

# Standardized Operating Procedures in Petroleum Logging Engineering Technology

夏学锋 孙中原 著



北京邮电大学出版社



自然科学与技术专著丛书

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## Abstract

This book aims to teach the Petroleum logging employees the standard operating procedure (SOP) in Petroleum Logging Engineering Technology. The book is divided into eleven chapters. The eleven chapters named, respectively, Openhole Wireline Logging SOP, Pipe conveyed logging SOP, Fishing Operation SOP, Vertical Seismic Profile SOP, Free Point Indicator SOP, Bridge Plug Setting SOP, Truck Preventive Maintenance 1 SOP, Truck Preventive Maintenance 2 SOP, Truck Preventive Maintenance 3 SOP, Wireline Conveyed Perforating SOP and Tubing Conveyed Perforating SOP.

This book narrates the standard operating procedure (SOP) from the whole process of petroleum logging engineering in detail. It can be used as a guidance book in petroleum logging employees' work and would improve their operation standardization and security.

This book also should attract the attention of the managers in petroleum Logging industry, both domestic and abroad. They could supervise their employees whether operate in a standard procedure and teach them what the correct procedure is.

What's more, this book also could be used for the students, who prepare to engage in the industry work, as a self-study book in Petroleum University.

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## PREFACE

In today's society, standardized operation process has been actively advocated by various countries and enterprises, and is an important guarantee for the personal safety of technical personnel in construction. Standardized processes are highly concerned among industry managers, business operators and practitioners in all professions and trades. The book based on the author's years of practical experience and management experience, combined with the Management Science theory, takes the basic analysis paradigm to "Observe—Refining—Summary—Application", according to the basic rule of standardized operation and safe operation, through repeated observation and study, formulate the basic operation rules of petroleum logging industry. In the every part of the book, beginning with preparation and mobilization, the site operation procedures are detailed step description, and finally formulated the petroleum logging industry standardized technical process. The novelty of content and the perfect combination with practice are the two main features of this book.

This book is written by Dr. Xia Xuefeng and Dr. Sun Zhongyuan on the practice and observation of construction operations in the petroleum well logging industry. Dr. Xia Xuefeng, a senior engineer, expert of petroleum logging technology, engaging in petroleum logging industry for more than 20 years, has a rich experience of petroleum well logging construction operation and management, having developed a number of petroleum logging technical standards and application in actual operation and achieved good results. Dr. Sun Zhongyuan, has a profound theoretical basis, published a lot of high level papers in national important publications, participated in the study of a number of National Natural Science Fund project. Through the study of logging data and photographic data, he combed the standard framework of the book and supplemented and improved the content of this book.

Under the guidance of well logging technology and scientific management theory, this book refined operating standards of employees in logging industry from eleven chapters, through repeating observation of petroleum logging operation, decomposing and reorganizing actions and actively promote in the petroleum industry. This book completed of the basic research paradigm from the actual to reality, which provided the originality of the operational standardization process for petroleum logging industry.

In the process of the writing, the author interviewed a large number of employees in the logging industry, and photographed an amount of images and videos data. Thanks for the contribution of the industry personnel. Due to the development of information technology is very rapid, the application of information technology is becoming more and more popular and the limited level of the author, if the book has come inappropriate parts, hope for the experts and readers comment.

Authors  
Sept.2017



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# Chapter 1 Openhole Wireline Logging SOP

## 1.1 Preparation at Base

### SCOPE

The purpose of this section is to provide the way to prepare the openhole wireline logging job at the base, and establish a one-system procedure for all field operations so that each member of the service team will know what his responsibilities are, and perform his duties efficiently and safely.

It is the purpose of this manual to help you know Field Engineer, Maintenance Engineer, Senior Operator (Mechanic) and Operator, and your job responsibilities so you can perform as a professional. However, it is beyond the scope of this manual to cover each and every situation that can conceivably arise. Only the more explicit duties will be discussed. It shall be your responsibility to become familiar with job functions not discussed, but which are necessary for the performance of a professional service.

The documents ensure equipment reliability by defining the test procedures and maintenance routing.

### Post and Responsibility

| STEP                                       | POST           |                 |          |
|--|----------------|-----------------|----------|
|  | Field Engineer | Senior Operator | Operator |
| Preventative Maintenance of Logging System | ○              | ●               | ○        |
| Downhole Tool Calibration                  | ●              | ○               | ○        |

## NOTE

Openhole logging covers a large scope of services. This book is only a general guide for conventional openhole logging services, since CNLC has different measurement systems used in the fields, the specific operation procedures of each particular tool must be referred to for the detailed tool operating manual.

### 1.1.1 Preventive Maintenance of Logging System

PM1 shall be carried out at base on the downhole tools and surface logging system at the earliest opportunity whenever one of these conditions happens:

- Coming back from one job;
- The equipment has been modified or quality checked;
- It's been one month after last PM1.

#### 1. PM1 of Downhole Tools

Step1: Put the downhole tools on the washing area, open the caliper of the caliper tool.

Step2: Wash the tools with water-gun, hot water could be needed in winter.

Step3: Clean the tool bodies with dry rags, and bring the tools into the shop or working area.

Step4: Open the thread protectors of the tools, clean the threads at both ends of the tools, a brush could help to remove the sticking mudcake in the threads.

Step5: Lubricate the threads with grease, change the O-rings that are in bad condition, as shown in Figure 1.1.

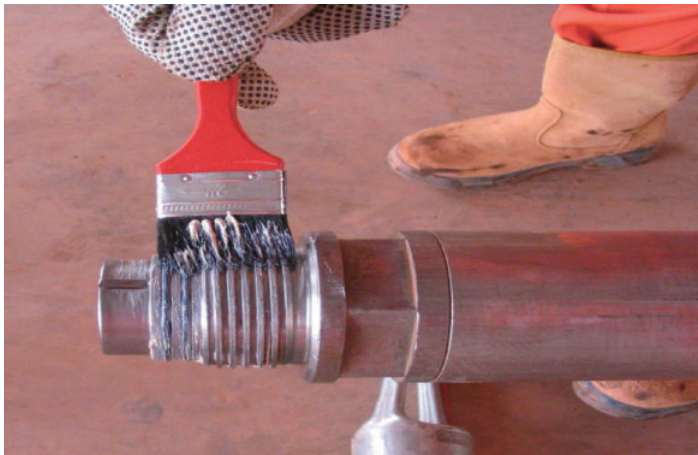


Figure 1.1 Lubricate the threads with grease

#### CAUTION

The oil type in the sonde must be confirmed before filling, a mixture of different oils in the tool could cause it to function incorrectly downhole.

Step6: Check the condition of the radioactive sources doors of the Neutron and Density tool, and lubricate them with grease.

Step7: Check the oil level of the hydraulic sondes, fill up to the required level if needed.

Step8: Check the insulation and continuity of each tool by Multi-meter, record the result in the tool history book.

Step9: If all the downhole tools pass the PM1 check, they should be connected in the shop for operational check.

## 2. Operational Check

The operational check shall be performed immediately after the PM1. The purpose of the operational check is to check the response of each particular tool and the whole toolstring combination, so it is strongly suggested to connect the tools in exactly the same configuration as it runs in the hole for the real job.

Step1: Locate the downhole tools to be connected by their names and serial numbers from the engineer. Put them on the stands.

Step2: Judge the size of the working area and decide where to lay the toolstring, then connect the toolstring starting from the bottom tool, as shown in Figure 1.2.



Figure 1.2 Connect the toolstring

### CAUTION

It's recommended not to use the jumps in the toolstring if the working area size allows, for checking the toolstring to simulate the real job situation.

Step3: After connecting all the tools, connect the cablehead to the downhole toolstring, as shown in Figure 1.3.

Step4: Connect the test boxes to the corresponding tools, bring the calibrators (GR jig, caliper rings) alongside the toolstring, as shown in Figure 1.4.

Step5: Double check to ensure the toolstring is in correct configuration, set up the logging services and power on the tools.

Step6: Refer to operation manual to perform each tool's operation check which could involve

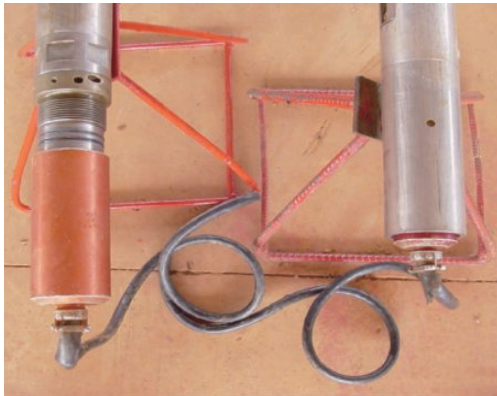


Figure 1.3 Connect the cablehead to the downhole toolstring



Figure 1.4 Connect the test boxes to the corresponding tools

- Inner electronic calibration;
- Calibrations with calibrators;
- Data acquiring with text-box attached.

Step7: Monitor tool's data and status for any abnormality or failure; the field engineer must fill **problem report** and keep original data or hardcopy, submit to line or project manager, then hand to the maintenance engineer for troubleshooting.

Step8: Tag each tool correctly, disconnect the toolstring.

#### CAUTION

Make sure the toolstring has been powered off before disconnecting the tools.

### 1.1.2 Downhole Tools Shop Calibration

Shop Calibrations should be performed at periodic intervals to ensure accuracy and repeatability. The frequency of this procedure is dependent on the standards of CNLC LQC. Generally one month intervals are the accepted standards considered adequate for most logging tools, however there are some tools that only require Shop Calibrations to be performed at intervals of up to six months. Below are basic steps to calibrate open hole conventional tools, the detailed calibration instruction should be found in the operation manual of each particular tool.

#### NOTE

It should also be calibrated any time there is a Major Repair, New Tool, or a Software Change. If the calibration shows a change outside prescribed tolerances after a major repair, then a second shop calibration should be performed to verify the calibration, and to bring the current and calibrated values into tolerance.

## 1. Calibration Equipment Preparation

Step1: Inspect the condition of the calibrators to be used. Locate the radioactive sources if they are needed, leave them in the sources pit. Calibration Equipments are shown in Figure 1.5 and Figure 1.6.



Figure 1.5 Neutron calibrator



Figure 1.6 Density calibrator

Step2: Connect the tool to be calibrated in the calibrating area, position or attach the calibrator to the tool if it's required, and attach the cablehead to be ready for tool power up. A calibrator example is shown in Figure 1.7.



Figure 1.7 The density tool is ready for calibration

Step3: For any calibrations using radioactive sources, a security area shall be lined out by tape or warning sign and only the person who is going to load/unload the sources can enter. The warning sign is shown in Figure 1.8.

Step4: Use the last shop calibration result as the comparing reference.



Figure 1.8 Warning sign

## 2. Calibration Procedure

Step1: Set up acquisition system, power up tools for at least 15 mins before proceeding.

Step2: Check the tool response; wait till the tool has warmed up and stabilised, then proceed with the calibration steps.

Step3: Perform the shop calibration for each particular tool.

### NOTE

Since different types of tool have different calibration program, please refer to the tool operation manual for detailed operation procedure.

### CAUTION

**All the CNLC safety rules must be strictly followed when operating with radioactive sources. The source must be brought to the tool just before loading and returned to the source pit immediately after unloading. The source shielding container must keep locked whenever the source is in it.**

### Source loading procedure

(1) Bring the source shielding container to calibration area and position it in such place that the source can be easily caught and loaded to the tool. The source shielding containers are shown in Figure 1.9 and Figure 1.10.

(2) Check the condition of the source door and lock-screw of the tool. Check the condition of the source loading tool.



Figure 1.9 Neutron source w/  
shielding container



Figure 1.10 Density source w/  
shielding container

(3) Unlock the source shielding container, catch the source with source loading tool. The operation is shown in Figure 1.11.

(4) Ensure the source is caught tightly, pull it out of the container and insert it in the tool. The operation is shown in Figure 1.12.



Figure 1.11 Unlock the source  
shielding container



Figure 1.12 Ensure the source  
is caught tightly

(5) Screw in the lock-screws to lock the source door, as shown in Figure 1.13.

Step4: Check the calibration result is in tolerance, compare it to the result of last calibration, ensure the tool status is stable and the calibration result is valid.

**CAUTION**

**In correctly working tools, deviations from the averages can be traced and should be very small for a particular tool. So it must be noticed if the calibration is in tolerance but the tool response has been shifted from previous status, the reason to cause change must be addressed.**



Figure 1.13 Screw in the lock-screws

Step5: Ensure again the calibrated tool is properly

identified, perform the calibration summary list and record the result in tape/file.

Step6: Disconnect the tools and put them back in the tool storage rack.

## 1.2 Mobilization

**SCOPE**

After completion of the of the equipment preparation, the logging crew are ready to transport them to wellsite. The section describes all requirements for tools transportation.

### Post and Responsibility

| STEP         | POST     |                 |          |
|--------------|----------|-----------------|----------|
|              | Engineer | Senior Operator | Operator |
| Mobilization | ○        | ●               | ○        |

Step1: When dispatch order received from clients, chief engineer to prepare single well QHSE plan and Job Safety Analysis in base.

Step2: Based on well information, chief engineer to hold a meeting to discuss operation plan with crew, assign job to each crew member, emphasize the key points of operation,