KING FAHD UNIVERSITY OF PETROLEUM AND MINERALS

HAFR AL-BATIN COMMUNITY COLLEGE

COOP Report

"Equipment of Drilling Services and Electronic"

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Abstract

In this COOP report different equipments used in the Sperry-Sun department of Halliburton Saudi Arabia are presented. Also the functions of each sub unit in the department viz; probe unit, workshop, the drilling equipments used, has been discussed comprehensively. In general these drilling equipments construction, testing procedures, working conditions, etc, are presented.

CHAPTER 1

INTRODUCTION

1. About Halliburton

Halliburton was founded in 1919; Halliburton is the world's leading diversified energy services, engineering, energy equipment, construction and maintenance company [1]. In 1999, Halliburton's consolidated revenues were $14.9 billion and it conducted business with a workforce of approximately 100,00 in more than 120 countries. Earle p. Halliburton was the company's founder. His ingenious oil well service methods revolutionized the oil industry. His grit and willingness to accept risk help his company to rapidly grow into a worldwide oil field service departments. There are some product and service lines for these departments [1]:

1. **Petroleum Engineering Services:** A leading subsurface oil and gas production and well technology company, specializing in the design and manufacture of down hole well completion and intervention products.
2. **Integrated Solutions:** Integrated solution unit the best people, technology, products, and equipment to offer oil and gas companies the most effective and profitable solutions to their challenges.
3. **Tools, Testing & TCP:** A vast products service profile based on a single goal: performance. Halliburton's ability to help customers obtain accurate reservoir information begins with state of the art technology and experienced personnel. Customers can count on Halliburton to provide the tools and equipment designed with the reliability and accuracy.

4. **Sperry-Sun:** Sperry-Sun is drilling department of Halliburton for drilling services.

2. Sperry-Sun

A technological leader in drilling engineering services, tools, sensors and software for integrated systems, rigsite information systems, directional drilling, measurement-while drilling services and systems and multi-string completion systems [2]. Sperry-Sun also provides production, reservoir deliverability, steering, survey and orientation, and horizontal under balanced drilling services. Sperry-Sun is subdivided into three units

1. **Probe Unit**: Probe means sensor which sense the temperature, inclination, direction, and gamma radiation.
2. **Kid Unit**: this unit arranged and sends the tools to the field.
3. **Work Sho**p: is arranged and check the equipments to go to the field.

3. Report Organization

This report is organized in a comprehensive manner so that the reader may easily follow the progress of the training. It starts from a brief review of Halliburton and the Sperry-Sun department and then proceeds in a comprehensive manner to the construction, working and testing procedures of different equipments of the Sperry-Sun.

Chapter 1 is an introductory chapter which surveys the historical background of Halliburton and the function of the Sperry-Sun department.

Chapter 2 discussed the probe unit of Sperry-Sun. The working and testing of different sensing equipments of the probe unit is presented and explained in detail for the reader.

Chapter 3 and is devoted to Workshop which is another unit of Sperry-Sun. The functions of this unit are presented.

Chapter 4 and 5 discussed about the main and secondary equipments used for drilling purpose are explained in detail. Also the construction, working and testing procedures are written.

In the final chapter (chapter 6), the presented COOP training is summarized along with conclusions.

CHAPTER 3

PROBE UNIT

Probe Unit is a sensor which senses the temperature, inclination, direction, and gamma radiation [3]. They are two parts of probe unit, the probe and the pulser. The probe takes the information from the well and sends the information to pulser. Now in the following I will explain about probe and pulser:

1. Probe

Probe means sensor which sense the temperature, inclination, direction, and gamma radiation. The probe receives this information and transmits it to the pulser. There are two types of probes namely [3]:

- Solar Probe.
- Non solar Probe.

1.1 Solar probe

It can withstand very high temperature and is better than Non solar probe. It is again divided into five types.

- GM (gamma Module) Probe.
- DM (Directional Module) Probe.
- SBM (Smart Battery Module) Probe.
- TM (Telemetry Module) Probe.
- PM (Position Monitor) Probe.

Halliburton uses gamma module and directional module [3]. The Gamma Module probes are the probe that senses the gamma radiation and the Directional Module probes are the probe that senses the temperature, inclination, and direction.

1.2 Non solar

These probes cannot withstand very high temperature. They are again divided into two types.

- PCD – R (Probe Carry Directional-Radiation)
- PCG – R (Probe Carry Gamma-Radiation)

The PCG-R (Probe Carry Directional-Radiation) probe is used to sense the gamma radiation. The PCD-R (Probe Carry Gamma-Radiation) probe is used to sense the temperature, inclination, and direction.

2. Test the probe

We make the QA test (Quality Assurance test) for the probe. If the computer accepts the probe, then the test is successful otherwise we do calibration test, after that if the probe fail the Halliburton in Saudi do not make repair to probe but send it to Dubai. There are two types of testing probes [3].

2.1 QA test (Quality Assurance test)

Coil field test: I put the probe in magnetic field at 0, 90, 180, and 270 degree and follow the computer commend show in the figure 3.1. If the computer says ok, then the probe is good. In this test if probe pass then l do another test is called fixture test show in the figure 3.2.

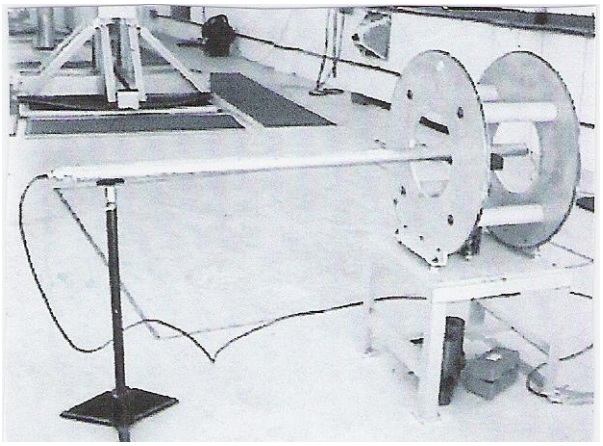

Figure 3.1 Coil Field Test

Fixture test: Once the probe passes coil field test we do another test called fixture test. In this test I put the probe at the shape like triangle at 0, 45, 90, 180, 225, and 270 degree. If the probe fails we do the calibration test.

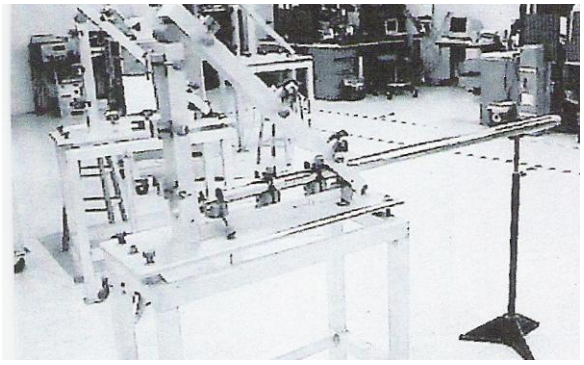

Figure 3.2 Fixture Test

2.2 Calibration test

In calibration test we connect the probe to the computer and set 25 V to the probe, then the computer match between ideal probe and our probe. Match about

voltage, current, and resistance as shown in figure 3.3. If the computer accepts the probes, then the probe is good, otherwise the probe failure.

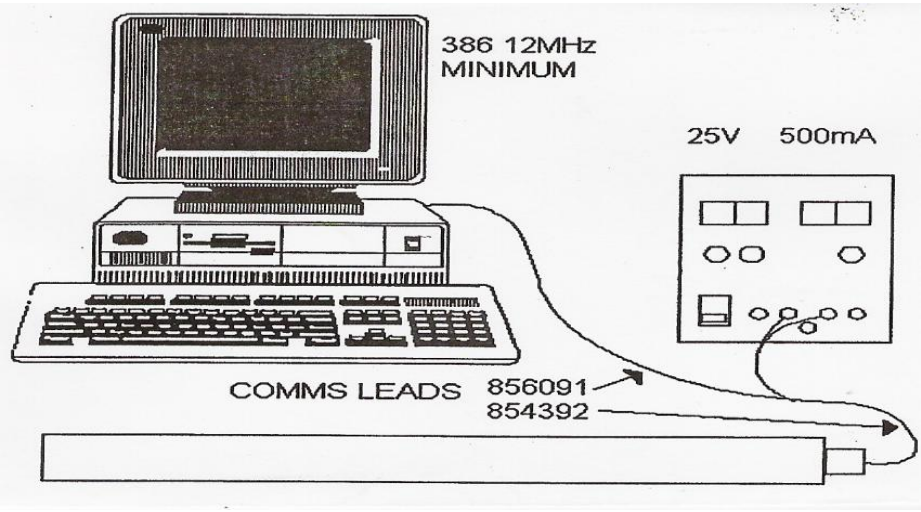

Figure 3.3 probe test

3. Pulser

The data acquired by Sperry-sun MWD (Measurement While Drilling) and LWD (Laboratory While Drilling) downhole sensors can be transmitted to the surface in real time using one of three different telemetry systems [3]. Pulser is used to provide directional and gamma radiation and send the information in the form of digital number to the receiver; the receiver can change the digital signal into useful information. There are three types of pulser:

- Positive mud pulse.
- Negative mud pulse.
- Electromagnetic.

The training was only with positive mud pulse, therefore this is explained in detail.

3.1 Positive mud pulse

Positive pulser is used to receive the information from probe and transmit the information to the computer. Positive pulser transmits data at up to 1.5 bits/second. There are two type of positive pulser [3].

*Solar positive mud pulse***:** It is very important because it can withstand very high temperature. It divides into two types:

- Mark 8 (M8): It has short stroke at the top end.
- Mark 7 (M7): It has long stroke at the top end.

DWD (Directional While Drilling) positive mud pulse: it is cannot withstand very high temperature. There are again divide into two types.

- Mark 6: It has long stroke at the top end.
- Mark 8: it has short stroke at the top end.

The positive mud pulsers are powered by a mud turbine shown in figure 3.4. The turbine rotor seen in the figure 3.4 is magnetically coupled to an internal drive shaft. The poppet valve seen in the figure 3.4 used to induce a pressure pulse. The orifice seen in the figure 3.4 is used to increase the pressure.

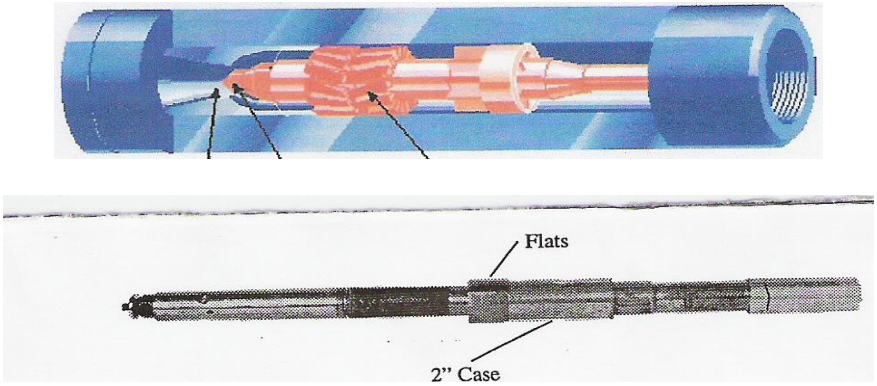

Figure 3.4 pulser

4. Test the Pulser

Step 1: *Torque check*: In this step we check the torque of the pulser and fill the table shown in table 3.1 [3]. If the pulser is good we write yes in the pass, otherwise write yes in the fail.

Table 3.1 Torque Check

Pump outer case\ Top End	100 Nm	Pass yes	Fail NO
2"Case\ Intermediate Case	180 Nm	Pass yes	Fail NO
Bulkhead	150 Nm	Pass yes	Fail NO
Bulkhead filler plug	10 Nm	Pass yes	Fail NO

Step 2: *Retraction test*: First we apply 9 volts to the pulser then I see stroke if the stroke go back during two minutes then the pulser is bad and therefore fails. If the pulser stroke does not go back it is good.

Step 3: *Resistance test*: In this test pulser must be at room temperature 25 degrees at the start.

1) Set the multmeter to the highest Ohms.

2) Connect the test leads to the black (-) and white (+) Ohms out parts.

3) Check resistance reading by rotating switch S1 and S2 through all positions by using MWD pulser test see at figure 3.5.

4) The resistance of the pulser must be as table 3.2 reading.

Table 3.2 Pulser Test Set Resistance Reading

		Switch 2						
		A	B	C	D	E	F	G
Switch 1	A	0-1	∞[a]	∞	∞	∞	∞	∞
	B		0-1	∞	∞	∞	∞	∞
	C			0-1	∞	∞	∞	∞
	D				0-1	∞	∞	∞
	E					0-1	∞	∞
	F						0-1	∞
	G							0-1

a. ∞ denotes infinity.

Step 4: *Alternator check*: In this step we check voltage and current by using voltmeter while the pulser is work. The table shows the voltage and current of a good pulser. So if we measure the voltage and current which satisfy the table value 3.3 then the pulser is good.

Table 3.3 Voltage and Current Test

Voltage (solenoid off)	Must be >30V
Current (solenoid off)	Must be >170mA
Voltage (solenoid on)	Must be >28V
Current (solenoid on)	Must be >250mA

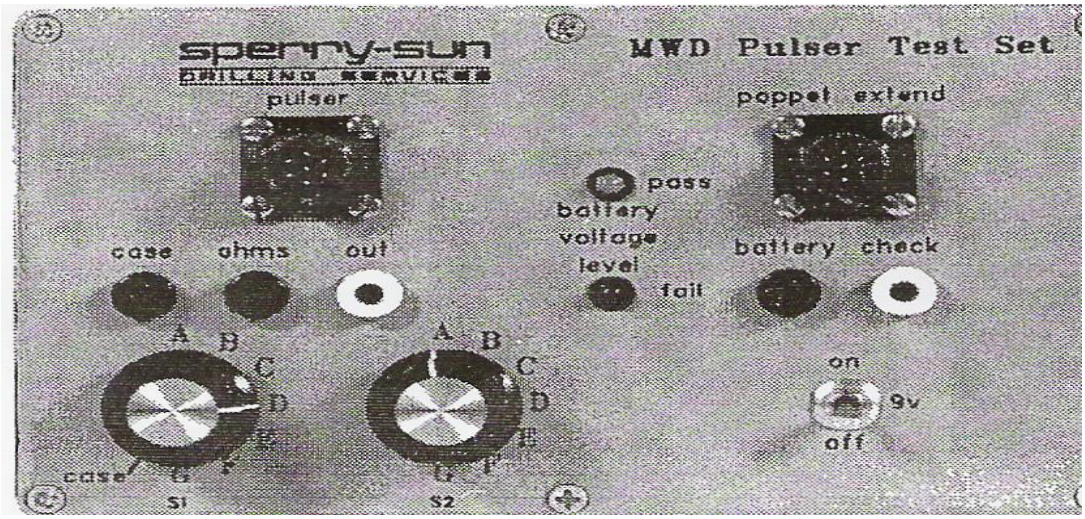

Figure 3.5 MWD pulser test

CHAPTER 6

CONCLUSION

1. Conclusion

The knowledge of Probes, Pulsers, Slim Phase 4, Hard connects, Battery, The Dual Gamma Ray, The EWR-Phase 4 sensor, SLD sensor, HCIM, etc, was obtained from the training. Also live testing, working principle, of each equipment resulted in a good experience which would prove fruitful in near future.

2. Recommendations

You can write any recommendation here that you would like to share with the students. This can help future students.

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1. www.halliburton.com.
2. “About Halliburton”, Halliburton Brochure, 2001.
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