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Guidance on Practice for Welding of Pipelines

GP 43-33

BP GROUP
ENGINEERING TECHNICAL PRACTICES

Foreword

This is the first issue of Engineering Technical Practice (ETP) BP GP 43-33. This Guidance on Practice (GP) is not derived from any heritage documents.

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Introduction

This GP for welding of pipelines is an overview document that provides guidance to BP management on a number of important issues which shall be addressed before and during pipeline construction and as appropriate in subsequent operations.

This GP points the way to other standards that are frequently used to specify requirements for welding pipelines and which provide a greater level of detail on individual issues. Standards and codes relating to pipeline welding, construction, and NDT are frequently referenced or linked to specific design codes. This GP also references other BP ETPs that amplify or extend requirements of relevant codes and standards.

There are currently three ETPs for welding of C-Mn steel pipelines that supplement the following standards:

- a. API Std 1104, Welding of pipelines and related facilities, i.e., GIS 43-331.
- b. ISO 13847, Petroleum and natural gas industries - Pipeline transportation systems - Welding of pipelines, i.e., GIS 43-332.
- c. BS 4515-1, Specification for welding of steel pipelines on land and offshore Part 1: Carbon and carbon-manganese steel pipelines, i.e., GIS 43-333.

If the project has the option of specifying a base welding code for C-Mn steel pipelines, it is BP's philosophy that ISO 13847 should take precedence.

Additionally, GIS 43-334 provides guidance on BP requirements for welding of CRA and CRA internally clad/lined C-Mn line pipe.

BP's philosophy regarding welding is that mechanised or automatic welding methods shall be used if practical. Welding procedures and materials shall have been rigorously qualified to produce welds that are fully capable of meeting all aspects of the design premise of the pipeline.

Construction, welding, and NDT shall be performed by competent Contractors using a trained and qualified workforce using reliable, modern, and well maintained equipment. All work shall be fully compliant with safe and environmentally sound working practices and shall comply with BP's HSSE policy.

Every pipeline weld shall be subject to full examination and NDT using reliable and proven techniques and shall meet design acceptance criteria in all respects before the pipeline is put into service.



1. Scope

- a. This GP provides guidance for application of welding and associated operations for design and construction of both onshore and offshore pipelines.
- b. Unless indicated otherwise, responsibilities and requirements defined in this GP apply to both BP and its Contractors.
- c. This GP assumes that BP retains overall management responsibility for project execution and operations.
- d. Responsibilities and requirements assigned by this GP are independent of contract strategy selected for project execution.

2. Normative references

The following normative documents contain requirements that, through reference in this text, constitute requirements of this technical practice. For dated references, subsequent amendments to, or revisions of, any of these publications do not apply. However, parties to agreements based on this technical practice are encouraged to investigate the possibility of applying the most recent editions of the normative documents indicated below. For undated references, the latest edition of the normative document referred to applies.

BP

GIS 43-331	Guidance on Industry Standard for API 1104 Pipeline Welding.
GIS 43-332	Guidance on Industry Standard for ISO 13847 Pipeline Welding.
GIS 43-333	Guidance on Industry Standard for BS 4515-1 Pipeline Welding.
GIS 43-334	Guidance on Industry Standard for Welding of CRA Internally Clad and Mechanically Lined Pipelines.
GP 43-34	Guidance on Practice for Automated Ultrasonic Testing (AUT) of Girth Welded Joints in Steel Pipelines during Their Construction.

International Organisation for Standardisation (ISO)

ISO 3834-1	Quality requirements for welding. Fusion welding of metallic materials, Part 1. Guidelines for selection and use.
ISO 3834-2	Quality requirements for welding. Fusion welding of metallic materials. Part 2. Comprehensive quality requirements.
ISO 3834-3	Quality requirements for welding. Fusion welding of metallic materials. Part 3. Standard quality requirements.
ISO 3834-4	Quality requirements for welding. Fusion welding of metallic materials. Part 4. Elementary quality requirements.
ISO 3834-5	Quality requirements for welding. Fusion welding of metallic materials. Part 5. Documents with which it is necessary to conform to claim conformity to the quality requirements of ISO 3834-2, ISO 3834-3, ISO 3834-4.
ISO 3834-6	Quality requirements for welding. Fusion welding of metallic materials. Part 6. Guidance on implementing ISO 3834.

3. Terms and definitions

For the purposes of this GP, the following terms and definitions apply:



Quality Assurance (QA)

Those planned and systematic actions necessary to ensure quality and technical compliance as part of the Quality Management System (QMS). (i.e., to provide adequate confidence that a product will be fit for its intended service, having required technical integrity).

Quality Plan (QP)

Document prepared by Contractor, subcontractor, or supplier, setting out specific quality (technical integrity) practices, resources, and sequence of activities relevant to a particular pipeline welding contract.

Specification

Contractual document defining requirements for welding procedure specification (WPS) and their qualification, testing, and inspection.

4. Symbols and abbreviations

For the purpose of this GP, the following symbols and abbreviations apply:

AUT	Automatic ultrasonic testing.
CV	Curriculum vitae.
GMAW	Gas-metal arc welding.
NDT	Non destructive testing.
QA	Quality assurance.
QMS	Quality Management System.
QP	Quality plan.
SPA	Single point of accountability.
WPS	Welding procedure specification.

5. Statutory authorities and regulators

Mandatory technical and procedural requirements of relevant statutory authority shall be addressed and complied with by BP and its Contractors during design and each successive stage of project.

The construction of pipelines is generally subject to controls and rules of statutory authorities (regulators). Statutory requirements and the method of enforcement vary from country to country and are likely to include welding and inspection activities.

6. Emphasis of BP's role

Historically, BP has maintained and retained in depth expertise in the subject of welding and materials engineering.

The following guidance is described to emphasise the BP role and the added value that is provided by BP's specific involvement, regardless of Contractor responsibilities put in place for the project.



- a. BP shall ensure that welding and associated operations are undertaken in a competent manner, meeting specified quality requirements.
- b. BP shall verify that welding is performed in accordance with GIS 43-331, GIS 43-332, GIS 43-333 or GIS 43-334. Annex A provides important background information for project personnel to assist in ensuring compliance.
- c. BP shall use the services of engineering specialists, such as a BP welding engineer, at appropriate project stages.
- d. BP shall as a minimum be involved in welding inspection in a monitoring role.
- e. BP shall not rely solely on inspection organised by and reporting to Contractors and Subcontractors.
- f. BP shall consult engineering specialists as necessary.

At critical stages of the project, BP engineering specialists or independent consultants may be assigned for specified durations. The main use of welding and fabrication processes occurs during pipeline construction.

- g. The BP welding engineer shall be consulted at stages, such as design review, Contractor evaluation, tender evaluation, and preproduction meetings.
- h. The BP welding engineer shall review line pipe material specification and manufacturing procedures, provisional welding and NDT procedures, and results of welding procedure and NDT procedure qualification testing.
- i. The BP welding engineer shall also conduct technical audits of Contractor systems for welding and associated processes.
- j. BP shall appoint an appropriate number of welding inspectors to cover all work sites.
- k. Welding inspectors shall monitor all aspects of welding and fabrication on pipeline and prefabricated subassemblies and ensure Contractor compliance with agreed QMS.
- l. Duties of BP welding inspector shall also include:
 - 1. Witnessing of welding procedure qualification.
 - 2. Welder testing.
 - 3. Review of Contractor documentation packages, including as built drawings, material test certificates, and inspection reports, before handover to BP.
- m. The BP welding inspector role shall be additional to and separate from the Contractor inspection team and shall not release Contractor from obligation of employing inspectors to perform detailed inspection of work in accordance with approved QP.

7. Contractor selection

7.1. General

- a. The ability of Contractor to manage fabrication of the pipeline shall be assessed at prequalification and no later than the bid evaluation.

For some pipeline development projects, activities, such as materials selection and management, together with welding and fabrication, may be among several different disciplines that Contractor is required to manage.

- b. Projects shall be aware that it is common practice to subcontract welding and NDT activities.
- c. Identification and evaluation of Subcontractors shall be undertaken at the same time as Contractors.



- d. Quality standards for each Contractor in respect of management of welding and fabrication operations shall be appropriate to work scope awarded to them and shall ensure competent execution of all welding and fabrication activities.

Within the ISO series of standards for QMSs, welding is treated as a “special process” because welds cannot be fully verified by subsequent inspection or by testing of the welded product to ensure that the required quality standards have been met. Welding exerts a profound influence on the cost of fabrication, the quality of the product, and the ultimate service performance of the fabricated item. Therefore, it is important to ensure that welding is performed effectively and competently and that appropriate control is exercised over all aspects of the construction operation.

- e. For welded constructions to be effective and free from occurrence of serious problems in manufacture or in operational service, suitable controls shall be implemented by Contractor from initial design phase, through material selection, into fabrication, construction, installation, and subsequent inspection.

7.2. Contractor and fabricator certification

- a. Contractors, fabricators, and suppliers shall be prequalified before being invited to tender to supply goods and/or services under a BP contract.
- b. Prequalification of such companies shall generally be performed by combination of questionnaire, document audit, and quality/technical audit.
- c. Prequalification of welding Subcontractors shall also be required and shall be undertaken before award of contract to Contractor.
- d. Frequent prequalification of Contractors and/or fabricators in respect of demonstrable competence and control of welding operations may be minimised if such Contractors are certified by accredited independent third party in accordance with ISO 3834 or similar standards. (Detailed guidance on the compliance with ISO 3834 Parts 1-4 may be found in ISO 3834 Parts 5 and 6.) Certification may be awarded on completion of satisfactory technical audit by independent audit authority.
- e. For such certification to be acceptable, certificates issued by independent third party shall be valid at date of review and shall have minimum of 6 months remaining before expiration.
- f. If any contract due to be let by BP or its Contractors is expected to continue after expiration of current certification, Contractor/fabricator shall be required to demonstrate that arrangements are in place for next review by third party such that certification shall be continuous.

7.3. Demonstration of competence

To demonstrate meaningful compliance in terms of welding operations as “special process”, Contractors shall demonstrate to BP that their welding quality requirements and systems comply with guideline principles in ISO 3834-1 and that detail relating to control of all production operations affected by welding comply as described in a. through e. and are appropriate for work scope being managed.

- a. Contractors offering wide ranging services from project system design (including pipeline design) through materials selection and procurement, welding, fabrication, construction, inspection, and installation shall be required to demonstrate that control of their operations involving welding complies with principles of ISO 3834-1 and detailed “comprehensive quality” requirements of ISO 3834-2.
- b. Contractors offering services of more limited scope and/or fabricators working under subcontracts to managing Contractor or design Contractor shall be required to demonstrate



to BP and its Contractors that control of operations involving welding complies with principles of ISO 3834-1 and “standard quality” requirements of ISO 3834-3.

- c. Contractors offering services of a very basic scope, e.g., very simple welded fabrications or maintenance items of noncritical nature and for which any design review will be performed by others, rather than in house by fabricator, shall be required to demonstrate to BP and its Contractors that control of welding operations complies with principles of ISO 3834-1 and “elementary quality” requirements of ISO 3834-4.
- d. As a general rule, most Contractors and fabricators shall be required to demonstrate to BP their competence to levels in accordance with ISO 3834-2.
- e. Fabricators demonstrating competence only to elementary quality level of ISO 3834-4 shall not be awarded large contracts or comprehensive work scope, and monitoring of such Contractors during execution of contract by BP with managing Contractor shall be put in place when such contracts are let.

8. BP personnel

- a. BP welding engineers, welding inspectors, pipeline inspectors, and NDT personnel shall, as a minimum, have equivalent qualifications to those in similar positions with Contractors, i.e. in principle, qualifications and experience of BP welding engineers, welding inspectors, and any NDT personnel should parallel that of Contractor personnel. See Annex A, section A.9.

This is particularly important for inspection and NDT personnel who are operating at work sites.

- b. BP Welding engineers employed shall have metallurgical knowledge required to support underlying technical issues associated with effects of welding and fabrication on materials.

Experience demonstrates that the BP welding engineers and inspectors can often provide support to Contractor personnel in the reinforcement of good welding practice and specification compliance in the face of strong production pressures.

9. Preproduction consultation

9.1. General

Services of BP welding engineer shall be put in place by BP at the following stages:

- a. During bid evaluation to review and approve basic welding and NDT methods.
- b. For approval of proposed welding procedures.
- c. For weld procedure qualification and final WPS approval.

9.2. Review and approval of contractor welding and NDT personnel

- a. The BP welding engineer shall review curriculum vitae (CVs)/resumes of Contractor supervisory welding and NDT personnel.
- b. Such documents shall include CVs of key subcontract welding and NDT supervisory personnel.

Experience has shown that Contractor welding supervisory personnel are not always suitably experienced, and Contractor key personnel of proven competence nominated in the tender may no longer be available after contract award and may be replaced by persons of lesser competence.

- c. If Contractor tender states that subcontract services will be used, the BP welding engineer shall assess competence, qualification, and experience of such Subcontractors.

