

# WHY WE NEED IEEE PC135.30

NEED FOR PRECISE TECHNICAL

SPECIFICATION ADDRESSING

COPPER-COATED, GALVANIZED & STAINLESS-STEEL

GROUND ROD ELECTRODES



GALGR6258® LIST440F

## TECHNICAL STANDARD

RAISE THE BAR FOR MANUFACTURING ALL GROUND ROD

ELECTRODES TO COMMON, MINIMUM, **SAFE**

YET NON-PROPRIETARY STANDARD



# NATIONAL ELECTRICAL GROUNDING RESEARCH PROJECT

- 5 Test Sites
- 78 Test Samples
- 2 Galvanized Ground Rods (only at 1 of 5 sites)
  - 1 vertical
  - 1 horizontal



# THE DURABILITY OF GALVANIZED STEEL IS UNDENIABLE

- The NCSPA/CorrPro study examined 7000 buried galvanized steel culverts to predict service life of the galvanized coating.
- The study concluded that 93.2% of plain galvanized installations have a soil side service life in excess of 75 years
- 81.5% have a service life in excess of 100 years



GALVAN 6256 5/8" x 3'

# COPPER OVER STEEL

...sacrificial losses

<b>Corroded End</b> Anodic or less noble (ELECTRONEGATIVE)
Magnesium
Zinc
Aluminum
Cadmium
Iron or Steel
Stainless Steels (active)
Soft Solders
Lead
Tin
Nickel
Brass
Bronzes
Copper
Nickel-Copper Alloys
Stainless Steels (passive)
Silver Solder
Silver
Gold
Platinum
<b>Protected End</b> Cathodic or most noble (ELECTROPOSITIVE)



Copper coating

GALGR6258®ALIST440F

# ZINC OVER STEEL...

## self-healing properties

### Corroded End

Anodic or less noble  
(ELECTRONEGATIVE)

Magnesium

Zinc ←

Aluminum

Cadmium

Iron or Steel ←

Stainless Steels (active)

Soft Solders

Lead

Tin

Nickel

Brass

Bronzes

Copper

Nickel-Copper Alloys

Stainless Steels (passive)

Silver Solder

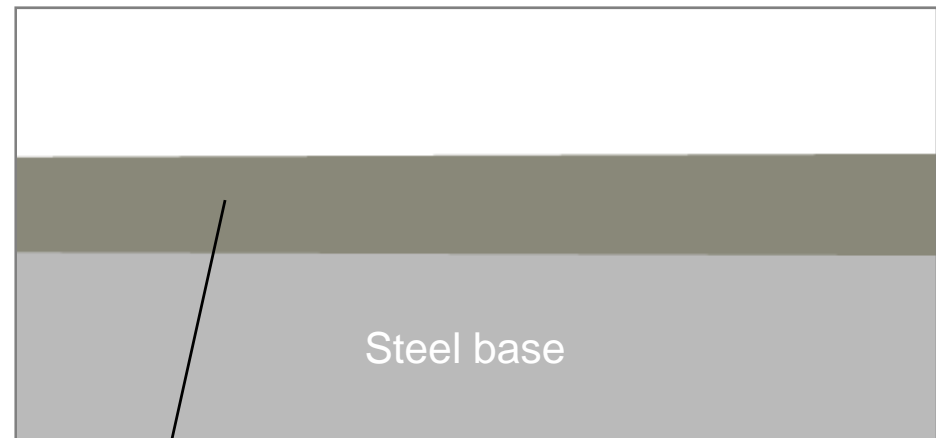
Silver

Gold

Platinum

### Protected End

Cathodic or most noble  
(ELECTROPOSITIVE)



Zinc coating

# LIFE EXPECTANCY

## Galvanized Vs. Copper-Coated

- **Misconception:** *Copper-coated steel has longer life than galvanized steel below grade.*
- **Reality:** Galvanized steel has a proven effective life of 65 years or more underground. Galvanizing provides better corrosion protection than copper coating if the coating is damaged during installation process.

GALVAN Industries, Inc.

GALVAN 6256 5/8" x 8'


**Truth is...**

Both copper-coated, galvanized and stainless-steel  
ground rods provide long life and safe grounding





GALVAN Industries, Inc.



GALGR6258® LIST440F

Standards should be maintained that allow contractors to safely choose either rod based on system requirements and sound engineering site analysis...

...not anecdotal misinformation.



# MYTH VS. FACT

## Myth:

*Galvanized Rods Have A Lower Tensile Strength Than Copper-Coated Rods*

## FACT:

Copper-coated and galvanized rods manufactured to identical physical and mechanical properties.

# MYTH VS. FACT

## Myth:

*Copper-Coated/Galvanized Rods  
Are Well-Suited To All Installations*

## FACT:

Ground rod selection must always be based on sound engineering practices, taking into consideration corrosion factors and system requirements.



## MYTH VS. FACT

### Myth:

*Thicker Coatings On Copper Coated Rods  
Always Mean Better Corrosion Protection*

### FACT:

Copper protects the steel core of the rod by acting solely as a barrier to the soil. Galvanizing (zinc) provides both as a barrier and through cathodic protection. This simplistic comparison on the basis of thickness is the equivalent of apples = oranges.

# MYTH VS. FACT

## Myth:

*Copper-Coated Materials Last 40 Years Or More  
Underground But Galvanized Steel Won't*

## FACT:

Both copper-coated and galvanized steel have proven life of 40+ years and more below grade in most soil conditions.

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Sound engineering requires consideration of many factors to determine the correct grounding electrode, including;

- Soil pH
- Electrical resistivity
- Moisture
- Stray current
- Proximity of dissimilar metals
- Chemical Contamination
- Permeability
- Aeration
- Chlorides
- Sulfates / Sulfides



## OTHER MISCONCEPTIONS

- Larger rod diameter equates to longer life
- Larger rod diameter critical to improved path to ground
- Rod length of minimal importance
- Parallel driven & bonded rods same resistance as multiple driven
- Stainless-steel rods the best available (nobility)
- Utilities often not concerned about UL Listing
- Three-mil non-listed copper rod life equivalent to UL galvanized rod

***These issues alone demonstrate the need for a comprehensive manufacturing specification.***

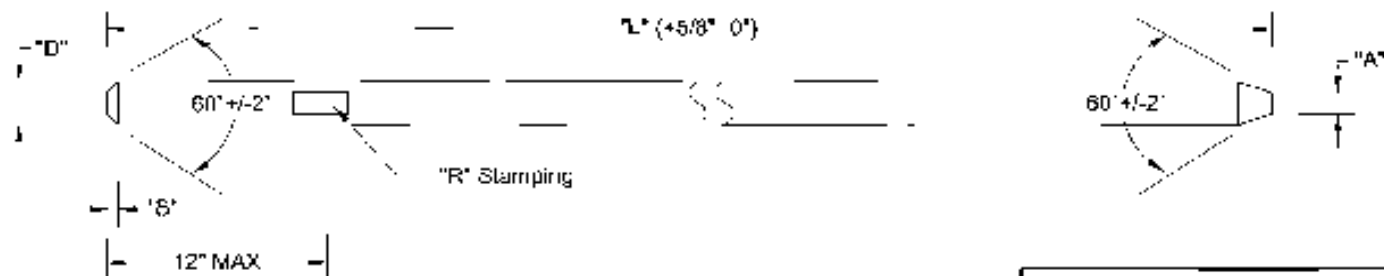
# CONCLUSIONS

- Fundamental design considerations of IEEE PC135.30 are sound for both galvanized, stainless-steel and copper-coated rods (diameter, steel composition, point and chamfer design, straightness)
- IEEE PC135.30 has received substantial industry and committee review
- Copper-coated, stainless-steel and galvanized ground rods are in service across the country, each have decades of actual service
- Extensive recent data exists confirming the service life of buried copper-coated, galvanized and stainless-steel rod electrodes
- It is not good engineering practice to classify ground rod life by only coating type, diameter or thickness

# RECOMMENDATIONS

- Continue to develop and update technical specification to insure that **ALL** ground rods are manufactured to consistent, safe, code compliant and minimum nationally accepted quality manufacturing standards.
- Support development and adoption of an installation guideline document to further clarify important factors in rod selection. No single rod type is always suitable for every application. (One size doesn't fit all.)
- Recognize and endorse legitimate studies where the service history of copper-coated and galvanized ground rod demonstrate the excellent performance of each protective coating system.

Galvan Part	Specification	Nominal Diameter	Finished "D"	Length (feet)	"R"	"A" max (in.)	"B" max (in.)	Coating min (in.)	For use with Coating
5005		1/2	0.471 - 0.481	5	N/A	3/16	3/32	0.002	50-TC
5006		1/2	0.471 - 0.481	6	N/A	3/16	3/32	0.002	50-TC
5008		1/2	0.471 - 0.481	8	N/A	3/16	3/32	0.002	50-TC
5008L	UL-467/NEMA GR-1	1/2	0.500 - 0.510	8	GAL5008 UL LISTED 44DF	3/16	3/32	0.010	50-TC
5010		1/2	0.471 - 0.481	10	N/A	3/16	3/32	0.002	50-TC
5010L	UL 467/NEMA GR-1	1/2	0.500 - 0.510	10	GAL5010 UL LISTED 44DF	3/16	3/32	0.010	50-TC
6255		5/8	0.565 - 0.565	5	N/A	3/16	1/8	0.002	60-TC
6256		5/8	0.565 - 0.565	6	N/A	3/16	1/8	0.002	60-TC
6258	UL-467/NEMA GR-1	5/8	0.565 - 0.565	8	GAL6258 UL LISTED 44DF	3/16	1/8	0.010	60-TC
6260C13	UL-467/RUS	5/8	0.561 - 0.571	8	GAL6260C13 UL LISTED 44DF	3/16	1/8	0.013	60-TC
6260	UL 467/NEMA GR-1	5/8	0.565 - 0.565	10	GAL6260 UL LISTED 44DF	3/16	1/8	0.010	60-TC
6260S13	UL-467/RUS	5/8	0.561 - 0.571	10	GAL6260S13 UL LISTED 44DF	3/16	1/8	0.013	60-TC
7508	UL-467/NEMA GR-1	3/4	0.673 - 0.683	8	GAL7508 UL LISTED 44DF	1/4	1/8	0.010	70-TC
7510	UL-467/NEMA GR-1	3/4	0.673 - 0.683	10	GAL7510 UL LISTED 44DF	1/4	1/8	0.010	70-TC
1010	UL 467/NEMA GR-1	1"	0.907 - 0.917	10	GAL1010 UL LISTED 44DF	3/8	1/4	0.010	80-TC



**MATERIAL:**

COATING: PURE COPPER ELECTROLYTICALLY BONDED TO SUBSTRATE  
 SUBSTRATE: COLD DRAWN STEEL (SAE 1035)

**NOTE:**

GROUND RODS MEETING THIS REQUIREMENTS MAINTAIN 15 MLS AVERAGE - 13 MLS MINIMUM

**GALVAN ELECTRICAL PRODUCTS**



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REV. #	NONE	APPROVED BY	DESIGNED BY	RM/W
DATE	05/13/05			
COPPER BONDED GROUND ROD				CLASSIFICATION
				GR-1



## Rod Electrode Resistance

ANSI/IEEE Standard - 80 (page 255 of the 1986 issue) provides a definition of grounding resistance per the following:

$$\text{Resistance} = \left[ \frac{\text{Resistivity of Soil}}{4\pi \times \text{Rod Length}} \right] \log_{\epsilon} \left[ \frac{2 \times \text{Rod Length}}{\text{Surface Area}} \right]$$

**Conclusion:** Rod diameter (surface area) has minimal impact on ground resistance, but soil resistivity and rod length are very important.