

Corrosion Checklist

Important observations before any money is spent on chemical, metallurgical, or corrosion testing !!!
Things to consider before investing in more expensive materials !!!

The more information you have about the corrosion, the better choices you can make about testing and interpreting those tests.

Identical alloy used for all system components
Similar alloys used for all system components
Mixed materials used in the system
Coatings and/or surface treatments used on the metals
Is the corrosion under insulation, wrapping, or an organic coating?

Composition of the liquids that contact the corroded materials and range of composition
typical temperature, range of temperatures
typical flow, range of flow rates
Is the liquid left in the piping or tanks stagnant for any period of time?

Only certain components are corroding
All components are corroding in a similar manner
Different forms of corrosion on different materials
Different forms of corrosion on one material
Which materials are electrically bonded and which are electrically isolated?

Have this combination of materials worked well in the past?
What changed? Supplier of materials, fabrication methods, cleaning procedures, contamination, temperature, flow, heat treatment, surface treatment

Is the corrosion uniformly distributed?
Is the corrosion primarily on the top or bottom surface inside of a pipe or tube?
Is the corrosion on the inside or outside of the pipe or tank?
Is the corrosion primarily in an area associated with the level of the liquid? at, above, or below
Is the corrosion associated with highly stressed areas? formed flanges, tubing flares, bends, stamping, threads
Is the corrosion on the machined surfaces, as-cast surfaces, or mill-formed surfaces?
Is the corrosion associated with welding or thermal processing? Centered on weld, one or both sides adjacent to weld? in HAZ, outside of HAZ?
Is the corrosion associated with a mechanical joint? Metal to metal, what is the gasket material?

Is the corrosion uniform over large areas? Thinning of walls, general loss of material
Is the corrosion uniform over local areas? Blotches, corners
Is there pitting? shallow, deep pinholes, few, many
Has the corrosion created a crevice?
Do the crevices or pits follow a pattern that can associated with joining, forming, machining, or direction of flow?
Are the pits associated with macroscopic inclusions or surface defects?
Do the crevice lines follow coarse grain boundaries?
Is the corrosion associated with any surface contamination or deposits?

Is the surface clean or covered by deposits?

Is the metal surface smooth, etched, or eroded?

What color are the deposits?

Are the corrosion deposits smooth or rough? Tubercules, blisters, delamination

Can the deposits be easily wiped off?

Is there electrical current flowing between the parts?

Is electrical power leaking to ground?

Is there nearby electrical power that can couple with the corroding materials?

Look at the overall picture!!! Are there regions of the corrosion that are subtly different? Are there different size distributions of the holes or pits? Are some pits a different color or shape than the others?

If you would like to contribute to this list, send your comments to rab@bauertesting.com

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Major Forms of Corrosion

These are primarily descriptive and may have multiple causes
(refer to any corrosion textbook or ASM Handbook, Volume 13)

Uniform corrosion

Galvanic corrosion

Erosion corrosion

Pitting corrosion

Crevice corrosion

Selective Leaching

Intergranular corrosion

Stress corrosion cracking

Other Forms of Corrosion

Filiform

Fretting

Biologically induced corrosion

Hydrogen induced cracking

Dusting

Dezincification

Graphitization

Exfoliation

Erosion-corrosion

Liquid metal embrittlement

Chemical Mechanisms for Corrosion

Multiple chemical reactions may be contributing to a particular corrosion process and even these may change over time. However, there will always be one dominant reaction. By identifying the chemical mechanism and aggravating conditions, usually one can control the corrosion process.

General chemical attack

Selective chemical attack

Corrosion by impressed anodic potential

Galvanic corrosion (dissimilar materials, area effects)

Localized galvanic corrosion (inter-granular, pits, concentration-cell)

Leaching (solvation)

Decomposition

Aggravating Conditions

Temperature

Bulk activity of reactants (concentration)

Localized chemical activities

Abrasion of the surface

Tensile stresses at the surface

Local deformation from machining or forming

Segregation in the alloy

Surface contamination

Flow

Microbial activity