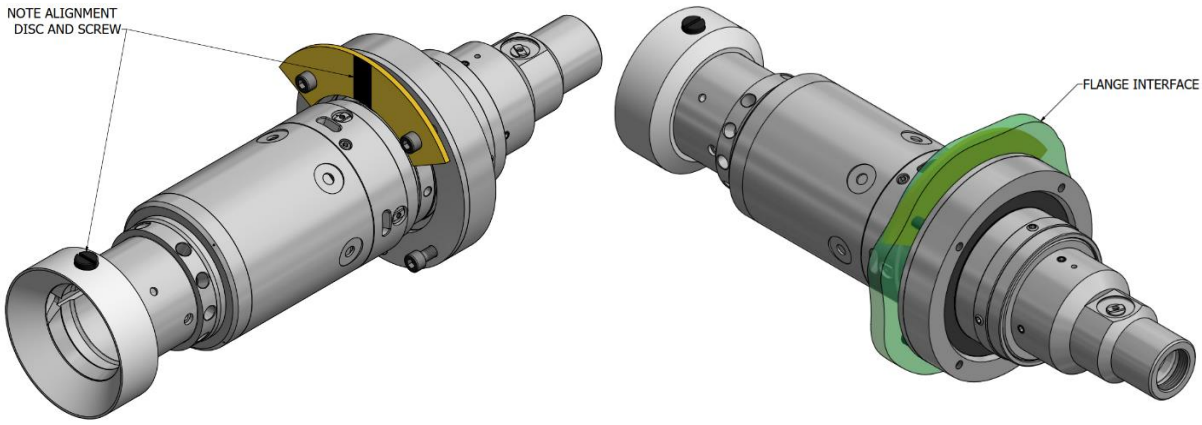


Figure 13 Installation of compliant flange-mount ROV receptacle

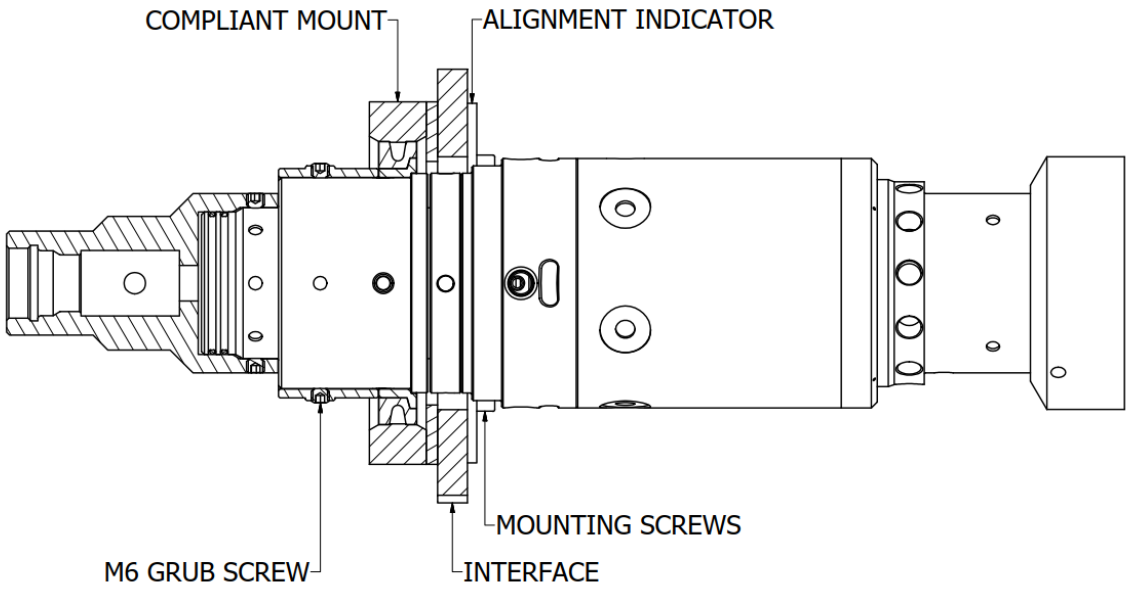


Figure 14 Sectional view of installation and parts of compliant mount connector

7.3.2 Installation of Fiber Marshalling Unit

Referring to **Figure 15**, the FMU can be mounted horizontally or vertically. If vertically mounted, ensure the hoses are supported sufficiently to maintain the minimum bend radius.

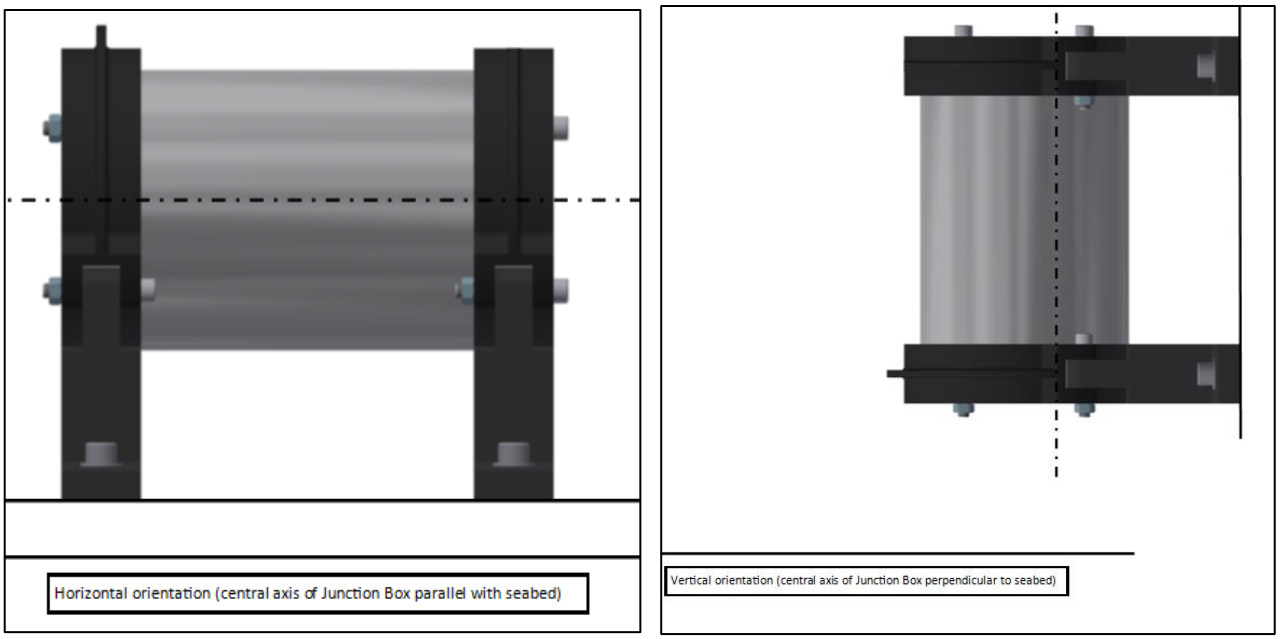


Figure 15 Junction box mounting horizontal (left) and vertical (right)

It is critical the brackets for the junction box are installed as identified on Siemens Energy drawing 10199114, available from Siemens Energy Technical Support

Drill interface holes as required for installation as per drawing 10199114.

Apply a spot of Loctite 243 to the threads of the cap head screws. Fix the junction box to the structure with 4x M8 screws, torque to 10-12Nm (7.38 – 8.85 lbf.ft)

In the event that the brackets are supplied separate to the FMU body, these will need to be assembled and installed. If applicable: assemble brackets to the body taking into account the anti-rotation peg, which is to be situated on the underside of the unit and locates into a recess in the body. Fit 1-off black nitrile strip to each bracket on the opposite side to the anti-rotation peg. Tighten the M6 fasteners to 3.5Nm (2.58 lbf.ft) to complete the bracket installation. See Figure 16 and Figure 17.

FMU Body material is super duplex stainless steel and does not require CP protection.

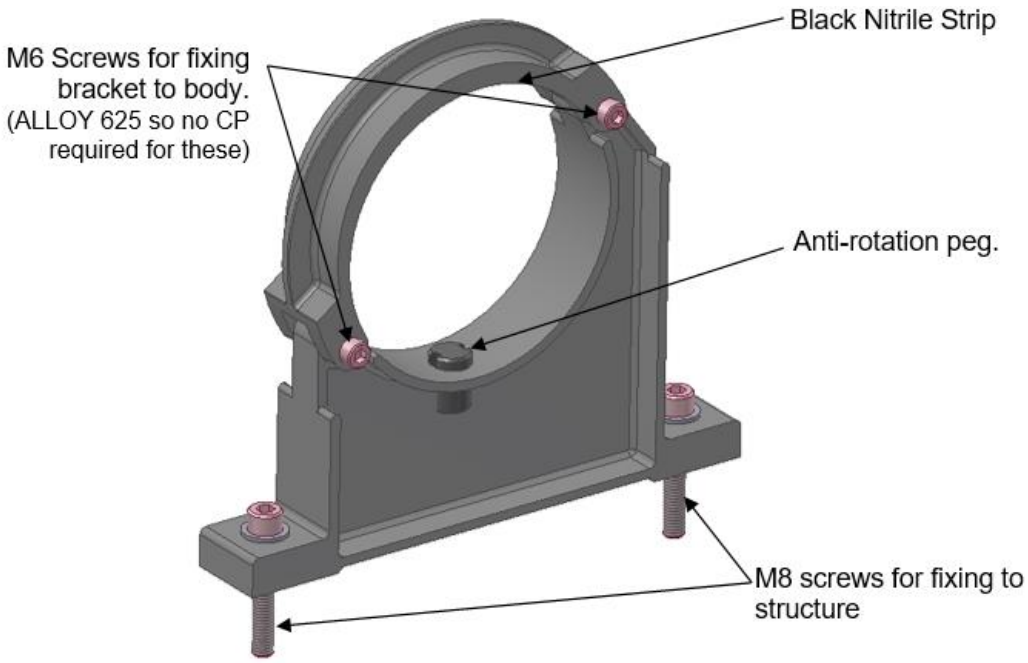


Figure 16 Junction box mounting bracket assembly

Ensure mounting brackets are secure and the FMU is orientated correctly. This completes the installation of the junction box.

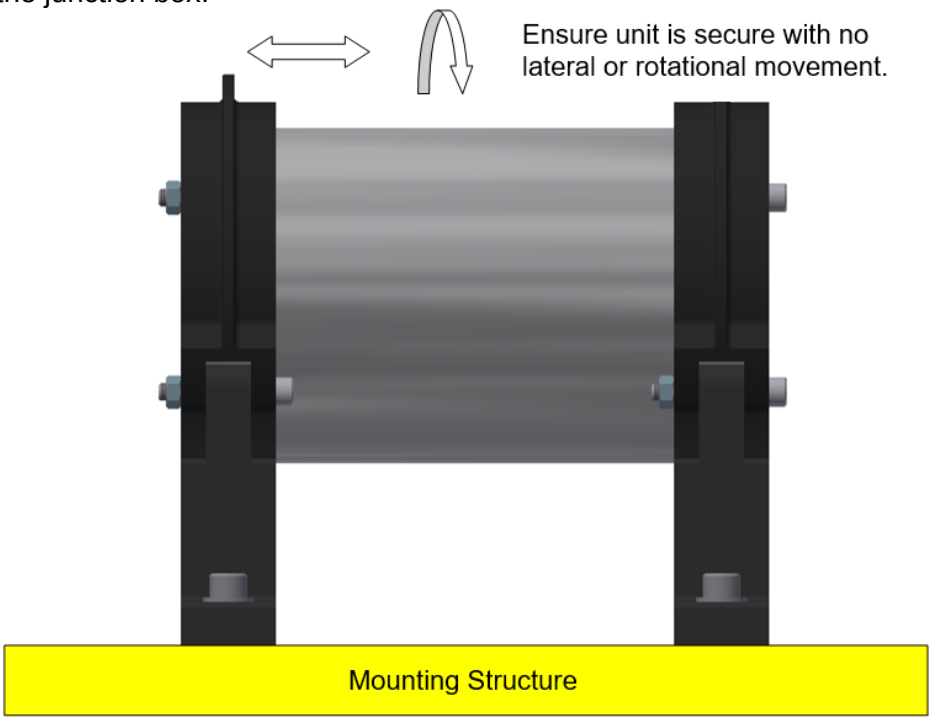


Figure 17 FMU correctly installed on structure

7.3.3 Product mounted within umbilical termination assemblies (UTA)

This section applies to Advanced Fiber Termination (AFT) assemblies, complete with oil-filled hoses and connectors, that are terminated to the umbilical and mounted inside the UTA.

These products should be securely mounted to the UTA structure using the fastenings supplied with the product, or suitable alternatives. The fiber cable from the umbilical should be routed inside the UTA such that no undue strain is applied where the cable enters the product.

The cable should be clamped onto a cable tray or similar before entering the product, such that any movement of the cable in the UTA (planned or otherwise e.g. shock load) does not transmit strain to the product. It is recommended to position a cable clamp circa 200mm prior to the cable entry to the product and coaxially to ensure a straight run of cable up to the product.

7.4 TESTING OF OFL'S

DigiTRON**f** test harness comprise of a standard subsea connector, hose conduit containing the fibers (no oil), and a termination box, as shown in Figure 18. The termination box accepts patch leads to be connected to it via E2000 type connectors

The test harness can be used in the dry, or for shallow-water testing. The termination box is not water-tight so must not be submerged, i.e. shallow water testing has the connector submerged and the termination box in the dry.

	**Danger!** Risk of imminent danger to life or risk of severe personal injury. Sudden release of stored pressure. DigiTRON products are not intended for use as a penetration for fixed top-side or land-based pressure vessels. They are not designed to comply with the requirements of the Pressure Equipment Directive (2014/68/EU). They are intended for integration into subsea equipment only. All pressure testing of DigiTRON product must be undertaken by a competent person.
	**Warning.** Risk of musculoskeletal injury from manual hand-mating or demating connectors. - Referring to the mate / demate forces specified herein, ensure suitable manual handling precautions are taken. It is recommended to use the Manual Mate Tool to mate and demate the connector. - Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.
	**Caution.** Risk of material damage. The appropriate test harness must always be used to make optical contact during testing.
	**Caution**. Risk of material damage. The test harness termination box should never be used in water. There is a high change of damage to the test harness.



Test Receptacle Test Plug

Figure 18 Test harnesses

All test connectors should be periodically inspected and cleaned (refer to section 9.5). Optical integrity should be checked by measuring insertion loss and return loss.

Check that there is no debris or dirt on the test connector; this can be transferred to the connector under test.

8 USER INFORMATION DURING NORMAL OPERATION AND FAULT CONDITIONS

8.1 Visible/audible signals

There are no visible or audible signals from the product during use that identify particular operations to the user.

The product should be silent during operation and its appearance should not change.

8.2 Normal and faulty/dangerous operation

Do not operate the product if there appears to be a fault. If in doubt contact Siemens Energy Technical Support. Below are some indications of a product fault.

- Any loose items such as metal bodies, fasteners, other fixings
- Any oil leak is present, either from the connector or from the oil-filled hoses or from fibre splice or marshalling units.
- Any damage to the rubber seal at the front of the plug connector, such as tears or nicks
- Blackening or darkening of the rubber seals at the front of the plug connector
- Any noise coming from the product.

8.3 Troubleshooting

If there is any problem with the product failing to operate correctly, please contact Siemens Energy for advice. Do not dismantle the product in any way.:

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

Table 6 Troubleshooting product contact details

9 PRODUCT OPERATION AND MAINTENANCE

9.1 Safety precautions

Before use, read section 3 on product safety advice.

9.2 Product maintenance and servicing

DigiTRON products require zero maintenance for their 30 year subsea lifetime and up to 250 subsea mate and demate cycles.

There are no user serviceable parts in the connectors, OFLs, jumpers or harnesses. Disassembly of the product should not be attempted. If there are any problems developed with the product then the user should contact Siemens Energy Technical Support for advice.

9.3 Product protection; caps and dummy connectors

There are five types of caps and dummy connectors available to protect the product in use. The following gives the use case for each type.

9.3.1 Topside caps

Referring to Figure 19:

- Transport cap: Supplied with the connector to protect it against damage during transport
- Protective cap: Provides greater degree of mechanical protection to the connector than the transport cap. Recommended for when connectors are exposed to higher risk of damage outside of transportation

Topside caps can be fitted and removed by hand

Topside caps should not be deployed subsea.

	**Caution.** Risk of material damage. If storage is carried out in saline conditions, e.g. on a ship's deck or hold, then a Subsea Environment Cap or Dummy Plug connector should be used to protect the receptacle pins from corrosion.



Figure 19 Transport Caps (left) and Protective Caps (right)

9.3.2 Subsea caps

Figure 20 shows from left to right, Subsea Protection Caps, Subsea Environment Cap, and a Loopback Plug.

- Subsea Protection Cap: Protects the connector from gross mechanical damage while deployed subsea. Typically used for short-term protection e.g. fitted for deployment of the connector and then removed within a few weeks to hook-up the flying lead. These caps can be used for longer-term protection in benign subsea environments (e.g. low marine-fouling sites). These caps do not protect the front seals of the connector.
- Subsea Environment Cap: Protects the receptacle from gross mechanical damage and environmental protection of the front-seals of the receptacle. Typically used for long-term subsea storage, especially in areas of high marine growth. This cap does not have any optical function.
- Loopback Plug: Provides protection the same as a standard subsea flying plug, plus loopback test facility.

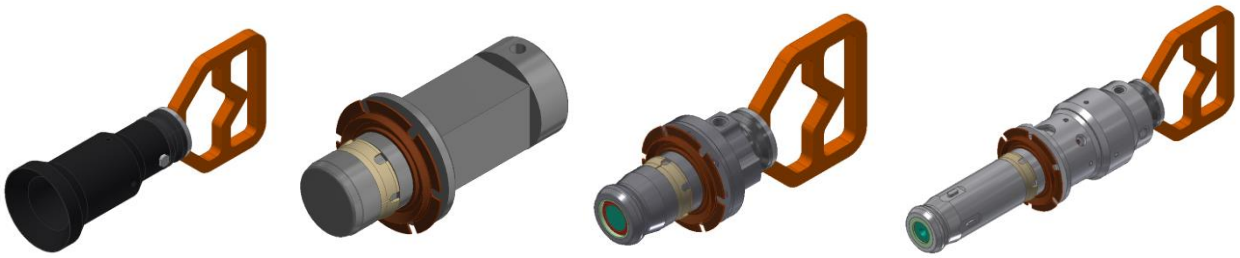


Figure 20 Typical subsea protection caps

9.4 Live Mate / De-mate

The connectors can be mated or demated while transporting optical signals.

9.5 Inspection and cleaning of connector products

All connector products should be thoroughly inspected before use, refer to section 8.2 for faults to look for.

Connectors can be safely cleaned using Isopropyl Alcohol (IPA) and lint-free cloth, but do not soak the product in IPA. Allow time for IPA to evaporate before mating the connector together. Be careful not to leave any cloth fibres on the front-face of the plug or receptacle connectors. Other cleaning fluids should not be used as they may not be compatible with the rubbers or plastics used in the product.

Under no circumstances should a foreign object be used to depress the shuttle pins of the plug.

9.6 Removal of marine growth and calcareous deposits

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

Other acid cleaners, such as 50% Acetic Acid, should not be used as they may cause deterioration of the elastomeric materials. Chiselling and abrasive methods are not recommended. Use of a water

jet is acceptable, but the jet should not be directed onto the shuttle pins at the front of the plug, or the front face of the receptacle, as this could result in a risk of water being forced through the primary seals.

Water jetting is permitted subsea (not in air) providing water jet is not directed at end faces of connectors (see below). After water jetting, it is recommended to visually inspect connectors for signs of damage

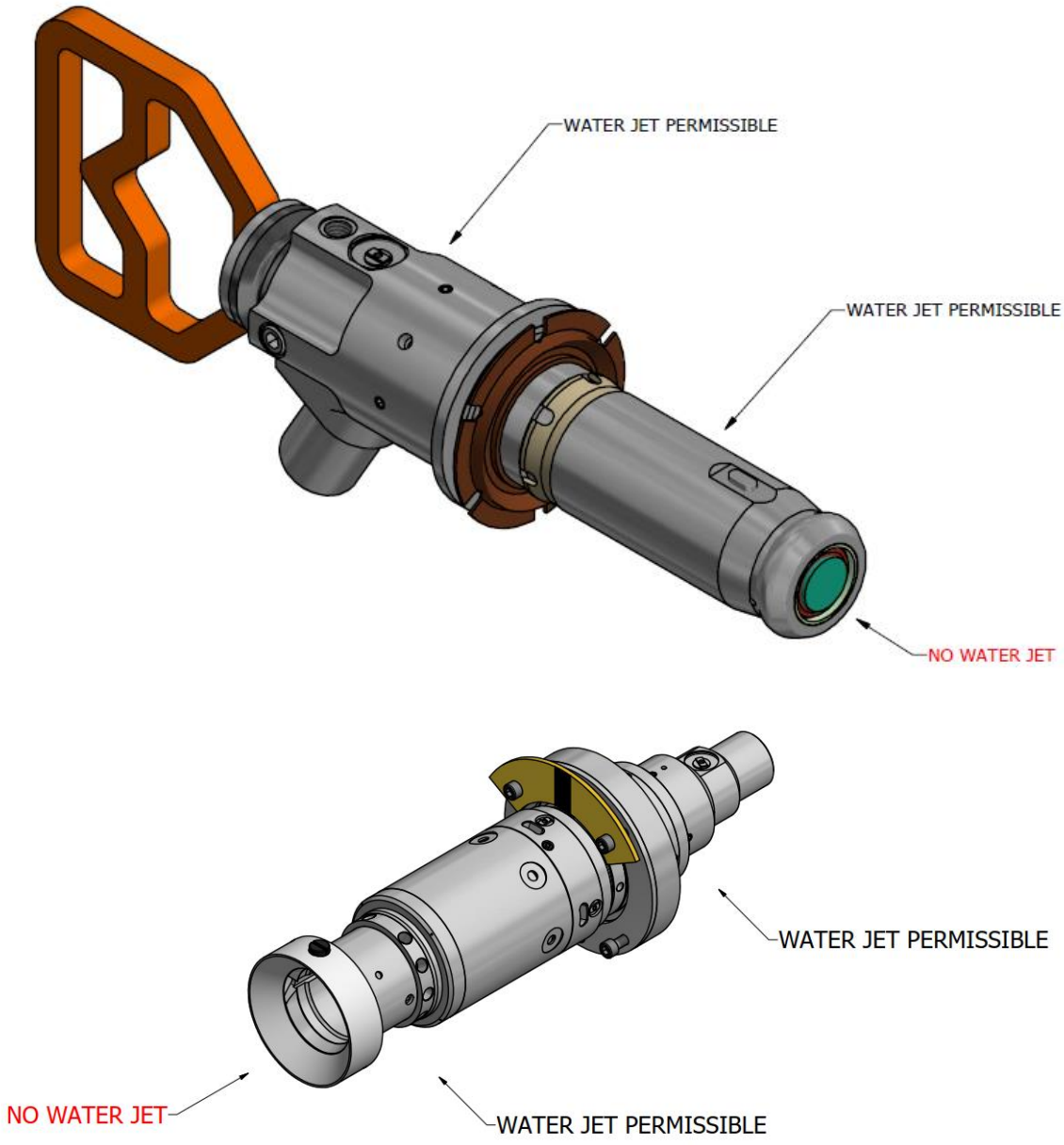


Figure 21 Permissible Water Jetting

⚠	**Warning.** Risk of minor personal injury to persons with sensitivities to a solution of 50% Citric Acid, should wear appropriate hand 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.
	**Caution.** Risk of material damage. Chiselling and abrasive methods are not recommended. Use of a water jet is acceptable, but the jet should not be directed into the shuttle pins at the front of the plug as this could result in a risk of water being forced through the primary seals.

9.7 Checks before mating the product

Transport and topside protection caps must be removed before subsea deployment

Before mating, the receptacle connector should be checked for debris and damage. The connectors have been designed to accommodate sand and silt contamination; however large pieces of debris should be removed. Use a water jet if subsea, see water jetting details in section 9.5

Check the front-face of the plug connector. There should be no tears to the rubber or any darkening of colour.

If evidence of such faults exists, do not use the connector. Please contact Siemens Energy Technical Support for advice.

9.8 ROV connectors mating and de-mating

	**Warning.** Risk of musculoskeletal injury from manual hand-mating or demating connectors. - Referring to the mate / demate forces specified herein, ensure suitable manual handling precautions are taken. It is recommended to use the Manual Mate Tool to mate and demate the connector. - Ensure all product testing activities are completed by competent persons in accordance with relevant procedures.

9.8.1 ROV connector alignment and mating

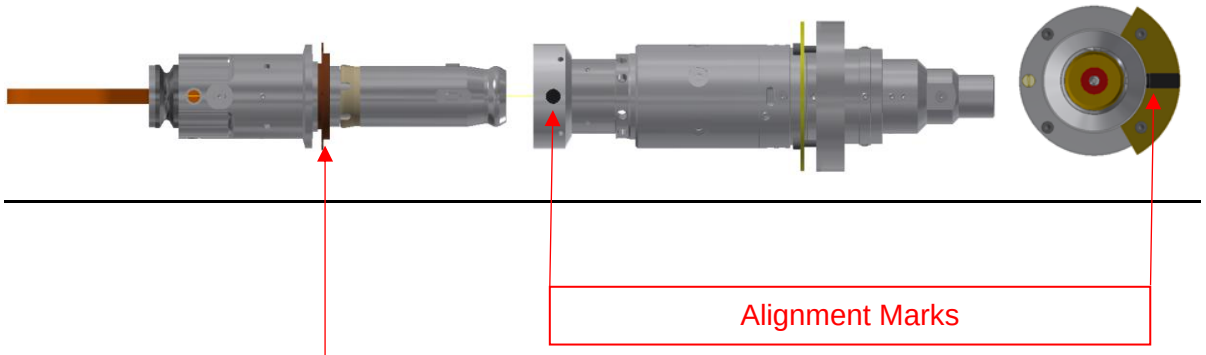
These instructions apply to the Flying Plug (on an OFL) and the Loopback Plug.

Refer to Figure 22 for images of alignment marks and mating

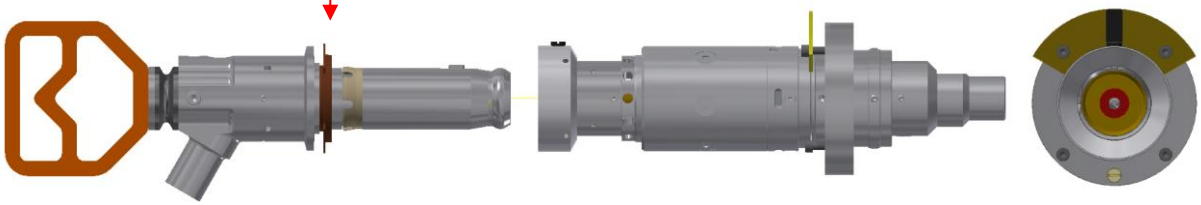
- DigiTRON f connectors have been designed to self-align during mating.
- The connectors must be roughly aligned using the alignment marks on the plug body, alignment disc and receptacle cone.
- The mounting of the ROV handle has sufficient compliance to accommodate fine adjustments during the final approach prior to connector engagement.
- Ensure correct orientation of the alignment disc
- When the connector is fully mated, the lip seal will not be visible from the ROV camera first-person view, i.e. view from behind the connector. A thin orange-colour line approx. 2mm may be visible from side-on view.
- If the lip seal can still be seen from the first-person view, remove and retry making connection by following the procedure again.
- If the lip seal can still be seen, remove and retry making connection by following the procedure again.

- If connectors can't be mated both the plug and receptacle need to be inspected for any mis-alignment damage or debris that is preventing connection.
- If any damage has occurred, please contact Siemens Energy Technical Support for advice.

Top View



Side View



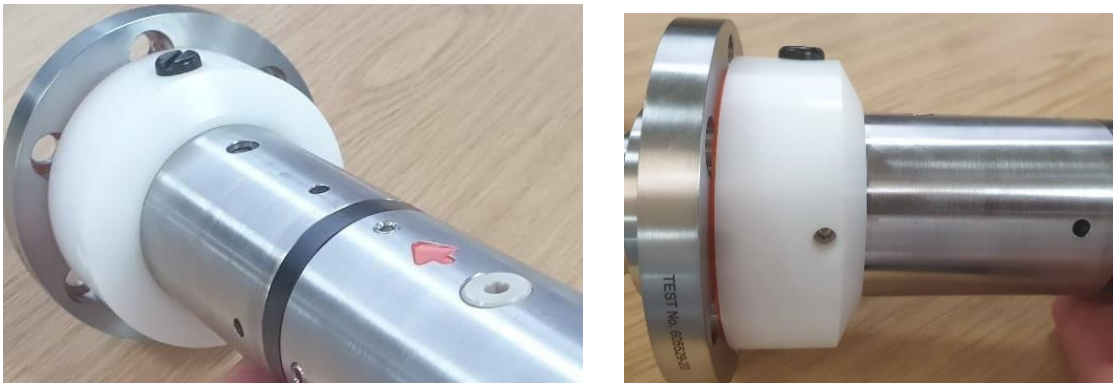


Figure 22 Alignment marks and lip seal mating indicator

9.8.2 ROV connector maximum misalignment values and mating forces

Refer to section 5.1

9.8.3 ROV connector mate / demate speed

The connectors have been designed to operate across a wide range of mate / demate speeds. There is no practical limit to the speed at which the connectors may be mated or demated, however as a guide mating/demating speed should not exceed those stated in section 5.1.

9.8.4 ROV connector post-mating checks

During mating the orange indicator lip seal located on the plug connector will fold back and disappear into the alignment cone on the receptacle connector. After a successful mating of the connectors no part of the indicator lip seal should protrude through the joint between the plug and receptacle connector.

9.8.5 ROV connector demating

Demating is achieved by a straight pull on the ROV handle, sufficient to release the Snap Ring. Force required is detailed under the mechanical forces in section 5.1

9.9 Manual (hand) mating and demating of the connectors

For manual (by hand) mating and demating of the connectors, the Manual Mate-Demate Tool should be used (Figure 23). This applies to mating in the dry, and also for divers operating the product subsea.

The tool has to be adjusted for either the connector mating operation or demating operation, by moving the lever arm pivot pin into a different position, see Figure 24. Do this before using the tool.

The tool should not be stored subsea but recovered to the surface after intervention work has been completed and washed with fresh water. Storage Temperature Range of tool is -40°C to +70°C

	**Warning.** Risk of hand or finger entrapment resulting in injury or loss of finger(s). Do not remove the transparent plastic guards from the tool. Do not use the tool if the guards are damaged or not present.
	**Warning.** Risk of personal injury from release of stored mechanical energy when connectors are mated or partially mated. Do not modify the tool in any way as it's mechanical strength may be compromised.
	**Warning.** Risk of personal injury from release of stored mechanical energy when connectors during demating of the connectors During the demate process, due to the high loads from the spring arrangement inside the connectors, there may be a slight 'kick-back' felt through the tool as the plug breaks away from the latching feature with the receptacle. This is normal functionality, and the operator should be prepared for this before the tool is used, such that there is no surprise during operation that may lead on to other risks such as a fall or trip incident.
	**Warning.** Risk of personal injury from release of stored mechanical energy when connectors are mated or partially mated. Never attempt to reposition the pivot pin when the connectors are partially mated.
	**Warning.** Risk of personal injury from release of stored mechanical energy when connectors are mated or partially mated. Make sure the tool is correctly and firmly located on the plug and receptacle, such that it cannot slip off either connector in use. This would cause a significant kick-back of the plug connector and / or the tool towards the operator, due to the high mating forces between the connectors. Make sure the connectors are free of debris and marine growth before the tool is used, especially around the cone on the receptacle where the tool fits (Figure 26).

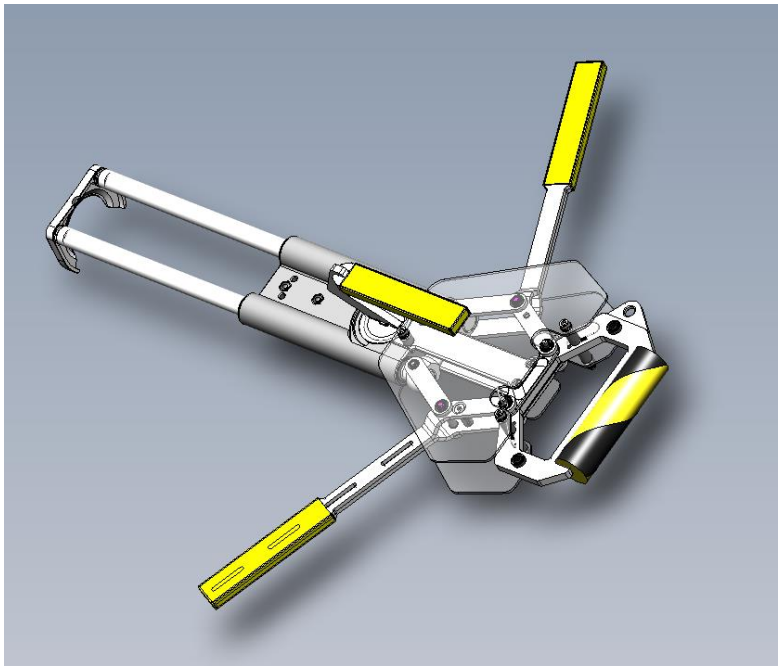


Figure 23 Manual Mate/Demate tool, part Number S1U10509147

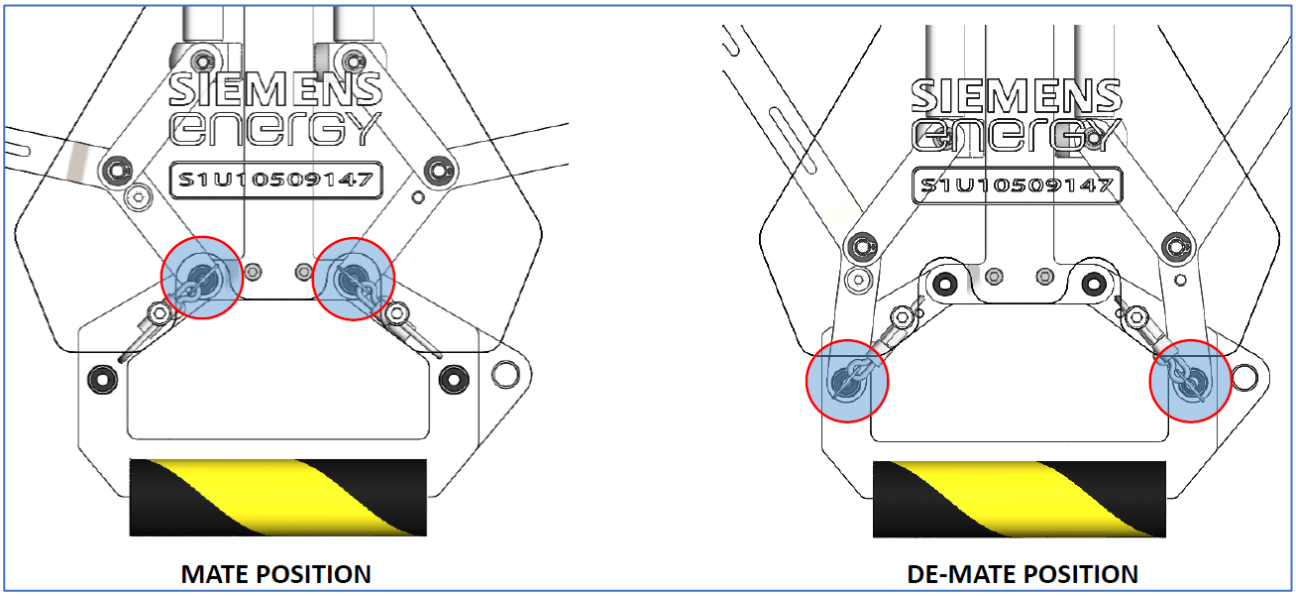


Figure 24 Mate/demate lever arm pivot pin position

9.9.1 Mounting the plug to mate/demate tool

- The tool is designed to accept the plug via the ROV handle and locked into position by turning the trigger activation lever, as below (Figure 25).

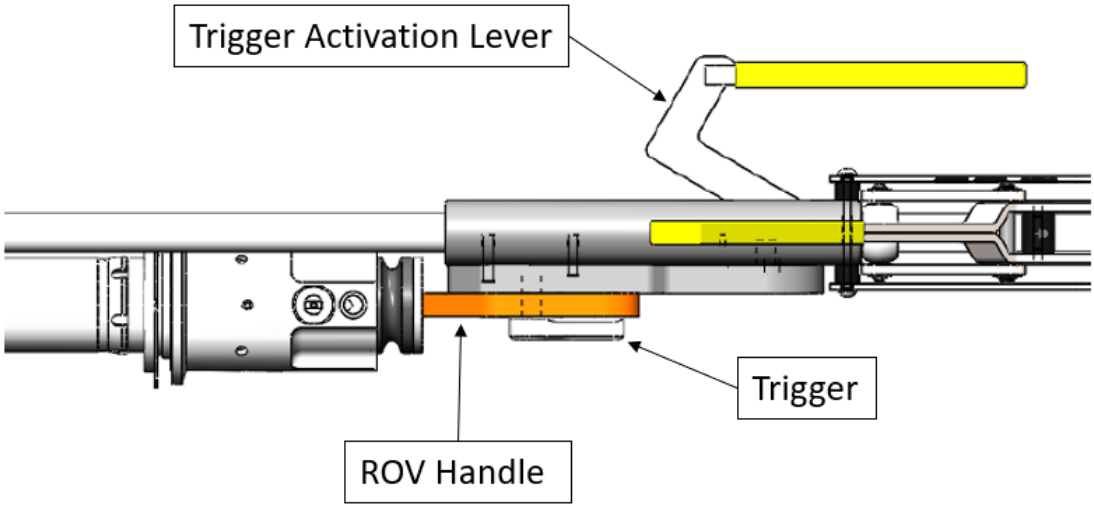


Figure 25 Plug mount to Mate/Demate tool

9.9.2 Connect tool to receptacle

With the plug locked into position, the tool can be offered up in-line with the receptacle alignment indicators (Figure 22). There is sufficient compliance to accommodate the tool to be tilted to allow the tool horseshoe to engage behind the receptacle capture cone as depicted below (Figure 26).

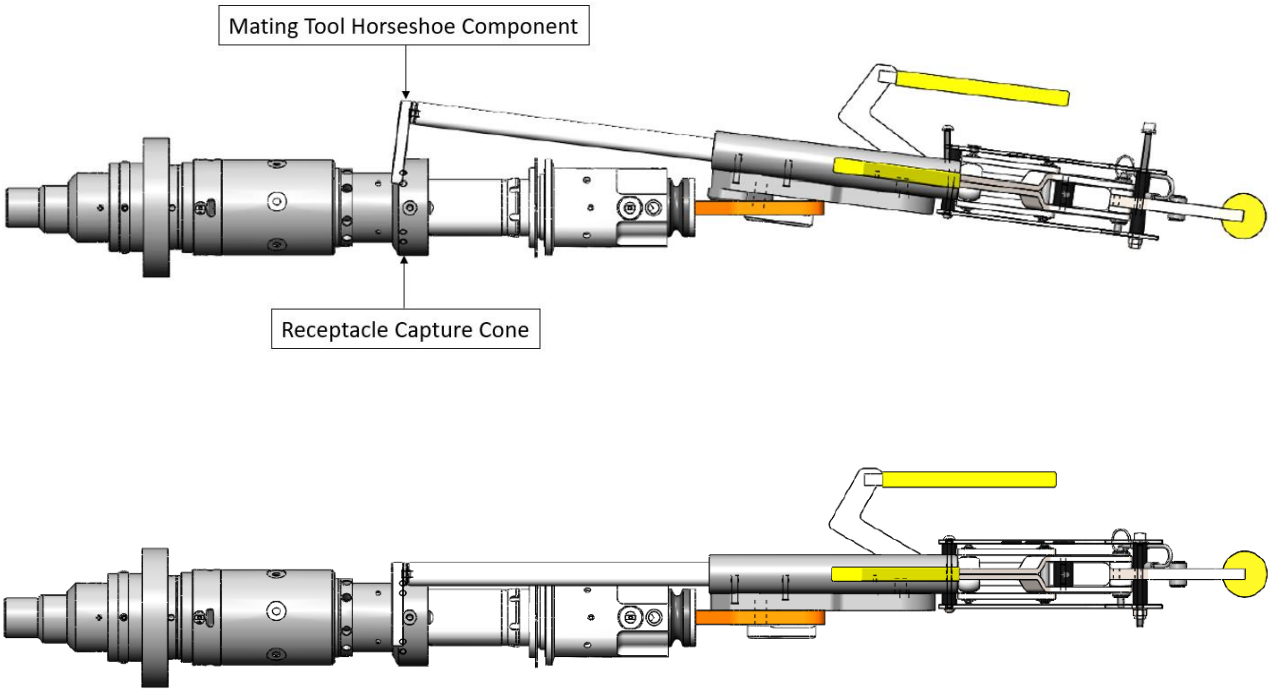


Figure 26 Receptacle mount to Mate/Demate tool

9.9.3 Mate operation

Mate by moving the lever arms as shown below (Figure 27)

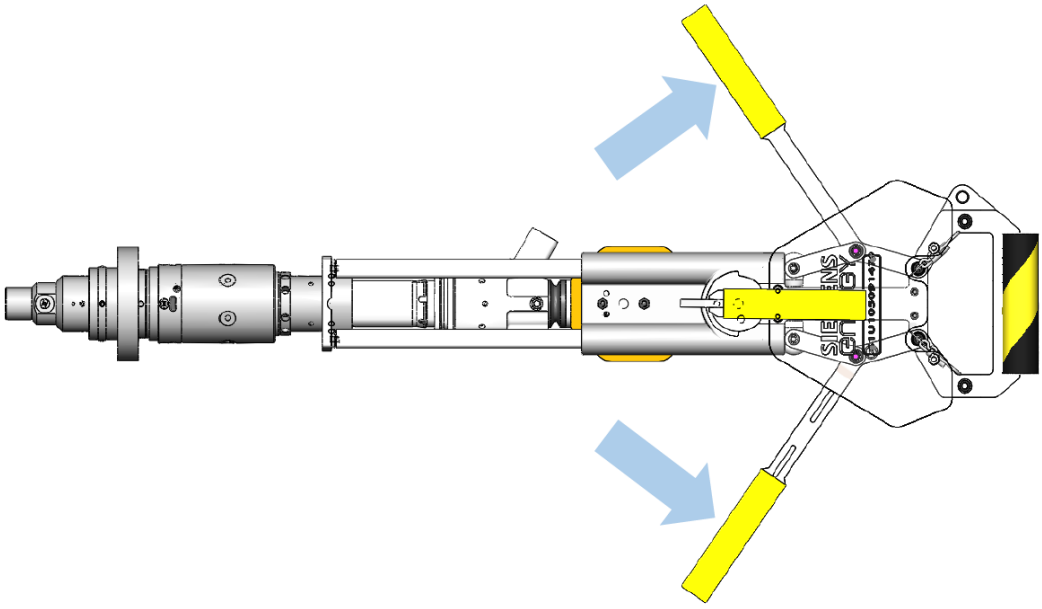


Figure 27 Mate operation

9.9.4 Demate operation

- Check the lever arm pivot pin is in the demate position (Figure 24) or reposition. Do this before attempting to demate the connector
- Fit the tool as before to the mated connector, and then demate the connector by moving the lever arms as shown in Figure 28.

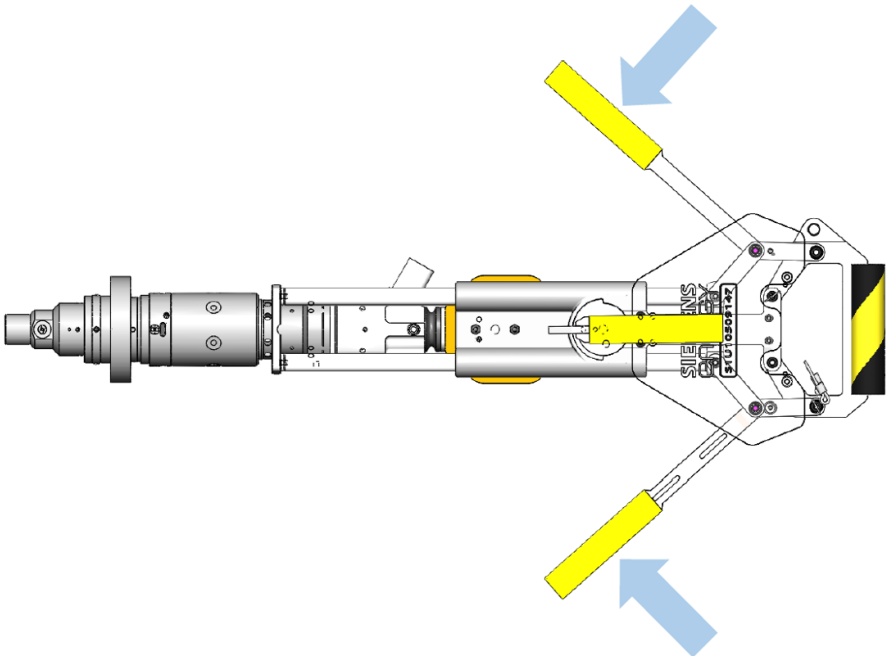


Figure 28 Demate operation

10 CUSTOMER COMMENTS/FEEDBACK

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✉ Contact Details		☎ Contact Details
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Product Type	Part Number (P/N)	Serial Number (S/N)
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