

Recommended Practice on Application and Testing of Electric Submersible Pump Seal Chamber Sections

API RECOMMENDED PRACTICE 11S7
FIRST EDITION, JULY 1993

REAFFIRMED, OCTOBER 2013



AMERICAN PETROLEUM INSTITUTE

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Upstream Segment

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SECTION 1 GENERAL

1.1 Introduction

This recommended practice applies to the seal chamber section used in support of an electric submersible motor. Seal chamber sections are assemblies connected in tandem with oil filled motors to provide several supporting functions to the ESP system. They are also referred to as protectors, equalizers, or seal sections.

1.2 Scope

This RP contains tutorial, testing, and failure evaluation information. It provides a general understanding of construction and functioning of seal chamber sections and identification of well conditions, system requirements and characteristics that influence component selection and application. Also included is information needed to evaluate causes of seal chamber section failures. Testing sections establish acceptable test procedures and criteria to help verify seal chamber section functionality. General shipping and handling information is also included.

SECTION 2

DEFINITIONS

Bag — The bladder.

Barrier Fluid — Blocking Fluid.

Bladder — An elastomeric membrane within the seal chamber section that separates the filling fluid from the well fluid.

Blocking Fluid — A heavy fluid occasionally used to separate well fluid and filling fluid.

Chamber — The enclosed compartment which houses the labyrinth or bladder(s).

Check Valve — Mechanical devices that allow one-directional flow of fluid when a differential pressure exists across the valve. It may not seal against positive pressure.

Communication Hole — A passage to allow flow of fluid between chambers and from the top chamber to the wellbore.

Coupling — The splined concentric mechanical connection between the seal chamber section shaft and adjacent shafts.

Drain Port — A port to allow draining of fluid from a chamber.

Equalizer — Seal chamber section.

ESP — Electric submersible pump.

Filling Fluid — Motor oil.

FIM — Full Indicator Movement: the total movement of an indicator when appropriately applied to a surface to measure its variation (per ANSI Y14.5M).

Housing — A cylindrical casing that contains the components of the seal chambers.

Labyrinth Chamber — A labyrinth chamber provides a fluid interface between the well fluid and motor oil. Separation is maintained by the difference in specific gravity of the fluids.

Motor Oil — A dielectric oil used to insulate, lubricate, and cool the motor and seal chamber section.

Motor Seal Section — An obsolete term for seal chamber section.

Operating Temperature — Temperature of the component during operation.

Protector — Seal chamber section.

Relief Valves — Mechanical devices that allow one-directional flow of fluid when a pre-set differential pressure is exceeded across the valve.

Seal Section — Seal chamber section.

Shaft Seal — A device used to seal the interface between the shaft and a stationary component.

Thrust — Axial force transmitted from the pump shaft to the top of the seal section shaft.

Thrust Chamber — An assembly or a section of the seal chamber section which houses the thrust bearing assembly.

Vent Port — A port to allow venting of air during the filling process.

SECTION 3

FUNCTIONS OF THE SEAL CHAMBER SECTION

3.1 General

The seal chamber section has several functions that support operation of the liquid filled submersible motor and the centrifugal pump. These supporting functions must be addressed in any ESP configuration.

3.2 Provide Oil Expansion Volume

The motor and seal chamber section are filled with a dielectric oil that lubricates the bearings and cools the motor. During system installation, operation, and pulling, the motor oil will expand or contract. This change in the motor oil volume is accommodated by the seal chamber section.

3.3 Pressure Equalization

The seal chamber section equalizes the pressure inside the motor with the well bore pressure and thus eliminates pressure differences across the shaft seals.

3.4 Exclude Well Fluids

The seal chamber section prevents entry of well fluid into the motor.

3.5 Thrust Compensation

The seal chamber section carries downthrust transmitted from the pump to prevent loading the motor thrust system. An upthrust system is usually included to protect the seal chamber section should an unusual operating condition cause the pump to develop upthrust.

3.6 Torque Transmittal

The seal chamber section transmits torque from the motor shaft to the pump shaft. This function includes the reaction torque transmitted through the housings.