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1 Company

TWD is a dynamic engineering firm specialized in the design of temporary works, structures which facilitate the construction of permanent works. Our thorough knowledge of structural and mechanical engineering, finite element methods, and design for offshore conditions, enables us to develop creative solutions to meet the wide variety of client demands.

Projects range from the design of a piling template used to drive foundation piles for offshore wind turbines, a motion study for an offshore lifting operation, to a parbuckle tool for a salvage project. Flexibility, practicality, and creativity are the driving forces behind each of our designs and our enterprising work ethic.

We offer cost-efficient solutions for the heavy civil, offshore, and salvage industries, specializing in the custom design of:

- Pile handling tools
- Lifting tools
- Seafastening
- Cable handling equipment
- Support structures
- Vessel motion analyses

We are able to assist in each stage of a project’s execution, whether it be drafting, engineering, commissioning, or fabrication management. Our talented, international team of mechanical, civil, and maritime engineers is available for your requests.

For more information please visit our website: http://www.twd.nl

Piling template at Hay Point during driving of a test pile
2 Overview of offshore oil & gas services

Our designs reflect the demands of the Offshore Oil & Gas industry: quick, practical and cost-efficient. We have delivered designs and calculations for reputable contractors, like Total E&P, BAM International, Fugro Survey, Royal Boskalis NV, and Jumbo Offshore. In addition to our typical deliverables, TWD also designs a variety of other equipment, including:

- Offshore floating drilling equipment
- Vessel deck equipment

In the following paragraphs, the abovementioned Offshore Oil & Gas projects are described in more detail. References can be provided upon request.
2.1 **Moonpool guide structure**

TWD designed a practical solution for the safe handling of a ‘SmartPipe’ measurement tool through the moonpool of Fugro’s vessel Synergy. The existing insert frame onboard was not compatible with the SmartPipe. TWD therefore designed a catcher and guide frame which possessed a unique bent shape, ensuring easy entry, and was equipped with a knuckle, which automatically rotated the SmartPipe into the correct position for lifting it through the moonpool.

![Smartpipe lying next to the vessel Fugro](image)

2.2 **Chain Hang Off Platform**

Enquest PLC developed a new Tension Leg Platform (TLP) and Floating Production Storage Offloading unit (FPSO) on the Alma and Galia fields in the North Sea. TWD designed the seafastening of the anchor piles for the TLP on the Jumbo HLV Fairplayer. Piles ranging from 32-40 meters in length were seafastened on hatches covering the main hold. For the FPSO, a 900mT mast crane was used to apply tension to the chains used for mooring. The Chain Hang Off Platform, also designed by TWD, was used to hold the mooring chain between two tensioning sequences of the crane.

![Chain Hang Off Platform](image)
2.3 **Hang off module lifting frame**

TWD assisted in the engineering and design of several temporary works for the installation of a jacket, topside module, and Hang-Off Module (HOM) at the Conwy Field. One of these designs included a spreader frame to lift the 285mT HOM onto a barge and from the barge onto the platform. The HOM was then transported to the Irish Sea on six TWD-designed seafastening grillages.

![Testing of the hang off module lifting frame](image)

2.4 **Refurbishment of SAL system**

TWD designed the refurbishment of a Single Anchor Loading (SAL) system for Boskalis. This SAL system is used to transfer crude oil from the South Arne Platform to shuttle tankers. The main piece of equipment is the hose hang-off platform, which assists in the recovery and installation of the loading hoses. TWD also designed joints to connect the lower and upper loading hoses in order to facilitate the subsea recovery and installation process.

![The SAL system](image)
2.5 Retrofit clamp

TWD delivered the design for a retrofit clamp, which was being used for the replacement of one of the conductor pipes of the Total L4A platform. The new pipe was to be installed by divers at mudlevel. The clamp redirected the reaction forces of the conductor pipe due to environmental loads and initial displacement into the L4A structure, and was easily adjustable for conductor pipe deviations. The design included operation sequence and cathodic protection with anodes.

*Retrofit clamp in construction hall*
3 Organisation

3.1 Design team
The project engineer (PE) in the TWD project organisation plays the central role and is the primary point of contact for the client. The PE focuses on one single project and guides the complete process from kick-off to detailed design. In this role, the PE translates client wishes into practical, safe, and economical designs. The PE is responsible for budget and planning and supervises the design team of engineers and draftsmen.

The lead engineer (LE) supervises the project team and plays an active role in the design process. The LE oversees the design process, suggests concepts, and performs quality checks on every deliverable. (see chapter Quality system).

The senior draftsman (SD) is responsible for timely delivery of drawings, revision status, work distribution and planning of the draftsmen. The SD is in charge of the master model and analyzes the sub-assemblies provided by the draftsmen regarding overall function, clashes, and consistency.

3.2 Project documentation
The design team members work in close cooperation and constant communication with each other. For cases in which the basis of design report (BoD) is not sufficient or specific enough, a so called ‘mini-BoD’ will be created stating all requirements, functions, loads, and points of attention for a sub-design.

Decisions made throughout the design process are tracked by the design decision sheet, a to-the-point BoD, easy to update and maintain.

All deliverables (drawings, calculations, and reports) are listed in a document list, including revision and status, and will run through the quality system (see chapter Quality system).

The project planning is made in Microsoft Project, depicting an overview of deadlines, relations between processes, and capacity planning.
Project hours are electronically registered and can be split per project part. The weekly hour sheet will give a detailed overview of the hours spent per topic, providing a clear detailed overview of the budget status. The project parts to be monitored can be agreed upon.

4 Quality system

TWD is dedicated to achieve client satisfaction by delivering high quality designs that are practical, safe, and economical. We do this by using a quality management system that provides a framework for our complete design and engineering process.

4.1 Document control and quality checks

Most of TWD’s clients are involved in projects where delay and/or failure is very expensive. Consequently, TWD has developed and implemented thorough quality control systems for calculations, reports, and drawings. Clear file and revision names are used and registered in document lists to avoid errors. Check sheets are used to register the checks performed for every revision of a document. An example flow diagram of the report quality check process used by TWD is shown on page 9.

4.2 Quality accreditation

TWD’s designs are routinely reviewed, approved and certified by certifiers including DNV-GL, London Offshore Consultants (LOC), Lloyds Register, Bureau Veritas and ABS.

TWD quality check process diagram
Quality check process (drawing + MTO)

Deliverable

- Drawing
- MTO

Quality Check

1. Intermediate check (IC)
   - By SD

2. Final Check (FC)
   - By PE

3. Approval (AP)
   - By LE or TM
   - LE/TM signs on drawing

Administration

Registration

- Deliverable in project binder (PE)
- Update document list (PE)

Client

Also send to involved LE, engineer and draftsman

TWD quality check process diagram

LD: Lead Engineer
PE: Project Engineer
E: Engineer
SD: Senior Drafstman
St: Drafstman
TM: Technical Manager
5 Overview services

The overview below shows the different services that are offered by TWD. Allowing TWD to manage the entire design process, from support disciplines to fabrication services, will result in short communication lines, a solid project overview, and savings in time and costs.
6 Software

TWD has developed several calculation tools for reliable and efficient calculation of pad- and lashing eyes, kicker plates, current and wave loading, loading capacity of deck constructions, and forces acting on cargo due to vessel motion. Furthermore, the following several widely recognized software packages are used:

- **Amarcon Octopus**
  Accurately determining vessel motions based on strip theory. By calculating vessel and cargo motions, the resulting seafastening loads can be accurately determined.

- **Autodesk AutoCAD**
  Industry standard 2D- and 3D drafting software

- **Autodesk Inventor**
  Intelligent digital prototyping software developed for mechanical engineering design

- **Delftship**
  Software which allows for fast and accurate hull modelling and hydrostatic analysis

- **Dlubal Rfem**
  Finite element method structural analysis software with 1D, 2D, and 3D analysis capabilities

- **Global Maritime GMOOR**
  Analyses the performance of mooring systems by simulating the station keeping behavior and line tensions for catenary moored vessels

- **Mathworks MatLab**
  Mathematics / programming software with numerous tools for analysis of complex problems and processing of large amounts of data

- **Nemetschek SCIA Engineer**
  Finite element method structural analysis software for 1D and 2D elements. Capabilities include buckling and non-linear calculations. The extensive profile library ensures rapid calculation

- **OrcaFlex**
  Marine multibody dynamics program for static and dynamic analysis of a wide range of offshore systems, including all types of marine risers (rigid and flexible), moorings, offshore installations and towed systems

*Example of 2D FEM analysis of barge construction (left) and of detailed motion analysis (right)*
7 Example of installation sequence retrofit clamp