













# Contents

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## Introduction

These recommended practices and requirements are offered to assist gas-lift system operators, analysts, technicians, engineers, and others in understanding how to effectively plan, operate, maintain, troubleshoot, and provide surveillance of gas-lift systems and gas-lift wells.

These recommended practices discuss continuous gas-lift with injection down the casing/tubing annulus and production up the tubing. Annular flow gas-lift (injection down the tubing and production up the annulus), dual gas-lift (two tubing strings in the same casing), and intermittent gas-lift are mentioned; however, most of the discussion focuses on conventional continuous gas-lift. Many of the recommended practices in this document can be pertinent to the other forms of gas-lift, but they should be considered and used with caution. Other API recommended practices address dual gas-lift (API 19G9) and intermittent gas-lift (API 19G10).

This document includes the following.

- Gas-lift operating system components and potential problems.

Sections 3 through 13 describe the several components of an operating gas-lift system and discuss a number of problems that can be encountered and addressed to operate a gas-lift system effectively and efficiently. These sections may be used for:

- part of a training course dealing with gas-lift system operation;
  - a review before beginning a major gas-lift system study;
  - a review before designing or modeling a gas-lift system, or both;
  - a review before trying to troubleshoot difficult gas-lift system problems.
- Recommended practices for gas-lift operation, maintenance, surveillance, and troubleshooting.

Sections 14 and 15 are revisions/upgrades of information that has been in existence since the first edition of this document. These sections contain recommended practices for common gas-lift operations:

- initial unloading of the completion or workover fluid from the annulus of the gas-lift well;
- restarting or kickoff after a period of downtime;
- adjusting or fine-tuning the gas injection rate for optimum operation.

These sections discuss commonly used gas-lift troubleshooting tools. They conclude with sections that review the potential locations of gas-lift problems, a table of possible causes and cures of some common gas-lift system problems, and a troubleshooting checklist.

These sections are recommended for use as:

- part of a training course dealing with gas-lift system operation;
- part of a training course dealing with gas-lift system maintenance;
- a review before trying to troubleshoot a difficult gas-lift operating problem.

# Operation, Maintenance, Surveillance, and Troubleshooting of Gas-lift Installations

## 1 Scope

This recommended practice (RP) provides guidance, background, and requirements for the application and use of gas-lift wells and their related systems. Discussion is included for operation, maintenance, surveillance, and troubleshooting of gas-lift wells and installations.

This RP is intended for use by managers, production technologists, reservoir engineers, facilities engineers, production engineers, well testing engineers, well analysts, operators, and researchers who want to gain a general understanding of gas-lift wells and gas-lift operations. It can be used to prepare and present courses on gas-lift wells and operations.

This RP focuses primarily on continuous gas-lift. However, use of intermittent gas-lift, dual gas-lift, and gas-lift for gas wells is mentioned.

## 2 Terms, Definitions, and Abbreviations

### 2.1 Terms and Definitions

For the purposes of this document, the following definitions apply.

#### 2.1.1

##### **bottomhole pressure**

##### **BHP**

The pressure measured at the midpoint of the perforated interval.

#### 2.1.2

##### **flowing bottomhole pressure**

##### **FBHP**

The pressure measured at the bottom of the well, at the midpoint of the perforations, when the well is on production.

#### 2.1.3

##### **inflow performance relationship**

##### **IPR**

The ratio of production rate (expressed in bbl/day or m<sup>3</sup>/day) divided by the pressure drawdown (static bottomhole pressure minus flowing bottomhole pressure).

#### 2.1.4

##### **injection pressure operated gas-lift valve**

##### **IPO gas-lift valve**

A gas-lift valve where the primary opening pressure is provided by the injection pressure.

NOTE The injection pressure is provided by the casing pressure.

#### 2.1.5

##### **production pressure operated gas-lift valve**

##### **PPO gas-lift valve**

A gas-lift valve where the primary opening pressure is provided by the production pressure.

NOTE The production pressure is provided by the tubing pressure.

### 2.1.6

#### static bottomhole pressure

#### SBHP

The pressure measured at the bottom of the well, at the midpoint of the perforations, when the well is not on production.

## 2.2 Abbreviations

AWT	automatic well test
BHP	bottomhole pressure
FBHP	flowing bottomhole pressure
FGLR	formation gas-to-liquid ratio
GOR	gas/oil ratio
IGLR	injection gas-to-liquid ratio
IPO	injection pressure operated (gas-lift valve)
IPR	inflow performance relationship
PI	productivity index
PPO	production pressure operated (gas-lift valve)
PVT	pressure-volume-temperature
SBHP	static bottomhole pressure
TGLR	total gas-to-liquid ratio

## 3 Gas-lift Operating System Components and Potential Problems

### 3.1 Purpose

Each gas-lift system consists of many components to be understood, operated, and maintained. It is necessary for these components to function together for the system to be efficient.

This document discusses the system components and presents a summary of recommended practices for recognizing and dealing with many of the problems that can cause upsets or inefficient operations in continuous gas-lift, or both. The checklist in 3.3 may be used as a quick reference guide for spotting and addressing common problems that affect continuous gas-lift. This document does not address intermittent gas-lift; it is addressed in API 19G10.

### 3.2 Gas-lift System Components

The primary components of the gas-lift production system are the following:

- surface gas-lift compression, dehydration, and distribution system;
- gas injection metering and control equipment;
- gas-lift valves;
- well equipment-tubulars, completion, and wellhead;
- gathering system-flowline and manifold;
- well production rate testing facility;
- production handling system.

Each of these components is shown on Figure 1 and is discussed in the sections that follow, along with specific recommended practices that should be followed to reduce inefficiencies and unstable operations.

### 3.3 Gas-lift System Operating Problems

These are gas-lift system-wide operating problems and recommended practices that should be followed to address them. They are cross-referenced to the section where they are discussed.

- a) Wells that are being under-lifted (lifting too shallow, too little gas) (see 4.1).
  - Provide monitoring and control equipment and procedures.
  - Compare actual vs design/optimum gas-lift performance.
  - Ensure gas-lift valves and other equipment are working properly; allocate the available supply of gas to the most productive wells in an optimal way when the supply is limited.
- b) Wells that are being over-lifted (too much gas) (see 4.1).
  - Provide monitoring and control equipment and procedures.
  - Compare actual vs design/optimum gas-lift performance.
  - Reduce compression or sell excess gas; do not try to inject all of it if overall gas supply is excessive.
- c) Gas-lift distribution is ineffective (lack of good distribution control) (see 4.2).
  - Evaluate overall system constraints, including gas-lift compression, distribution, wells, and handling systems.
  - Distribute or allocate available gas to each well by considering both the gas distribution system and the wells.

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- b) Wells that are being over-lifted (too much gas) (see 4.1).
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  - Reduce compression or sell excess gas; do not try to inject all of it if overall gas supply is excessive.
- c) Gas-lift distribution is ineffective (lack of good distribution control) (see 4.2).
  - Evaluate overall system constraints, including gas-lift compression, distribution, wells, and handling systems.
  - Distribute or allocate available gas to each well by considering both the gas distribution system and the wells.

### 3.2 Gas-lift System Components

The primary components of the gas-lift production system are the following:

- surface gas-lift compression, dehydration, and distribution system;
- gas injection metering and control equipment;
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- well equipment-tubulars, completion, and wellhead;
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  - Compare actual vs design/optimum gas-lift performance.
  - Reduce compression or sell excess gas; do not try to inject all of it if overall gas supply is excessive.
- c) Gas-lift distribution is ineffective (lack of good distribution control) (see 4.2).
  - Evaluate overall system constraints, including gas-lift compression, distribution, wells, and handling systems.
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  - Ensure gas-lift valves and other equipment are working properly; allocate the available supply of gas to the most productive wells in an optimal way when the supply is limited.
- b) Wells that are being over-lifted (too much gas) (see 4.1).
  - Provide monitoring and control equipment and procedures.
  - Compare actual vs design/optimum gas-lift performance.
  - Reduce compression or sell excess gas; do not try to inject all of it if overall gas supply is excessive.
- c) Gas-lift distribution is ineffective (lack of good distribution control) (see 4.2).
  - Evaluate overall system constraints, including gas-lift compression, distribution, wells, and handling systems.
  - Distribute or allocate available gas to each well by considering both the gas distribution system and the wells.