Review of ASME Guidance Articles on Repair Strategies

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• Introduction
  – About the articles/what they are
  – Guidelines for application
  – Publication details

• Review of Balloted Articles
  – What they cover
  – Key details
  – Status

• Other articles in progress/articles with an identified need
Scope

• Provides methods for repairs of equipment & piping within the scope of ASME Pressure Technology Codes & Standards after they are placed in service

• May be temporary or permanent, depending on the circumstances

• Provides only technical procedures and information; administrative or policy requirements are outside its scope
Section 1 – covers Scope, Organization & Intent

Section 2 – repair methods involving welding, brazing, soldering, or other methods involving metal deposit

Section 3 – mechanical repairs, with and without sealant, such as bolted clamps & fixtures

Section 4 – repairs using nonmetallic means, such as nonmetallic liners and wraps, and bonding

Section 5 – covers examination and testing methods and techniques
Intent

• Provides technical information, procedures, and recommendations for repairs
• Determined by consensus to be recognized and generally accepted good engineering practice
• Refer to post construction codes and jurisdictional requirements for administrative requirements
Guidelines for Application

• Users are cautioned that these articles have been developed generically and are recommended for general applications

• Precautions that are provided should not be considered to be all inclusive

• Sound engineering practices/judgment should be used to assess applicability to a specific situation

• Each repair should be subjected to an appropriate review by qualified personnel

• Reviews should consider subsequent degradation of the repaired component
Details of Publication

• Current plan is publish in hard copy; no electronic version planned
• First edition will be published when a sufficient number of articles are available
• Subsequent articles will be issued as an addenda service
• Should publish First edition in 2nd half of 2003
Layout of Articles

• Introduction
• Limitations
• Design
• Fabrication
• Inspection
• Testing
• References
• Appendices (As Needed)
Freeze Plugs

- A technique for isolating a section of piping by cryogenically cooling the outer wall of the pipe and freezing the contained liquid to form a plug
- CO$_2$ and liquid nitrogen used as medium
- Can be used on a variety of liquids
- Experience holding pressures up to 2500 psi
- Status: Board Approved
Freeze Plugs

Figure 1 – Nitrogen Freeze Plug Assembly.

(A) Freeze jacket, (B) Liquid nitrogen supply, (C) Liquid nitrogen supply and jacket drain,
(D) Nitrogen gas vents, (E) Thermocouples,
(F) Temperature monitor, (G) Thermocouple (Optional)
Butt Welded Insert Plates

- Replacement of pressure boundary mat’l with insert plate with full penetration butt welds
- Covers portions of plates (not complete plates, courses, or components)
- Replacement plate may include nozzles
- Limited in size only as req’d to meet tolerances
- Status: Approved by PC Stds Committee
Butt Welded Insert Plates

Figure 1 - Flush Insert in Pipe or Tube

Figure 2 - Flush Insert Plate (With or Without Nozzle/Manway) With Its Butt Weld Intersecting Existing Butt Weld in Shells or Heads

Figure 3 - Intersecting "Doghouse" Type Insert Plate Butt Weld (with or without Nozzle/Manway) With Shell Butt Weld in Vessel Shells and Heads
Welded Leak Repair Box

• Covers welded enclosures placed over component being repaired/welded in place
• Can cover pipe, flanges, valves, fittings, etc
• May/may not be pumped with sealant
• Does not include bolted or clamped boxes
• Status: Approved by PC Stds Committee
Welded Leak Repair Box

Figure 1
Example of a Welded Leak Repair Box for Straight Pipe

Figure 2
Example of a Welded Leak Repair Box for Pipe Elbow

Figure 3
Example of a Welded Leak Repair Box used to Cover a Leaking Vent
Damaged Threads in Tapped Holes

• Options include:
  – Drilling damaged holes to larger size for tapered bolts
  – Drilling damaged holes to larger size for helical coil thread inserts
  – Filling w/ weld metal, redrilling & retapping

• Status: Approved by PC Stds Committee
Damaged Threads in Tapped Holes

Figure 1 - Example of Tapered Stud

** For other sizes, as needed to attain a 2:1 taper

Appendix A - Recommended Detail for Stud Threads Modification to Prevent Damage to Threads in Tapped Holes

D.O. THREAD X 45° CHAMFER

O.D. THREAD X 45° CHAMFER

INSIDE SURFACE
Non-Metallic Internal Lining (Sprayed Form) for Buried Pipe

- Covers thermosetting resins sprayed as protective or structural lining to buried pipe
- Can provide structural strength, chemical/abrasion resistance, leakage barrier, improve flow
- Limited to buried pipe
- Most effective for diameters > 24 inch
- Status: Resolving Stds Committee Negatives
Flange Refinishing

- Covers refinishing of flange faces to:
  - Repair mechanical imperfections
  - Restore material lost due to corrosion or other damage
  - Change flange face finish or enable use of different gasket

- Status: Resolving Stds Committee Negatives
Flaw Excavation

- Covers surface or embedded flaws that exceed code allowances
- May be removed by excavation and filled with weld metal or left as-is as appropriate
- Includes grinding, machining, lapping, honing, flapping, or thermal gouging
- Status: Resolving Stds Committee Comments
Flaw Excavation

Figure 1 – Excavation and Weld Repair of Surface Flaw
(This figure will be revised not to imply that a 3:1 profile is required if it will be subsequently filled.)

Figure 2 – Excavation and Weld Repair of Embedded Flaw.
Note: A 3-to-1 Taper is not Required when the Cavity Will be Filled with Weld Metal
Mechanical Clamps

• Split bolted fittings to enclose leaking components/reinforce damaged components
• Std catalog items or custom designed
• May/may not include injectable sealant
• Reinforced to resist pressure end thrust
• May be non-structural or structural
• Status: Resolving Subcommittee Negatives
Figure 1 – Example of Mechanical Clamp for Repair of Straight Pipe
External Weld Overlay for Repair of Internal Thinning

- Covers repairs due to internally thinned components by external weld overlay
- Excludes repair of components with cracks
- In some cases, may be performed in service
- Engineered repair (qualified by design calcs or proof test of mockup)
- Status: Resolving Subcommittee Negatives
External Weld Overlay for Repair of Internal Thinning

Figure 1. Weld Overlay Profile
Damaged Anchors in Concrete

- Covers repairs to column base anchors in concrete
- Involves post installed anchors by mechanical or chemical means
- Includes extension of existing anchor bolts when appropriate
- Status: Resolving Subcommittee Negatives
Damaged Anchors in Concrete
Full Encirclement Steel Sleeves

• Type A Sleeves:
  – Not pressure containing, reinforcing only
  – For non-leaking, non-growing defects

• Type B Sleeves:
  – Welded circumferentially to carrier pipe
  – For leaking defects and to provide full pressure & load carrying capability

• Status: Resolving Subcommittee Negatives
Full Encirclement Steel Sleeves

Figure 1 – Type A Sleeve

Figure 2 – Type B Sleeve

Figure 3 – Welded Split Sleeve for Use over a Girth Weld.
Seal Welded Threaded Connections/Seal Weld Repairs

- Covers requirements for seal welding of threaded connections
- Can be used for original construction or in-service piping systems
- Status: Resolving Subcommittee Negatives
Pipe Straightening

• Provides requirements and cautions for correcting a bent metallic pipe using hot or cold bending

• Does not cover systems that include mechanical joints (flanges, threaded joints, expansion joints, compression fittings, etc)

• Status: Subcommittee Level (1st Draft)
Replacement

• Covers replacement of pressure equipment or piping components or subassemblies
• May be replacement in kind or a modification
• Status: Resolving Subcommittee Comments
Other Articles in Progress

- Fillet Welded Patches With Reinforcing Plug Welds
- Non-Metallic Composite Wrap System for Pipe
- Post Weld Heat Treatment of Welded Repairs
- Repairs & Alterations Without Pressure Testing
- Repair Method for Valves with Pressure Seal Type Bonnet Joints
- Welded Lip Seals
Other Repair Articles

- General repair considerations
- Valve repairs
- Stem failure
- Pipe & tube crimping
- Cured in place inserted liners
- Low pressure composite wrap sleeves
- High pressure composite wrap sleeves
- Cured in Place Wrap Coatings
- Live Pipe Insertions
- Compressed Seal at Joints
- Straightening & Rounding
- Repair of Flange Leaks Other Than Clamps
- General Weld Repairs
- Weld Overlay
- Hard Surfacing
Other Repair Articles (Cont’d)

- Strip Lining
- On-Line Welding
- Seal Welding
- Repair of Weld Overlays
- Hot Torquing/Tensioning
- Bolt Changeout
- Heat Exchanger Tube Repairs
- Heat Exchanger Retubing
- Hydrogen Blisters
- Repair of Expansion Joints
- Local Post Weld Heat Treatment
- Stress Improvement
- Alternatives to Preheat
- Pressure Testing
- Riveted Tanks & Vessels
Summary

• Articles document good repair practices based on experience

• Provide technical considerations only – not administrative requirements

• Are not a “cookbook” – still require sound engineering judgment

• Because articles rely on experience base, increased participation will benefit industry