Mechanical Interference Fit Connection

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Mechanical Interference Fit Connection

1 Scope

This standard contains information for the use of mechanical interference fit connections in the assembly process of API 5L pipe, after production by the pipe manufacturer. Mechanical interference fit connections, as considered within this standard, are to establish common aspects that can then be used by connection manufacturers and end users.

This standard provides fundamental guidance to educate the end users, connection manufacturers, and suppliers by identifying the critical features of the technology. This standard is intended for use by project engineers as they evaluate mechanical interference fit connections for pipeline applications and designs; it is not intended for use as an equipment-purchasing specification.

This standard does not prevent suppliers/manufacturers from offering alternative equipment or engineering solutions to users/purchasers. There can be additional requirements, beyond the information outlined in this standard, that may be needed for specific applications; this may be particularly applicable where there is innovative or developing technology.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda) applies.

API Specification 5L, *Line Pipe*

3 Terms and Definitions

For the purposes of this standard, the terms and definitions of the following apply.

3.1
assembly
The fitting together of the prepared pipe ends into a complete structure.

3.2
assembly contractor
The party performing any connection operation, including subcontractors.

3.3
axial compression
The stress imposed on a body that tends to make it become shorter.

3.4
axial tension
The stress imposed on a body that tends to make it become longer.

3.5
company
The pipeline owner/operator.

3.6
connection manufacturer
Service provider that modifies pipe ends.

3.7
end preparation
The modification of pipe ends to accommodate mechanical interference fit connection.

3.8
inspection
The process of measuring, examining, testing, gauging, or otherwise comparing the unit of product with the applicable requirements.

3.9
mechanical interference fit connection (MIF)
A connection, also known as a press fit or friction fit, that is a form of fastening between two tight-fitting mating parts that produces a joint that is held together by friction after the parts are pushed together.

4 General Information for Mechanical Interference Fit Connections and End Preparation

4.1 Applicability and Considerations

Mechanical interference fit connections may be used in pipeline systems where applicable, if:

– the source pipe meets API 5L; and

– a sample of the joint type to be used has been proof tested under simulated service conditions.

The axial tensile, axial compressive, and hoop strengths of the joint shall be as specified by the designer of the mechanical interference fit assembly system and shall be based upon test data or experience acceptable to the company.

The connection manufacturer shall provide an inspection and test plan.

4.2 Characteristics of the Inspection and Test Plan

Before production commences, the manufacturer shall supply the purchaser with summary information or identification of the control documents, as applicable, on the main characteristics of the inspection and test plan. This plan shall include at least the following:

a) inspection activity;

b) organization or individuals responsible for performing the inspection activity (including manufacturer, subcontractor, purchaser, or third-party representative);

c) inspection/test and calibration practices, as applicable;

d) frequency of inspection;

e) acceptance criteria;

f) actions to nonconformances;

g) result recording, as applicable;

h) identification of processes requiring validation; and

i) witness and hold points.

NOTE The above list is identical in API 5L.

These procedures and any others agreed to by the purchaser and the connection manufacturer determined necessary to provide a consistent product for pipeline service shall be used. If the pipeline is to be externally coated, the connection manufacturer shall provide any documentation regarding coating application requirements/ limitations.

4.3 Quality and Inspection

The connection manufacturer shall develop written specifications to include end preparations and assembly procedures. The connection manufacturer shall establish, implement, and maintain a quality management system where activities are controlled. The connection manufacturer shall be responsible for maintaining records required by this standard.

4.4 End Preparation Qualification and Training

Mechanical interference fit end preparation assembly contractors shall be qualified to properly prepare pipe ends for assembly. The degree of training required for assembly contractors shall be determined by the connection manufacturer and approved by the company.

Training should include the following:

a) safety;

b) the function and operation of the end preparation equipment;

c) the end preparation procedure;

d) equipment troubleshooting;

e) inspection; and

f) connection manufacturer tolerances.

Documented evidence of qualification upon satisfactory completion of the training requirements shall be made available upon request. The evidence shall show an expiration date and shall be valid for a period not exceeding two years.

4.5 End Preparation Inspection Procedures

End preparation inspection procedures shall be developed by the connection designer of the mechanical interference fit assembly system and approved by the company. Such procedures should include the inspection, before assembly, for imperfections and detrimental mating surface conditions of the prepared pipe ends. Manufacturer tolerances shall include tolerances to ensure proper interference fit.

4.6 Assembly Procedures

Mechanical interference fit assembly contractors shall be qualified to produce acceptable, consistent assemblies. The designer of the mechanical interference fit assembly system shall develop detailed assembly procedure specifications that include the assembly operation requirements. Qualification of such specifications shall be supported by engineering test data and field trials. The acceptability of such qualifications should be determined by the company.

For mechanical interference connections that use multicomponent lubrication materials, special attention should be given to proper mixing according to the lubricant manufacturer’s recommendations. The connection manufacturer and company should discuss pipeline operating temperatures to assure appropriate lubricant selection.

Any restrictions on assembly operations due to weather conditions as specified by the assembly contractor shall be included in the qualified assembly procedures.

NOTE The assembly contractor may consider restricting to automatic epoxy mixing machines for assembly.

5 Qualification of Assembly Contractors

5.1 Assembly Training

The degree of training required for assembly contractors shall be determined by the designer of the mechanical interference fit assembly system and approved by the company.

Training should include the following:

a) safety;

b) function and operation of the assembly equipment;

c) preparation and application of any anti-galling materials;

d) proper pipe-handling techniques;

e) assembly procedure;

f) inclement weather assembly techniques;

g) equipment troubleshooting;

h) recognition of an improper connection or where assembly has exceeded acceptable tolerances;

i) corrective actions to take for unacceptable assembly; and

j) ability to stop work in the event of unsafe or unacceptable work product.

Evidence of qualification shall be issued to the assembly contractors upon satisfactory completion of the training requirements. The evidence shall show an expiration date and should be valid for a period not exceeding two years.

5.2 Inspection Procedures and Training

The designer of the mechanical interference fit assembly system shall specify the joint dimensions, dimensional tolerances, and interference range within which the joint can meet its designed performance capabilities. Joint designers shall provide or recommend methods for determining that the mechanical interference of installed connections falls within the specified range, and they shall include such methods in the inspection procedures.

Inspection procedures shall be developed by the designer of the mechanical interference fit assembly system and approved by the company; such procedures shall include the inspection of proper insertion. The mechanical interference fit designer shall notify the pipeline operator and assembly contractor of any limitations or modifications necessary for hydrotesting the assembled pipeline.

Inspection personnel shall receive training in the following topics:

a) principles of the joint design;

b) inspection procedure and applicable inspection methods; and

c) insertion tolerances during assembly.

6 Material Requirements, Performance, and Documentation

6.1 Requirements

API 5L grades shall be required for mechanical interference fit connection applications. When materials (pipe) are furnished, they shall be accompanied by traceable material test reports or data sheets stating chemical analysis, heat treatment condition, and mechanical properties. Key variables for qualification shall be agreed between the company and connection manufacturer and shall cover such elements as the pipe mill manufacturing process.

6.2 Performance

The designer of the mechanical interference fit assembly system shall specify the joint dimensions, dimensional tolerances, and interference range within which the joint can meet its designed performance capabilities. This shall also include cold deformation restrictions for sour service in accordance with NACE MR0175/ISO 15156 or as qualified by sour service testing.

Designer of the mechanical interference fit assembly system shall establish design margins of the connection through physical testing as agreed upon by the company. Testing may include, but not limited to, the following:

— axial tension to failure;

— axial compression to failure;

— fatigue to failure;

— bending to failure;

— pipeline electrical continuity;

— crevice corrosion; and

— sour service (if applicable).

6.3 Documentation

6.3.1 Documents and data shall be legible and maintained to demonstrate conformance to specified requirements. The documents and data may be in the form of any type of media, such as hard copy or electronic. The documents and data shall be available and auditable by the company. Documentation shall be retained for a minimum of five years from the date of last manufacture.

6.3.2 The supplied operating manual shall contain the following information, as a minimum:

a) safety precautions;

b) size, type, and model of insertion equipment;

c) post-insertion inspection;

d) installation, operating, and special feature operation procedures;

e) troubleshooting procedures;

f) repair and/or redress limitations and procedures; and

g) any other documents by contractual agreement.

Bibliography

[1] API Recommended Practice 54, *Occupational Safety and Health for Oil and Gas Well Drilling and Servicing Operation*

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[4] API Recommended Practice 5UE, *Ultrasonic Evaluation of Pipe Imperfections*

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[15] ASTM E165, *Standard Practice for Liquid Penetrant Testing for General Industry*

[16] NACE MR0175/*ISO 15156-1, Petroleum and Natural Gas Industries—Materials for Use in H_2S-containing Environments in Oil and Gas Production—Part 1: General Principles for Selection of Cracking-resistant Materials*

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