

Well Casing Cathodic Performance Review - Case Study

Maryam Al Hashmi
Petroleum Development of Oman
PO Box: 81, Muscat
Sultanate of Oman

Hamed Al Habsi
Petroleum Development Oman
PO Box: 81, Muscat
Sultanate of Oman

Fatih Boluk
Petroleum Development Oman
PO Box: 81, Muscat
Sultanate of Oman

Monica Fernandez
Petroleum Development Oman
PO Box: 81, Muscat
Sultanate of Oman

Naveed Munir
Petroleum Development Oman
PO Box: 81, Muscat
Sultanate of Oman

ABSTRACT

Assessing the Cathodic Protection (CP) performance of well casing is part of well casing Corrosion Management to ensure its integrity. CP is essential in managing well casing integrity by mitigating external corrosion, preventing well casing leaks, reducing operating/capital costs and maximizing total production over the life cycle.

Petroleum Development Oman (PDO) has reviewed the corrosion management strategy to ensure proper mitigation of well casings external corrosion in several clusters. This paper will detail the review process followed for two clusters; which included: i) confirmation of total amount of wells (with and without CP) within the clusters, ii) re-visit the requirement of external protection for well casings without CP, iii) identify historical failures relevant to external corrosion in well casing (with and without CP) to confirm barrier effectiveness and/or future requirement, iv) assessment of CP performance (protection level, cause of failure / lack of protection and recommendation for reinstatement).

Key words: Corrosion management, Corrosion monitoring, Cathodic Protection, Failure, Underground Corrosion

INTRODUCTION

Oil and gas wells represent a large capital investment. It is imperative that corrosion of well casings be controlled to prevent loss of oil and gas, environmental damage, and personnel hazards, and in order to ensure economical depletion of oil and gas reserve.^[1] Wells placed in external corrosive environment shall be protected by appropriate barriers such as additional cemented casing, cathodic protection and

coating to assure well casing integrity. It should be recognized that no one solution fixes all and a combination of these may be required and a final decision must be based on history of corrosion problems in analogous fields/ wells, economics (high volume producers, long design life, repair like scabbing), HSSE (high pressure, sour wells, populated areas) over the lifecycle of the well. As per Company standards, the following combinations are considered to be reliable barriers to protect the well casing from external corrosion:

1. Coating + Cathodic protection (recommended for high sour/gas/critical wells with long design life > 25 years)
2. Sacrificial casing + coating
3. Coating + fully assured cementing (with cement log to verify), recommended for low risk wells
4. Thicker casing/Corrosion allowance + coating for clusters/areas identified as low corrosion severity/reduce service life (repairs).
5. Non metallic/corrosion resistance material (primary barrier)

A casing leak on production well is an expensive repair that can be minimized by the application of CP. If cathodic protection is implemented, all the wells in the vicinity shall be protected as well to avoid interference that has detrimental effect on the well casing integrity by stray current.^[2] Typical Arrangement of Well Casing CP System is shown in Figure 1:

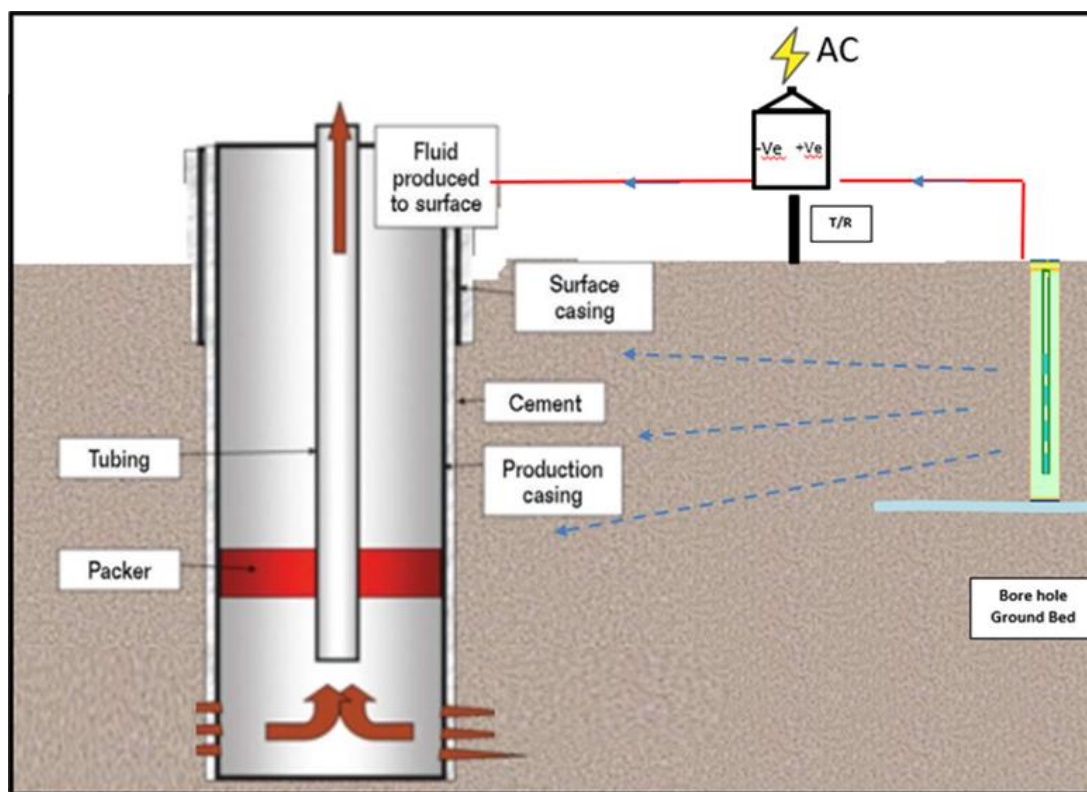


Figure 1: Typical Arrangement of Well Casing CP System

The well casing CP design & installation follows the Company standards in addition to the international standards NACE SP0186, NACE SP0572 and BS 7361.

For well casing, the minimum current requirement for design purposes is determined by “E- log I” tests on at least one well of each type of casing completion in that field.^[1] Where conditions allow, a casing current density profiling tool shall be used to confirm that CP is achieved with a given applied current to

ensure full protection along the casing. The data determined from such tests will form the basis for the CP design for all well casings in the field.

Proper protection of well casings can provide trouble-free operations and minimize the required maintenance. Once CP is installed, ongoing monitoring of cathodic performance can be done without production interruption. Well casings protection is based on the current requirement determined by the E-log I tests to achieve protection plus a minimum 100 mV potential shift in the negative direction. In the Company, there are three main steps to ensure effectiveness of well casing CP system, which are :

Table 1: Methods for Evaluating CP Performance of Well Casing

#	Method	Description
1	CP monitoring data	The CP current & potential are recorded for each protected well in frequent basis (e.g. quarterly). In which, these values are compared to the required current & potential as per design requirement for that specific cluster.
2	Well Log Data	If corrosion log is done for the well casing, the corrosion rate, cementing quality & any casing leak will be identified in the interpretation report.
3	Historical Data	Any historical failure occurred/raised at the well casing on specific well.

In accordance to above steps, an assessment was conducted for CP performance to ensure mitigating well casing external corrosion in three clusters (B, A & N) . The assessment covered well casing asset verification, identification of well casings that have CP and assess their protection level, investigate the historical external corrosion failures on well casings and develop rectification plan accordingly. The assessment process is summarized in Figure 2.

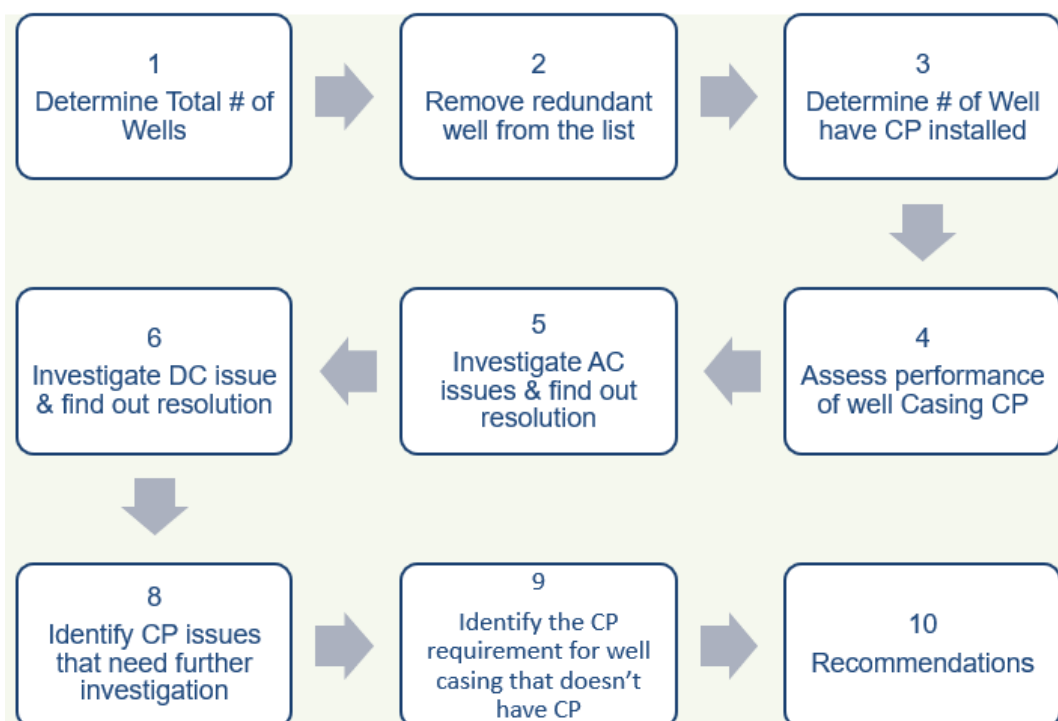


Figure 2: Procedure of Assuring CP performance on Well Casing

The main failures associated with well casing CP system are captured in Table 2.