

Recommended Practice for Testing of Electric Submersible Pump Cable Systems

API RECOMMENDED PRACTICE 11S6
FIRST EDITION, DECEMBER 1, 1995

REAFFIRMED, OCTOBER 2013



AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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Foreword

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Recommended Practice for Testing of Electric Submersible Pump Cable Systems

1 Scope

1.1 GENERAL

This recommended practice covers testing of Electric Submersible Pump Cable Systems. Cable testing, in general, can be broken into two basic categories: Factory Testing and Field Testing. This recommended practice only addresses procedures for Field Testing.

Factory Tests provide assurance that the finished product meets the anticipated performance criteria for the intended application. All the tests involved are used to detect gross cable defects in materials and workmanship. Typical tests on new cable include ac, dc, IR and Conductor Resistance, and are covered under such standards as IEEE 400, IEEE 1017, IEEE 1018, and IEEE 1019.

One consideration of any testing is that an electrical failure may not occur on a damaged cable during the actual test since testing is done under controlled conditions relative to oil well conditions. A more costly failure may then occur with the damaged cable downhole. Testing is simply an indicator of the insulation at that time. It is not a guarantee of future performance.

The test procedures and values outlined in this document are based upon accepted practices. Nevertheless, engineering judgment should be used to determine values and procedures applicable in specific situations.

1.2 ORGANIZATION

This recommended practice addresses field testing of electric submersible pump cable systems. It is organized into three major topic categories. The first category provides general definitions and overview of terms, safety considerations, and cable system preparation guidelines (Sections 2–6). The second category identifies various situations under which testing is performed (Sections 7–10). The third category identifies test methods and procedures (Sections 11–14).

1.3 JURISDICTION

This document covers generally accepted practices for submersible cable systems. All applicable local, state, and national codes and regulations should be followed for each installation.

2 Definitions

2.1 AC TESTS

AC Tests are tests performed by the manufacturer to determine cable insulation integrity. The applied ac voltage is used as a pass/fail test. AC tests have seldom been performed in the field. (See Section 13.)

2.2 ACCEPTANCE TESTING

Acceptance testing is performed by the user upon receipt of new cable and connection devices to confirm that no damage occurred during shipping and handling. (See Section 7.)

2.3 CONDUCTOR RESISTANCE

Conductor Resistance is that property of the conductor that resists the flow of electrons (direct current). It is affected by conductor cross-sectional area, conductor length, conductor material, and conductor temperature.

2.4 CONNECTORS

Connectors are attachments for electrically conducting power through the wellhead and downhole packer. These devices consist of two separable components which complete the electrical circuit when mated.

2.5 DC TESTS

DC Tests are tests performed by the manufacturer or user to determine insulation integrity. The applied dc voltage may be used as a pass/fail test. The leakage current of the applied voltage may be used as a comparative measure of cable system quality. (See Section 12.)

2.6 DIAGNOSTIC TESTING

Diagnostic Testing is performed to locate faults, determine the cause of failure, and evaluate the condition of used cable after faults have been located and repaired. These tests may also be used to help determine suitability for reuse. (See Section 10.)

2.7 GROUNDING STICK (DISCHARGE RESISTOR)

A grounding stick should be used to discharge a cable after testing. A grounding stick is an assembly with a resistance not less than 10,000 ohm/kV of test voltage.

2.8 HIGH POTENTIAL (HI-POT) TESTS

High potential insulation tests are intended to provide nondestructive ac or dc strength testing of insulation. A dc test is considered high potential when it is conducted at a voltage level two times the insulation rating plus 1000 volts or more. An ac test is considered high potential when it is conducted at a voltage level greater than 1.2 times the insulation rating.

The tests may be leakage current tests or voltage withstand tests. Direct current high potential tests are widely used for acceptance and maintenance (proof) testing.