Copperhead Tracerwire Specifications for #12 Solid CCS Extra High Strength Hard Drawn 1150 lbs

Part #s: 1245*-EHS-500 / 1245*-EHS-1000 / 1245*-EHS-2500
Part # description: 12 (AWG), 45 (jacket mil), * (indicates jacket color: B=Blue, Y=Yellow, R=Red, K=Black, N=Orange,G=Green, P=Purple) – EHS (extra high strength-hard drawn) – 500, 1000 or 2500 (wire length in ft.)

Print Line: Physical, permanent markings: surface legend print on insulating jacket to repeat at minimum interval of every two linear feet. Ink colors will include: Black Ink for the following jacket colors: Yellow, Blue, Red, Orange, Purple and Green. White Ink for Black jacket.
COPPERHEAD * 12 AWG-SOLID EHS-CCS HORIZONTAL DIRECTIONAL DRILL TRACER WIRE * 45 MIL HDPE * 30 VOLT * DIRECT BURIAL ONLY

Spool Label: Wound wire on a compact spool made of metal, plastic, or wood. A separate label will be affixed to the spool. The label will read: CAUTION: WIRE MAY BE SUBJECT TO SPRING RELEASE

COPPERHEAD INDUSTRIES, LLC
1245*-EHS-500 (Production Trace Code)
12 AWG-Solid CCS Directional Drill Tracer Wire
45 Mil HDPE * 30 Volt
Direct Burial Only
www.copperheadwire.com

Product Description:
Tracer wire for directional drilling/boring shall be Copperhead® SoloShot™ #12 AWG (0.0808" diameter) hard drawn, high carbon 1055 grade steel, solid extra-high-strength copper-clad steel conductor (EHS-CCS), insulated with a 45 mil, high-density, high molecular weight polyethylene (HDPE) insulation, and rated for direct burial use at 30 volts. EHS-CCS conductor must be at 21% conductivity for locate purposes. Break load of 1150 lbs. HDPE insulation shall be RoHS compliant and utilize virgin grade material. Insulation color shall meet the APWA color code standard for identification of buried utilities. Manufacturers supplying copper clad steel tracer wire must have available detailed performance data including 5 years of underground testing in terms of durability related to damage of protective insulation and effects of potential corrosion of the specific copper clad steel used. Origin of copper clad steel manufacturer is required and steel core must be manufactured in the United States. If manufacturer has not completed 5 year corrosion testing, a 5 year warranty must be provided. Tracer wire shall be Copperhead® SoloShot™ EHS-CCS HDPE 45 mil or *district pre-approved equal* and made in the USA.

Recommended Engineering Specifications:

Conductor Specifications for Extra High Strength Tracer Wire
#12 Solid CCS Extra High Strength Hard Drawn 1150 lbs.

Specification: This specification describes the properties of the hard drawn conductor to be used in the fabrication of extra high strength tracer wire.

1. Material Description: Copperhead® Copper-clad steel wire as manufactured by Copperweld® is composed of a steel core with a uniform and continuous copper cladding thoroughly bonded to the steel throughout.

a. **Cladding:** The steel and copper interface must have a metallurgical bond achieved through a high heat and pressure bonding process. Established process for porosity-free material.
b. **Steel:** Extra High Strength with 0.54 carbon or greater. Verified to meet required mechanical properties.
c. **Copper:** UNS-C10200; OF Copper according to ASTM B-170 (latest revision). High conductivity, oxygen free copper to achieve optimal signal performance.

2. Surface Condition: Wire surface shall be free of any defects, including flakes, grooves, pits, and voids. Wire surface shall be smooth, bright and shiny, and free of excessive copper dust and residual drawing lubricants.

3. Physical, Mechanical, and Electrical Properties

The wire shall conform to the properties listed in Table 1.

TABLE 1: Physical, Mechanical, and Electrical Properties

#12 CCS High Carbon, Hard Drawn 1055 Grade Steel 21% Conductivity	**CCS Conductor**
Conductor Size	12 AWG
Conductor Type	Copper Clad Steel (CCS)
Temper	Hard Drawn (HD)
Average Break Load	1150 lbs.
Minimum Tensile Strength	200,000 psi
Minimum Elongation	1.0%
Copper Thickness (% of Diameter)	3.0%
Minimum Copper Weight	13%
Nominal DC Resistance (ohms/1000 ft.)	7.5648

**Diameter tolerances: ± 1%*

Insulating Jacket Specifications for Extra High Strength Tracer Wire
#12 Solid CCS Extra High Strength Hard Drawn 1150 lbs.

Specification: This specification describes the properties of the insulation material to be used in the jacketing of extra high strength tracer wire.

1. Material Description: insulating jacket is comprised of a co-polymer high molecular weight natural high density polyethylene (HDPE) designed specifically for high-speed copper wire insulating. It contains the required levels and types of primary antioxidant and metal deactivator additives to satisfy most Wire and Cable industry requirements. HDPE material will be produced with an excellent balance of surface smoothness, processing ease, tensile and elongation properties, abrasion toughness, environmental stress crack, thermal stress crack resistance, and electrical consistency.

2. Physical, Mechanical, and Electrical Properties

The wire shall conform to the properties listed in Table 1.

TABLE 1: Physical, Mechanical, and Electrical Properties

High Density Polyethylene Insulator	Value
Density (ASTM D 792)	0.943 g/cc
Bulk Density (ASTM D 1895)	0.58 g/cc
Melt Index (ASTM D 1238/E)	0.70 dg/min
Tensile-Yield (ASTM D 638)	4300 psi
Tensile-Ultimate (ASTM D 638)	2900 psi
Tensile-Elongation (ASTM D 638)	850%
Flexural Modulus (ASTM D 790/1)	120,000 psi
Hardness (ASTM D 2240)	63 Shore D
Environmental Stress-Crack (ASTM D 1693/B)	F_{20} > 48 h
Thermal Stress-Crack (ASTM D2951)	F_0 > 1000 h
Brittleness Temperature (ASTM D 746)	< -95° F
Melting Point (DSC) (ASTM D 3417)	262° F
Softening Point (Vicat) (ASTM D 1525)	250° F
Oxidative Induction Time (ASTM D 3895)	> 50 min. @ 200° C
Dielectric Constant (ASTM D 1531)	2.34 @ 1MHz
Dissipation Factor (ASTM D 1531)	0.00007 @ 1 MHz
Volume Resistivity (ASTM D 257)	5 x 10_{17} ohm-cm
Dielectric Strength (ASTM D 3755)	1000 volts @ 20 mils