

Russell W. Brown

Riley Industrial Services, Inc.

Tank Maintenance & Construction, Inc.

Tank Maintenance Services LLC

Farmington, New Mexico 87499-2014

www.rileyindustrial.com

www.tankmaintenancenow.com

Session Objective

- Our objective today is to address some water tank design issues and the positive impact of general inspection basics on final contract quality.
- An owner can and should insist on having more control over what is and isn't done when building a new or maintaining an existing potable water storage tanks.

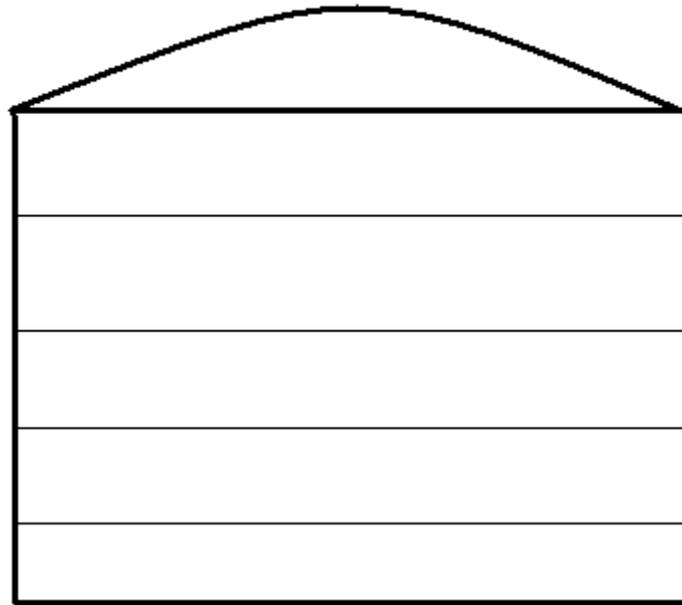
Some topics to cover

- Basics of corrosion
- NACE guidelines for designing and using steel components in corrosive environments
- Surface preparation methods and their results
- Protective coatings basics
- Coating system selection
- Types of coating systems - Barrier systems
- Galvanic acting systems
- Film formation mechanisms
- Surface preparation and coating application conditions

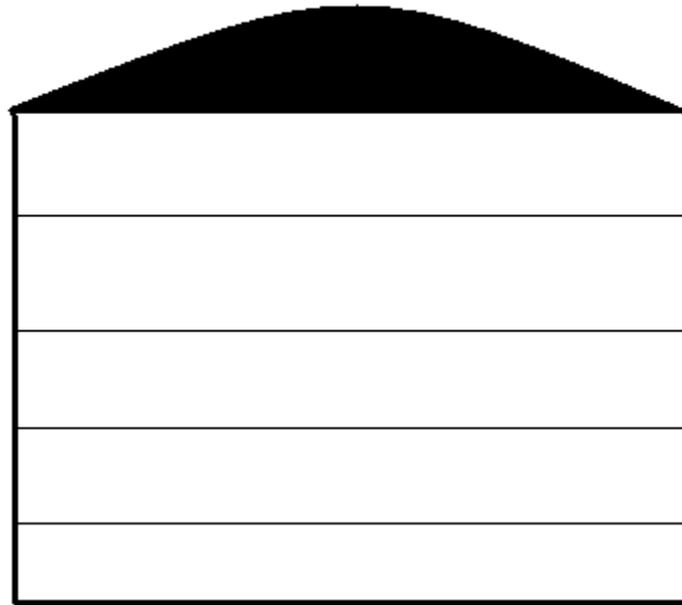
Topics continued...

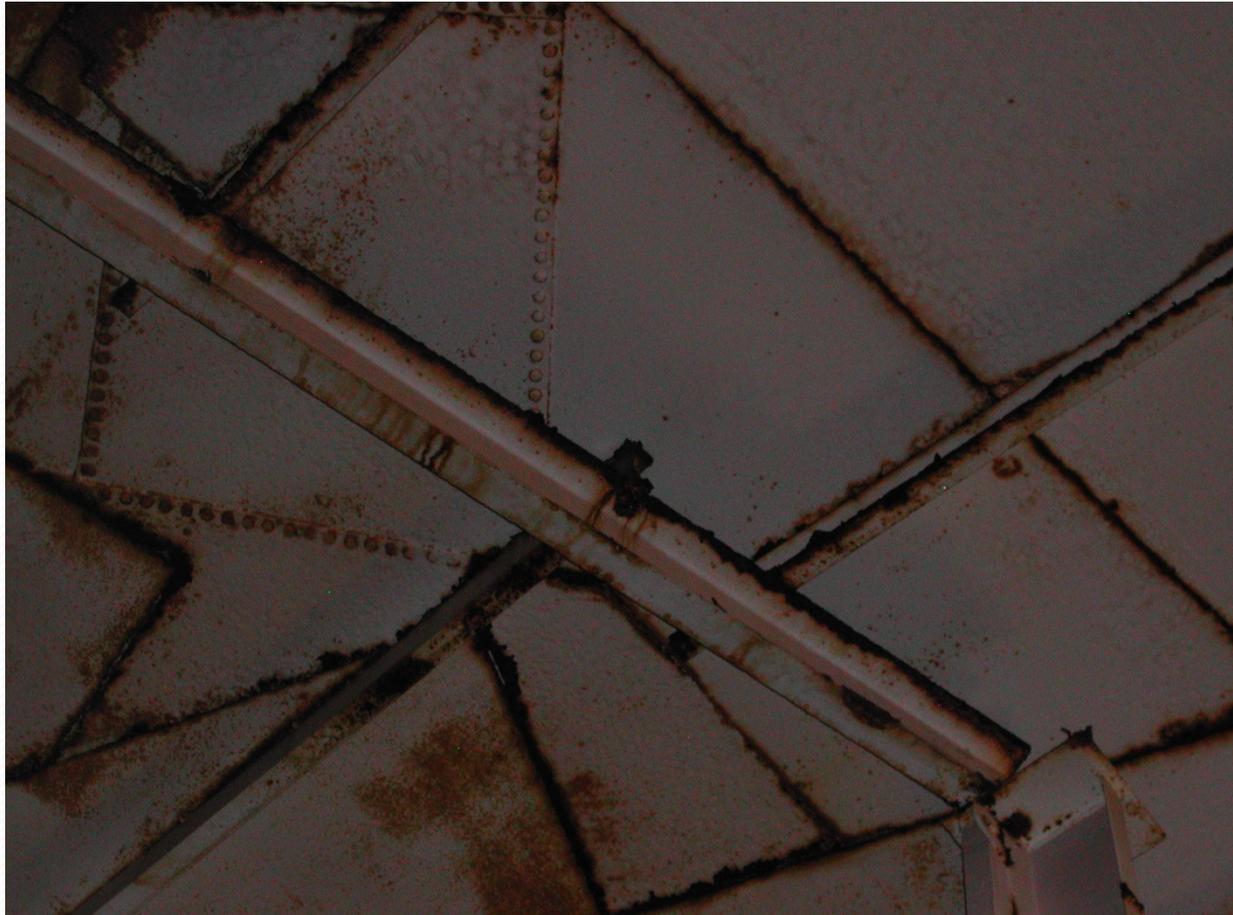
- Blast air & its effects on coating systems
- Mixing paint thoroughly (Full containers of A & B)
- Some types of coating application equipment
- Basic inspection equipment
- Adequate inspection records

Typical Ground Storage Tank

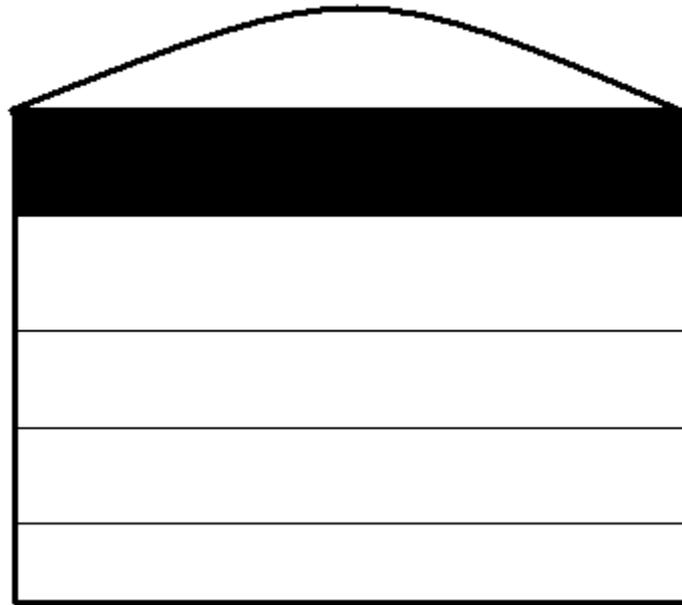


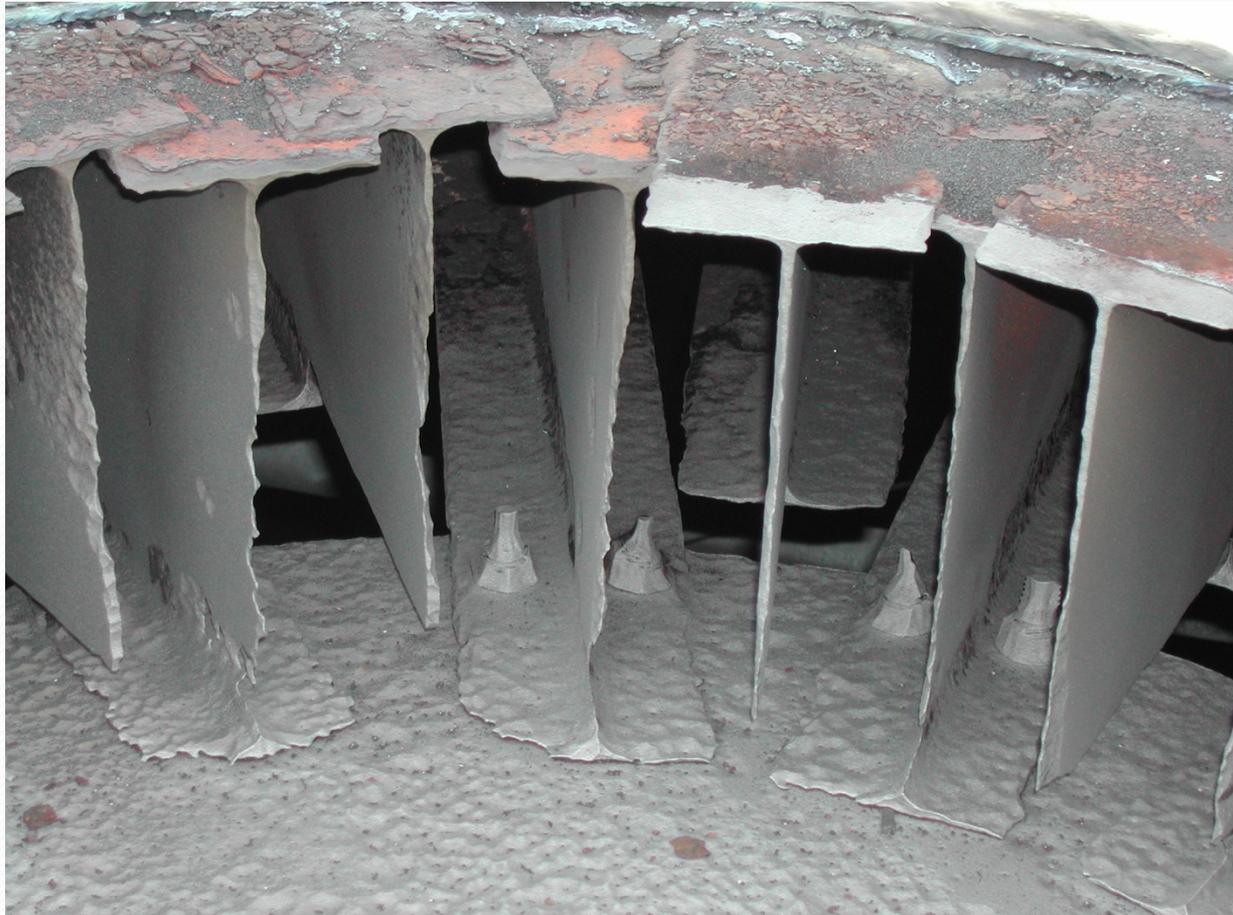
High Area of Corrosion Activity





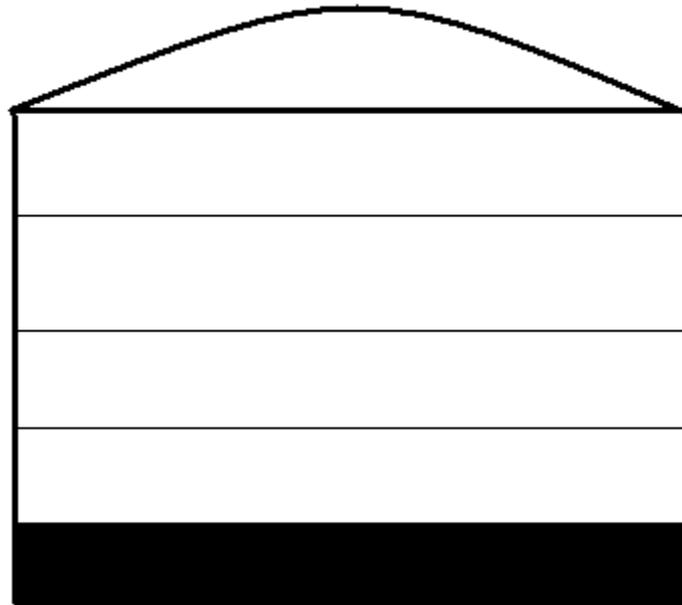
Next highest area of metal loss







Floor corrosion cannot be ignored







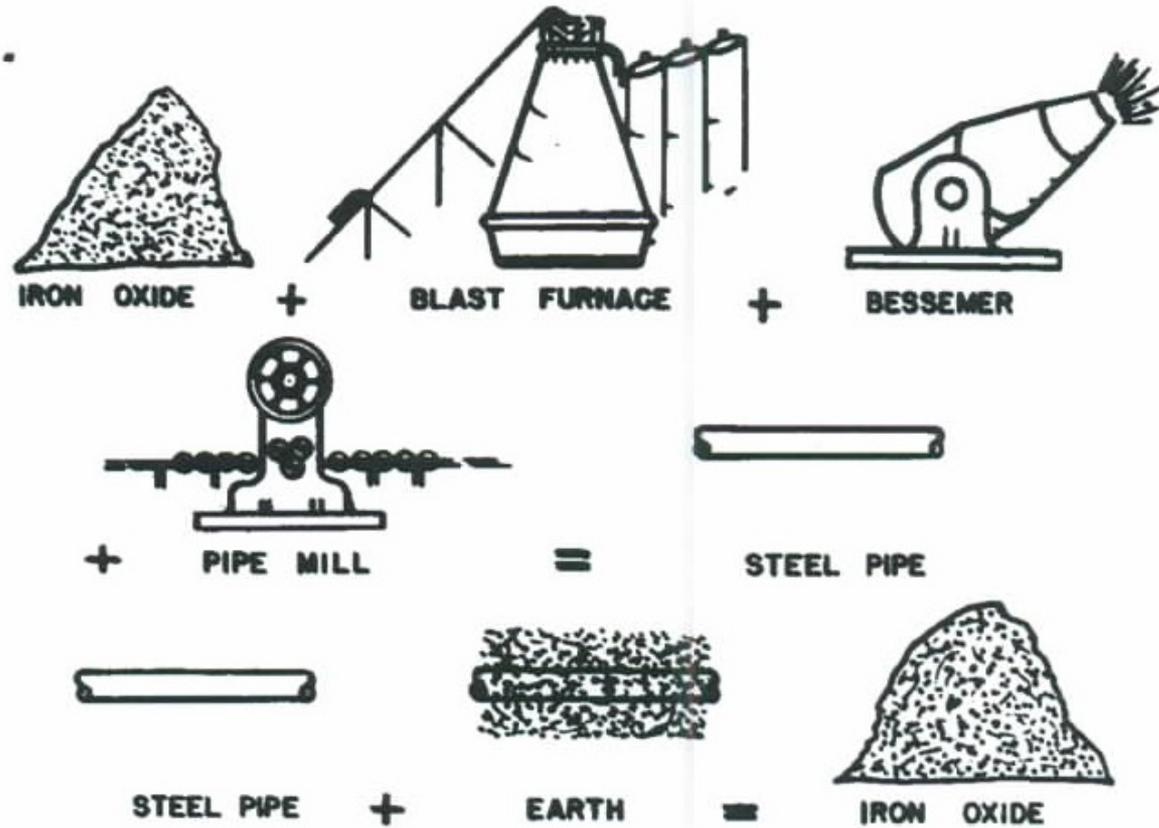


Basics of corrosion

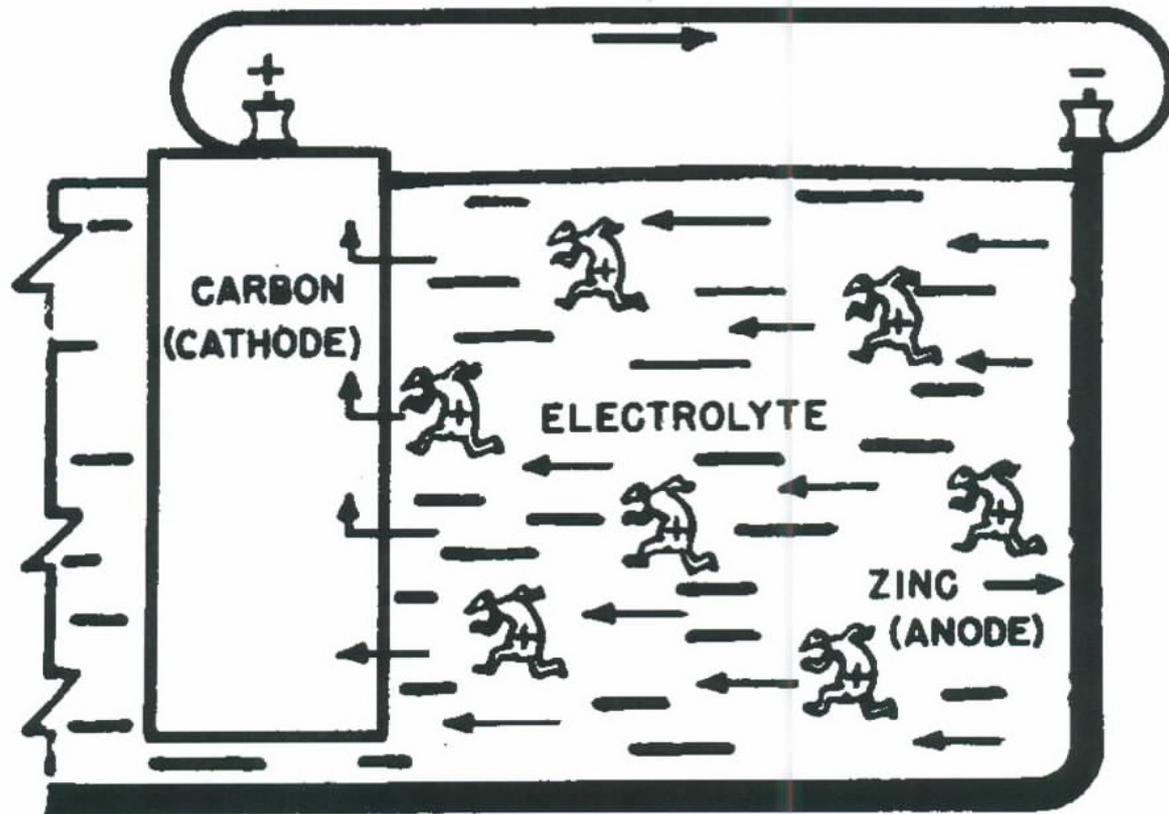
- Four basic requirements for a corrosion cell
 - Anode
 - Cathode
 - Metallic substrate
 - **Electrolyte**

Corrosion is Inevitable

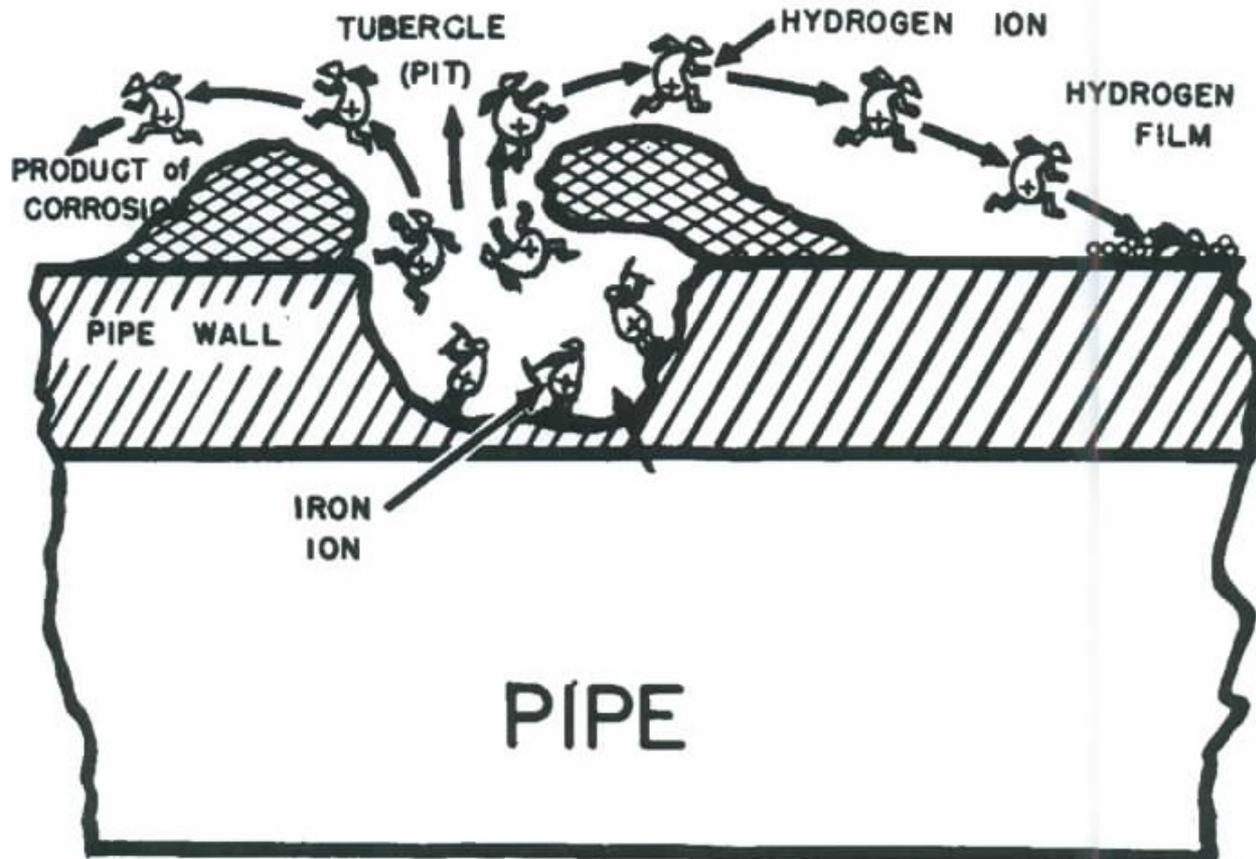
Dust to dust



Everyday Corrosion Cell



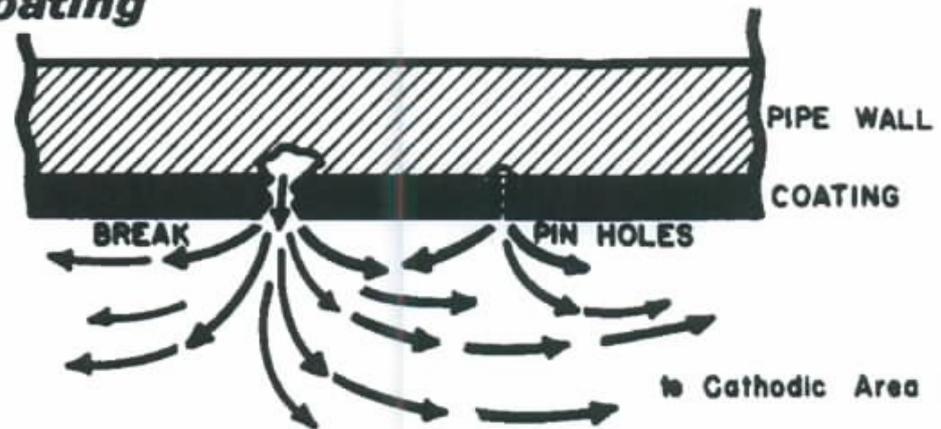
Why we need to control it



Coatings are a corrosion/control tool

Concentration of Corrosion at Breaks and Pin Holes in Coating

Rate of Corrosion
Depends on Conductivity
of Earth

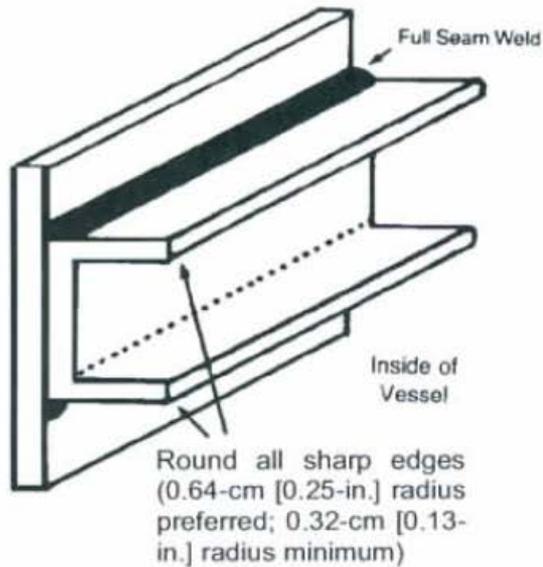


NACE Design Guidelines - RP178-2003

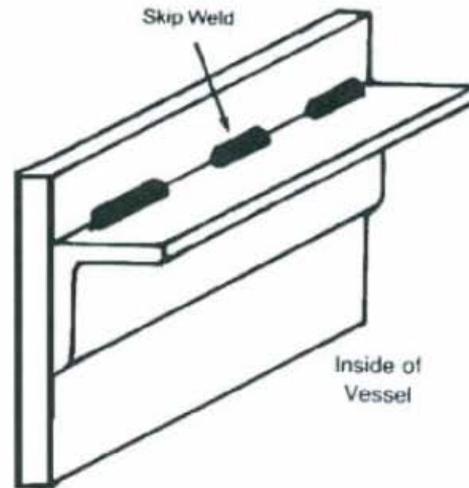
- Corrosion is a natural process. It will happen! The challenge at hand is to slow it down and make it an acceptable and economical fact of life
- Poor design, sloppy construction and lack of attention to detail cause most severe corrosion problems
- Not watching what you buy is just asking for huge financial outlays later; after time and service environments attack your structure

Some Do's and Don'ts Building with Steel Components in Immersion

Appendix A: Fabrication Details, Surface Finish Requirements, and Proper Design Considerations for Metal Tanks and Vessels to Be Lined for Immersion



DO



DON'T

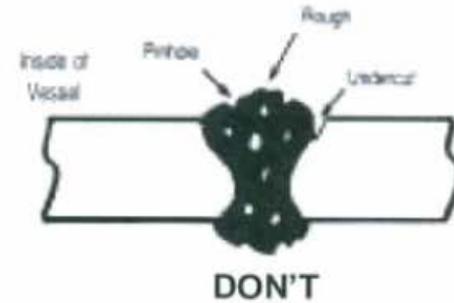
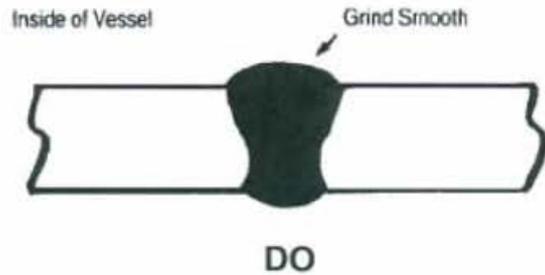


DON'T

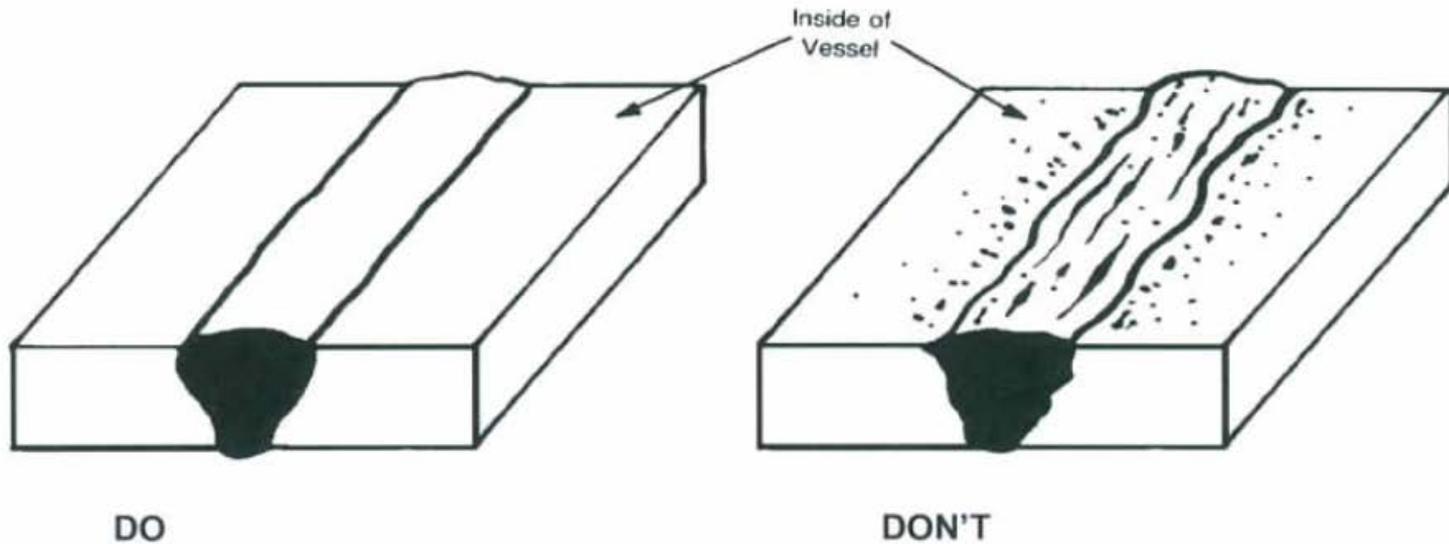
FIGURE 11



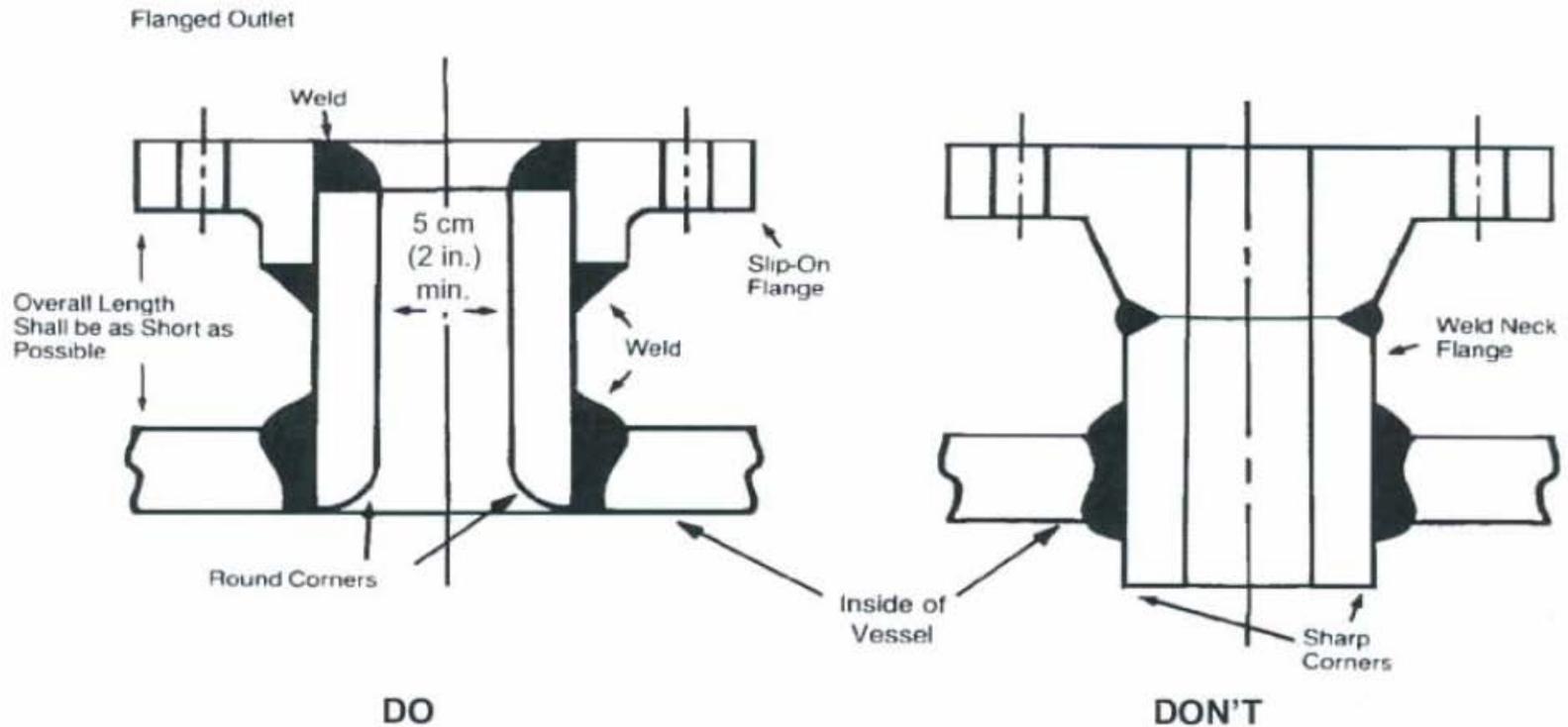
General weld preparation



Weld-spatter means immediate start to immersion coating failure



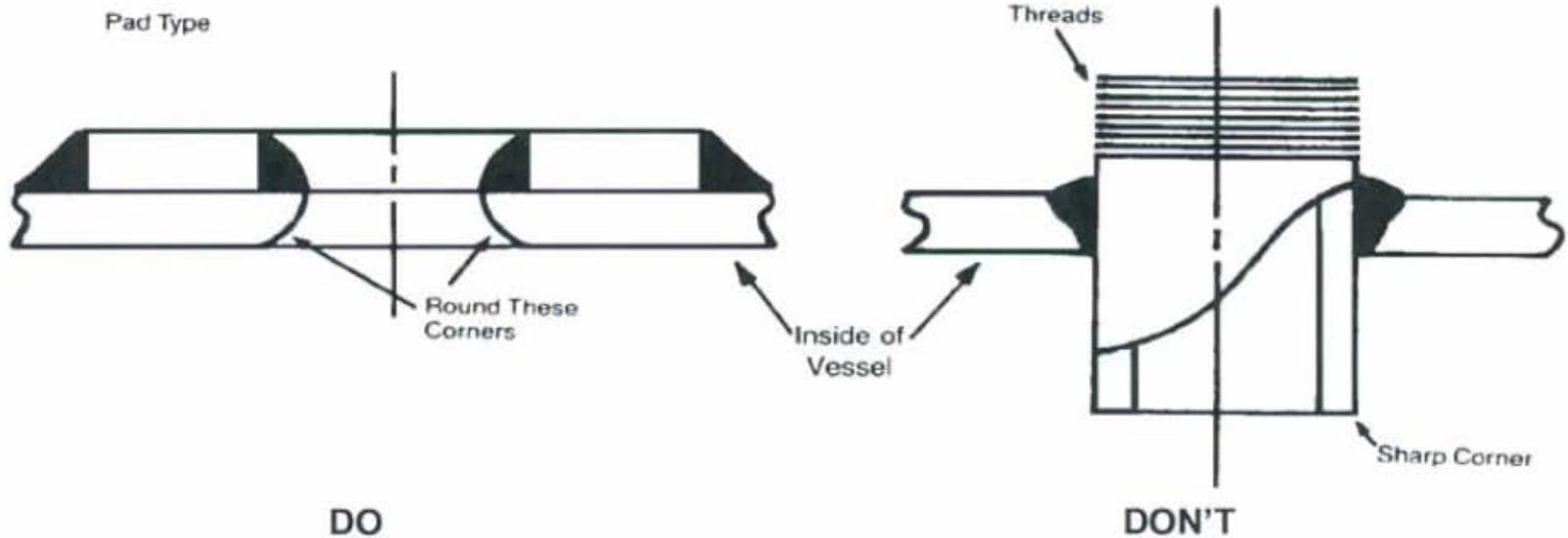
Small opening treatment



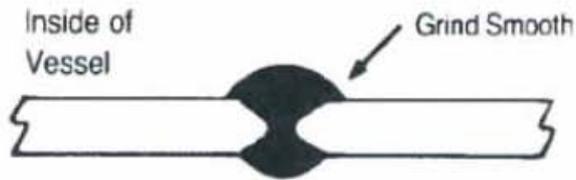
Typical small opening failure



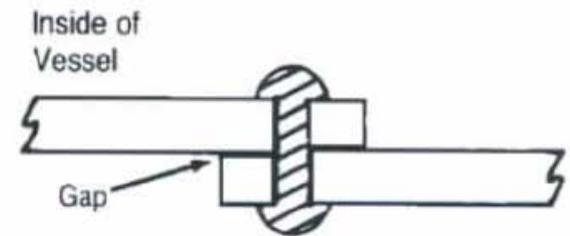
No threads in immersion service



On Internet - NACE RP178-2003



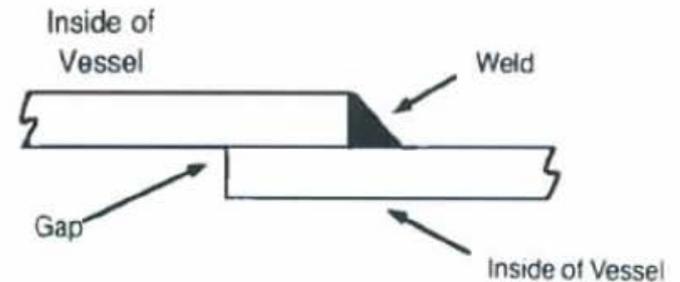
DO



DON'T



DO



DON'T

Specification writing for maintenance projects

- Based on best intelligence gained by an inspection before writing bid document or request for proposals
- Best type of inspection is a structural inspection done in a cleaned out, well lit empty tank
- Dive inspections are easy on everyone but the tank's future. ROV inspections are only a little better
- Dives, and to a lesser extent float-downs or ROV use are easy/convenient/cheap... however they don't cut it economically in the long run though

Benefits of a washout inspection

- Easier to see substrates and judge the severity of corrosion problems & coating failures
- Silt can be removed and most times bio-films can be washed off the surface quickly and economically
- Pitting is better revealed on floor and shell-wall
- Take time to remove roof vent cover to look into rafter assembly on top of the dollar-plate
- Consider using AWWA spray method # 2 to disinfect - to gain quicker use of tank

Can you say bio-film?



Here is why the vent cover should come off



What can be left when test-blasted



Who chose this site?



What's wrong with this picture?



No room for errors here!



Protective coating basics

- **ANSI/NSF Standard 61 Testing is Required for potable water storage interior use**
- **Barrier coating systems**
 - Many varied epoxy formulas - polyamides, amines, polyamines, polyamidoamines, cycloaliphatic amines
- **Galvanic acting systems**
 - Organic zinc-rich formulas - moisture cured urethane binders
 - Inorganic zinc-rich formulas - Never

Surface preparation specifications

- Interior blast SSPC-SP10, near-white level of cleanliness – 2.0 to 3.0 mil profile
- Exterior blast to SSPC-SP6, commercial-grade level of cleanliness – 1.5 to 2.5 mil profile
- Exterior – if overcoating (based on cross-hatch test or X-scribe results, etc. Power wash using < 3,000 psi water, SSPC-SP3 Power-tool cleaning to tight edges, feather boundaries
- Spot prime with epoxy mastic/finish with water-borne acrylic polymer

Choosing an interior lining system

- First choose the material supplier
- Look for any available extended warranty from that supplier
- Demand a minimum of a two-year warranty from the low bid tank fabricator or renovator
- Include a formal two-year inspection - empty/washout/detailed inspection/required touchup
- Check the credentials of the sub-contractor doing the painting for the fabricator
- Talk to the last two or three owner's that they teamed up with to check their quality outcomes

Continued...

- What exterior color will you choose and how will that effect the life of the chosen interior lining system
- Pick a VOC compliant system for the exterior coating and interior lining systems
- All epoxy system? One coat, two coats or three coats?
*Always include a stripe coat on welds and prominences
- Assure that the interior system has ANSI/NSF Standard 61 credentials when reviewing submittals

Choosing an exterior finish system

- How important is graffiti resistance to your group
- Will your final site be securely/adequately fenced
- Will the fence be right on top of the tank or will space be allowed for later maintenance equipment and crews to work effectively
- Is the surrounding area now built up with homes or commercial buildings
- If not now, will there be a built up surrounding by the time the first maintenance work is done on the tank

Continued...

- Is the intent to hide the tank/keep it discreetly visible only or to flatter the neighborhood with an extra aesthetic effort and bold colors
- Do you want high gloss or low gloss finish
- What about color and gloss retention
- Will exterior coats need to be sprayed or rolled
- When sprayed, some coatings can drift in the wind and stay wet for a mile or more

General tank considerations

- Will there be adequate clearance between excavated hillside and the tank shell
- Will there be an 12” deep steel ring-wall built 18” out from around the base of the new tank shell
- Will there be two shell Manways & what sizes will they be
- Will the shell Manways have hinges
- Will the overflow outlet enter the ground or splash onto the ground with a concrete splash-pad
- Will the latter be equipped with a flapper-valve

No steel ring-wall around shell wall



Ideal 30" shell Manway complete with hinges



Continued...

- Will the access ladder have a cage and a practical security ladder-gate (meet OSHA Regs)
- Will the ladder meet the roof to one side of the roof Manway or force a dangerous entry by stepping onto or over the roof hatch
- Will there be fall-protection on the access ladder
- Will there be a second roof hatch for ventilation/light
- Will the roof vent be corrosion-resistant

Continued...

- Will there be Cathodic Protection installed inside tank
- If there will be, will it float or hang from the ceiling
- Will there be a water-mixer or THM relief system in the tank
- why place one there
- If no mixer is installed, how many feet will the drain line be from the fill-pipe entrance
- What level will the overflow weir-box be set at with respect to the rafter end-clips

This unit was set too high



Continued...

- Will there be an internal ladder to the floor from a roof Manway (consider OSHA confined space entry here)
- Will each shell Manway be equipped with warning notices for vessel entry training requirements
- Will there be handrails each side of the arrival point at top of access ladder
- Will SCADA be installed. If so, keep antenna/conduit off the ladder for safer climbing

Basic inspection equipment

- Testex Kit for measuring blasted surface profile (Interior)
- Visual SSPC Blast result pictorial standards (Exterior)
- Wet film indicator for use during coating application
- Dry film indicator, c/w calibration set for checking dry paint films
- Digital camera for documenting situations
- Chloride testing kit (Chlor-rid[®]) - redos
- Chemical (sulphates) contamination testing kit - redos
- Clean, soft, absorbent rags for trace oil, grease testing

Storage/mixing/using paints & coatings

- Sit in on contractor's safety meetings to be on the same page as they are
- Store paint in a safe (thievery) fire-secure, dry, temperature controlled environment if at all possible
- Mix whole container when mixing parts A & B, etc.
- Measure temperature of material before mixing and compare to directions on Manufacturer's PDS
- Read and understand the Manufacturer's MSDS*
- Ground in-use containers, pumps, etc. as well as tank
- Wear appropriate breathing-air protection* when around application activity (per applicable MSDS)

Continued...

- Assure that interior LEL's are controlled by ample air-movement when application, film formation and cure activity is going on (consider using exhaust outlet filtering to stop extended overspray damage)
- Watch for overspray activity when forced-ventilation is adopted. Understand prevailing wind directions and watch for shifting weather/wind patterns
- Contractor foreman/crew often too close to the potential problem to see it happening until too late

Continued...

- Personal Risks that affect individual inspectors, and workers
 - Entering a hazardous work environment
 - Tripping/Falling
 - Breathing toxic materials (Solvent vapors, dusts, etc.)

Testing a lining for final cure

- Substrate temperature matters most
- Time/temperature film formation - see the manufacturer's product data/application sheet
- Humidity control is often very helpful
- Air movement matters immensely
- Project record keeping for surface temperatures
- Final MEK double-rub testing

Disinfection before use

- AWWA C652 – Spray method # 2
- Know your state rules on dumping water with chlorine residuals in it
- Don't be bashful about demanding proper disposal methods for over-chlorinated water
- Let the contractor submit a disinfection plan and do the testing with his crew
- Conduct and pay for your own Bac-T tests



Questions?

Powerful Statement!

Water always flows uphill toward the money!