

**API Ballot id# 5798  
SC5 TGLP**

<b>Work Item</b>	4239 – Mechanical Interference Fit Connections
<b>Distribution-type</b> [Ballot (vote and comment), Comment-only (review), Recirculation (comment resolution), Re-ballot ... etc.]	Ballot #2 (reballot limited to changes, comment and vote)
<b>Document</b>	RP 5MIF, 1 <sup>st</sup> Edition
<b>Other Impacts</b>	None
<b>Revision Key</b>	<i>Previous</i> (i.e. ballot 1) proposed/unchanged (i.e. accepted) content in BLACK; this ballot with Track Changes as: 1) Additions in <u>underlined BLUE</u> 2) Deletions in <del>stricken RED</del>

**Work Item Charge:**

Create a standard for interference fit connections to be used with new 5L material.

**Ballot Rationale:**

Due to observing an increase in the use of mechanical interference fit connections on line pipe, it would be good to have a standard on how to properly use them since there is not one available.

NOTE See the ballot email notification for additional information regarding this ballot.

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# Mechanical Interference Fit Connection

API RECOMMENDED PRACTICE 5MIF  
FIRST EDITION, [MONTH] [YEAR]

(Ballot2) Draft—For Committee Review

**NOTE** The *Contents*, *Special Notes*, and *Foreword* will be inserted by API during the page proofing process prior to publication.

# 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 which 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 is also not intended to inhibit a supplier / manufacturer from offering the user / purchaser from accepting alternative equipment or engineering solutions. 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.

[NOTE The pipe manufacturer or processor providing API 5L pipe may not be responsible for the pipe ends affected by the MIF's manufacturing process \(i.e. cold forming, stress relieving, machining, coating, etc.\).](#)

## 2 Normative References

The following referenced documents are indispensable for the application of this standard. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any addenda or errata) 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

#### end preparation

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

### 3.7

#### inspection

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

### 3.8

#### 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 which is held together by friction after the parts are pushed together ~~non-threaded joint for metallic pipe involving the controlled plastic deformation and subsequent interference mating of pipe ends.~~

## 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 ~~materials are qualified~~ 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 ~~should~~shall be as specified by the designer of the mechanical interference fit assembly system, and ~~should~~shall be based upon test data or experience acceptable to the company.

The connection manufacturer ~~should~~shall provide an inspection and test ~~process control 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:

- inspection activity.
- organization or individuals responsible for performing the inspection activity (including manufacturer, subcontractor, purchaser, or third-party representative).
- inspection/test and calibration practices, as applicable.
- frequency of inspection.
- acceptance criteria.
- actions to nonconformances.
- result recording, as applicable.
- identification of processes requiring validation, and
- witness and hold points.

NOTE The above list is identical in API 5L.

~~The process control plan should include procedure numbers, as well as associated revision levels, for all applicable sub-tier documents.~~ These procedures and any others determined necessary to provide a consistent product for pipeline service ~~should~~shall be used.

If the pipeline is to be externally coated, the connection manufacturer ~~should~~shall provide any documentation regarding coating application requirements / limitations.

#### **4.23 Quality and Inspection**

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

#### **4.34 End Preparation Qualification and Training**

Mechanical interference fit end preparation assembly contractors ~~should~~shall be qualified to properly prepare pipe ends for assembly. The degree of training required for assembly contractors ~~should~~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) 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~~Evidence of qualification should be issued to the end preparation assembly contractor upon satisfactory completion of the training requirements.~~ The evidence ~~should~~shall show an expiration date and ~~should~~shall be valid for a time-period not exceeding two years.

#### **4.45 End Preparation Inspection Procedures**

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

The visual inspections are applicable to all material sizes and all expanded end-types

#### **4.56 Assembly Procedures**

Mechanical interference fit assembly contractors ~~should~~shall be qualified to produce acceptable, consistent ~~connections~~assemblies. The designer of the mechanical interference fit assembly system ~~should~~shall develop detailed assembly procedure specifications that include the assembly operation requirements. Qualification of such specifications ~~should~~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 multi-component lubrication materials, special attention should be given to proper mixing according to [the lubricant manufacturer's](#) recommendations. For high-temperature operating conditions, the mechanical interference fit connection designer should be consulted to assure the proper selection of the appropriate lubricant.

Any restrictions on assembly operations due to weather conditions ~~should~~[shall](#) be included in the qualified assembly procedures.

[NOTE The designer of the mechanical interference fit assembly system 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 ~~should~~[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 ~~should~~[shall](#) be issued to the assembly contractors upon satisfactory completion of the training requirements. The evidence ~~should~~[shall](#) show an expiration date and should be valid for a time-period not exceeding two years.

### **5.2 Inspection Procedures and Training**

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

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

Inspection personnel ~~should~~[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 ~~should~~shall be accompanied by traceable material test reports or data sheets stating chemical analysis, heat treatment condition, and mechanical properties. ~~This connection process should only be used on seamless or electric welded products~~Key variables for qualification shall be agreed between the user and manufacturer and shall cover such elements as mother pipe manufacturing process.

### 6.2 Performance

The designer of the mechanical interference fit assembly system ~~should~~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 ~~should~~shall establish design margins of the connection through physical testing as agreed upon by the purchaser. 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 ~~should~~shall be legible and maintained to demonstrate conformance to specified requirements. ~~The documents and data should be retained in facilities that provide an environment that prevents damage, deterioration, or loss.~~ The documents and data may be in the form of any type of media, such as hard copy or electronic. The documents and data ~~should~~shall be available and auditable by the user / purchaser. Documentation ~~should~~shall be retained for a minimum of five years from the date of last manufacture.

**6.3.2** The supplied operating manual ~~should~~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.

**6.3.3** ~~For proper manufacture and operation of the mechanical interference fit connection, pipe suppliers and MIF manufacturers should record observations of the following:~~

~~gouges, cuts, pits, dents, grinds, mechanical damage, lack of straightness, eccentricity, end damage, and ovality.~~

## **Bibliography**

- [1] API Recommended Practice 54, *Occupational Safety and Health for Oil and Gas Well Drilling and Servicing Operation*
- [2] API Recommended Practice 5C1, *Care and Use of Casing and Tubing*
- [3] API Recommended Practice 5L8, *Field Inspection of New Line Pipe*
- [4] API Recommended Practice 5UE, *Ultrasonic Evaluation of Pipe Imperfections*
- [5] API Specification Q1, *Quality Management System Requirements for Manufacturing Organizations for the Petroleum and Natural Gas Industry*
- [6] API Standard 579-1 / ASME FFS-1, *Fitness-For-Service*
- [7] API Technical Report 5C3, *Calculating Performance Properties of Pipe Used as Casing or Tubing*
- [8] ASME B31.3, *Process Piping*
- [9] ASME B31.4, *Pipeline Transportation Systems for Liquids and Slurries*
- [10] ASME B31.8, *Gas Transmission and Distribution Piping Systems*
- [11] ASTM A370, *Standard Test Methods and Definitions for Mechanical Testing of Steel Products*
- [12] ASTM E4, *Standard Practices for Force Verification of Testing Machines*
- [13] ASTM E83, *Standard Practice for Verification and Classification of Extensometer Systems*
- [14] ASTM E110, *Standard Test Method for Rockwell and Brinell Hardness of Metallic Materials by Portable Hardness Testers*
- [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<sub>2</sub>S-containing Environments in Oil and Gas Production — Part 1: General Principles for Selection of Cracking-resistant Materials*