Marathon Pipe Line LLC

PHMSA R&D Forum
Regulatory Compliance Breakout Tanks
Methods to Prevent Corrosion of Tank Bottoms

Dec. 1, 2021

Agenda

- Regulatory requirements
- Technical analysis
  - Tank designs on concrete pads (steel in contact with concrete).
  - Tank designs with high density polyethylene (HDPE) liner.
  - Tank designs with concrete pads placed on top of HDPE liner.
  - Tank designs for double bottom tank (e.g., El Segundo tank)
- Technical discussion
- Design advantages/disadvantages

Regulatory Requirements

§195.563 Which pipelines must have cathodic protection?

- (a) Each buried or submerged pipeline that is constructed, relocated, replaced, or otherwise changed after the applicable date in §195.401(c) must have cathodic protection. The cathodic protection must be in operation not later than 1 year after the pipeline is constructed, relocated, replaced, or otherwise changed, as applicable.
- (b) Each buried or submerged pipeline converted under §195.5 must have cathodic protection if the pipeline--
- (1) Has cathodic protection that substantially meets §195.571 before the pipeline is placed in service; or
- (2) Is a segment that is relocated, replaced, or substantially altered.
- (c) All other buried or submerged pipelines that have an effective external coating must have cathodic protection.(see Note below) Except as provided by paragraph (d) of this section, this requirement does not apply to breakout tanks and does not apply to buried piping in breakout tank areas and pumping stations until December 29, 2003
- (d) Bare pipelines, breakout tank areas, and buried pumping station piping must have cathodic protection in places where regulations in effect before January 28, 2002 required cathodic protection as a result of electrical inspections. See previous editions of this part in 49 CFR, parts 186 to 199.
- (e) Unprotected pipe must have cathodic protection if required by §195.573(b).

Regulatory Requirements

§195.565 How do I install cathodic protection on breakout tanks?

After October 2, 2000, when you install cathodic protection under §195.563(a) to protect the bottom of an above-ground breakout tank of more than 500 barrels 79.49m3 capacity built to API Spec 12F (incorporated by reference, see §195.3), API Std 620 (incorporated by reference, see §195.3), API Std 650 (incorporated by reference, see §195.3), or API Std 650's predecessor, Standard 12C, you must install the system in accordance with ANSI/API RP 651 (incorporated by reference, see §195.3). However, you don't need to comply with ANSI/API RP 651 when installing any tank for which you note in the corrosion control procedures established under §195.402(c)(3) why complying with all or certain provisions of ANSI/API RP 651 is not necessary for the safety of the tank.

Regulatory Requirements

API 651 (Third Edition)

5.1.4. Limitations of External Cathodic Protection

Cathodic protection is an effective means of corrosion control ***only if it is possible to pass electrical current between the anode and cathode (tank bottom).*** *Many factors can reduce or eliminate the flow of electrical current and, therefore,* ***may limit the effectiveness of cathodic protection in some cases or preclude its use in others****. Such factors include:*

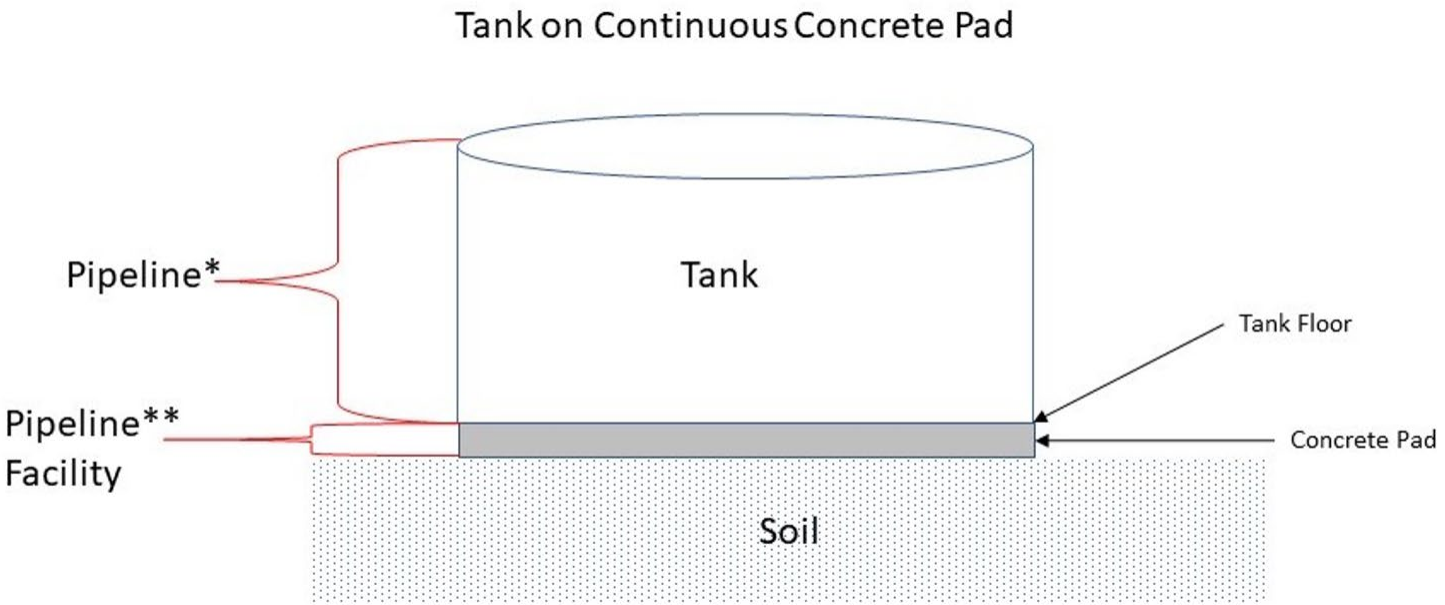
a. Tank pads such as concrete, asphalt, or oiled sand;

b. An impervious external liner between the tank bottom and anodes;

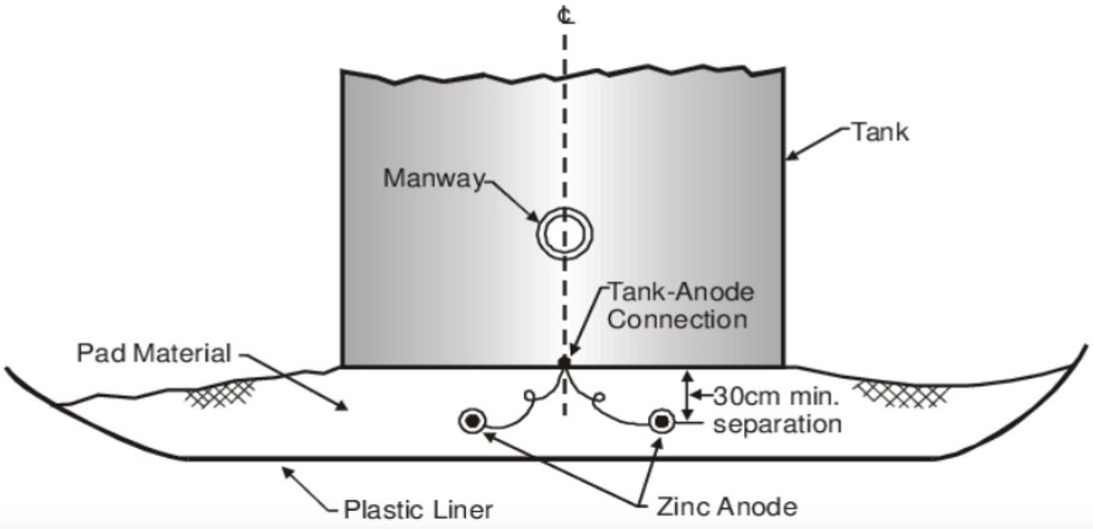
c. High resistance soil or rock aggregate pads;

d. Old storage tank bottoms left in place when a new bottom is installed.

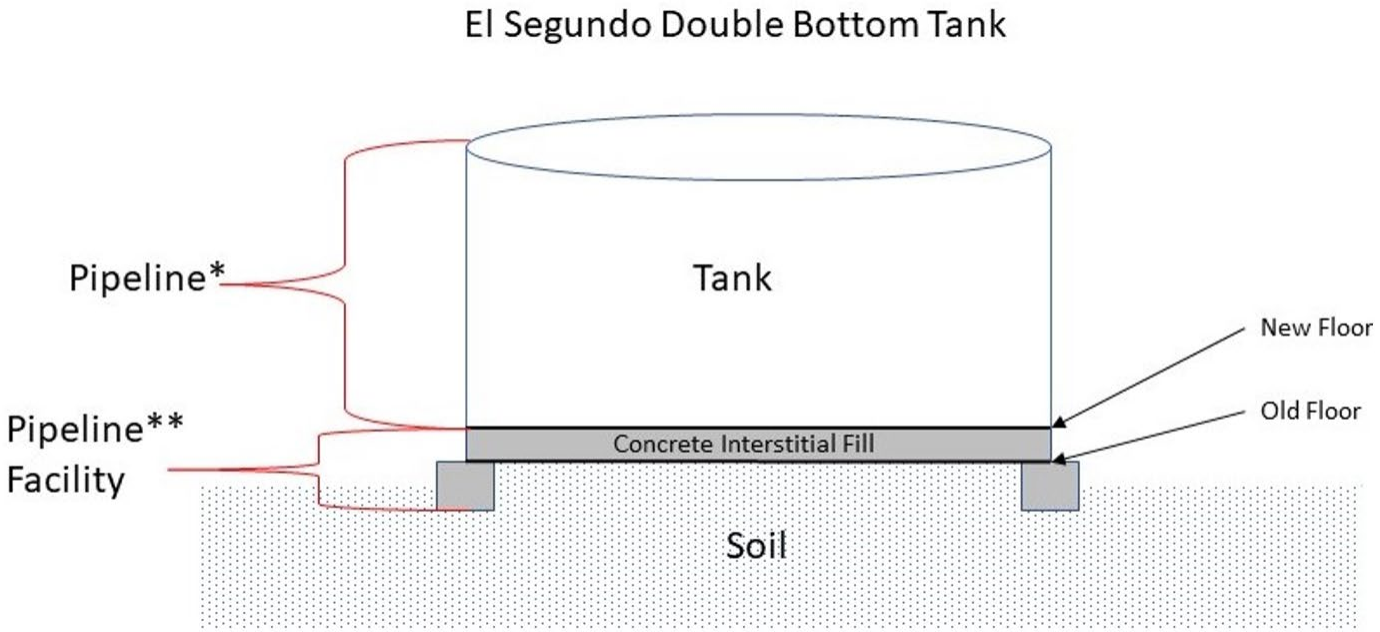
Tank Designs – Concrete Pad



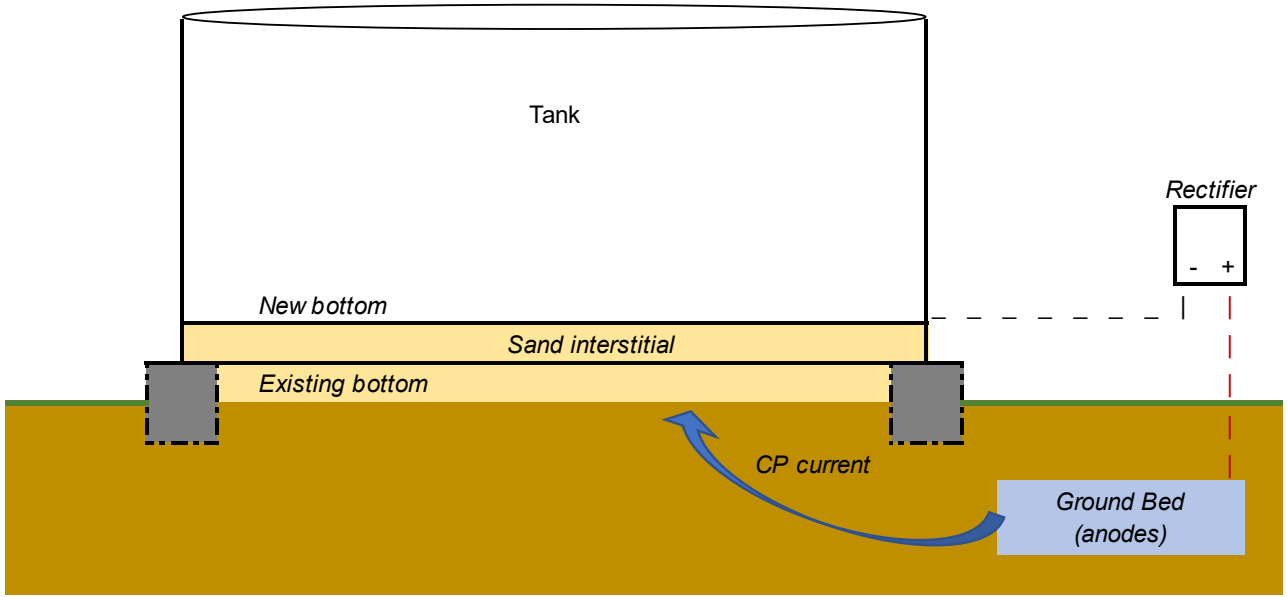
Tank Designs – HDPE Liner



Tank Designs – El Segundo

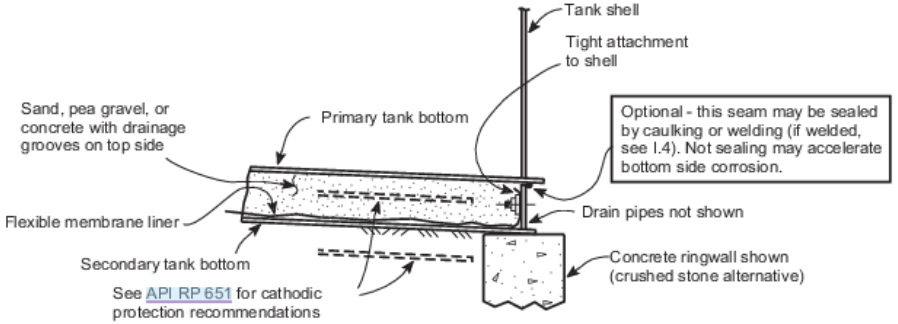


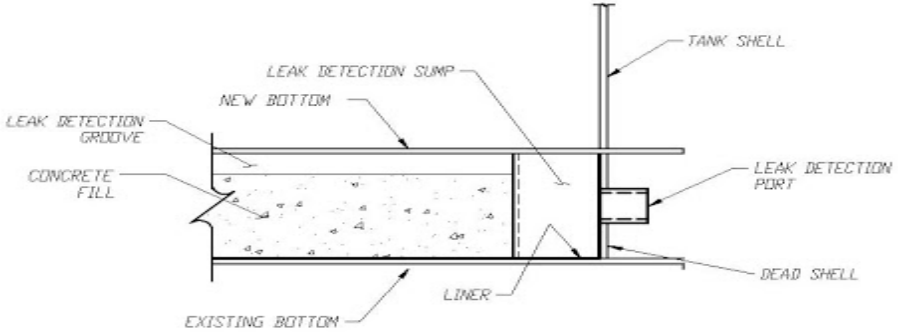
Tank Designs – Double Bottom



Technical Discussion

- Original floor left in place
  - Secondary bottom / “dead shell”
- Impervious liner (typical)
- Filler material (typically sand, 4” - 6”)
  - El Segundo design has concrete fill
- New primary bottom
- Leak detection ports around perimeter





AST Designs That Limit CP Effectiveness

- New tank bottom constructed over sand, creating interstitial space
  - Impervious liner commonly installed
- CP current protects original tank bottom
  - Does not transfer current to new bottom
- Galvanic anodes sometimes installed in interstitial space (eventually deplete)
  - Difficult to size large enough to protect new bottom
  - Can short with bottom movement

Advantages of Double-Bottom and Concrete Pad Designs

- Interstitial space provides leak containment
  - Impervious liner prevents hazardous liquid to permeate soil beneath tank
- Leak detection ports provide early positive confirmation
  - Traditional single-bottom design can be difficult to detect leak
- Interstitial space can provide sealed / controlled environment
  - Prevent moisture ingress
- Prevent moisture ingress

Questions