



SUBSEA

Aftermarket Services



Subsea | Aftermarket Services

TIS Manufacturing provides a range of after market solutions to fully service both OEM and third party equipment.

Aftermarket Services

- ▶ Survey Inspections
- ▶ Repair & Maintenance Plans
- ▶ Retrofits, Modifications & Upgrades
- ▶ Orbital & Autogenous Welding Services
- ▶ Recertification
- ▶ Spares Management
- ▶ Flushing & Pressure Testing
- ▶ Offsite Commissioning
- ▶ Pre-FEED & FEED Studies
- ▶ FMECA Surveys
- ▶ Reverse Engineering



Subsea | Aftermarket Services



TIS Aftermarket Services specialises in **rapid optimisation** of OEM or third party equipment to meet client required specification.



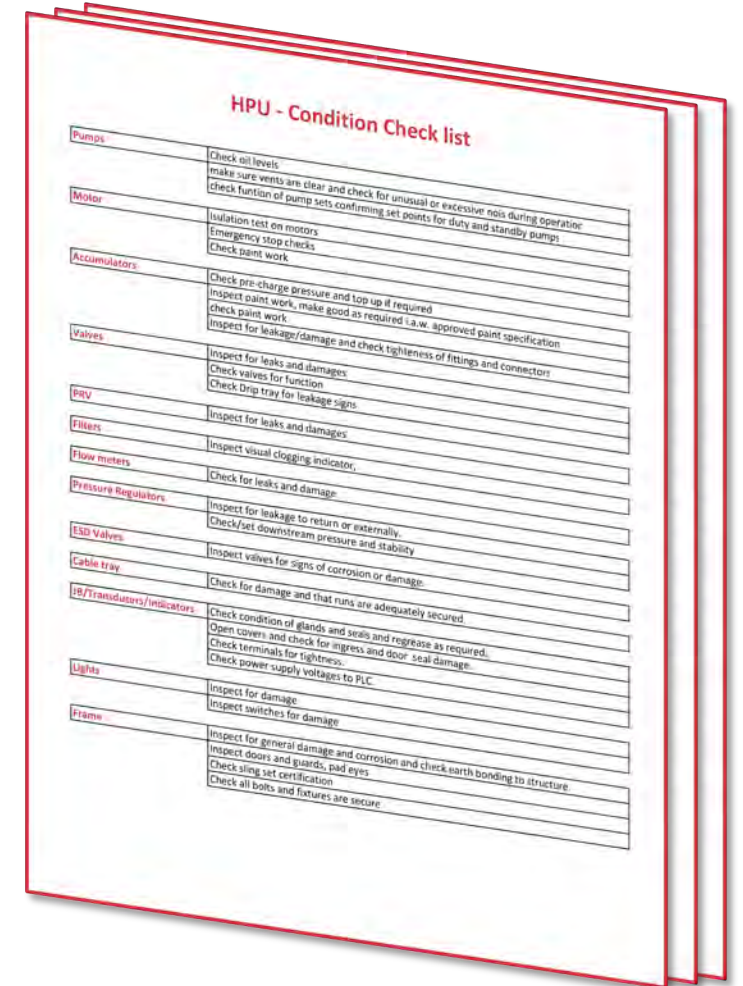
Our mission is to provide **cost effective solutions** for legacy equipment, product obsolescence, spares sourcing and system reliability.



We have the **knowledge & resources** required to meet the challenges of subsea field maintenance and upgrade projects.

Subsea | Aftermarket Services | Maintenance Plans – Subsea HPU

HPU	L1	L2	L3
Operation Function checks	✓	✓	✓
Paint Repair on damage of external damage surface	✓	✓	✓
HP & LP pumps - maintenance	✓	✓	✓
Replacement all filters and pump suction strainers	✓	✓	✓
Check fluid cleanliness (Flushing Unit if necessary)	✓	✓	✓
Recheck the accumulator pre-charge to ensure the bladder integrity after purging lines	✓	✓	✓
Electrical safety checks (E.g. Earth Bonding/Earth Leakage checks etc.)	✓	✓	✓
Paint Repair on damage of external damage surface	✓	✓	✓
Refurbishment of Hydraulic/Pneumatic/Electrical Instrumentation		✓	✓
Change pipe work due to leakages/damages		✓	✓
Pump/motor replacement due to damages		✓	✓
Calibration (gauges, PRVs, Flow meters) and re-certification (sling set)		✓	✓
Charge accumulators in accordance with manufacturers procedure to project specific pressures.		✓	✓
Leak Test		✓	✓
Pump/motor replacement due to damages		✓	✓
Full disassembly			✓
Refurbishment mechanical components			✓
New hydraulic/pneumatic control system			✓
New Electrical system			✓
Full FAT			✓
Unit Modification			✓



Subsea | Aftermarket Services | Maintenance Plans – Umbilical Reelers

UMBILICAL REELER	L1	L2	L3
Check fluid cleanliness (Flushing Unit if necessary)	✓	✓	✓
Replacement all filters	✓	✓	✓
Paint Repair on damage of external damage surface	✓	✓	✓
Lubricate all mechanical components	✓	✓	✓
Operation Function checks	✓	✓	✓
Refurbishment of Hydraulic/Pneumatic/Electrical Instrumentation		✓	✓
Calibration (gauges, PRVs) and re-certification (sling set)		✓	✓
Leak Test		✓	✓
Change pipe work due to leakages/damages		✓	✓
Motor replacment due to damages		✓	✓
Full disassembly			✓
Refurbishment mechanical components			✓
New hydraulic/pneumatic control system			✓
New Electrical system			✓
Full FAT			✓
Unit Modification			✓

Reeler - Condition Check list

Pumps	Check oil levels make sure vents are clear and check for unusual or excessive noise during operation check function of pump sets confirming set points for duty and standby pumps.
Motor	Isolation test on motors Emergency stop checks Check paint work
Accumulators	Check pre-charge pressure and top up if required inspect paint work, make good as required i.e. approved paint specification check paint work
Valves	Inspect for leakage/damage and check tightness of fittings and connectors Check valves for function Check Drip tray for leakage signs
PRV	Inspect for leaks and damages
Filters	Check valves for function Check Drip tray for leakage signs
Flow meters	Inspect visual clogging indicator
Pressure Regulators	Check for leaks and damage
ESD Valves	Inspect for leakage to return or externally. Check/set downstream pressure and stability
Cable tray	Inspect valves for signs of corrosion or damage
IB/Transducers/Indicators	Check for damage and that runs are adequately secured Check condition of glands and seals and regrease as required. Open covers and check for ingress and door seal damage. Check terminals for tightness. Check power supply voltages to PLC.
Lights	Inspect for damage Inspect switches for damage
Frame	Inspect for general damage and corrosion and check earth bonding to structure. Inspect doors and guards, pad eyes Check sling set certification Check all bolts and fixtures are secure

Subsea | Aftermarket Services | TIS Hydraulics

We are supported by our sister company – **TIS Hydraulics** – a specialist supplier of hydraulic components and fluid power equipment to the oil & gas, marine, renewable and defence industries.

This partnership greatly increases our product sourcing capabilities and reduces lead time on many items with approximately £1m of stock located on site.

- ▶ Instrumentation Fittings (LP / MP / HP)
- ▶ Weld Fittings
- ▶ Instrumentation Valves (LP / MP / HP)
- ▶ Pneumatic Components
- ▶ HP Pressure Regulators
- ▶ Subsea & Topside Pressure Gauges
- ▶ Hose Assemblies (4:1 Safety Factor)
- ▶ Ancillary Hydraulic Components



Subsea | Aftermarket Services | Rental Fleet

We offer a comprehensive **Rental Fleet** of equipment commonly required for survey and refurbishment works.

Our service partnerships in Nigeria, Baku and Oman provide staging areas for rental fleet equipment to be held prior to work scope commencement.

- ▶ Umbilical Spooling Unit
- ▶ Pressure Test Pumps (10k, 15k, 20k)
- ▶ Gas Booster Pumps
- ▶ Flushing Units
- ▶ Particle Fluid Samplers
- ▶ DCV Test Unit



Subsea | Aftermarket Services | Orbital & Autogenous Welding

TIS Orbital & Autogenous Welding Services

use a comprehensive library of qualified welding procedures for a variety of materials and sizes.

- ▶ Coded Welding Certification
- ▶ Inspection, Repair, Maintenance & Installation utilities pipework
- ▶ Materials: Stainless Steel, Inconel 625, Nitronic 50/60, Alloy 6Mo, Duplex and Super Duplex
- ▶ Competent Welding Operators and Inspectors
- ▶ Quality Specification: ASME IX, Norsok 601, ISO 15614-1
- ▶ Comprehensive Experience & In-house Technical Authority
- ▶ Socket Welds



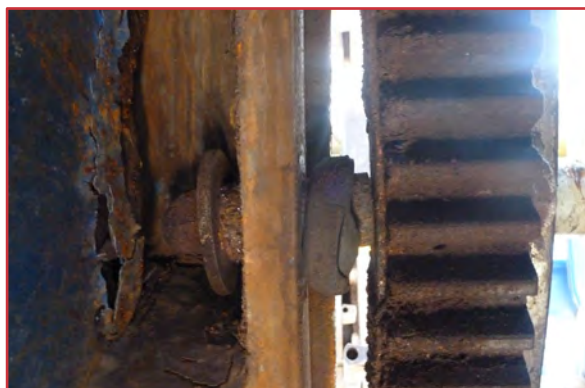
Subsea | Aftermarket Services | Case Study

Major Survey for Topside Package - Nigeria

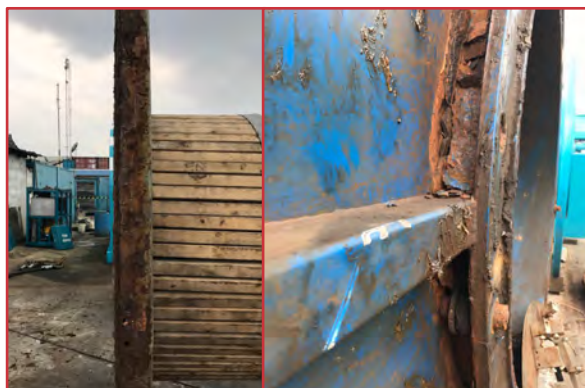
TIS Manufacturing supplied a comprehensive survey report and subsequent level 3 maintenance programme for an OEM topside package.

Equipment was comprised of 2x Reelers, 1x Subsea HPU, 1x Test HPU, 1x Chemical Injection Skid, and 3x Sheaves.

All spares were sourced by TIS (including a complete replacement drum for 1x reeler), prior to delivery to the client's base in Port Harcourt, Nigeria, where work was completed by TIS Technicians.



water ingress



severe structural damage



replacement drum

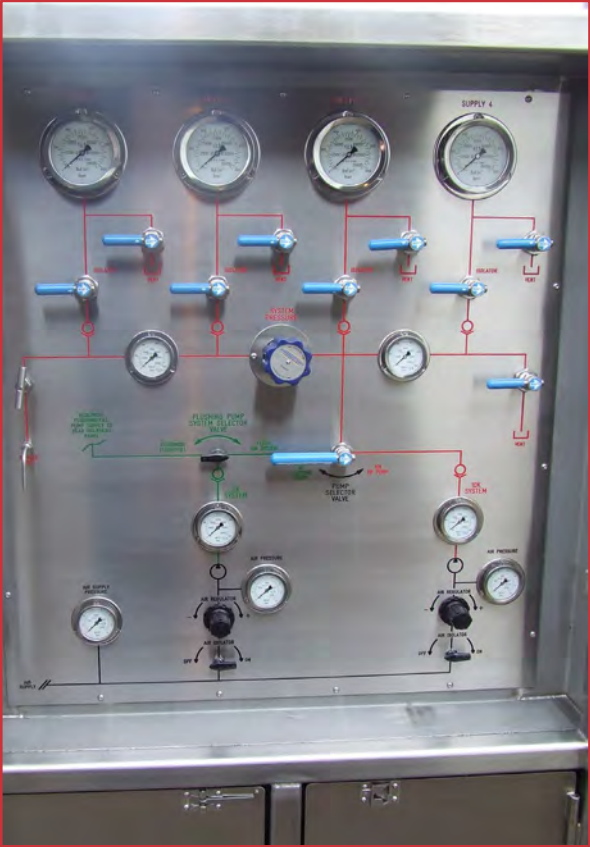
Subsea | Aftermarket Services | Case Study (continued)



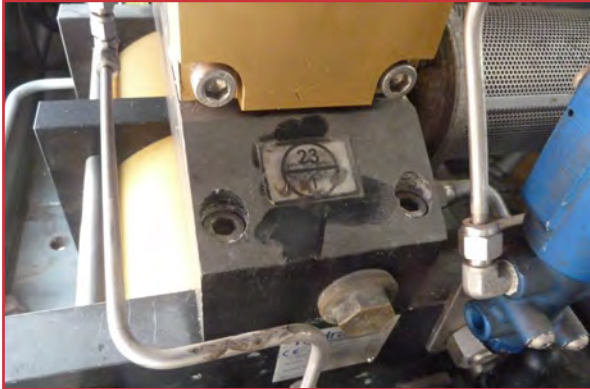
damaged hydraulic components



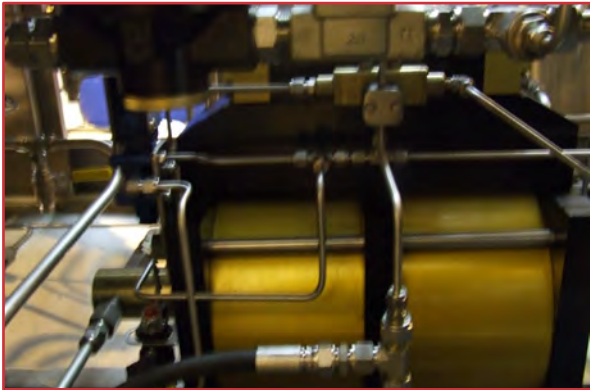
missing hydraulic components



replaced new, recalibrated & cleaned



heavily used pumps systems



redressed or replaced new



damaged/missing
mechanical components
replaced new

Subsea | Aftermarket Services | Case Study

Retrospective modification/support production HPU

TIS Manufacturing delivered topside production package – 1x Production HPU, 3x TUTUs, and 3x HDPs – which has required retrospective modification and engineering support due to changes in end client operation parameters.

Post delivery, the equipment sat idle for some time on a worksite in Singapore awaiting the completion of an FPSO, requiring a maintenance survey to be completed prior to kick-off.

Some system upgrades were also included in the refurbishment workscope as per client request.



Hydraulic Distribution Panels (HDPs)



Topside Umbilical Termination Units (TUTUs)



Production HPU

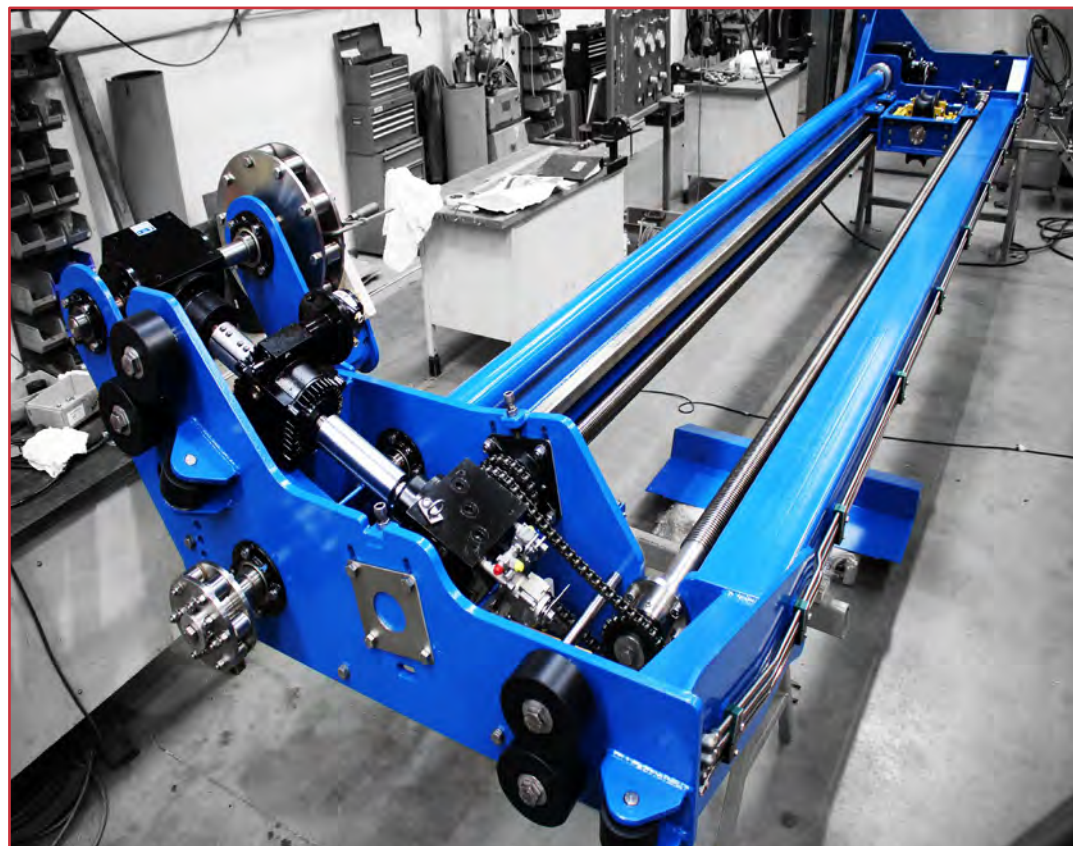
Subsea | Aftermarket Services | Case Study

Retrofit of Spooling Head Assembly to 3rd Party Reeler

TIS Manufacturing supplied a spooling head assembly to upgrade a client's non-OEM umbilical reeler.

The spooling head runs on an endless diamond screw which is synchronised with the rotation of the reeler drum to provide an automatic even wrap of the umbilical onto the drum.

The assembly was designed and manufactured in Aberdeen after an initial on-site survey of the reeler unit, and then delivered to GOM for final fitting and commissioning.



spooling assembly in workshop



before installation



after installation

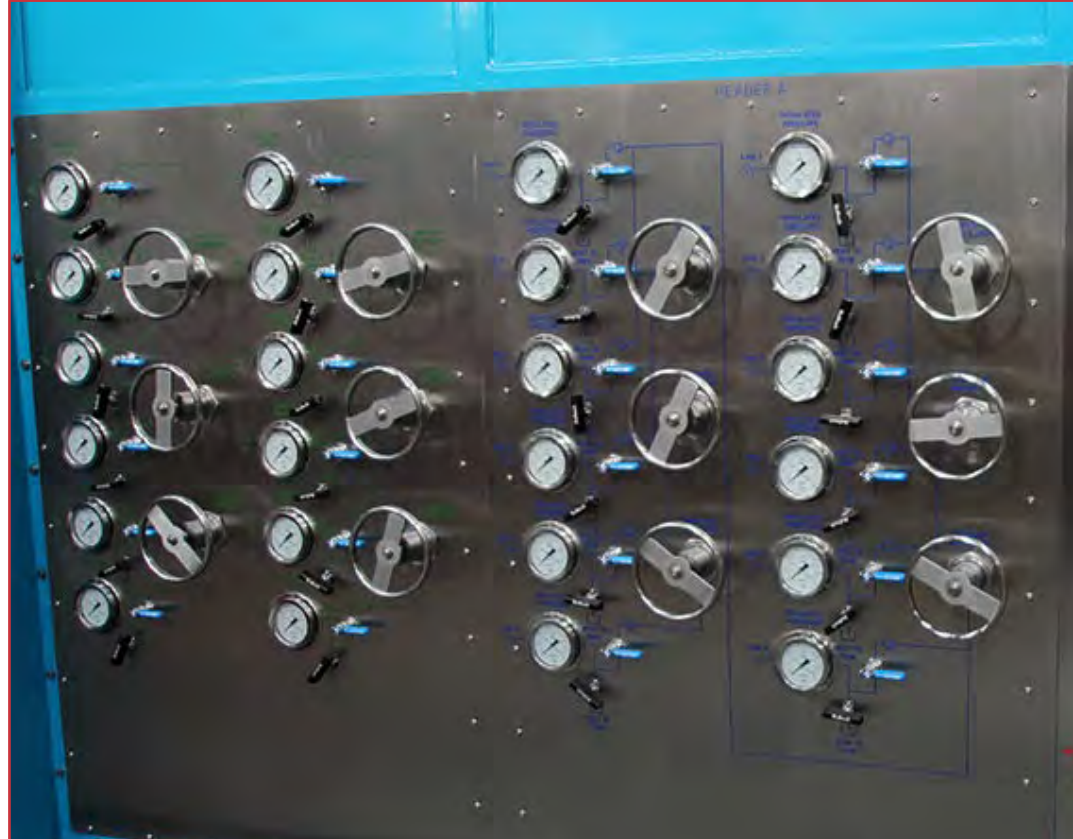
Subsea | Aftermarket Services | Case Study

Onsite Modification to 2x IWOCS HPUs

TIS Manufacturing supplied a retrospective modification to 2x IWOCS HPUs in Baku, where the requirement was to replace 20x ball valves with needle valves due to end-client preference.

Components were prepared and sourced in Aberdeen, with tubing lengths cut and one end coned & threaded, prior to a complete work pack being dispatch to location ahead of mobilisation of the TIS Technician.

The first HPU modifications were completed onshore while the second took place offshore, and all revised engineering drawings were submitted via client document transmittal process.



External panel w/ 20x ball valves for replacement



Internal fixtures/pipework

Subsea | Aftermarket Services | Case Study

Major Survey for Reeler

TIS Manufacturing performed a major survey on a 13 year old reeler to assess functional capability and structural damage.

Due to primary structural damage present, the framework was repaired and re-certified with notified body witnessing all load test and structural assessment.

All required components were sourced and fitted by TIS at our local facility, with lines flushed and function tested in compliance with industry standards.

The reeler was then painted and labelled in accordance with client specifications, prior final dispatch.



Subsea | Aftermarket Services | Case Study

5 Year Major Service for Reeler

TIS Manufacturing performed a 5 Year Major Service on a 16-year-old reeler to assess functional capability and structural damage. With an aim to have unit redeployed within 6 weeks.

Due to primary structural damage present, framework was repaired and re-certified with notified body witnessing all load test and structural assessment.

All required components were sourced and fitted by TIS at our local facility, with lines flushed and function tested in compliance with industry standards.

The reeler was painted and labelled in accordance with client specifications, prior final dispatch.



Unit upon arrival at our facility



Fully repaired/repainted following successful service

Subsea | Aftermarket Services | Case Study

5 Year Major Service for Triplex Pump

A major service carried out on a triplex pump. TIS' scope included;

- Function test and survey inspection report.
- ATEX electrical inspection.
- Calibration of flowmeter, PT and gauges.
- Weld repair frame damage.
- Shotblast, repaint frame.
- Air receiver & filter elements renewed.
- New Triplex Pump installed
- Complete strip, redress of existing pump.
- Pneumatic filter, isolator, lubricators replaced.
- Totaliser, Motor Control Panel, Barrier J/B replacements.



Unit upon arrival at our facility



Fully repaired/repainted following successful service

Subsea | Aftermarket Services | Case Study

Modification to Flowhead Control Unit

TIS carried out a replacement mimic panel for a client's purchased flowhead control panel.

Included in the scope, our team carried out an inspection of the unit and identified issues with the LP & HP lines unable to hold pressures, leaking valves, faulty gauges, damaged components and failing batteries.

Our workshop crew replaced all recommended components, installed new mimic panel, carried out FAT, repackaged and delivered to our client.



Removed Components



New Mimic Panel

Subsea | Aftermarket Services | Case Study

Reeler Upgrade & Service

TIS Manufacturing delivered engineering and manufacturing of a bolt-on spooling sub-assembly to modify an existing reeler for a project specific deployment arrangement.

The solution was produced within a 3 week period from initial survey to final delivery, as required by a tight client operational deadline.

While at the TIS facility awaiting parts for upgrade, the reeler was serviced as the time frame allowed, including replacement/repair of damaged safety switches, hose assemblies, air receivers, gauges, roller bearings, motor oil and gearbox oil.



original spooling head assembly



bolt-on spooling head sub-assembly

Subsea | Aftermarket Services | Case Study

Subsea Stab Modification

TIS Manufacturing delivered engineering and manufacturing on an umbilical reeler sent to us for inspection and service work. Our scope featured the modification of our clients' subsea stab plate at the end of the umbilical.

The newly modified stab plate would be a slimline version, fully engineered, manufactured and applied to the termination end of our client's umbilical by TIS at our facility in Dyce.

As well as fitting the new stab plate, our team carried out flushing & pressure testing of stab, purge/ filling and pressure testing the umbilical. Our team ensured all components were fully re-certified to ATEX.



Original Stab Plate



Fully Engineered, Modified Stab Plate

Subsea | Aftermarket Services | Case Study

Hydraulic Control Panel Modification

TIS Manufacturing modified a non-OEM hydraulic control panel to provide additional functionality within an existing frame.

The work scope included installation of three additional lines for control of Production Wing / Annulus Wing (5000psi), Production / Annulus SSV (7500psi), and a Soft Landing Valve (10000psi).

Component sourcing (Ball Valves, Needle Valves, Gauges, Tubing, Clamps, Plates & Labels) and work was completed within 4 weeks.



original panel



newly modified panel

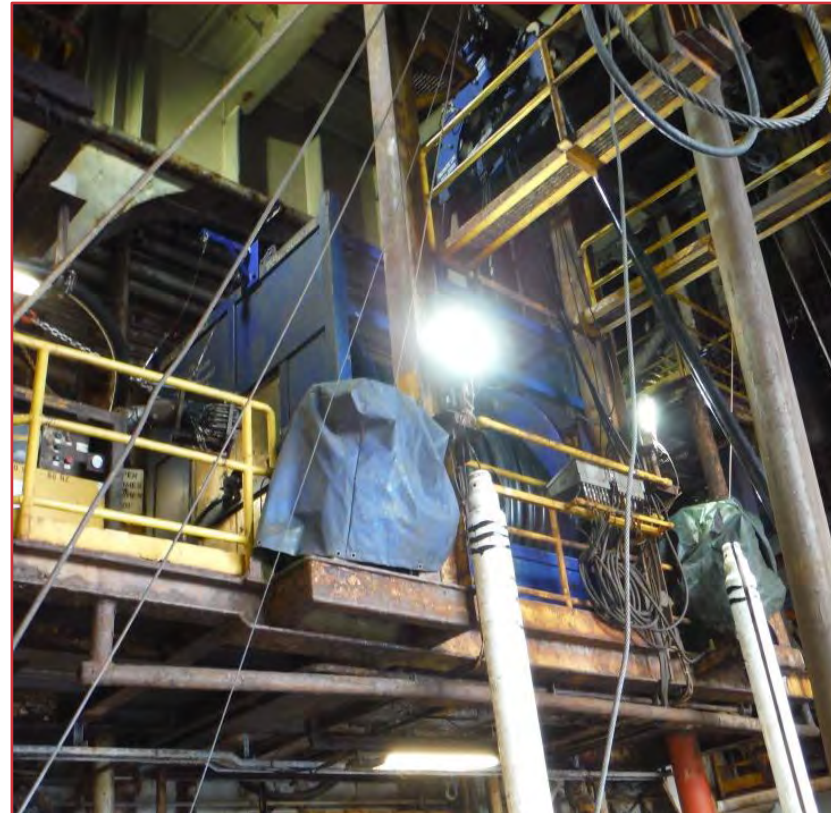
Subsea | Aftermarket Services | Case Study

Major Survey for 2x Reelers – Stena Spey, offshore Norway

TIS Manufacturing performed a major survey on a pair of reelers with works performed onsite on the Stena Spey Semi-Sub, offshore Norway.

Accessibility for completing service works was a challenge as both units have been permanent fixtures (although classed semi-permanent) since their delivery and commissioning by TIS in 2008.

The units have been through several maintenance schemes, included major services & spooling system upgrades, and continue to be supported at present.



reeler 1 onsite – Stena Spey Semi-Sub



reeler 2 onsite – Stena Spey Semi-Sub