AWES

Advanced Well Equipment
Standards Group

AWES Recommended Practice For Multiphase Flow Testing

AWES Recommended Practice: 3362

Version 1

1st September 2019

OTM Consulting Ltd

Date	Version Number	Changes	Initials

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Thanks to the following companies for their contributions to this document:

Baker Hughes, a GE Company
C-FER Technologies
ExxonMobil
Halliburton
RGL Reservoir Management, Inc
Schlumberger
SouthWest Research Institute
Weatherford International Ltd

Special thanks to the following for their substantial contributions to this document:
Paul James from Halliburton (Work Group Leader)
Gocha Chochua from Schlumberger
Haldun Unalmis from Weatherford
Jared Schoepp from C-FER Technologies
Seth Nelson from SouthWest Research Institute

1 Foreword

AWES (Advanced Well Equipment Standards) is a global industry work group formed under the guidance of OTM Consulting. Invitation to this group has been extended to members of various branches of the oil and gas industry including oil and gas exploration and production companies, service companies and equipment vendors.

The task of this technical committee is to prepare an international recommended practice to guide the design and use of multiphase flow testing facilities as well as best practices for multiphase flow modeling (e.g. CFD). This committee and the resultant recommended practice is not designed to hamper innovation of equipment developed by suppliers/manufacturers. Instead the focus has been dedicated to standardizing the testing and CFD methods to ensure that valid data is produced.

This document is only valid if it has been verified to be the latest revision.

2 Introduction

This recommended practice has been developed by users, designers and testers of downhole equipment that is intended for use in the petroleum and natural gas industry worldwide. This recommended practice is intended to provide guidelines and information to all parties regarding testing and simulation methods and facilities to validate the functional performance of a given device.

Users of this recommended practice should be aware that requirements above those outlined in this recommended practice may be appropriate for individual applications.

Finally, this recommended practice is not intended to inhibit alternative equipment or engineering solutions. This may be particularly applicable where there is innovative or developing technology, or where the environment to be simulated is complex and very specific. Where an alternative is offered, the supplier/manufacturer should understand the impacts of any variations from this recommended practice.

2.1 Why Multiphase Flow Testing Matters

Multiphase fluid flow is a common phenomenon in downhole well casing and tubing in the oil and gas industry, since the fluid mixture passing from the reservoir into a well is typically composed of multiple constituents (some desirable to produce and some undesirable). Many pieces of downhole equipment will perform differently while operating under multiphase flow conditions than in single-phase flow conditions (e.g. inflow control devices, outflow control devices, steam splitters, pumps, downhole multiphase flowmeters, etc.); therefore, it would be advantageous for oil and gas operators to be able to test or model the device in multiphase flow conditions.

Although multiphase flow is understood relatively well from a qualitative perspective, there are significant knowledge gaps with both quantifying multiphase flow and understanding the effect that this type of flow can have on the performance of downhole equipment. Standards exist relating to testing multiphase flow measurement systems (API MPMS Chapter 20.3), but there is a limited amount of information available specifically for performing standardized multiphase flow testing of downhole equipment.

2.2 Purpose of This Recommended Practice

The purpose of this recommended practice is to provide guidance and best practices when designing a flow loop and performing testing with one or more test fluids to validate equipment performance and correlate results to actual downhole conditions. Multiphase flow will be discussed, along with the basic flow patterns. Guidance is provided regarding the common equipment used in flow loops, and the design limitations imposed through equipment selection. Finally, the modeling methods, analytical and numerical, available to simulate flow conditions and support the validity of flow loop results will be addressed.

3 Scope

3.1 Limitations of This Recommended Practice (Scope)

This recommended practice introduces the concept of multiphase flow and the associated systems that will allow replication of downhole conditions during production. The recommended practice also describes how the performance of a downhole device may be tested directly in full-scale multiphase flow conditions, or where this is not practical, provides guidance concerning how the testing may be modified so that the test results are meaningful to operation in the field conditions.

However, some areas are considered beyond the scope of this recommended practice. These include: surface equipment, multiphase testing involving solids, testing in the field, and testing where the fluid properties change within the test section (e.g. gas liberation in the test section). While this recommended practice does not explicitly address these out-of-scope areas, this document may still prove useful when designing testing equipment and methods or when testing with these conditions.