TITLE: Selection of Steel Gas Pipeline Repair Methods

Purpose

This standard provides criteria for assessing damage levels for steel pipelines on pipe body and girth welds, and it provides a selection guide for repair options. Fitting-damage assessment will be treated on a case-by-case basis. Repair methods and requirements for reporting repairs are described in the appropriate gas design standard.

Recision

This revised standard cancels and supersedes UO Standard S4134, "Selection of Steel Gas Pipeline Repair Methods," effective June 2002.

Safety

Compliance with this standard will ensure that damaged pipelines are correctly repaired, which will result in increased public and employee safety.

Implementation Responsibilities

The vice president of California Gas Transmission (CGT) and the vice president of Engineering and Planning (E&P) are responsible for reviewing, approving, and distributing this standard.

The Gas System Maintenance and Technical Support (GSM&TS) department, Gas Distribution and Technical Services (GD&TS) department, and the Operations, Maintenance and Construction (OM&C) area directors, managers, superintendents, and supervisors are responsible for ensuring that employees are trained on and comply with the requirements of this standard. In addition, they are responsible for providing sufficient resources to achieve the requirements of this standard.

Employees are responsible for carrying out their assigned tasks. For their own safety, and that of the general public, employees are responsible for performing only the tasks for which they are trained, knowledgeable, and qualified. Employees shall notify their supervisor of any additional training, equipment, or resources needed to perform their assigned tasks.

Compliance

The responsible GSM&TS, GD&TS, and OM&C directors, managers, and superintendents implement and measure the effectiveness of this standard. In addition, internal Company departments may conduct periodic audits. The California Public Utilities Commission (CPUC) also conducts compliance reviews of the requirements in this standard.

Procedure

The managers of GSM&TS and GD&TS are authorized to modify the detailed procedures, forms, or instructions, as needed, or approve variances from the procedures on an exception basis. The manager of Pipeline Engineering, the manager of System Integrity in GSM&TS, or the manager of GD&TS in E&P can approve variances from this standard for specific repair operations.

Pipeline damage not addressed by this standard shall be evaluated and repaired in accordance with 49 CFR 192.

This standard does **not** include the requirements for repairing new pipe (49 CFR 192.309).

Definition of Terms

Arc Burns: Any localized, remelted metal, heat-affected metal, or change in the surface profile of any part of a weld or base metal surface resulting from an arc. Arc burns are considered a form of mechanical damage.

Corrosion: Destructive attack on metal by reaction with the environment.

Dents: A depression in the pipe wall that produces a gross disturbance in the pipe wall's curvature. A dent is different from a scratch or gouge, which reduces the pipe wall's thickness. Measure the depth of a dent from the lowest point of the dent to the point where the original contour of the pipe lay before it was dented. The percentage of distortion is defined as the ratio of the depth of the dent to the actual diameter of the pipe, times 100.

Direct Deposition Weld: A welding process used to restore pipe (or pipe fitting) wall loss that was caused by corrosion. Direct deposition weld process may be conducted without reducing pipeline pressure.

External Corrosion: Corrosion-based deterioration originating from the outer surface of the pipe.

High-Frequency Electric Resistance Weld (ERW) Seam Weld: A pipe seam weld produced by the electric resistance welding process, using high-frequency alternating current electricity. Unless otherwise determined, all ERW pipe produced in 1970 or later can be considered the high-frequency type.

Hoop Stress: Stress on a pipe wall produced by the pressure exerted against the inside of the pipe by the medium in the pipe.

Internal Corrosion: Corrosion-based deterioration originating from the inner surface of the pipe.

ksi: Kips per square inch (1,000 psi).

Longitudinal Seam: The weld used to join the plate edges to form pipe manufactured from plate.

Low-Frequency ERW Seam Weld: A pipe seam weld produced by the electric resistance welding process, using low-frequency alternating current electricity. Unless otherwise determined, all ERW pipe produced before 1970 should be considered the low-frequency type.

MAOP: Maximum allowable operating pressure. The pressure at which a pipeline, pipeline segment, or component is qualified to operate in accordance with the requirements of 49 CFR 192.

Mechanical Damage: Damage to the pipe surface caused by external forces. Mechanical damage includes features such as creasing of the pipe wall, gouges, scrapes, smeared metal, arc burns, and metal loss not due to corrosion. Cracking may or may not be present with mechanical damage. Dents in the pipe may or may not be apparent with mechanical damage.

Plain Dents: Depressions in the pipe wall that exhibit or contain no creases, mechanical damage, corrosion, or arc burns, but do affect the girth or seam welds.

Potentially Non-Ductile Weld: Welds known to potentially exhibit non-ductile properties. Unless otherwise exempted by Pipeline Engineering, all pre-1947 girth welds fall into this category. The following types of long seam welds fall under this classification, unless exempted by Pipeline Engineering: A. O. Smith welds, Furnace butt-welds, lap-welds, flash-welds, single submerged-arc-welds, low-frequency ERWs. Pipeline Engineering may add additional welds on specific lines, based on materials testing or other data.

RSTRENG: A computer program for calculating the safe pressure for corrosion-damaged pipe, as referenced in 49 CFR 192.

SMYS: Specified minimum yield strength. The minimum yield strength in pounds per square inch (psi) prescribed by the specification under which the pipe is purchased from the manufacturer or as specified in 49 CFR 192.

Temporary Measure: Repair techniques that are allowable when a permanent repair is not feasible at the time the defect is discovered. Temporary repairs shall be replaced with permanent repairs as soon as feasible.

Type A Sleeve: A repair sleeve designed so that welding of the sleeve-ends to the carrier pipe *is not* required. Type A sleeves function as reinforcement for a defective area, but are not intended to contain pressure and are used only for non-leaking defects.

Type B Sleeve: A repair sleeve designed so that welding of the sleeve-ends to the carrier pipe *is* required. Type B sleeves are capable of containing pressure and carrying longitudinal stresses, which may be imposed by lateral loads.

Date Issued/Updated

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Signed,

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Vice President
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Signed,

Michael A. Katz
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California Gas Transmission

Reference Documents 49 CFR 192 Sections 245, 483, 485, and 487

CGT Engineering Guideline EG 4124, "Emergency Pre-Tested Transmission Pipe"

CGT Standard 4711, "Natural Gas Pipe Wrap: Removal, Handling, and Disposal"

CGT Recommended Practice RP 4710, "Production Fluid/Pipeline Liquid – Leak Response and Contaminated Soil Handling Procedure"

UO Standard D-S0350/S4110, "Leak Survey and Repair of Gas Transmission and Distribution Facilities"

UO Standard 4133, "Corrosion Control of Gas Transmission Facilities"

UO Standard D-S0443, "Natural Gas Distribution Pipe Wrap Removal, Handling and Disposal Procedure"

Gas Standard A-34, "Piping Design and Test Requirements"

Gas Standard A-53, "Recommendation for Taps (Hot and Cold) on Steel Lines"

Gas Standard A-60, "Gas Main Welding Sleeves (Type B Sleeves With Circumferential Welds)"

Gas Standard A-60.1, "Dresser Style 110 Sleeve"

Gas Standard A-60.2, "Type A Reinforcing Steel Sleeves"

Gas Standard A-61, "Low Pressure Gas Main Welding Sleeve Fabricating, Installing, and Purchasing Data"

Gas Standard A-63, "Gas Main Repair Can"

Gas Standard A-64, "Gas Line Patches and Half Soles"

Gas Standard A-68, "Leak Repair Tapes"

Gas Standard B-23, "Weldolets, Thredolets, and Sockolets"

Gas Standard B-53, "Skinner Leak Repair Clamps"

Gas Standard B-53.1, "Repair Clamps"

Gas Standard B-53.2, "High Pressure Clamps"

Gas Standard D-22, "Arc Welding Procedure Requirement - All Stress Levels"

Gas Standard D23.1, "Direct Deposition Welding"

Gas Standard D-40, "Weld Inspection"

Gas Standard O-16, "Corrosion Control of Gas Facilities"

Attachments and Exhibits

Attachment 1, "Procedures for Repair of Steel Gas Pipelines"

Exhibit A Table 1-A, "Acceptance Criteria and Allowed Repair Methods for Non-Leaking Corrosion Damage in Pipe and Welds"

Exhibit B Table 1-B, "Acceptance Criteria and Allowed Repair Methods for Leaking Corrosion Damage in Pipe and Welds"

Exhibit C Table 1-C, "Acceptance Criteria and Allowed Repair Methods for Dents Without Mechanical Damage (Plain Dents)"

Exhibit D Table, 1-D, "Acceptance Criteria and Allowed Repair Methods for Mechanical Damage (With or Without Dents)"

Exhibit E Table 1-E, "Acceptance Criteria and Allowed Repair Methods for Non-Leaking Cracks in Welds"

Exhibit F Table 1-F, "Acceptance Criteria and Allowed Repair Methods for Leaking Cracks in Welds"

Exhibit G Table 1-G, "Non-Leaking Corrosion Damage Repairing Steel Pipe Defects With MAOP $\leq$ 60 psig"

Exhibit H Table 1-H, "Leaking Corrosion Damage Reparing Steel Pipe Defects With MAOP $\leq$ 60 psig"

Exhibit I Table 1-I, "Non-Leaking Cracks or Defects in Welds Reparing Steel Pipe Defects With MAOP ≤ 60 psig"

Exhibit J Table 1-J, "Leaking Welds Reparing Steel Pipe Defects With MAOP ≤ 60 psig"

Exhibit K Table 1-K, "Leaks in body of Fittings or in Clamps Repairing Steel Pipe Defects With MAOP ≤ 60 psig"

Exhibit L Table 1-L, "Non-Leaking Mechanical Damage: Notches, Scratches, Gouges, Grooves, and Dents Repairing Steel Pipe Defects With MAOP ≤ 60 psig"

Attachment 2, "Calculation to Determine the Estimated Maximum Strain in a Dent"