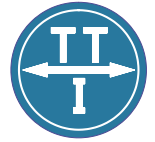


RISER PROTECTION NETS



Energy Absorbtion Systems

Technical Notes 04, January 2005



TTI Engineers are experienced in every aspect of riser protection net design, from analysis of wave and vessel impact and fatigue response to the design, specification, documentation (design brief, design report), procurement and installation of net components and complete net systems.

In 1990/91 TTI undertook the failure analysis of the previous unsuccessful system (not designed by TTI) used on Conoco's Hutton field. This study concluded that the polyester fibres ropes functioned as designed and still had a very high 98% residual strength after 6 years service. The mechanical terminations and tensioning system led to net tension being lost which caused fatigue induced failures in the system. This information was invaluable in that it led to the development of key design principles to be applied to future RPN systems. TTI also undertook a

full conceptual study leading to the design of an improved protection system, including novel tensioning and installation procedures with optimisation of material and rope construction.

Also in 1991 TTI secured the contract for design engineering of the Shell Auger field Riser Protection Net system.

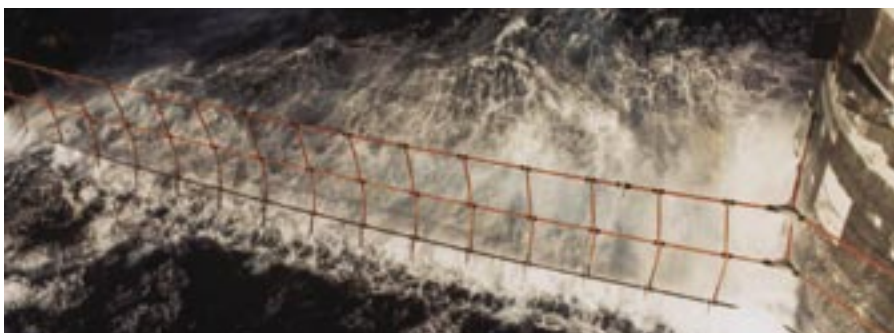


This was followed in 1992 by the ongoing contract from Norwegian Contractors on behalf of Conoco Norway to design a net system for the Heidrun TLP. These and other projects have led to the development of a suite

of in-house computer programs for the response analysis and fatigue life of riser protection net systems.

Design effort has ranged from component design to the design of complete systems suitable for both steel and concrete platforms (TLP's, semi-submersibles, jackets). A typical RPN will arrest a 7500 tonne deadweight supply vessel travelling at 2m/s that creates up to 22MJ energy. Synthetic polyester fibre ropes up to 650 tonnes breaking load and 130m long are used. This long length combined with a large net deflection reduces the forces imposed on the platform structure or deck.

The largest net ever produced was designed by TTI for Statoil's Asgard B semi-submersible platform. This RPN covered a span of around 80m, was 10m high and weighed around 10 tonnes.



The successful design and installation of each of these RPN's was the result of the unique combination of skills and expertise of the TTI project team. TTI's independent technical expertise in synthetic fibre ropes, their design and construction, performance, and the selection and design of terminations ensures the best available installed life coupled with lower through life costs. Bend shoes are used to lengthen the rope to minimise rope forces, thus

enabling location of tensioning and anchoring equipment at deck level. These also function to limit wave-induced motion of the net so as to prevent tension-bend fatigue of the ropes. The design of the bend shoes utilises polymeric shoes which prevents wear, yet provides low friction in the event of vessel impact at which time maximum energy absorption is required. TTI have developed an in-house computer model 'NET' to determine net

deflection, tensions, energy and wave drag forces for calculation of fatigue life. Extensive verification of this model has been carried out. TTI also has an in-house computer model 'FIBRE ROPE MODELLER' that determines the load/torque/ twist and fatigue response of synthetic fibre ropes.

Offshore Facility/ Operator	Installed	Material	Main Span Ropes MBL tonnes
Auger TLP (Shell)	1993	Polyester	360
Heidrun TLP (Conoco)	1995	Polyester	400
Asgard B FPS (Statoil)	2000	Polyester	600
Modec Prince Mini TLP	2001	HMPE	218
Modec Marco Polo Mini TLP	2002	HMPE	240
AIOC PDQ jacket Caspian Sea BPAmoco	2003/4 ongoing	High modulus Twaron	425

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