



GUIDELINES FOR CATHODIC PROTECTION OF GALVANIZED STEEL GRADIENT CONTROL MATS

1.0 APPLICABILITY

- 1.1 These guidelines apply to cathodic protection of galvanized steel gradient control mats installed at pipeline appurtenances to reduce electrical step and touch potentials in areas where persons could come into contact with a pipeline appurtenance subject to hazardous potentials.
- 1.2 These guidelines do not apply when the gradient mat is connected to other grounding systems, either directly or indirectly through the pipeline appurtenance. These applications require consultation with a cathodic protection specialist.
- 1.3 If the pipeline is not cathodically protected, the galvanized steel mat should be connected only via a decoupling device, or provision should be made to protect both the pipe and the mat in consultation with a cathodic protection specialist.

2.0 ANODES

- 2.1 The magnesium anodes used to protect the mats should be either high potential packaged magnesium anodes (Alloy M1C) or H1-Alloy (Standard) packaged magnesium anodes, as indicated in Table 1.

Table 1. Magnesium Anode Data

Anode Type	Alloy (ASTM B843-93)	Weight (Lbs.)	Standard Package Dimensions
17S4	H-1 Alloy Grade A	17	6.5" x 19"
17D4	M1C (High Potential)	17	6.5" x 19"
32S5	H-1 Alloy Grade A	32	8" x 30"
32D5	M1C (High Potential)	32	8" x 30"

- 2.2 The packaged anodes should be provided with 10 ft. of AWG 6/7 RWU 90 cable. The backfill should be a mix of 75% hydrated gypsum, 15% bentonite, and 5% sodium sulphate.



CP of Galvanized Steel Gradient Control Mats

2.3 The type and quantity of the packaged anodes should be in accordance with Table 2. Contact DEI if the size of the mat exceeds 16' x 16'.

Table 2. Required Type and Number of Magnesium Anodes

Mat Size	Soil Resistivity (Ω -cm) ^[1]	Anode Type	Required No. of Anodes	Calculated Anode Service Life		Layout
				Decoupled GCM	Directly Connected GCM ^[2]	
4' x 8'	Low (1000 to 2000)	32S5	1	>20 years	>18 years	Figure 3
	Moderate (Over 2000)	17S4	1	>20 years	>20 years	Figure 3
8' x 8'	Low (1000 to 2000)	32S5	1	>20 years	>17 years	Figure 1
	Moderate (Over 2000)	17D4	1	>20 years	>20 years	Figure 1
8' x 16'	Low (1000 to 2000)	17S4	2	>20 years	>19 years	Figure 4
	Moderate (Over 2000)	32D5	1	>20 years	>20 years	Figure 3
12' x 16'	Low (1000 to 2000)	32S5	2	>20 years	>20 years	Figure 4
	Moderate (Over 2000)	32D5	2	>20 years	>20 years	Figure 4
16' x 16'	Low (1000 to 2000)	32S5	2	>20 years	>19 years	Figure 2
	Moderate (Over 2000)	32D5	2	>20 years	>20 years	Figure 2

^[1] The cathodic protection system was designed to provide an anode life in excess of 20 years in soil resistivities as low as 1000 Ω -cm and to provide the required protection current at soil resistivities up to 15,000 Ω -cm. Soils with resistivities higher than 15,000 Ω -cm are not considered corrosive.

^[2] If the gradient control mat is directly connected to a pipe appurtenance, then the polarized potential of the protected structure is expected to drop from -1100mV_{CSE} to -850 mV_{CSE} and the service life of the anode would be reduced by 28% for high potential anodes and by 36% for H1-Alloy anodes.



3.0 ANODE INSTALLATION

- 3.1 The anodes should be installed horizontally approximately 3 ft. below the mat, as indicated in Figures 1 to 4.
- 3.2 The anode wire should be run to a close mat wire. The radius of bends should be at least 8".
- 3.3 The #6 AWG anode wire connections to the 0.135" diameter galvanized steel wire of the gradient control mat and the mechanical/electrical bonding of the galvanized steel wires in adjacent gradient control mats should be done by thermit welding. Custom molds and the weld metal for each case are available from DEI (Dairyland Electrical Industries, Inc.) All thermit welded connections should be sealed with two or more layers of Denso LT tape.

3.0 ANODE INSTALLATION CONT'D

3.3 Cont'd

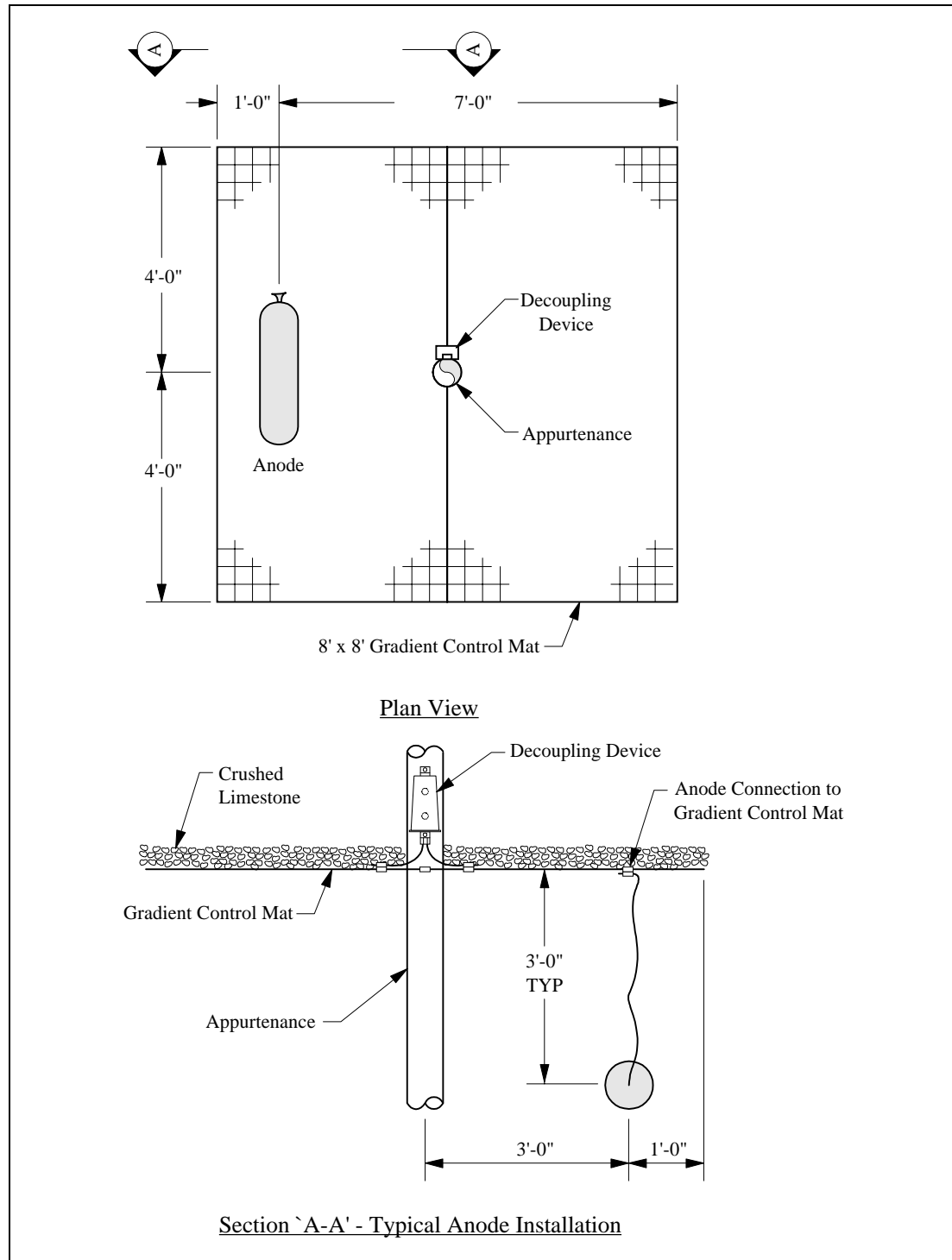


FIGURE 1 • Square Gradient Control Mat with One Anode

3.0 ANODE INSTALLATION CONT'D

3.3 Cont'd

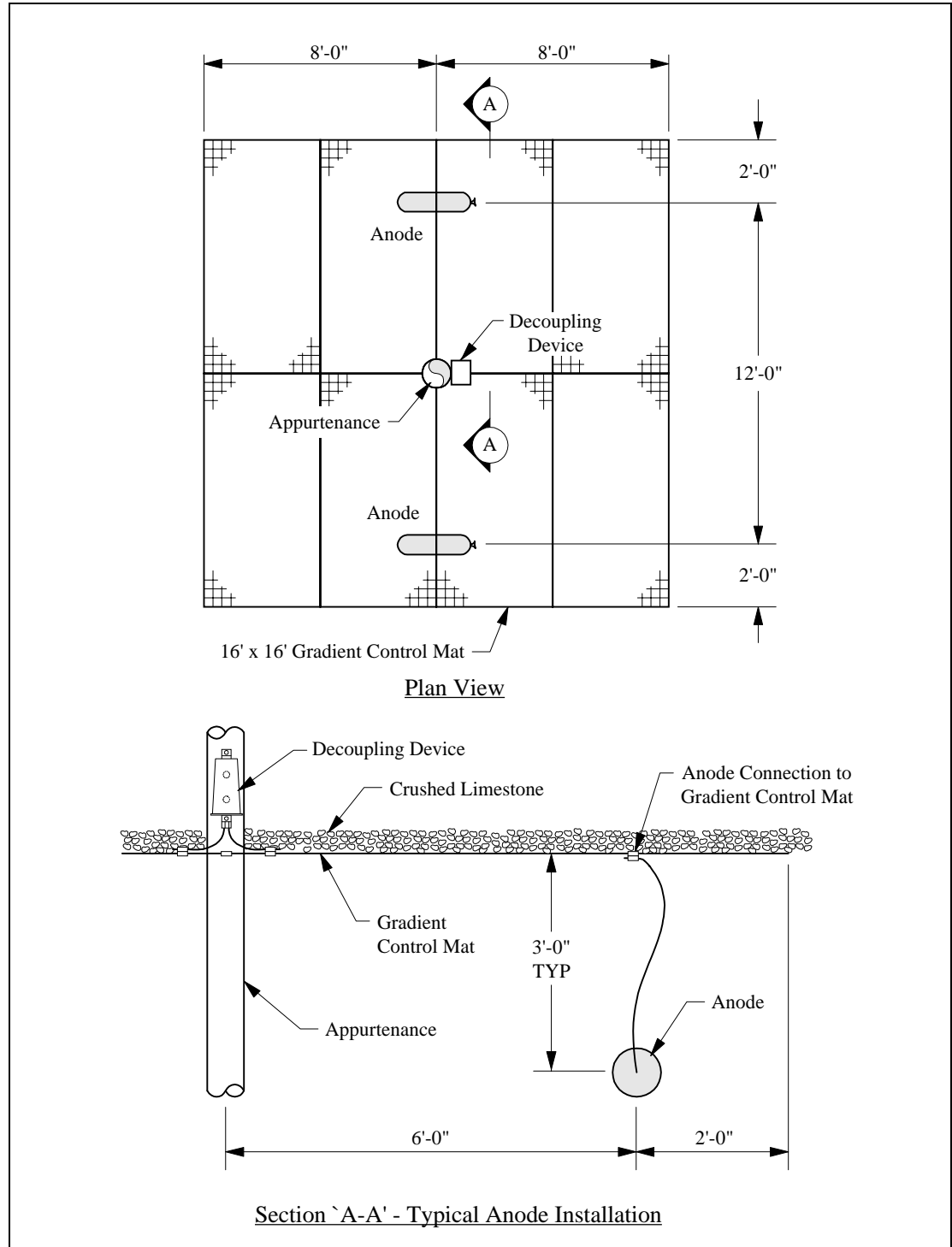


FIGURE 2 • Square Gradient Control Mat with Two Anodes

3.0 ANODE INSTALLATION CONT'D

3.3 Cont'd

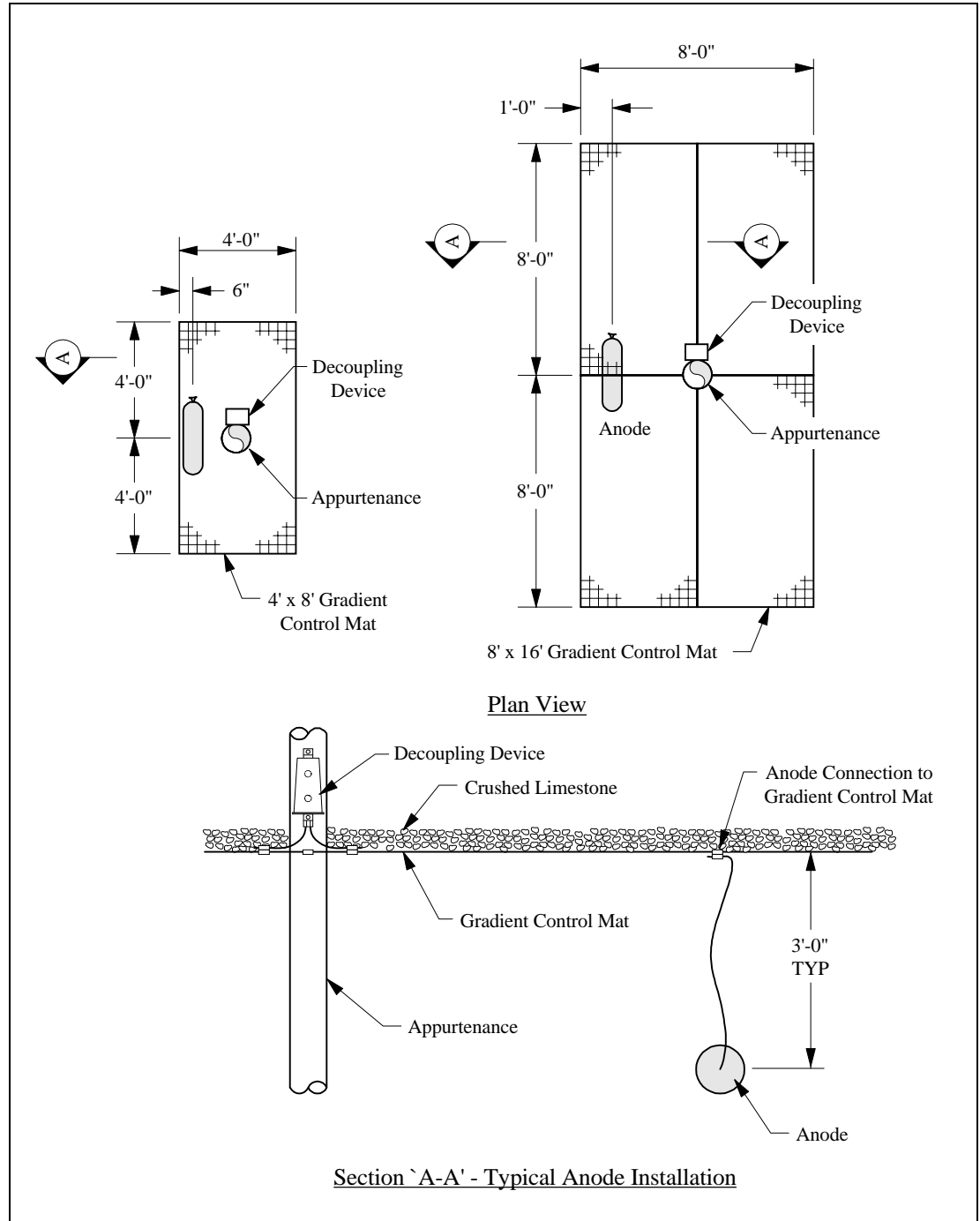


FIGURE 3 • Rectangular Gradient Control Mat with One Anode

3.0 ANODE INSTALLATION CONT'D

3.3 Cont'd

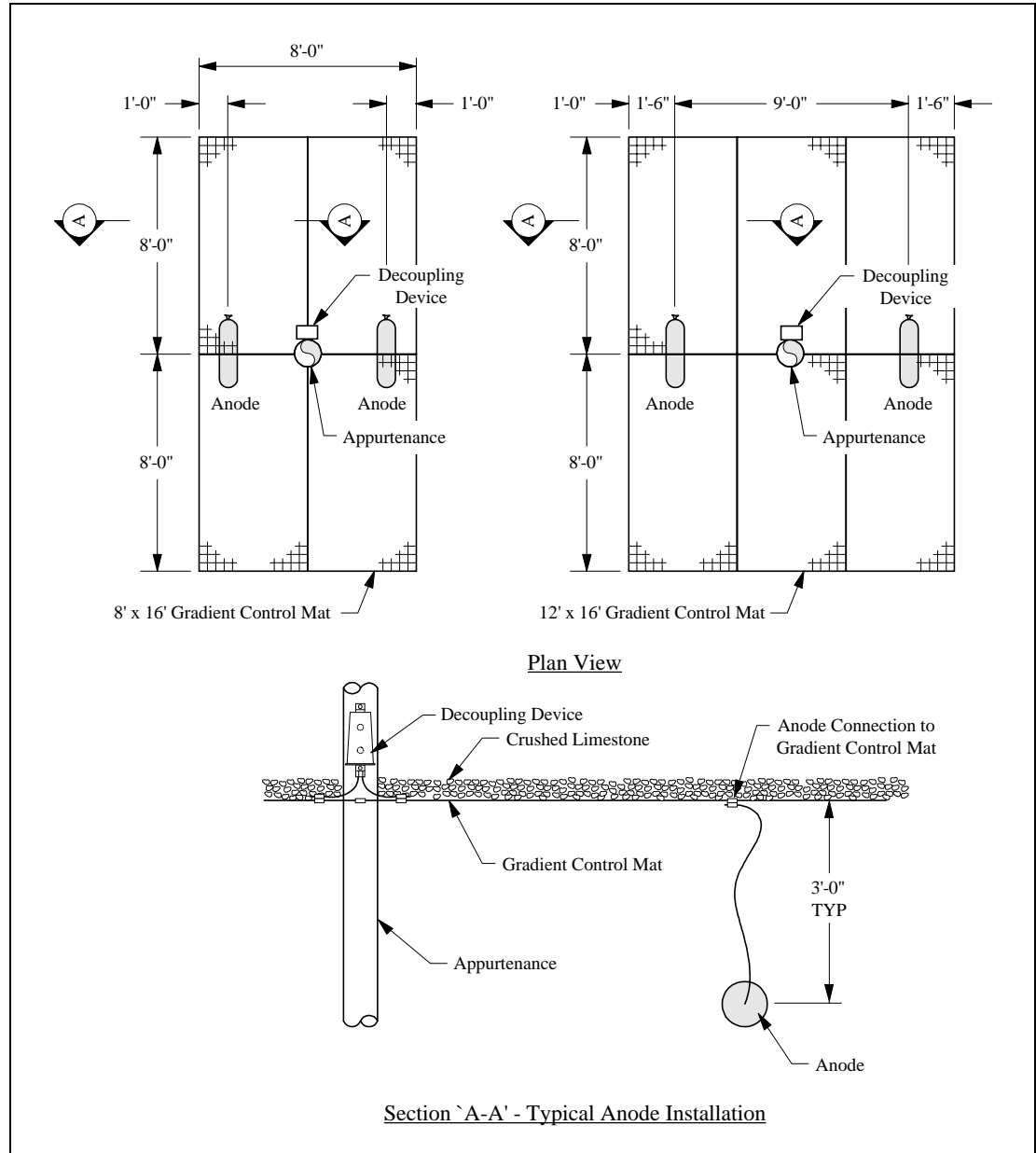


FIGURE 4 • Rectangular Gradient Control Mat with Two Anodes



4.0 ADDITIONAL RECOMMENDATIONS

- 4.1 It is recommended to use crushed limestone as the high resistivity layer to be installed on top of the safety mat, in order to minimize the attack of acid rain on the galvanized steel.