Standard Form for Hardcopy Presentation of Downhole Well Log Data

API RECOMMENDED PRACTICE 31A
FIRST EDITION, AUGUST 1997

REAFFIRMED, SEPTEMBER 2004

AMERICAN PETROLEUM INSTITUTE

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FOREWORD

Development of Recommended Practice 31A was initiated by the API Executive Committee on Drilling and Production Practices. This document was prepared by the API Subcommittee on Standard Format for Electromagnetic Logs.

This document was derived in part from API Recommended Practice 31, which was originally adopted in 1947, and revised in 1967. Recommended Practice 31 is being superseded by API Recommended Practice 31A. API Recommended Practice 31A provides significant enhancements to both the content and format of the standard log heading and data presentation sections of the original API Recommended Practice 31. The revised heading will allow more complete and convenient reporting of data that should accompany each log in order to facilitate its correct interpretation and use. The revised format has been designed to apply not only to electric logs, but also to all wireline-logging measurements commonly obtained in either cased or open holes. Additionally, the revised format applies to downhole measurements obtained while drilling. Together these changes will allow greater ease of merging information from multiple logging runs, or from multiple tools in a single run.

The recommendations within API Recommended Practice 31A have been developed to apply to a wide range of commonly obtained logging measurements. Additional recommendations regarding content and format of data presentation may be contained in other API documents relating to specific classes of logging measurements. Finally, all of the information content recommended within API Recommended Practice 31A for hardcopy presentation is recommended also for inclusion within digital presentation of the same well log data. The recommended digital formats to be used are provided in API Recommended Practice 66.

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Suggested revisions are invited and should be submitted to the director of the Exploration and Production Department, American Petroleum Institute, 1220 L Street, N.W., Washington, D.C. 20005.

CONTENTS

Standard Form for Hardcopy Presentation of Downhole Well Log Data

1 Scope

The variety, use, and value of log recordings of subsurface properties have been greatly increased and expanded since the last revision of Recommended Practice 31. A wide diversity of log measurements (from both open and cased hole) are routinely being combined to interpret the original status of newly drilled wells and to evaluate performance and potential throughout each well's life. Standardization of the log form and data presentation will allow the user to conveniently combine log data from various devices and dates. Recognizing the wide variability in the tools covered by these recommendations, this document attempts to preserve flexibility wherever possible. The format selected allows for presentation of data that can be measured as a series of values at specified well depths. Consequently, this document can be easily applied to most logging measurements, and will serve as a reference document to technology-specific documents. This document makes no recommendations concerning the standard log record (refer to Section 4) for measurements that are data series at individual depths (for example, pressure transients, video images, sonic traces, and so forth). To the extent that recommended practices for the presentation of such data are appropriate, they should be included within separate Recommended Practices for the technologies involved.

In addition to the recommendations concerning the format for presentation of log data, this document provides several enhancements to the standard log heading. These changes are designed to provide the user with a more complete set of information in consistent locations on all logs. Due to the increasing use of tool calibration and data processing while logging, recommendations are provided concerning documentation of equipment history and processing software. One should identify tool-specific information in other appropriate recommended publications.

The recommended additions to the content of the support information included with hardcopy presentations of well log data, as described in the following, should also be included with digital recordings of the same well logs. The recommended digital formats to be used are provided in API Recommended Practice 66.

The recommendations contained within API Recommended Practice 31A provide some flexibility regarding the dimensions of the actual print field used in the hardcopy presentation of well log data. This flexibility will accommodate the use of commonly available printers and paper sizes as optional alternatives to the 6.25-inch by 9.25-inch fanfold paper on which log data has been traditionally printed. Example figures conforming to this document and printed at the dimensions required for 8.5-inch by 11-inch paper are provided. The changes made to accommodate this flexibility in paper and printer selection will in no way alter the actual scaling of the log data. Log data curves will precisely "overlay," regardless of the choice of paper or print field dimensions. Any hardcopy presentation of log data that meets all of the information content and format specifications described in the text of this document shall be considered to be in conformance with it.

2 References

Unless otherwise specified, the most recent editions or revisions of the following standards, codes, and specifications shall, to the extent specified herein, form a part of this standard.

API

RP 13B-1 *Recommended Practice for Standard Procedure for Field Testing Water-Based Drilling Fluids*

RP 13B-2 *Recommended Practice for Standard Procedure for Field Testing Oil-Based Drilling Fluids*

RP 13G *Recommended Practice for Standard Procedure for Laboratory Testing Drilling Fluids*

RP 66 *Exploration and Production Data Digital Interchange*

3 Standard Heading

3.1 INTRODUCTION

A recommended standard heading has been developed for all downhole well log data, which provides space for information pertinent to the interpretation of these logs. This information should be recorded on field copies as well as on final prints because considerable log interpretation is made from field copies. The logging company is normally responsible for recording complete standard-heading data. However, the logging company depends upon the operator for much of these data. Thus the operator shares the responsibility for providing complete and accurate data.

3.2 GENERAL INFORMATION

The recommended standard log heading has four parts consisting of a cover panel, followed consecutively by panels for well logging operations, borehole fluid properties, and a wellbore diagram. Generally, the length of each panel is between 8 inches and 8.25 inches, and the width is between 5.5 inches and 6 inches. Acceptable alternative formats are identified for specific panels in the detailed descriptions provided in the following.

3.3 COVER PANEL

3.3.1 Format

Two optional formats (portrait and landscape, see Figures 1 and 2 respectively) are provided for the Cover Panel. Both formats contain space for identical information. The well operator has the responsibility to select the preferred option. Each panel includes six fields as follows:

3.3.2 Service Company

The field at the top of the cover panel is for the logging company's name, company logo, and log name.

3.3.3 Well Identification

The well identification field includes the unique API well number, well name, operator, producing field, county/parish, state/province, and country. If the well is not drilled in a producing field, the term *wildcat* may be placed in the space for field name.

3.3.4 Location

The location field contains space for a description of the well's surface location. Data may include grid coordinates, latitude and longitude, section, township, and range or other detailed survey description.

3.3.5 Elevation

The elevation fields design affords accurate vertical reference for both drilling and logging operations. The permanent depth datum and its elevation, as designated by the well operator, should be recorded so that removal of the rig or other equipment will not result in loss of datum. The permanent datum should be ground level, mean sea level, or a specific point on permanent wellhead equipment. Where possible all logs and driller's measurements should relate to the top of the rotary table's kelly drive bushing. When there is no kelly bushing, the drilling floor elevation should be used for reference and the space on the heading for kelly bushing elevation should be entered with *N/A*.

3.3.6 Other Services

The other services field is provided for the logging engineer to list logging services performed in the well that are not included on this presentation. Each service should be identified by a unique mnemonic, as well as a brief English description (for example, DLL = dual laterolog).

3.3.7 Intervals, Dates, and Scales

The intervals, dates, and scales field is for information about the logged interval, print type, acquisition dates, depth units, depth scale ratios, and depth scaling. The log interval should identify the shallowest and the deepest logged depths presented. Acquisition dates refer to the beginning and conclusion of the acquisition of presented data.

Depth scale ratio is a unitless ratio of depth on the log to depth in the borehole. For example, a ratio of 1:240 is the same as that commonly referred to in the United States as a 5-inch scale where 5 inches of log equal 100 feet of borehole. If more than one depth scale is presented, each should be specified.

3.4 WELL LOGGING OPERATIONS PANEL

3.4.1 The *Well Logging Operations Panel* is placed immediately after the Cover Panel. This panel is a table for compilation of certain data about each log presented. Each column in the table relates to a single logging tool, including its auxiliary devices. Additional panels can be added as needed (see Figure 3). Definitions and instructions for the data entries contained within this panel are provided in the following paragraphs.

3.4.2 The *log* is an individual logging tool run in the borehole. Combination tool runs should be reported by individual tools. Auxiliary logs such as spontaneous pontential (SP), gamma ray, and caliper should not be included unless they are run separately.

3.4.3 The *date*: record the date when the logging job begins.

3.4.4 The *logging job* refers to the group of logs run from the time the service company begins the logging operation until the time the service company is released from the wellsite. Logging jobs are numbered consecutively. In most downhole measurements obtained during drilling operations, the logging job number will be 1.

3.4.5 The *logging suite* refers to the group of logs run in the same borehole environment during a single logging job. The borehole environment is controlled by the borehole diameter and fluid composition and may change during the logging operation. Possible reasons to change the logging suite number include (a) drilling ahead (after bit size change), (b) changing mud properties, and/or (c) performing clean-out trips. Suite numbers increase consecutively throughout the process of drilling and evaluating a well. The suite number should be 1 only for the first logging suite of the first logging job.

For downhole measurements obtained while drilling, the logging suite number should change each time there is a significant change in bit diameter or mud properties.

The following is a logging-suite example: During the first logging job, a clean-out trip with drill pipe was made. The logs obtained before the cleanout trip are included in Suite 1. logs run after the trip are included in suite 2. The logging job

performed after the final portion of hole was drilled is logging job 2. If no changes in mud properties occurred during this logging job and no clean out trips were made, all logs from logging job 2 would be in suite 3.

3.4.6 A *logging run*: a set of measurements by an individual tool, during which the formation properties are considered to be static. Runs are numbered consecutively for each tool (but not each tool string).

The following is a logging run example: A well is to be drilled with two intermediate logging jobs, the first requiring a dual induction tool, and the second requiring a dual induction/porosity combination tool. The final logging job requires a dual laterolog logging tool. The two intermediate logging jobs would include logging run 1 and logging run 2 for the dual induction tool even though the dual induction tool was run by itself on logging job 1 and was run as part of a combination tool on logging job 2. logging job 3 would include logging run 1 for the dual laterolog tool because this would be the first instance where that tool was used.

3.4.7 The *Number of repeats*: enter the number of repeat measurement passes made within each logging run. Repeat passes are considered to be identical within the precision of the logging measurement.

3.4.8 *TD—driller*: record the depth at the bottom of the hole according to the driller's measurements at the time the well is logged. If the well has been plugged back, one should record plugback depth and indicate by the abbreviation *P.B.*

3.4.9 *TD—logger*: record the depth at the bottom of the hole as measured by the logging company.

3.4.10 *Deepest reading*: record and mark on the log the deepest depth at which a formation measurement is recorded. The measurement at this depth may not be valid (see 3.4.11).

3.4.11 *Deepest valid data*: record and mark on the log the deepest depth at which the log provides a valid formation measurement.

3.4.12 *Shallowest reading*: record and mark on the log the shallowest depth at which a formation measurement is recorded. The measurement at this depth may not be valid (see 3.4.13).

3.4.13 *Shallowest valid data*: record and mark on the log the shallowest depth where the log provides a valid formation measurement.

3.4.14 *Deepest casing—driller*: record casing size and depth where the deepest casing string has been set according to the driller's measurements in the following manner: 12.25 inches at 9203 feet.

3.4.15 *Deepest casing—logger*: record casing size and depth where the deepest casing shoe is detected by the logging tool.

3.4.16 *Bit size*: record the size of the bit used to drill the deepest portion of the logged hole. The logged portion of the hole may have been drilled with bits of different sizes. This information should be incorporated in the wellbore diagram.

3.4.17 *Logging speed*: indicate the logging direction (up/down), record the average speed at which the tool is run while data is being acquired.

3.4.18 *Date/time on bottom*: record the date and time of day when the logging tool reaches its maximum depth.

3.4.19 *Logging unit number*: record the number of the logging company's wellsite unit that performs the logging job.

3.4.20 *Operations base*: record the name of the logging company's base of wellsite operations.

3.4.21 *Service order number*: record the logging company's service order number.

3.4.22 *Recorded by*: record the name of the logging company engineer primarily responsible for the wellsite logging job.

3.4.23 *Witnessed by*: record the name of the operating company representative primarily responsible for witnessing the logging job.

3.5 SPECIAL NOTIFICATIONS AND REMARKS PANEL

3.5.1 Location and Content

The Special Notification and Remarks Panel is placed immediately after the Well-Logging Operations Panel and is formatted to provide space for both generalized statements as described in the following paragraphs and specific comments relating to the log data or its presentation. An example of this panel is provided in Figure 4. The dimensions of this panel may be adjusted as necessary to accommodate the amount of information contained.

3.5.2 Service Company Disclaimer

If the logging company wishes to include a statement concerning liability or policy, the statement may be placed in this field on the Special Notifications and Remarks Panel.

3.5.3 Conformance with API Recommended Practice

When the hardcopy presentation of downhole well log data conforms to this recommended practice, a logging company may print this fact in a field adjacent to the service company disclaimer. The statement, "This hardcopy presentation of downhole well log data conforms to API Recommended Practice 31A," may be used.

COMPANY LOGO

Service Company: _____

Log Name: _____

API Well Number: _____

Well Name: _____

Operator: _____

Field: _____

County/Parish: _____

State/Province: _____

Country: _____

Location Description:

Elevations:

Kelly bushings: _____

Drilling floor: _____

Ground/sea floor: _____

Permanent datum is: _____

Permanent datum elevation: _____

Log is measured from: _____

Height above datum: _____

Drilling measured from: _____

Height above datum: _____ _____

Other Services:

Log interval is from: _____ to: _____

Print type is: ☐ Field ☐ Final ☐ Composite

Acquisition dates from: (month/day/year) _____ to: (month/day/year) _____

Depth unit: ☐ Feet ☐ Meters

Scale ratios: 1:_____ , 1:_____

Scaled depth is: ☐ MD ☐ TVD

Figure 1—Cover Panel Format (Portrait)

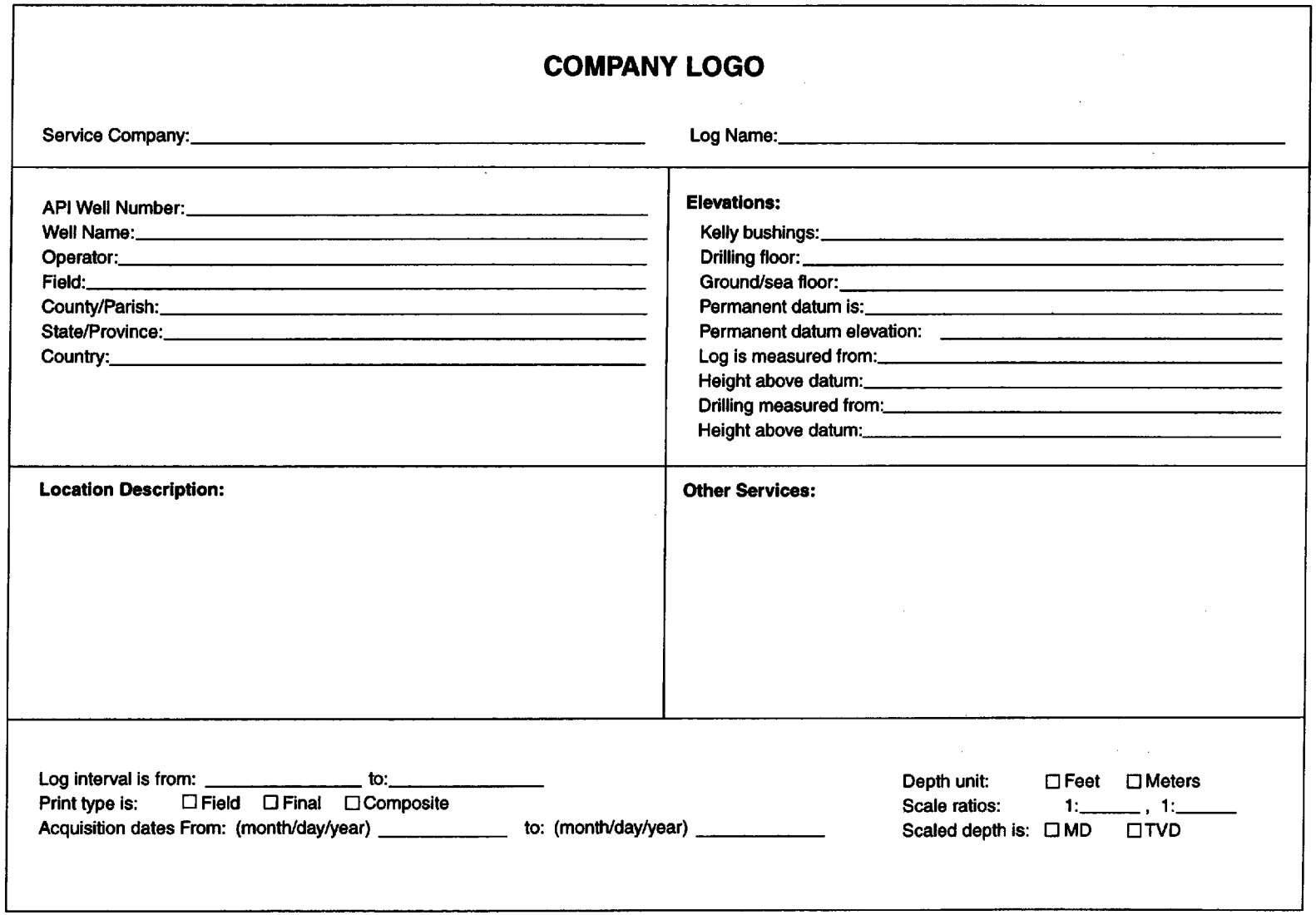


Figure 2—Cover Panel Format (Landscape)

WELL LOGGING OPERATIONS					
Log					
Date					
Logging job number					
Logging suite number					
Logging run number					
Number of repeats					
TD—driller					
TD—logger					
Deepest reading					
Deepest valid reading					
Shallowest reading					
Shallowest valid reading					
Deepest casing—driller					
Deepest casing—logger					
Bit size					
Average logging speed					
Date/time on bottom					
Logging unit number					
Operations base					
Service order number					
Recorded by					
Witnessed by					

Figure 3—Well Logging Operations Panel

3.5.4 Scale Changes

The scale changes field is designed to record the scale changes if the scale used to record the log was changed during logging. SP base line shifts are specifically included. See Figure 10.

3.5.5 Remarks

The remarks field is to be used to report all unusual situations related to the borehole condition and the logging instrument that occurred during the logging operation.

3.5.5.1 When describing a particular problem related to the borehole or the logging instrument, specify the depth interval where the problem was encountered, and provide an explanation of the problem.

3.5.5.2 Report and explain changes to the variable logging parameters made by the logging engineer.

3.6 BOREHOLE FLUID DATA PANEL

3.6.1 Location and Content

The information in the borehole fluid data panel is identified by logging suite number (see 3.4.5) and date. The order and format of the entries are designed to facilitate direct transcription from the Drilling Mud Report Form as specified in API Recommended Practice 13G. Details of the measurement standards are described in API Recommended Practice 13B-1 and API Recommended Practice 13B-2. Recommended entries not present on the Drilling Mud Report Form are described in the following paragraphs. Units must be specified for all applicable entries in the Borehole Fluid Data Panel. Units other than those shown in the sample panel are acceptable (see Figure 5).

3.6.2 Information Source and Date

Enter the source (with date) of the information in the Borehole Fluid Data Panel, for example, "3/15/92 Mud Report."

3.6.3 Type fluid

The type of drilling fluid or other fluid in the well at the time of recording the log should be described. If appreciable changes in the drilling fluid program were made while drilling the logged interval, an asterisk should be placed next to the logging suite number, and the changes in fluid type and depth of such changes should be indicated under "Remarks"

3.6.4 Weighting Material

Enter a generic description of the type of weighting material used, for example, barite, hematite, or calcium carbonate. If a generic description is not available, one should enter the trade name of the material used to weight the mud.

3.6.5 Continuous Phase

Identify oil or water as the continuous phase of the mud.

3.6.6 Solids Content

Indicate for each logging suite whether solids content was calculated or is based on a retort measurement.

3.6.7 pH or Alkalinity of Mud

Enter the pH of water-based mud or alkalinity of oil-based mud. Indicate whether pH comes from a meter or strip measurement by entering the letter *M* or *S*, as appropriate.

3.6.8 Chlorides

Milligrams/liter (mg/l) is the recommended unit chosen to conform with API Recommended Practice 13G. Units of parts per million (ppm) are commonly used and are acceptable.

3.6.9 KCl

Enter the fraction by weight of the total chloride content represented by potassium chloride.

3.6.10 Gilsonite/Asphaltic Additives

If any gilsonite or asphaltic additives have been added to the mud system, enter the pounds per barrel added.

3.6.11 Type of Lost Circulation Material

Describe any material added to the wellbore during the drilling of the logged interval to control lost circulation.

3.6.12 R_m at Measured Temperature, R_{mf} at Measured Temperature, and R_{mc} at Measured Temperature

Record the measured resistivity values for the mud (R_m), mud filtrate (R_{mf}), and mud cake (R_{mc}), and the temperatures at which these resistivity measurements were obtained.

3.6.13 Source of R_{mf} and R_{mc}

Record the source of the R_{mf} and R_{mc} data. For example, "Meas./chart" would show that drilling fluid-filtrate resistivity was measured and drilling fluid-cake resistivity was obtained from a chart.

SPECIAL NOTIFICATIONS AND REMARKS
Service company statement concerning data or interpretation correctness, business relationships, company policies, and/or liability may be placed here:
This hardcopy presentation of downhole well log data conforms to API Recommended Practice 31A:
Scale Changes:
Remarks:

Figure 4—Special Notification and Remarks Panel

BOREHOLE FLUID DATA PANEL				
Logging Suite Number/Date	/	/	/	/
Mud Information Source and Date				
Type Fluid				
Source of Sample				
Density (lb/gal)				
Funnel Viscosity (sec/qt) API	@ °F	@ °F	@ °F	@ °F
Plastic Viscosity cp	@ °F psi	@ °F psi	@ °F psi	@ °F psi
Yield Point (lbs/100 sq ft)				
Filtrate API (cm^3/30 min)				
API HTHP Filtrate	@ °F psi	@ °F psi	@ °F psi	@ °F psi
Cake Thickness (32nd in. API/HTHP)	/	/	/	/
Weighting Material				
Continuous Phase				
Solids Content (% vol)/Method	/	/	/	/
Solids Content Adjusted for Salt (% vol)[a]				
Liquid Content (% vol) oil/water	/	/	/	/
pH (M/S) or Alkalinity Mud (Pom)	@ °F psi	@ °F psi	@ °F psi	@ °F psi
Chlorides, Whole Mud/Water Phase (mg/l)	/	/	/	/
KCl (% Total Chlorides)				
Electrical Stability (VB)[a]				
Gilsonite/Asphaltic Additives (lb/bbl)				
Type Lost Circulation Material				
R_m @ Meas. Temp.	@ °F	@ °F	@ °F	@ °F
R_{mf} @ Meas. Temp.	@ °F	@ °F	@ °F	@ °F
R_{mc} @ Meas. Temp.	@ °F	@ °F	@ °F	@ °F
Source: R_{mf}/R_{mc}	/	/	/	/
R_m @ Max. Rec. Temp.	@ °F	@ °F	@ °F	@ °F
R_{mf} @ Max. Rec. Temp.	@ °F	@ °F	@ °F	@ °F
R_{mc} @ Max. Rec. Temp.	@ °F	@ °F	@ °F	@ °F
Max. Rec. Temp./Depth or "max" (F/ft)	/	/	/	/
Date/ Time Circulation Started	/	/	/	/
Date/ Time Circulation Stopped	/	/	/	/
Time Logger on Bottom				
Mud Flow During Drilling (gal/min)				
Remarks:				

Figure 5—Borehole Fluid Data Panel

[a]Oil-based methods.

3.6.14 R_m, R_{mf}, R_{mc} at Maximum Recorded Wellbore Temperature

Enter R_m, R_{mf}, and R_{mc} calculated for the maximum recorded wellbore temperature.

3.6.15 Maximum Recorded Temperature

Enter the maximum temperature recorded during the logging suite. If from a continuous thermometer, enter the depth at which the maximum occurred in the second part of the field. If from a max/min thermometer, enter max in the second part of the field.

3.6.16 Date, Time Circulation Started/Stopped

Enter the date and time of the start and stop of the last circulation period before logging.

3.6.17 Mud Flow Rate

For downhole measurements obtained while drilling, enter the mud flow rate during the time the logs were acquired.

3.6.18 Remarks

Enter any additional information that could be valuable to log interpretation, such as descriptions of fluid changes during drilling, additional information present on the mud report form, and any new measurements that become available (such as dielectric constant).

3.7 WELLBORE DIAGRAMS

3.7.1 Wellbore Diagram

A wellbore diagram depicting the physical dimensions of the downhole environment should be included with all hardcopy presentations of log data. An example wellbore diagram is shown in Figure 6. In the center of the field is a diagram of the borehole depicting the various casing strings and openhole portion of the well. To the right is space for wellbore mechanical details such as casing description and setting depth. The space on the left is reserved for formation tops, deviation information, and comments. If the hole is deviated, key deviation measurements may be indicated at appropriate intervals. Similarly, the comments section can be used to note depths of any cores, tests, dog legs, lost circulation zones, fish, debris, or other data that may aid in understanding or interpreting the log.

3.7.2 Completion Diagram

For logs run in cased holes, the addition of a completion diagram identifying all items likely to affect log response is recommended. Components shown in this diagram may include the productive string, estimated cement tops, known wellbore fluid contacts, perforations, and so forth. An example of such a diagram indicating many of the components that should be identified is shown in Figure 7.

3.8 EQUIPMENT DATA PANEL

3.8.1 This panel is designed to register distinctive instrument information for each individual logging instrument that was employed during the logging operation. Refer to Figure 8.

3.8.2 Logging run number, instrument type, serial number or other unique instrument identification number, series number, pad type, instrument position, and any other descriptive instrument information should be registered in this panel.

3.8.3 The terms *centered, eccentered, standoff,* and *free* should be used, as appropriate, to describe the instrument position in the wellbore.

3.8.4 All significant uphole data acquisition, processing, and recording equipment should be listed and identified by instrument type, serial number, and unique instrument identification number.

3.8.5 Computer software used in the acquisition, processing, and recording of log data should be identified by name, function, version number, and revision date.

3.8.6 The information contained in the Equipment Data Panel may alternatively be incorporated in the Instrument Diagram Panel (see 3.9).

3.9 INSTRUMENT DIAGRAM PANEL

3.9.1 The Instrument Diagram Panel must reflect the tool string as it appears downhole. A diagram of all downhole instruments (logging instruments, centralizers, spacers, bridles, and so on) should be included. The maximum outside diameter and length, and the measurement point of each individual instrument, must be provided. When tools are run in combination, the above information is also required for the entire tool string. The measurement point for all logging instruments should be referenced from the physical bottom of the tool string or bottom hole assembly.

3.9.2 If a separate Equipment Data Panel and Instrument Diagram Panel are used, they should be placed close together for ready reference. An Instrument Diagram Panel that includes information specified in 3.8 and 3.9 is shown in Figure 8. An Instrument Diagram Panel depicting a tool string used for measurements obtained while drilling is shown in Figure 9.

3.10 CURVE SPECIFICATION PANEL

3.10.1 Location and Content

The Curve Specification Panel is designed to provide space for the inclusion of all technical particulars required to describe each log curve and tie it to the specific logging instrument and logging system (i.e., uphole instrumentation and acquisition software) used to produce the curve. It may be placed either immediately before or after the presentation of the recorded log data. Refer to Table 1.

3.10.2 Curve Identification

All logging curves presented must be uniquely identified to provide the end user with a full curve name, the mnemonic used on the data presentation, the measurement units, and a basic description of the key data applications. Logging curves that are recorded digitally, but not presented on the hard copy, should be so noted.

3.10.3 Curve Traceability

References should be provided such that each curve has full traceability to the service company's published documentation. Special notification should be provided for any curves for which traceable documentation has not yet been published. Similar notification should be provided if curve data acquisition or processing differs significantly from available documentation.

3.10.4 Data Acquisition and Processing Parameters

All variable logging parameters controlled by the logging engineer during the logging operation (e.g., filters, environmental corrections, assumed lithology, sample rates, and special processing) must be recorded in this section.

4 Standard Log Record

4.1 LOG FORMAT

Refer to Figure 10 for a standard log record format.

4.1.1 Track Specifications

4.1.1.1 Track Definitions

The tracks are defined as follows: Log Track 1 is on the left edge of the log; Depth Track is on the right of Log Track 1; Log Track 2 is to the right of Depth Track; Log Track 3 is to the right of Log Track 2; Log Track 4 combines Log Tracks 2 and 3 into a single track. Log Track 4 is located to the right of Depth Track.

4.1.1.2 Track Width

Log Tracks 1, 2, and 3 should be 2.5 inches (6.35 centimeters) wide, and the Depth Track should be 0.75 inches (1.9 centimeters) wide. Log Track 4 should be 5.0 inches (12.7 centimeters) wide. An alternate width of 0.50 inches (1.3 centimeters) may be used for the Depth Track, allowing reproduction of Well Log Hardcopy Presentation using readily available 8.0-inch wide print formats.

4.1.2 Grid Specifications

4.1.2.1 Linear Grid

Each log track should have vertical grids with .25 inches (0.635 centimeters) between each grid. The left and right edges of the track should be thick. The center vertical grid should be medium. The remaining grids should be thin.

4.1.2.2 Logarithmic Grid

The left and right edges of the track should be thick. The grid lines separating the decades should be medium. The remaining grids should be thin.

4.1.2.3 Horizontal Grid

Horizontal lines representing 2 feet, 10 feet, and 50 feet of depth are standard. The 50-foot lines are heavy, the 10-foot lines are medium, and the 2-foot lines are light. Two-foot grid lines are omitted on correlation log presentations. Similar grids for metric presentations are acceptable.

4.1.3 Depth Scales

The depth scales must be clearly identified. The standard identification is the reduction ratio (interval on the log per interval of depth). Depth values should be printed on the Depth Track at least every 100-foot or 50-meter depth interval, with characters centered on the horizontal grid line to which they refer.

4.1.3.1 Standard Correlation Log Presentation

The standard correlation log presentation is either 1:600 or 1:500.

4.1.3.2 Standard Detail Log Presentation

The standard detail log presentation is either 1:240 or 1:200.

4.1.3.3 Alternate Log Presentations

An alternate correlation log presentation is either 1:1200 or 1:1000. Expanded scales to capture detail of high-resolution logs are acceptable.

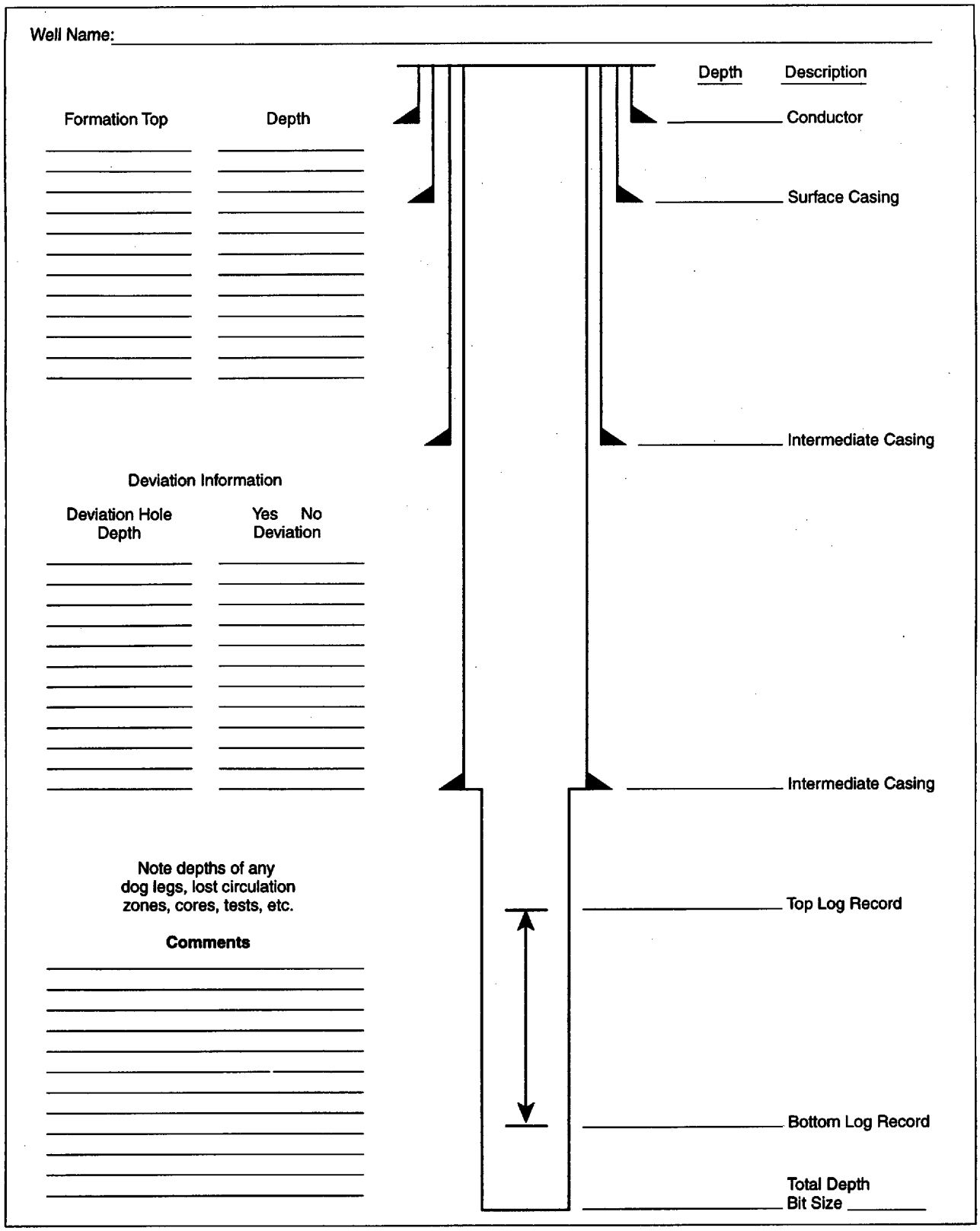


Figure 6—Wellbore Diagram

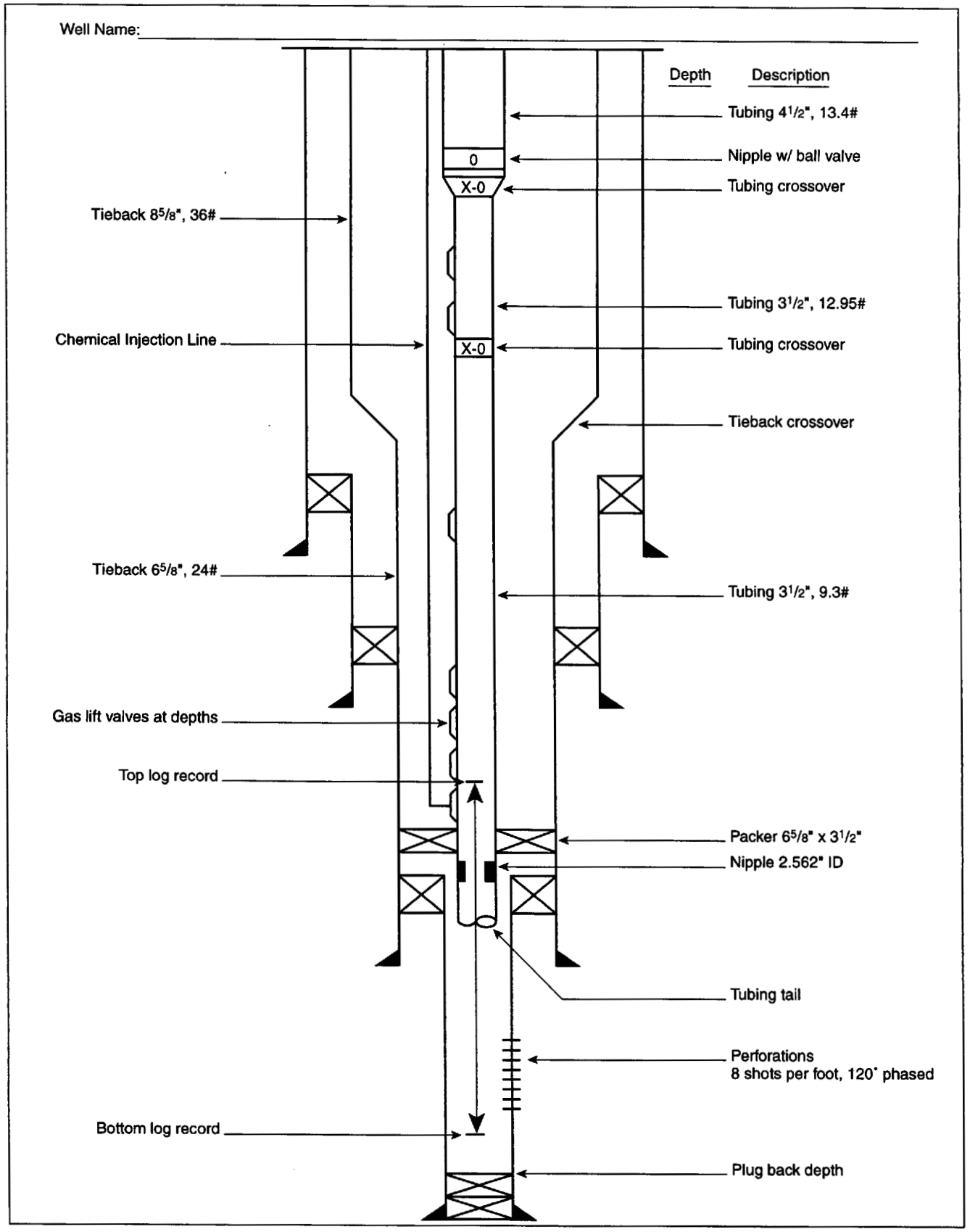
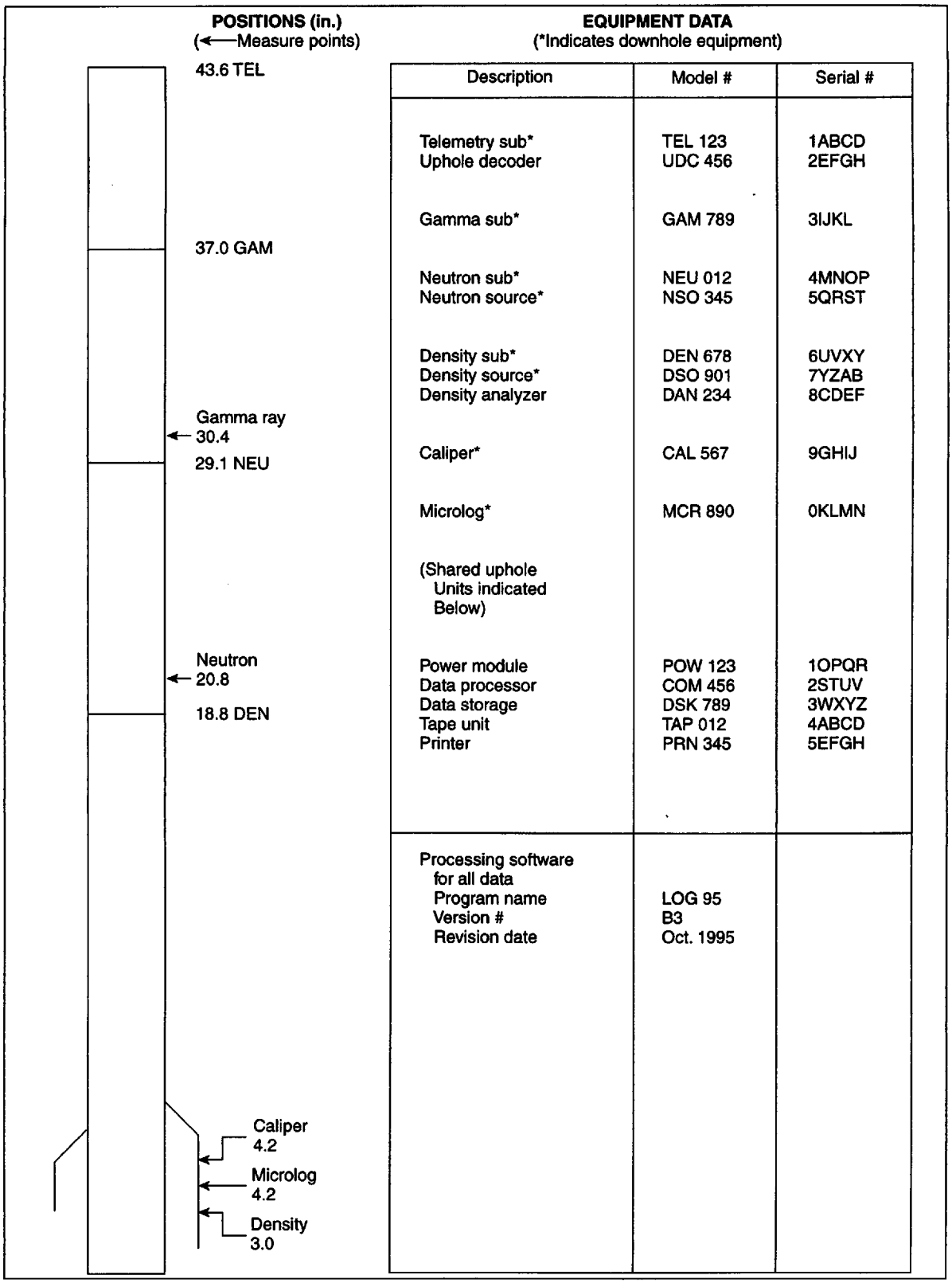


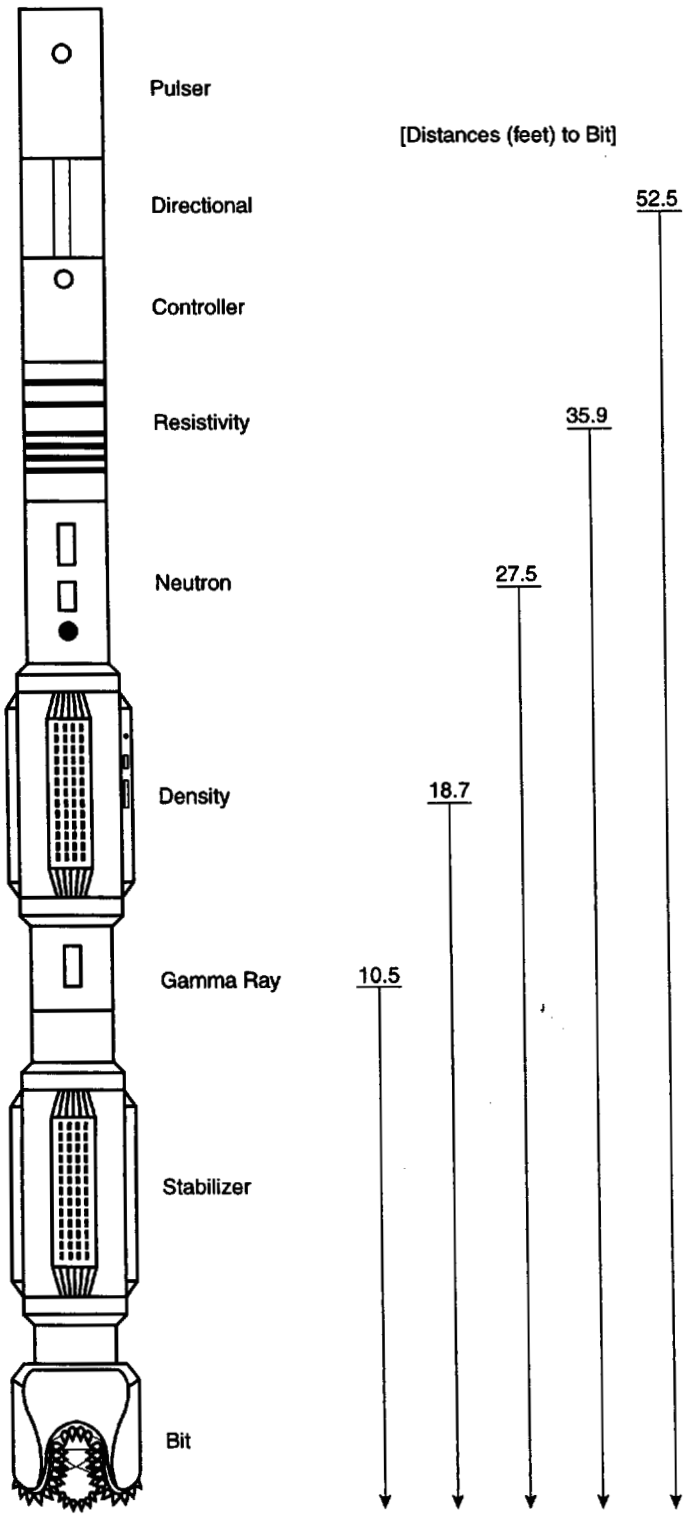
Figure 7—Completion Design



EQUIPMENT DATA
(*Indicates downhole equipment)

Description	Model #	Serial #
Telemetry sub*	TEL 123	1ABCD
Uphole decoder	UDC 456	2EFGH
Gamma sub*	GAM 789	3IJKL
Neutron sub*	NEU 012	4MNOP
Neutron source*	NSO 345	5QRST
Density sub*	DEN 678	6UVXY
Density source*	DSO 901	7YZAB
Density analyzer	DAN 234	8CDEF
Caliper*	CAL 567	9GHIJ
Microlog*	MCR 890	0KLMN
(Shared uphole Units indicated Below)		
Power module	POW 123	1OPQR
Data processor	COM 456	2STUV
Data storage	DSK 789	3WXYZ
Tape unit	TAP 012	4ABCD
Printer	PRN 345	5EFGH
Processing software for all data		
Program name	LOG 95	
Version #	B3	
Revision date	Oct. 1995	

Figure 8—Equipment Data/Instrument Diagram Panel



Equipment Data		
Description	Model #	Serial #
Pulser	PUL 123	1MMPNQ
Directional	DIR 456	8JNNOP
Controller	CON 012	2ACEVD
Resistivity	RES 234	4RFTGH
Neutron	NEU 443	0LLKJP
Density	DEN 778	6YNUKO
Gamma ray	GAM 543	5FFRTY
Stabilizer	STA 258	3REWDF
Bit	BIT 908	8KIJTG

Uphole Electronics		
Description	Model #	Serial #
Power	POW 369	2AEMW
Processor	PRO 482	5BFNX
Data unit	DAT 505	8CGOY
Printer	PRI 627	1DFPZ

Processing Software		
Program name	MWD DATA	
Version #	12 A	
Revision date	August 1995	

Figure 9—Equipment Data/Instrument Panel (MWD Version)

CURVE	ACRONYM	UNITS	COMMENTS
Gamma ray	GR	API	2' normal filter applied Commonly used to distinguish sand from shale
Caliper	CAL	Inches	Indicates washouts and mudcake buildup
Deep induction resistivity	DIL	OHMM	Used to calculate water saturation conventional 6FF40 design, two-phase processing[a]
Neutron porosity	NPOR	$\%BV_{ss}$	Environmental correction[b] and 2' normal filter applied Lithology identification and gas detection (with DEN)
Formation density	DEN	g/cc	2' normal filter applied Porosity, lithology, and gas detection (with NPOR), high-resolution processing applied to NPOR and DEN[b]
Density correction	DCOR	g/cc	Borehole correction applied to DEN IDCOR I > 0.15 suggests reduced data quality[c]

Notes:
a. Shea Lee Sands, *Log Analyst*, September 1994, p. 123.
b. I. C. Thinbeds, *1995 SPWLA Symposium Transactions*, Paper Q.
c. *Basic Logging Principles*, 2nd ed., Log-O-Matic Corporation, Brochure #21.

Table 1—Curve Specification Panel

4.1.4 Log Scales

The scale in units appropriate to the measurement should be recorded at both the top and bottom of the track in which the log data is recorded. Scale changes on the log should be noted at the depth where the change occurred by two scales, one for above the depth and one for below the depth. SP base line shifts should be indicated as they occur on the log. Scale changes and SP base line shifts should be recorded as specified in 3.5.4.

4.1.5 Miscellaneous

4.1.5.1 Depth Reference

The standard depth reference is measured depth. If another depth reference is used, it should be clearly identified on the log heading and in the Depth Track. This Depth Track identification should be repeated at least once for each 6 inches (15 centimeters) of log plot.

4.1.5.2 Log Sampling Markers

For wireline logs, a one-minute time marker should be displayed at the left edge of Log Track 1. For downhole measurements obtained while drilling, the spatial sampling density should be indicated on the log in a manner so as not to interfere with the data being presented.

4.2 ORGANIZATION OF HARDCOPY INFORMATION

4.2.1 Order of Information Panels

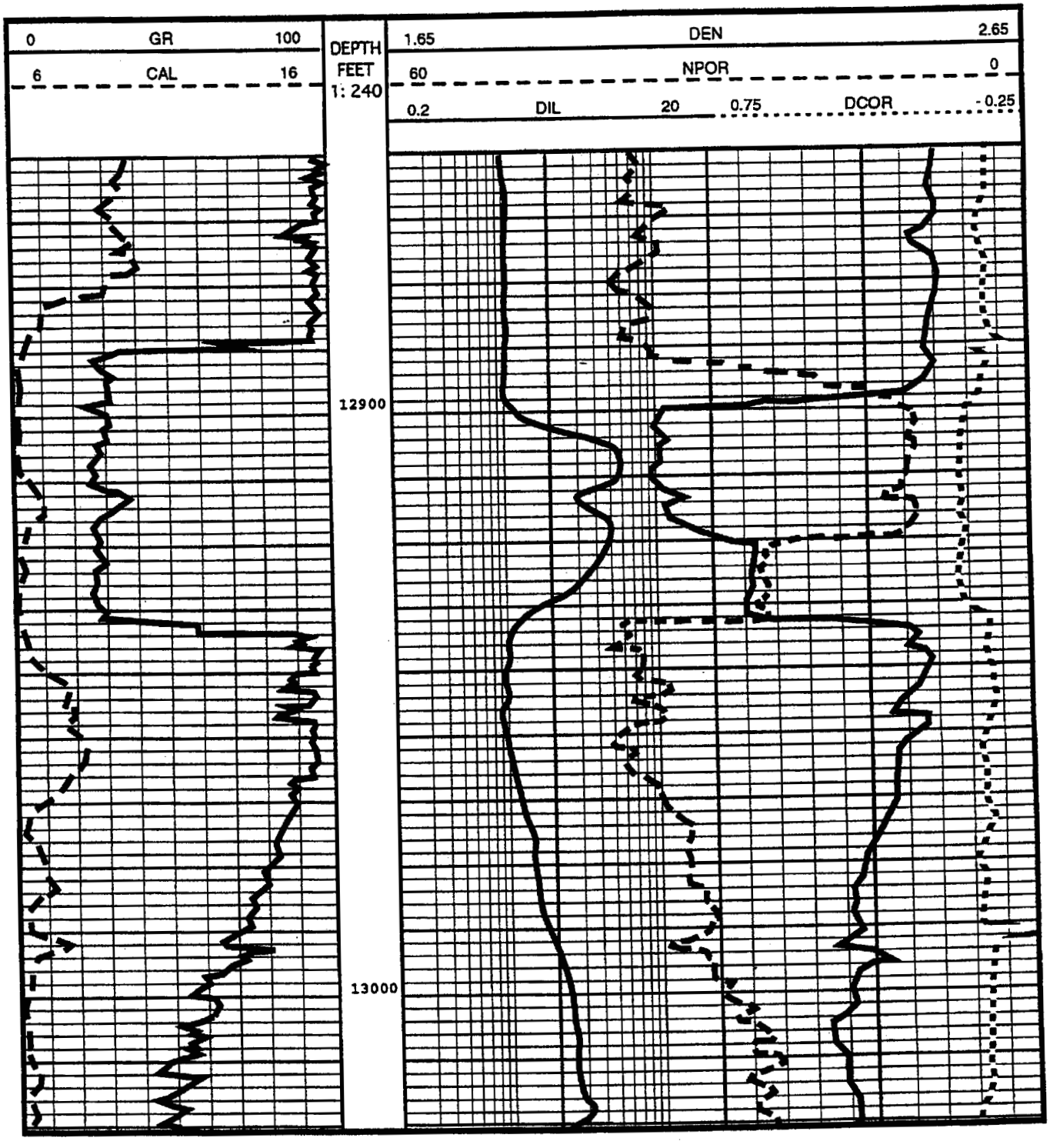
The recommended order for hardcopy presentation of the various information panels is indicated in the following. Panels for which the placement order or inclusion is optional are so noted.

a. Heading (refer to 3.1 through 3.12).
   1. Cover Panel
   2. Well Logging Operations Panel
   3. Special Notifications and Remarks Panel
   4. Borehole Fluid Data Panel
   5. Wellbore and Completion (cased hole logs only) Diagrams
   6. Equipment Data and Instrument Diagram Panel (location optional)
   7. Curve Specification Panel (location optional)

b. Main Log (Correlation scale should precede Detail scale if both are presented).
c. Repeat Sections.
d. Detail Log Overlaps (inclusion optional).
e. Calibration Records.

4.2.2 Selection of Data Curves

Data curves that are commonly associated with the primary logging service identified on the Cover Panel should be included in the presentation of the Log Record. Additional data curves may be included at the discretion of the operating company. Three recommended data curve selection options are indicated below.



Note: Actual size is $8^{7}/_{8}$" by 8". The figure was reduced to 85%.

Figure 10—Standard Log Record

4.2.2.1 Partial Tool String

Data curves associated with one or more specific tools that are run as part of a larger tool string may be selectively presented.

4.2.2.2 Full Tool String

Data curves from all services provided in a single logging suite are presented.

4.2.2.3 Composite Log

Data curves from separate logging jobs, suites, and runs, as described in 3.5, may be spliced together to create a composite of the entire well. Log presentations of this type should be so noted on the Cover Panel.

4.3 CALIBRATION AND QUALITY ASSURANCE RECORDS

Information relating to tool calibration and/or wellsite data quality assurance should be placed after the presentation of the log data curves. The information provided should conform to any specifications provided in other published recommended practices relating to specific classes of log measurements included in the presented log record.

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• Engine Oil Licensing and Certification System	Ph: 202-682-8233 Fax: 202-962-4739
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