

Technical Bulletin 0003

Subject: Recommended Installation Practice for the Stelth 2[®] Reference Electrodes at Pipeline Crossings and with Multiple Pipelines in the Right-of-Way

Question:

For two crossing pipelines that are electrically connected - Where should the **Stelth[®] 2 reference electrode** be placed when the pipelines are electrically connected (bonded) to each other?

Answer:

When two crossing pipelines are electrically connected, the **Stelth[®] 2 reference electrode** will sense the potential of both pipelines. The relative influence of pipelines with different potentials on the reading obtained at the reference electrode is a function of the distance between the pipelines and the reference electrode. For example if a reference electrode is placed as illustrated in Drawing TB-0003a & TB-0003b the potential reading will be influenced approximately 99% by pipeline one and 1% by pipeline two.

The basic answer to the question of reference electrode placement at a crossing where the pipelines are electrically connected (bonded) is **"As Close to the Pipeline of Interest as Possible"**.

Question:

For two crossing pipelines that are electrically isolated - Where should the **Stelth[®] 2 reference electrode** be placed when the pipelines are electrically isolated from each other?

Answer:

When the crossing pipelines are electrically isolated, the main concern regarding **Stelth[®] 2 reference electrode** placement is the shielding of the reference electrode from the unconnected pipeline. When the isolated pipeline is close to the reference electrode it will want to interfere with the flow of current from the pipeline connected to the reference electrode and the reference electrode itself. In this case, the effect is much less than when the crossing pipelines are connected. **As long as the reference electrode is placed so that there is a clear electrolyte path between the reference electrode and the pipeline connected to the reference electrode, the effect of the isolated pipeline will be minimal.** However, it is always good practice to place the reference electrode as close as possible to the surface being measured, as illustrated in Drawing TB-0003b.

The basic answer to the question of reference electrode placement at a crossing where the pipelines are electrically isolated is **"As Close to the Pipeline of Interest as Possible"**.

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Question:

For multiple parallel pipelines that are electrically connected - Where should the **Stelth[®] 2 reference electrodes** be placed when there are multiple pipelines in the right-of-way and they are electrically connected (bonded) to each other?

Answer:

When multiple pipelines are installed in parallel in a utility corridor, and they are electrically connected, it is preferred to install one stationary reference electrode for each pipeline. The **Stelth[®] 2 reference electrode** should be installed below the horizontal centerline (spring line) of each pipeline and should be spaced 18" to 24" from each pipeline. **The reference electrodes should be placed on the side of the pipeline away from the adjacent pipeline that is receiving most of the cathodic protection current.** This allows for the measurement of the potential of each pipeline with a minimum of error due to IR Drop, as illustrated in Drawing TB-0003c.

If only a single reference electrode is to be used, and the pipelines are electrically connected to each other, the reference electrode should be placed adjacent to the pipeline that is receiving the largest amount of current from the cathodic protection system. This can be based on either actual measurement of the current flow to each of the pipelines, or on an estimate of the current requirements for each pipeline. This placement minimizes IR Drop error. Review Drawing TB-0003e.

For two parallel, electrically connected, pipelines using a single **Stelth[®] 2 reference electrode**, the minimum IR Drop will be measured when the reference electrode is placed adjacent to the pipeline receiving the most cathodic protection current. **The reference electrode should be placed below the horizontal centerline (spring line) of the pipeline and should be spaced 18" to 24" from the pipeline on the side of the pipeline away from the other parallel pipeline.**

For multiple, electrically connected parallel pipelines using a single **Stelth[®] 2 reference electrode**, the reference electrode should be placed adjacent to the pipeline that is receiving the most cathodic protection current. The reference electrode should be placed below the horizontal centerline (spring line) of the pipeline and spaced 18" to 24" from the pipeline. It is preferable to locate the reference electrode on the side of the pipeline away from the pipelines receiving the least total current in the array, but this is less of a concern with multiple pipelines than when only two parallel pipelines are being monitored.

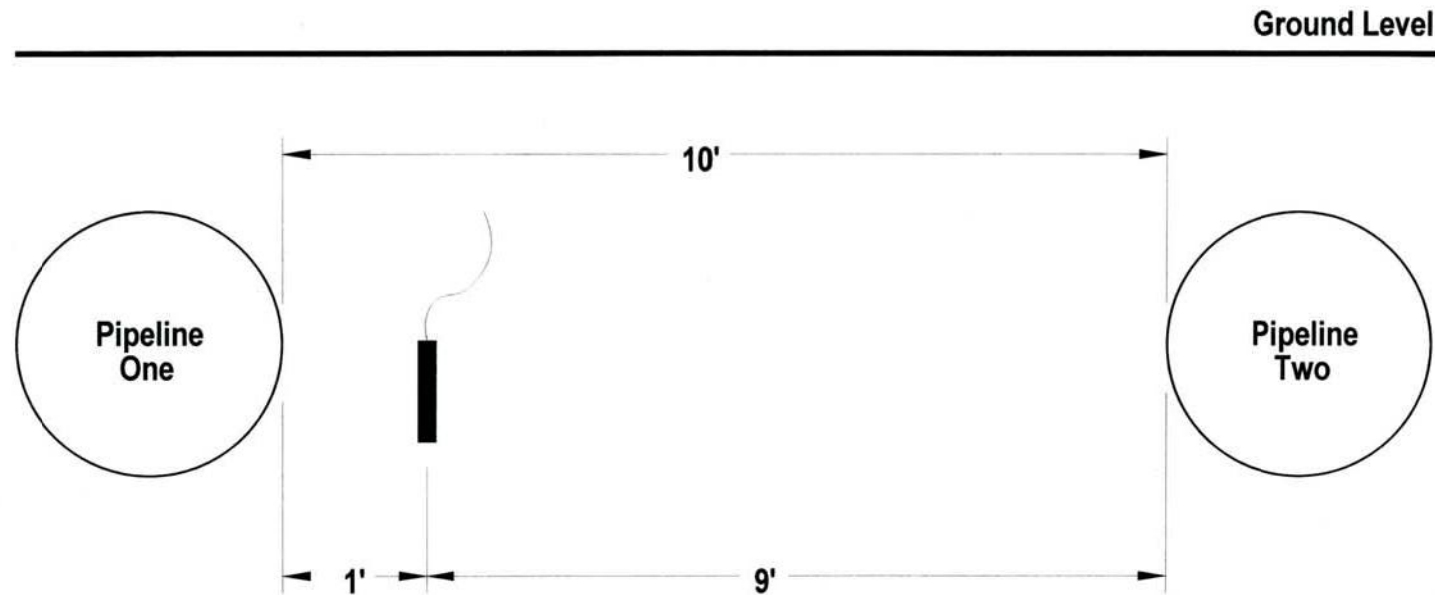
The best answer to the question of electrode placement with multiple parallel pipelines is to use multiple reference electrodes. If only a single reference is used it should be placed "Where the IR Drop is Minimal".

The ultimate answer to all of the above considerations is to use a **Stelth[®] 7 IR Free Probe** built, under license by **BORIN Manufacturing** to the EC/DIN-50925 standard. With the **Stelth[®] 7 IR Free Probe** you can easily isolate each pipeline without regard to distance, IR Drop or location of the pipelines or reference electrodes while taking IR Free On & Off potential readings. With the **Stelth[®] 7 IR Free Probe** you would always read the worst potential on your structure not the average potential. Additionally, you would read the current protecting this worst potential.

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Recommendation for Placement of Stelth 2 Reference Electrodes where Bonded Pipelines Cross



Formulas for Calculating the Relative Influence

$$\begin{array}{l} \text{\% of Influence} \\ \text{by} \\ \text{Pipeline One} \end{array} = \frac{(\text{distance from pipeline 2})^2}{(\text{distance from pipeline 1})^2 + (\text{distance from pipeline 2})^2} \times 100$$

$$\begin{array}{l} \text{\% of Influence} \\ \text{by} \\ \text{Pipeline Two} \end{array} = \frac{(\text{distance from pipeline 1})^2}{(\text{distance from pipeline 1})^2 + (\text{distance from pipeline 2})^2} \times 100$$

The basic answer to the question of reference electrode placement at a line crossing where the pipelines are electrically connected (bonded) is "AS CLOSE TO THE PIPELINE OF INTEREST AS POSSIBLE"

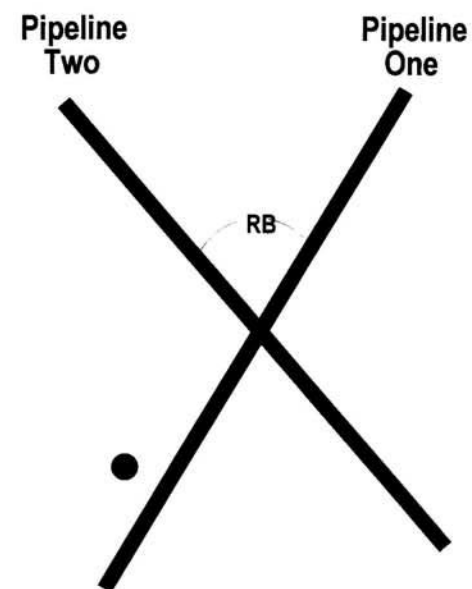
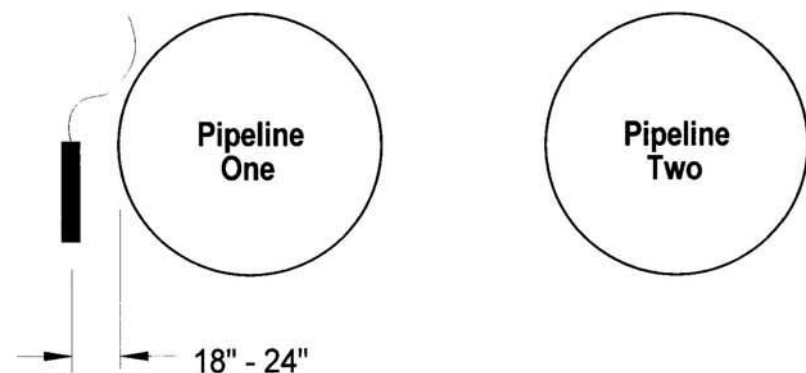


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TITLE SRE Placement at Line Crossings		
SIZE A	REVISION 1.0	DRAWING NUMBER Technical Bulletin TB-0003a
SCALE Representative	DATE February 29, 2000	Page 3 of 7

Recommendation for Placement of Stelth 2 Reference Electrodes where Two Bonded Pipelines Cross

Ground Level



RB = Resistance Bond

Example1: Single Reference Electrode, Two Parallel or Crossing Pipelines



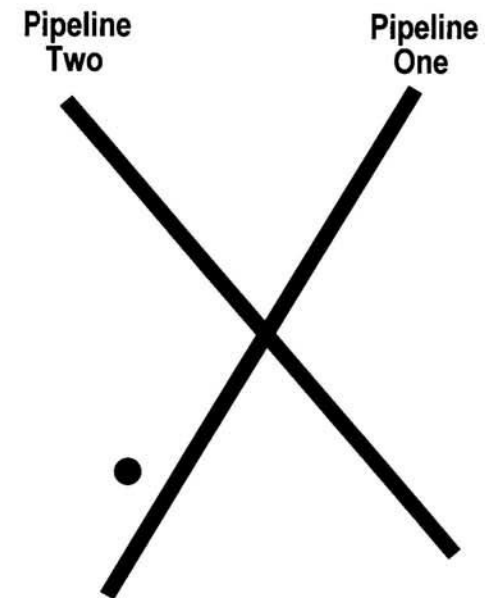
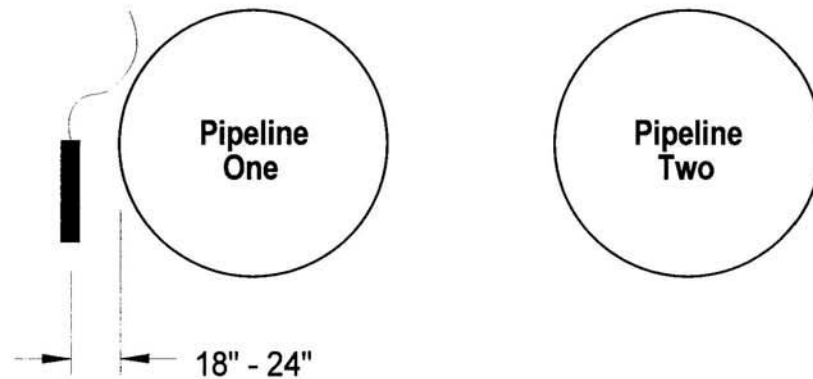
The basic answer to the question of reference electrode placement at a line crossing where the pipelines are electrically connected (bonded) is "AS CLOSE TO THE PIPELINE OF INTEREST AS POSSIBLE".

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TITLE SRE Placement at Line Crossings		
SIZE A	REVISION 1.0	DRAWING NUMBER Technical Bulletin TB-0003b
SCALE Representative	DATE February 29, 2000	Page 4 of 7

Recommendation for Placement of Stelth 2 Reference Electrodes where Two Isolated Pipelines Cross

Ground Level



Example 2: Single Reference Electrode, Two Parallel or Crossing Pipelines



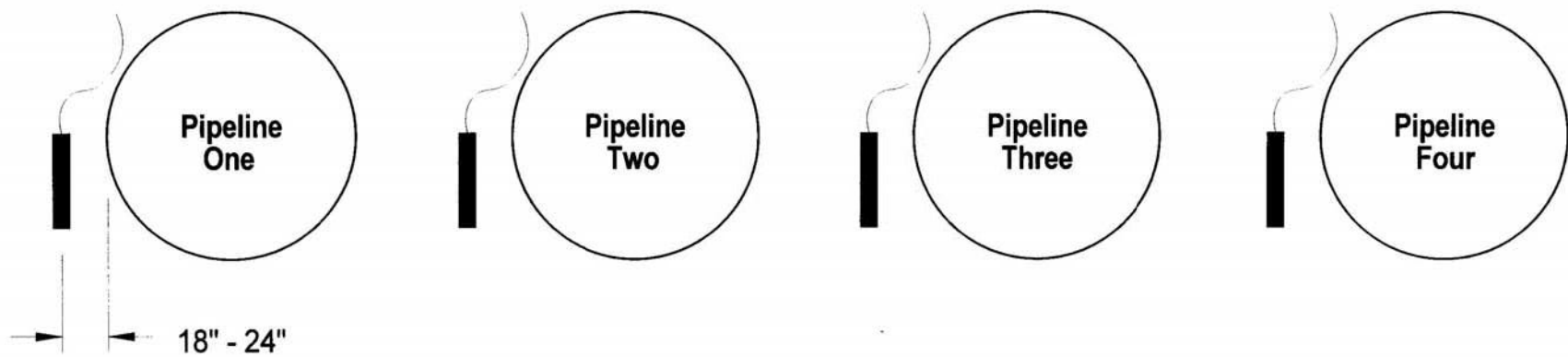
The basic answer to the question of reference electrode placement at a linecrossing where the pipelines are electrically isolated is "AS CLOSE TO THE PIPELINE OF INTEREST AS POSSIBLE", insuring that there is a very good electrical path with low resistance.

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TITLE SRE Placement at Line Crossings			
SIZE A	REVISION 1.0	DRAWING NUMBER Technical Bulletin TB-0003c	
SCALE Representative	DATE February 29, 2000	Page 5 of 7	

Recommendation for Placement of Stelth 2 Reference Electrodes for Bonded Multiple Parallel Pipelines

Ground Level



Example 3: Multiple Reference Electrodes (preferred)

The reference electrodes should be placed on the side of the pipeline away from the adjacent pipeline that is receiving most of the cathodic protection current.
"AS CLOSE TO THE PIPELINE OF INTEREST AS POSSIBLE"

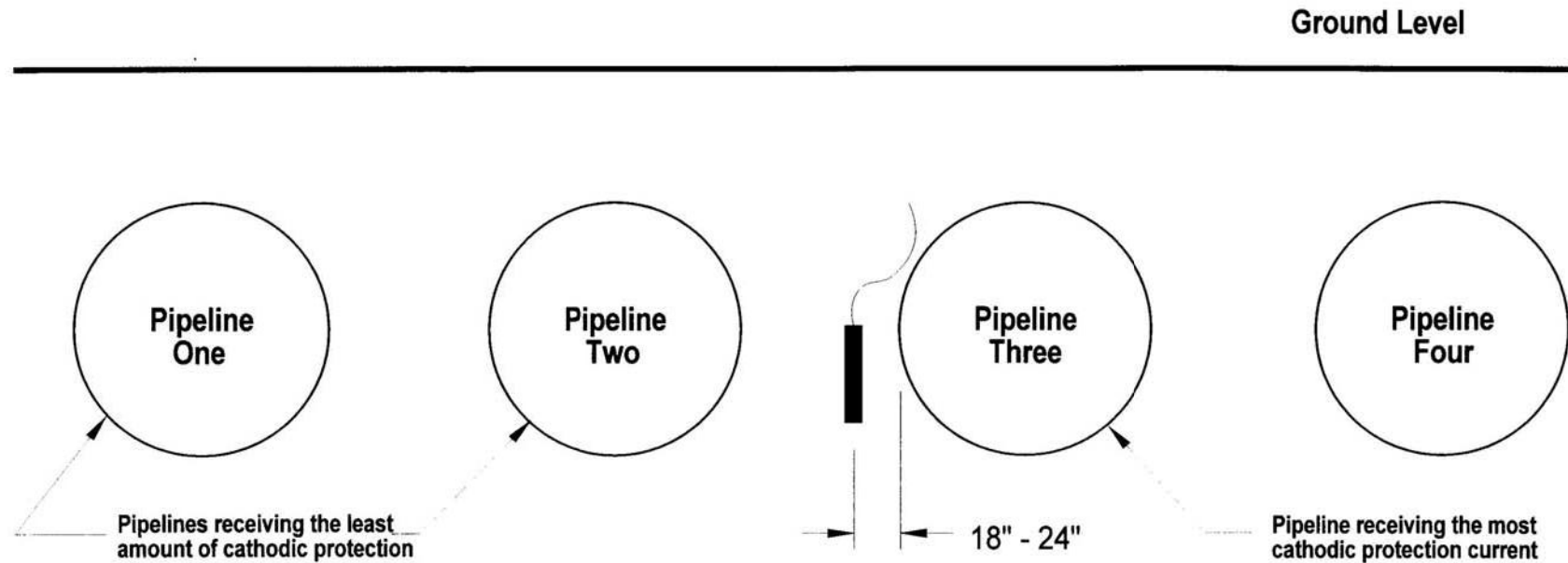


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TITLE SRE Placement at Line Crossings			
SIZE	REVISION	DRAWING NUMBER	
A	1.0	Technical Bulletin TB-0003d	
SCALE	DATE	Page	
Representative	February 29, 2000	6 of 7	

Recommendation for Placement of Single Stelth 2 Reference Electrode for Bonded Multiple Parallel Pipelines



Example 4: Single Reference Electrode, Multiple parallel pipelines.

The reference electrode should be placed adjacent to the pipeline that is receiving the largest amount of current from the cathodic protection system.



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TITLE SRE Placement at Line Crossings		
SIZE A	REVISION 1.0	DRAWING NUMBER Technical Bulletin TB-0003e
SCALE Representative	DATE February 29, 2000	Page 7 of 7