



Well Examination Handbook

A Guide to the Well Examination Process for
Well Design and Operational Teams

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1. Introduction and Purpose

This booklet provides information about the independent well examination process and is aimed at Well Operators' personnel involved in well operations.

The booklet aims to answer the following questions that operational teams may have prior to undertaking a campaign where well examination is a regulatory requirement or is viewed as best practice by the operational team's line management.

- What is Well Examination?
- Who carries it out?
- What is required from engineering teams?
- What will the examiner provide?

It includes the performance standards to be achieved both by well operations engineers and by the well examiner, allowing the well examination process to be effectively managed and audited to ensure that the system is working effectively and in accordance with the well examination contract.

Please note, this booklet is not a Well Examination Scheme.

2. What is Well Examination?

Well examination is an independent assurance or verification process that is put in place by a Well Operator to provide assurance that the pressure boundary of the well is controlled throughout its life and the pressure-containment equipment that forms part of the well is suitable for this purpose.

Independent assurance is a normal activity for companies wishing to ensure the quality of their processes. In the case of well examination, the assurance is on behalf of Well Operator's senior management so that they can be confident that high hazard (as opposed to high risk) well operations will be planned and carried out in accordance with the company's standards and with Good Oilfield Practice. Adherence to Good Oilfield Practice, including the Operator's own well design and operations standards and industry standards, contributes to reducing the risks to personnel arising from well operations to levels that are as low as reasonably practicable (ALARP).

In the United Kingdom there is a statutory requirement for independent well examination contained in The Offshore Installations (Offshore Safety Directive) (Safety Case etc) Regulations 2015 (for offshore wells) and The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996 (for onshore wells). These regulations are like others in the UK that require independent checks on high hazard activities (e.g. pressure vessels examinations, lifting appliance examinations, offshore installation safety critical equipment verification checks, etc.).

Following the issue of the EU Directive (2013/30/EU) on safety of offshore oil and gas operations in 2013, all EU member states were required to ensure that operators and owners establish schemes for independent verification which includes verification of wells. Therefore, well examination (verification) requirements now apply throughout Europe (for offshore wells).

Well examination is NOT a substitute for normal line management control and approvals. In fact, it relies on the examination of approved, formal documentation such as programmes, well basis of design documents, etc.

Well operations personnel are always encouraged to consult the well examiner during the well design and operations planning process to assist with the examination of the well design, the well programme as well as the examination of operations as they progress.

3. The Well Examiner

NRG Well Examination (NRG) is an independent company specialising in well examination and well engineering safety.

NRG carries out well examination for many oil companies both in the UK and overseas in accordance with their well examination arrangements. NRG has been audited by many of its UK clients as well as the UK Health and Safety Executive and each client has assessed NRG's examiners' competence.

NRG employs a team of competent examiners and normally one or more are assigned to a Well Operator depending on the contract. The examiner then works in accordance with the well examination scheme.

Each well examination scheme contains specific well examination contact details for the Well Operator. General contact details for NRG are summarised below.

Address:

NRG Well Examination Limited

1 St Devenick's Place

Cults, Aberdeen

AB15 9LN

Contact:	Zoë Fuller
Well Examination Telephone:	+44 (0)1224 865845
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The communication arrangements for well examination are contained in the individual well examination scheme.

4. Reporting Relationships

The well examiner is, by definition, independent of the line management responsible for the safety of well design and operations. However, there needs to be a method to resolve any issues or reservations, should they occur during the examination process. In addition, NRG is accountable to the client for their performance and a reporting relationship that allows clients to assess the company (by review/audit) as necessary.

Each well examination scheme contains details of the reporting relationships for the Well Operator. During the well examination process (for well construction) the normal communications channel is with the well operations engineers responsible for the design process. The project team leader is normally the focal point.

Should the examiner have any issues that cannot be resolved to his satisfaction then he is able to take these to the client's drilling (or production) management. Should any concerns remain, then he can raise these with the company's senior management, if necessary, referring to the client's safety or quality assurance functional management (as required by the scheme). A written audit trail will always be prepared as a record of all issues.

In addition, where applicable, the examiner can discuss issues with the Well Operator's functional management who are responsible for the company's management standards that apply to well designs and operations.

5. What Documentation is Examined?

Well examiners require two main categories of documentation to carry out examination (see Sections 5.1 and 5.2). The first is the Well Operator's management standards applicable to well design and operations and the second is the well-specific documentation. These both contribute to the reduction of risks to personnel arising from well designs and operations to a level that is "As Low As Reasonably Practicable" (ALARP). This is a legal requirement in the UK.

5.1. Standards for Well Design and Operations

The following is a typical generic well engineering and operations contents list of management standards that are typically prepared by most well operators to be used by engineers for designing and operating wells:

- Casing Design and Kick Tolerance
- Casing and Cementing Operations
- Barrier Policy and Standards
- Well Control including BOP Equipment
- Drill String Design
- Directional Design and Surveying
- H2S Operations
- Completion Design
- Drilling operations
- Well Testing Operations
- Well Servicing Operations
- Production Well Operations
- Well Examination Scheme

The well examiner will have access to these documents. Any dispensations from these standards that may be required by the Well Operator for a well should be referred to in the individual well programme or design documentation. The examiner should be made aware of any dispensation and may raise issues, but he is not responsible for the dispensation management process.

In addition, the examiner will use industry well-related standards that reflect good practice such as Oil and Gas UK Guidance, Institute of Energy Codes and international standards such as API and ISO Codes of Practice.

5.2. Well-Specific Documentation

The list of documents below is typical of those examined at the well design and programming phase. Daily operations reports are normally used by the examiner to verify that the operations have been completed in accordance with the well programme. This is the examination of “work in progress” which is also a requirement of the UK regulations.

For Drilling Operations:

- Well proposal (from the exploration team)
- Well basis of design documentation
- Drilling programme
- Casing design/kick tolerance documentation
- Testing programme/basis of design documentation
- Suspension or abandonment programme
- Government notification (if required)

For Completion Operations:

- Completion basis of design documentation
- Tubing stress analysis report
- Completion programme

For Well Intervention and Workover Operations:

- Well status description and diagrams
- Intervention/workover programme
- Re-completion design and programme

(Note: routine wireline operations on fixed platforms may not be subject to individual well examination where generic well services procedures for the installation have previously been examined).

For Production Well Operations:

- See Section 8: Production Well Examination

Authorised well programmes are sent to the rig and should contain enough information to ensure that all relevant operational risks arising from foreseeable hazards have been assessed and that sufficient measures are in place to reduce these to as low as reasonably practicable. For example: Tubing burst and collapse hazards have been considered and calculations made to ensure that the risks are reduced by selecting/running the correct tubulars. Such measures are usually self-evident but for more unusual operations a specific risk assessment may need to be included, e.g. the controls measures arising from a well test hazard/risk assessment.

5.3. Well Equipment Examination

See Section 7: Examination of Well Equipment

6. Document Submissions and Timings

The Well Operator's Well Examination Scheme contains the detailed well examination processes. This section explains what is normally required of the relevant well operations staff and of the well examiner so that the process works effectively.

6.1. Design and Programming Documentation

The relevant well operations programmes and design documentation (see Section 5) should be submitted to the examiner as early as possible. Draft documents are sometimes presented, since these allow comments to be made and, in any case, the final operations programme is often only authorised close to the date of operations commencing. The completion of programming well in advance of operations commencing is important for the effective control of operations, although it is recognised that offshore teams are normally involved in the review of this draft documentation in any case.

The minimum time required for the examination process varies with the type of programme/documentation under assessment. The following minimum timings are suggested:

- **Draft Programme:**
 - at least 2 weeks before operations are due to commence
- **Final Operations Programme:**
 - Distribute along with other recipients

Design documentation, especially for field development wells or more complex wells (e.g. HPHT wells), would be expected well in advance of the above timings.

Although the examination process is based primarily on written documentation submitted to the examiner, he/she is always available for consultation. Personnel are encouraged to contact the examiner to discuss any issue concerning well examination. However, examination is not a substitute for the normal line management process, including programme sign off.

The final programme submitted to the examiner should include all the relevant management authorisation signatures or a separate sign-off sheet.

Examiners will not normally repeat detailed engineering calculations (except for audit purposes or if the examiner specifically wished to check a calculation) contained in casing or completion design documents. Rather they will look for evidence that the calculations have been made, that they meet, or exceed, the relevant safety factors and that they have been signed off/accepted by line management. If requested by the Well Operator, detailed drilling and completions engineering calculations can be carried out by NRG engineers, although this is part of assisting with the line management process.

The examiner can visit the well operations management offices, if requested, to attend meetings (e.g. “Drill Well on Paper” or HAZOP meetings). This is not a mandatory part of well examination and if attending such meetings, the well examiner must ensure that he remains independent of the design of the well.

The programme documentation will be acknowledged by the examiner who will then complete the design examination documentation in accordance with the scheme. Schemes vary in the type of documentation that examiners must complete. However, in all cases issues will be documented. Any changes to the programme or design documentation or any dispensation from an operator’s well standards should also be notified to the examiner in writing.

6.2. Statutory Well Examination Reports (Wells in UK and Europe)

The well examination schemes will reflect that a report by the well examiner is also required to be submitted to the Regulator along with the Well Notification. The format and timings of these reports will be described in each scheme.

6.3. Well Operations Documentation

During well operations, daily operations reports are normally copied to the well examiner who examines the work in progress against the final well programme and completes the required documentation contained in the scheme. Any programme changes during this phase or any dispensation from an operator’s well standards should also be notified to the examiner and he will note the acceptance of the changes and any dispensations in the well construction examination documentation.

7. Examination of Well Equipment

Well examination encompasses the complete pressure boundary of the well, including pressure-containing equipment such as casing, wellheads, drilling BOPs, christmas trees, to the top of a wireline stuffing box and coiled tubing BOPs. Well test equipment such as landing strings and surface test trees, is also covered (the well envelope is defined in the UK regulations).

Most equipment used down hole is dealt with, in design terms, in the drilling/completion design documentation (e.g. wellhead design and rating or the BOP design and rating). The well examiner will normally examine the suitability of such equipment during the design documentation/programme examination.

The examiner does not examine the condition or maintenance of such equipment (see Section 7.1).

The well operations project team has to accept all well equipment, including third party temporary well equipment, as being “suitable”, on behalf of the Well Operator. This acceptance is in respect of the Well Operator’s responsibility to ensure that all parts of a well are suitable (a requirement of the UK and most other regulations). The acceptance procedure should be documented as part of the Well Operator’s management system.

Safety critical well equipment should be manufactured in accordance with an accepted industry standard (e.g. API 14B for the design and installation of subsurface safety valve systems). Normally such equipment is supplied by the vendor with documentary evidence of equipment performance standards and a certificate of conformity with the design standard.

The examiner is not normally responsible for the review and acceptance of well equipment suitability (condition) or assessment of vendor/contractors’ verification documentation.

The well examiner may request evidence that safety critical well equipment will be or has been accepted by the well engineering team in accordance with a management system. This may include both the equipment and acceptance documentation.

7.1. Relationship with Installation (Rig or Platform) Independent Verification

In the UK and Europe, the Safety Case Regulations (and their European States' equivalents) require the offshore installation owner/operator to prepare a listing and define the performance standards of any plant and equipment that is defined as "Safety and Environmentally Critical". This equipment has to be verified (i.e. examined/tested etc.) by an independent competent person in accordance with the written verification scheme. Examples of such safety critical equipment, which is also defined as being part of a well, would be a BOP stack, well test equipment, wireline lubricator, etc. An example of such an independent competent person (organisation) in this respect would be DNV.

If an item of rig/platform well equipment has been verified, the well examiner can take this into account and not duplicate the work. The examiner may require evidence from the well engineering team that the safety critical well equipment has been or will be verified as part of the Installation Verification arrangements.

8. Production Well Examination

Following completion, responsibility for well integrity management is normally handed over to the Well Operator's production line management, or perhaps the Well Operator will change (e.g. an FPSO operator may become the Well Operator for a subsea field). Well examination continues throughout all the well's life cycle phases in accordance with the well examination scheme.

Operational (Production) Well integrity should be managed in accordance with the Operator's production well operations management performance standards (See Section 5.1). The well examiner will normally examine the following documentary evidence of well monitoring maintenance and testing:

- Production well annulus integrity reports
- Tree and wellhead test reports
- Tree and wellhead maintenance reports
- DHSV test results
- Corrosion monitoring reports
- Conductor condition reports

The precise documentation requirements will be contained in the Operator's Examination Scheme. In addition, any failures of the production well pressure envelope that exceed the operational performance standards (e.g. casing or tubing failure) should be reported to the well examiner for assessment along with the risk assessments and the proposed remedial measures. The examiner will issue a written examination report on the failure and the proposed remedial measures.

Again, as described in Section 7, the offshore installation operator must prepare a listing of and the defined performance standards of any plant and equipment that is defined as "Safety and Environmentally Critical" to the installation. This equipment must be verified (i.e. examined/tested etc.) by an independent competent person in accordance with the written installation verification scheme. An example of such safety critical equipment, which is also defined as being part of a well, would be a christmas tree.

If an item of well equipment has been verified, the well examiner can take this into account and not duplicate the work.

9. Well Examination Records

The Well Examination Scheme contains the detailed well examination processes, including any report forms which are to be used by the examiner. These documents are normally updated operations progress as well.

All well examination documentation must be maintained by the Well Operator, however, if agreed with the client, a backup set can be maintained by NRG.

In the UK, the Offshore Installations and Wells (Design and Construction etc.) Regulations require the Well Operator to keep all well examination records until at least 6 months after the well is finally abandoned. The Well Operator must declare the address at which these records are kept.

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