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PULSE TESTING IN THE PRESENCE OF WELLBORE
STORAGE AND SKIN EFFECTS

By
David Oyibo Ogbe
William E. Brigham

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Stanford University Petroleum Research Institute
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SUPRI TR-43

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EDITOR'S NOTE

The computer programs resulting from this research are available upon request from Professor Brigham at the Stanford University Petroleum Research Institute

TECHNOLOGY TRANSFER BRANCH
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ABSTRACT

A pulse test is conducted by creating a series of short-time pressure transients in an active (pulsing) well and recording the observed pressure response at an observation (responding) well. Using the pressure response and flow rate data, the transmissivity and storativity of the tested formation can be determined.

Like any other pressure transient data, the pulse-test response is significantly influenced by wellbore storage and skin effects. At present there is no systematic study showing how to analyze storage-dominated pulse-test data. The purpose of this research is to examine the influence of wellbore storage and skin effects on interference testing in general and on pulse-testing in particular, and to present the type curves and procedures for designing and analyzing

pulse-test data when wellbore storage and skin effects are active at either the responding well or the pulsing well.

A mathematical model for interference testing was developed by solving the diffusivity equation for radial flow of a single-phase, slightly compressible fluid in an infinitely large, homogeneous reservoir. The equations, which included wellbore storage and skin effects at both the active and observation wells, were superposed in time to obtain the pulse-test response due to a periodic pulsing of the reservoir.

When wellbore storage and skin effects are present in a pulse test, the observed response amplitude is attenuated and the time lag is inflated. Consequently, neglecting wellbore storage and skin effects in a pulse test causes the calculated storativity to be over-estimated and the transmissivity to be under-estimated. The error can be as high as 30-percent.

New correlations and procedures are developed for correcting the pulse response amplitude and time lag for wellbore storage effects. Using these correlations, it is possible to correct the wellbore storage-dominated response amplitude and time lag to within 3-percent of their expected values without wellbore storage, and in turn to calculate the corresponding transmissivity and storativity. Worked examples are presented to illustrate how to use the new correction techniques.

Numerous type curves are also provided for analyzing interference test data affected by wellbore storage and skin effects.

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1. INTRODUCTION

Various methods of pressure transient analysis have been developed in the petroleum industry to determine formation properties such as permeability, porosity, average reservoir pressure, reservoir heterogeneity, and well condition. The most widely used well testing techniques include pressure buildup, pressure drawdown and multi-well interference testing. One type of interference testing technique that has been found to be particularly suited for the determination of reservoir heterogeneity is pulse testing.

Pulse testing is a special type of multi-well interference testing in which flow disturbances are generated by a series of constant rate production periods followed by shut-in periods (or injection periods followed by shut-in) in an active well or the pulser. With the aid of a very sensitive pressure gauge, the pressure response is recorded as a function of time in an offset well called the observation well or the responder. The pulse rate (flow rate) is also recorded at the pulser. Using these measurements, two independent characteristics of the pressure response, namely the time lag and response amplitude can be determined [Johnson et al., 1966; Brigham, 1970]. A time lag is defined as the elapsed time between the end of a pulse and the time of occurrence of the corresponding pressure peak or valley (Fig. 1.1). Figure 1.1 also shows the pulse-response amplitude--the vertical pressure increment between a tangent to the pressure peak of a specified pulse and the parallel tangent to the two consecutive valleys on either side of the selected pulse. Response amplitude can also be determined

FIG. 1.1: PULSE TESTING TERMINOLOGY (After Kamal, 1973)

by the difference between tangents to two pressure peaks and the intermediate pressure valley. The pulse rate, time lag and response amplitude provide a quantitative measure of the reservoir transmissivity (mobility-thickness product, kh/μ) and storativity (porosity-compressibility-thickness product, $\phi c_t h$). Thus pulse tests produce the same basic information as do standard interference tests. Pulse tests also provide a qualitative indication of reservoir heterogeneity, fracture compass orientation and fracture lengths. These parameters are important in the exploitation and development of petroleum reservoirs, and are particularly useful when engineering enhanced oil recovery projects.

Compared to conventional interference testing, pulse testing requires less interruption of routine field operations because other producing wells in the field that are not being used in the test can be kept on production. Thus there is an economic advantage compared to a field-wide shut-in that may be required in the case of a conventional interference test. Also, with the graphical technique of pulse-test analysis, the pressure response due to the flow disturbances can be distinguished from other reservoir pressure trends and noise because the pulse response acts as a linear filter of reservoir trends [Johnson et al., 1966; Kamal and Brigham, 1975]. Another advantage of pulse testing is that pulse-test values strongly reflect the formation properties between the pair of wells used in the test and are little affected by the heterogeneities beyond the tested wells.

As a result of the short pulsing times associated with pulse testing, the fluid flow behavior in a pulse-test system can be described by infinite-acting-system equations, regardless of the system size.

This implies that pulse-test data can be dominated strongly by wellbore storage effects. Previous studies have shown that when wellbore storage and skin effects are neglected either in the pulsed well or in the responding well, the calculated storativity will be over-estimated and the transmissivity will be under-estimated [Prats and Scott, 1975; Jargon, 1976].

Although many authors [Ramey, 1965, 1970; Agarwal et al., 1970; Ramey and Agarwal, 1972; Jargon, 1976; Garcia-Rivera and Raghavan, 1977; Sandal et al., 1978; Chu et al., 1980 and Tongpenyai and Raghavan, 1981] have studied the effects of wellbore storage and skin on interference testing, only Prats and Scott [1975] and Jargon [1976] have briefly examined the effect of wellbore storage and skin on pulse-test results. After examining a single-pulse test, Prats and Scott presented a limited study of the effect of wellbore storage at the responding well only. Jargon gave a brief description of how the presence of wellbore storage at the pulsing well would affect the expected transmissivity and storativity. At present there is no comprehensive study on the effect on pulse-test data of wellbore storage and skin operating at either one well or both wells. Thus, the objectives of this study are: 1) to determine the effects of wellbore storage and skin on pulse-test results; and 2) to develop a set of type curves and correlations to be used in the interpretation of pulse-test data, and to provide guidelines for the design and analysis of pulse tests influenced by wellbore storage and skin effects existing at the pulsing and/or responding wells.

2. LITERATURE REVIEW

A review of the available literature indicates two distinct categories of pulse testing techniques: vertical pulse testing and horizontal pulse testing. Vertical pulse testing involves a single, dually-completed well in which the pulser and responder locations (perforations) are separated by a packer. Falade [1974] provides a detailed literature survey on vertical pulse testing. Unlike vertical pulse testing, horizontal pulse testing requires two wells--the responder or observation well and the pulser or active well.

This is why horizontal pulse testing is sometimes referred to as multi-well interference testing. In this study, the literature review will be limited to horizontal pulse testing. This survey will focus on:

- 1) Pulse testing theory.
- 2) Application of pulse test techniques to determine reservoir properties--storativity, transmissivity, fracture orientation.
- 3) Procedures for the design and analysis of pulse tests.
- 4) The influence of wellbore storage and skin effects on pulse test results.

2.1 PULSE TESTING THEORY

Although groundwater hydrologists [Theis and Brown, 1954; Shenhan, 1966] have discussed pulse testing techniques since the 1950s, it was Johnson, Greenkorn and Woods who introduced the theory of pulse testing to the petroleum engineering literature in 1966.

Using the exponential integral solution of the unsteady-state flow of a slightly compressible fluid in a homogeneous reservoir, Johnson et al. [1966] derived the pressure response equations at the responding well when the producing well is subjected to a series of pulses. These pulses are generated by a series of flow rate changes at the pulsing well. They showed that because the cyclic pressure transients in a pulse test use the reservoir texture as the transfer medium, the pressure characteristics measured at the responder are imprints of the reservoir formation properties. Thus, the response amplitude and time lag which are two independent characteristics of the response curve can be combined to determine two rock-fluid parameters, transmissivity ($T = kh/\mu$) and storativity ($S = \phi c_t h$). Johnson et al. also conducted a series of experimental pulse tests in a sandstone reservoir in Oklahoma to confirm the reliability of the technique of data analysis using the line source or exponential integral solution.

In 1969, Culham provided a mathematical theory to clarify the tangent construction method of analyzing pulse test data. His work demonstrated that the graphical technique proposed by Johnson et al. [1966] correctly isolated the periodic portion of the total pressure response generated by a pulsing well. In addition, Culham presented equations for relating time lag to the diffusivity constant and relating response amplitude to transmissivity in a pulse test.

2.2 APPLICATION OF PULSE TESTING TO DETERMINE RESERVOIR PROPERTIES

McKinley et al. [1968] probably carried out the first extensive application of pulse testing in a producing field. Based on the analysis of the data obtained from pulse tests on 28 well pairs in an

oil field, they were able to construct contour maps showing the areal distribution of reservoir transmissivity and storativity. More important, their work showed that the values of permeability derived from pulse-tests were comparable to core-derived values and that there was a close agreement between pulse-test data (e.g. permeability, and porosity) and data obtained from conventional interference tests.

In a subsequent work also performed at Exxon Production Research, Vela and McKinley [1970] studied the effects of areally distributed heterogeneities on pulse-test results. They reported that pulse-test data tend to indicate the average properties of the formation between the pair of wells used in the test.

Pierce et al. [1975] investigated the determination of reservoir heterogeneity from pulse tests. They showed that, from pulse testing, it is possible to estimate the compass orientation and length of hydraulic fractures. They were able to determine these parameters by assuming that there is a correlation between the ratio of time lags before and after hydraulic fracturing and the length and angle of orientation of the fractures.

Pulse-test methods have also been evaluated in the laboratory. Odeh and McMillen [1972] conducted various pulse-testing experiments on linear cores initially saturated with air and then subjected to a series of pulses. Using the theory of fluid flow through a linear porous medium, they developed equations to determine permeability and porosity from these pulse tests. They concluded that experimentally-derived pulse-test values of porosity and permeability were comparable to those obtained from conventional methods such as core analysis.

Another laboratory study was performed by Shen [1974] at the University of Texas at Austin. He conducted pulse-testing experiments on Berea sandstone and Leuders limestone cores, and later checked his experimental results with a numerical model which considered the flow of a real gas through a linear porous medium.

In a case history presented in 1977, Pierce described how pulse testing was used to predict the performance of a waterflood in the Kelsey oilfield located in South Texas. He reported that selected wells in this highly-faulted field were pulse-tested before waterflooding to determine reservoir connectivity (interwell communication). The performance history of the waterflood and a subsequent core analysis program verified the reservoir connectivity as predicted earlier by the pulse-test results.

Field application of pulse testing has also occurred in oilfields outside the United States. Rijnders [1973] described the application of pulse testing to establish the principal permeability distribution of the Yibal field in Oman. More recently, Hutfilz et al. [1982] reported the successful application of pulse-testing methods to determine the permeability anisotropies in the highly permeable environments of the Ghawar oilfield located in Saudi Arabia.

One observation common to all these field studies is the emphasis placed on the need to design and conduct pulse tests systematically in order to obtain interpretable results. The following section will review the procedures developed for the design and interpretation of pulse testing as published in the petroleum literature.

2.3 PROCEDURES FOR THE DESIGN AND ANALYSIS OF PULSE TESTS

Prior to 1970, the analysis of pulse-test data was a tedious exercise, often requiring the repeated evaluations of the exponential integral equation which described the pressure-response function. To reduce the amount of computational effort involved in the interpretation and design of pulse tests, Brigham [1970] developed two simple graphs from the equations of the pressure response curve. With these graphs, the analysis of pulse-test results becomes less time consuming. However, the usefulness of these graphs was limited because the equations were valid only for pulse tests with equal pulsing and shut-in periods.

This limitation of equal pulsing and shut-in periods was removed by Kamal and Brigham [1975; 1976]. Their study was the first published systematic effort to provide generalized graphical and analytical correlations for the design and interpretation of pulse tests. They developed equations relating the time lag and pressure-response amplitude to a pulse cycle length and a pulse ratio. The pulse cycle length was defined as the sum of the pulse and shut-in periods and the ratio of the pulse period to the pulse cycle length was called the pulse ratio.

The Kamal-Brigham study was significant for two reasons. First, these correlations were developed without the limiting assumption of equal pulse and shut-in periods. Second, they provided graphs and two simple exponential equations which the analyst can use in designing and analyzing pulse testing without the aid of a computer.

However, a significant short-coming of this study is that the mathematical model did not consider wellbore storage and skin effects either at the responding well or at the pulsing well.

2.4 THE INFLUENCE OF WELLBORE STORAGE AND SKIN EFFECTS ON PULSE TESTING

The effects of wellbore storage and skin on pressure transient data was originally discussed by Van Everdingen [1953] and Hurst [1953]. In 1953, they proposed that the presence of an "infinitesimally" thin, steady-state skin at the wellbore reduced the productive capacity of the well. By the early 1970s, Ramey [1965; 1970], Agarwal et al. [1970], and Wattenbarger and Ramey [1970] had directed their studies to the comprehensive analysis of short-time pressure data influenced by wellbore storage and skin effects. These studies were significant in that they introduced the type curve matching procedure to analyze storage dominated data and also provided correlations and guidelines for determining the start of the semi-log straight line in a Miller, Dyes and Hutchinson or a Horner graph.

Since the seventies, Jargon [1976], Earlougher [1975], Sandal et al. [1978] and numerous other authors [McKinley, 1971; Earlougher and Kersch, 1974; Ramey et al., 1975; Garcia-Rivera and Raghavan, 1977; and Chu et al., 1980] have provided more useful correlations and extended the use of type curve matching procedures in the interpretation of early interference test-data influenced by storage and skin. However, all these studies were limited in scope in that they have examined pressure response either at the production well, or at the observation well, with wellbore storage and skin effects active at the production well only.

Prats and Scott [1975] briefly examined the effect on pulse-test results of storage at the responding well. Based on their study of a single-pulse test, they showed that wellbore storage at the responder would cause the time lag to increase and the maximum pressure-response amplitude to decrease. Their study concluded that neglecting wellbore storage at the responding well in a pulse test would lead to the calculated reservoir hydraulic diffusivity ($k/\phi\mu c_t$) being too low and the storage capacity ($\phi c_t h$) being too high.

A similar conclusion was reached by Jargon [1976] who examined the effects of wellbore storage and skin at the active well on the pressure response at the observation well. He concluded that when wellbore storage and skin at the active well are neglected, the calculated transmissivity ($T = kh/\mu$) would be under-estimated and the storativity ($S = \phi c_t h$) would be over-estimated.

Based on Jargon's conclusions, Mondragon and Menzie [1979] developed an empirical method to correct pulse-test results for wellbore storage at the pulsing well. They used the wellbore storage data presented by Agarwal et al. [1970] to derive empirical correction equations to the measured pressure drops and time lags for the determination of storativity and transmissivity.

To the best of our knowledge only Fenske [1977] and Tongpenyai and Raghavan [1981] have studied the pressure response at the observation well for an interference test affected by wellbore storage and skin effects at both the active and observation wells.

Reporting in the hydrology literature, Fenske [1977] showed that the pressure response at the observation well depended on the magnitude of the storage constant and the interwell distance. He concluded that

the effect of wellbore storage was more significant as the distance between the two wells decreased.

More recently, Tongpenyai and Raghavan [1981] showed that if wellbore storage and skin effects exist only at one of the two wells, the same pressure response will be recorded at the observation well regardless of the location of the storage mechanism--at the active well or at the observation well. This result should have been expected, based on the reciprocity principles expressed by McKinley et al. [1968]; however, no other authors prior to this work recognized that the reciprocity principles were valid in the presence of wellbore storage. Tongpenyai and Raghavan proposed that the pressure response at the observation well can be expressed by combining five dimensionless groups: C_{D1}/r_D^2 , C_{D2}/r_D^2 , $C_{D1}\exp(2s_1)$, $C_{D2}\exp(2s_1)$ and t_D/r_D^2 ; where C_{D1} and s_1 refer to the observation well dimensionless storage constant and skin factor, C_{D2} and s_2 are the dimensionless storage and skin effect at the active well, and r_D is the distance between the two wells. In keeping with the reciprocity principle, they concluded that the same pressure response would be obtained at the observation well if the values of $C_{D1}\exp(2s_1)$ and C_{D1}/r_D^2 at the observation well were interchanged with the corresponding values of $C_{D2}\exp(2s_2)$ and C_{D2}/r_D^2 at the active well.

2.5 STATEMENT OF THE PROBLEM

The published literature clearly shows that the effect of wellbore storage and skin at the pulsing well or at the responding well is to increase the observed time lag and to decrease the pressure-response amplitude of the pulse test. Consequently, as illustrated in Fig. 2.1,

FIG. 2.1: EFFECT OF WELLBORE STORAGE AT THE INJECTION WELL ON PULSE-TEST RESULTS. PULSE CYCLE LENGTH = 10 hours. PULSE-TEST FLOW RATE = -50 B/D. (After Jargon, 1976).

ignoring storage and skin effects at one of the wells would cause the estimated storativity to be too high and the transmissivity to be too low. However, none of these studies has comprehensively documented the quantitative influence of wellbore storage and skin effects on pulse-test data when the storage mechanism is active only at one well or at both the responder and the pulser. This study will attempt to address this problem.

In particular, a mathematical model will be developed incorporating wellbore storage and skin factor at both wells. Also provided will be general correlations and type curves which will aid the analyst in the design and correct interpretation of pulse-test data influenced by wellbore storage.

3. DEVELOPMENT OF THE MATHEMATICAL MODEL

This section discusses the derivation of the equations describing interference testing in an infinitely large reservoir. The boundary conditions include wellbore storage and skin effects at both the responding and pulsing wells. By superposing the interference test equations with respect to time, the mathematical model for pulse testing is obtained.

3.1. ASSUMPTIONS AND THE PARTIAL DIFFERENTIAL EQUATION

The mathematical model considered in this study assumes the flow of a single phase fluid in a homogeneous, uniform and isotropic porous medium. The fluid has a small and constant compressibility and constant viscosity.

Other assumptions include: 1) small pressure gradients exist everywhere in the reservoir, 2) gravitational forces are negligible, and 3) the reservoir is infinite in extent such that the outer reservoir boundaries do not influence the pressure response for the short time periods considered. A schematic diagram of the physical reservoir is shown in Fig. 3.1. The system consists of two wells, the pulsing well or pulser and the responding well (responder). These wells penetrate the entire thickness of the formation.

Considering the above assumptions, a mathematical description of fluid flow in the system can be obtained from the diffusivity equation:

$$\frac{\partial^2 p}{\partial r^2} + \frac{1}{r} \frac{\partial p}{\partial r} = \frac{\phi \mu c_t}{k} \frac{\partial p}{\partial t} \quad (3.1)$$

FIG. 3.1: A SCHEMATIC OF THE RESERVOIR MODEL (After Kamal, 1973)

As shown in Appendix A.1, the diffusivity equation can be derived by combining a continuity equation (the law of conservation of mass) with Darcy's law (i.e., a transport equation), and an equation of state.

Define the following dimensionless variables:

$$\text{Pressure, } p_D = \frac{2\pi kh}{qB\mu} [p(r,t) - p_i] \quad (3.2)$$

$$\text{Time, } t_D = \left(\frac{k}{\phi\mu c_t r_w^2} \right) t \quad (3.3)$$

$$\text{Distance, } r_D = \frac{r}{r_w} \quad (3.4)$$

With these definitions, we can transform Eq. 3.1 into a dimensionless form:

$$\frac{\partial^2 p_D}{\partial r_D^2} + \frac{1}{r_D} \frac{\partial p_D}{\partial r_D} = \frac{\partial p_D}{\partial t_D} \quad (3.5)$$

The initial condition is given by:

$$p(r,0) = p_i, \text{ for all } r \quad (3.6)$$

Substitution of Eqs. 3.2 through 3.4 in Eq. 3.6 yields:

$$p_D(r_D,0) = 0, \text{ for all } r_D \quad (3.7)$$

3.1.1 The Outer Boundary Condition

The reservoir is infinitely large such that the pressure response at any time and at all locations far away from the wells remain

essentially constant at the initial pressure, p_i :

$$\lim_{r \rightarrow \infty} p(r,t) = p_i, \text{ for all } t \quad (3.8)$$

In terms of dimensionless variables, the outer boundary condition becomes:

$$\lim_{r_D \rightarrow \infty} p_D(r_D, t_D) = 0, \text{ for all } t_D \quad (3.9)$$

3.1.2 The Inner Boundary Conditions

To define the sandface flow rate inner boundary condition, both the responder and pulser are treated as vanishing-radius wells. Thus, the flow rate boundary condition at the wells is expressed as:

$$q_{\text{sandface}} = - \frac{2\pi kh}{\mu} \left(r \frac{\partial p}{\partial r} \right)_{r \rightarrow 0} \quad (3.10a)$$

This treatment of the inner boundary condition is justified by the following reasons:

- (1) The vanishing wellbore radius concept makes it possible to derive the total system pressure drop by merely superposing the solutions of the pressure drops from the responding and pulsing wells without considering the pressure gradient distortions which would be present at the wellbore periphery if we had considered a

finite wellbore radius.*

- (2) The results presented by Agarwal, Al-Hussainy and Ramey [1970; see Tables 4 and 8 of this reference] showed that the pressure drops obtained by considering a finite radius inner boundary condition were not significantly different from the data obtained from the case of the vanishing radius well, because wellbore storage dominated the time period during which the radius of the pulser affects the result. Furthermore, in Section 4.2 of this work, is shown a proof through data comparison that the vanishing wellbore radius boundary condition also gives consistent results for the interference test problem.

Two inner boundary conditions are needed for each of the wells in this system:

Responding Well—the responding well is shut-in at the surface. Thus, the wellbore depletion rate must be equal to the sandface flow rate:

$$[q_{\text{annulus}}] + [q_{\text{sandface}}] = 0$$

$$q_a + q_{sf} = 0$$

-----*

* Note: In contrast to the vanishing wellbore radius inner boundary condition (Eq. 3.10a), the finite wellbore radius flow rate boundary condition is given by:

$$q_{\text{sandface}} = - \frac{2\pi kh}{\mu} \left(r \frac{\partial p}{\partial r} \right)_{r=r_w} \quad (3.10b)$$

The dimensionless storage constant is:

$$C_{Dj} = \left(\frac{1}{2\pi\phi c_t h r_w^2} \right) C_j \quad (3.12)$$

where C_j is the storage constant and subscript j is the well location, $j = 1$ at the responding well and $j = 2$ at the pulsing well. Using dimensionless variables, Eq. 3.11 becomes:

$$C_{D1} \left(\frac{dp_{wD1}}{dt_D} \right) - \left(r_{D1} \frac{\partial p_{D1}}{\partial r_{D1}} \right)_{r_{D1} \rightarrow 0} = 0 \quad (3.13)$$

Let us now consider the Van-Everdingen [1953] and Hurst [1953] infinitesimally thin, steady-state skin effect at the periphery of the wellbore of the responder. The skin effect will cause an additional pressure drop such that the pressure at the responding well will be:

$$p_{wfl} = p(r_{w1}, t) - \Delta p_{skin} \quad (3.14)$$

and the pressure drop due to skin effect, s_1 is given by:

$$\Delta p_{skin} = \frac{(q_{sf})_1 \mu}{2\pi k h} s_1 \quad (3.15)$$

With the previous definitions of dimensionless variables, Eq. 3.14 can be expressed as:

$$p_{wD1} = p_D(1, t_D) - s_1 \left(r_{D1} \frac{\partial p_D}{\partial r_{D1}} \right)_{r_{D1} \rightarrow 0} \quad (3.16)$$

Pulsing Well--the pulsing well is producing (or injecting) at a constant surface rate. Hence, the sum of the wellbore depletion rate and the sandface flow rate must be equal to the surface rate. That is:

$$[q_{\text{annulus}}] + [q_{\text{sandface}}] = [q_{\text{surface}}]$$

$$q_a + q_{sf} = q$$

$$C_2 \left(\frac{dp_{w2}}{dt} \right) - \frac{2\pi kh}{\mu} \left(r_2 \frac{\partial p}{\partial r_2} \right)_{r_2 \rightarrow 0} = q \quad (3.17)$$

Dividing Eq. 3.17 by q , and transforming to dimensionless terms, we get:

$$C_{D2} \left(\frac{dp_{wD2}}{dt_D} \right) - \left(r_{D2} \frac{\partial p_D}{\partial r_{D2}} \right)_{r_{D2} \rightarrow 0} = 1 \quad (3.18)$$

An infinitesimally thin, steady-state skin effect is also present at the pulsing well such that the pressure within the pulser is:

$$p_{wf2} = p(r_{w2}, t) + \Delta p_{\text{skin}} \quad (3.19)$$

and the additional pressure drop due to the skin factor, s_2 is:

$$\Delta p_{\text{skin}} = \frac{(q_{sf})_2 \mu}{2\pi kh} s_2 \quad (3.20)$$

Equations 3.19 and 3.20 are combined using the previous definitions of dimensionless variables to obtain:

$$p_{wD2} = p_D(1, t_D) - s_2 \left(r_{D2} \frac{\partial p_D}{\partial r_{D2}} \right)_{r_{D2} \rightarrow 0} \quad (3.21)$$

We can solve the boundary value problem using the method of Laplace transformation.

3.2 THE SOLUTION

If we take the Laplace transformation of Eq. 3.5 with respect to time (t_D), we obtain:

$$\frac{d^2 \bar{p}_D}{dr_D^2} + \frac{1}{r_D} \frac{d\bar{p}_D}{dr_D} = \ell \bar{p}_D - p_D(r_D, 0) \quad (3.22)$$

where ℓ is the Laplace transform variable.

The use of s or p as the Laplace transform variable is common in the petroleum literature. To avoid the confusion of s with the skin factor and p with pressure, we have chosen ℓ to denote the Laplace transform variable in this study.

Applying Eq. 3.7 (i.e., the initial condition) to Eq. 3.22 provides:

$$\frac{d^2 \bar{p}_D}{dr_D^2} + \frac{1}{r_D} \frac{d\bar{p}_D}{dr_D} - \ell \bar{p}_D = 0 \quad (3.23)$$

Thus, the solution to Eq. 3.23 becomes:

$$\bar{p}_D(r_D, \ell) = A I_0(r_D \sqrt{\ell}) + B K_0(r_D \sqrt{\ell}) \quad (3.24)$$

where A and B are constants to be determined from the boundary conditions. The I_0 and K_0 are the modified Bessel functions of the first and second kind, respectively, and order zero.

Using the outer boundary condition and noting that as $r_D \rightarrow \infty$,

$$\lim_{r_D \rightarrow \infty} I_0(r_D \sqrt{\ell}) \rightarrow \infty,$$

indicates that we must set A equal to zero for the solution to be bounded. Thus, Eq. 3.24 becomes:

$$\bar{p}_D(r_D, \ell) = B K_0(r_D \sqrt{\ell}) \quad (3.25)$$

Because Eq. 3.5 is linear, the total solution for our particular system is the sum of the pressure drops due to flow in the responding well and in the pulsing well. Consequently, the dimensionless pressure drop in Laplace space at any time and location in the reservoir is given by the superposition of Eq. 3.25:

$$\bar{p}_D(r_{D1}, r_{D2}, C_{D1}, C_{D2}, s_1, s_2, \ell) = B_1 K_0(r_{D1} \sqrt{\ell}) + B_2 K_0(r_{D2} \sqrt{\ell}) \quad (3.26)$$

where B_1 and B_2 are arbitrary constants.

Although the dimensionless pressure drops, $\bar{p}_D$, $\bar{p}_{wD1}$, and $\bar{p}_{wD2}$ are functions of r_{D1} , r_{D2} , C_{D1} , C_{D2} , s_1 , s_2 , and ℓ , henceforth in this presentation, for simplicity, we shall write them without showing the independent variables.

Evaluation of the Laplace transformation of the inner boundary conditions with respect to time, t_D provides:

$$C_{D1} \ell \bar{p}_{wD1} - \left(r_{D1} \frac{d\bar{p}_D}{dr_{D1}} \right)_{r_{D1} \rightarrow 0} = 0 \quad (3.27)$$

$$\bar{p}_{wD1} = \bar{p}_D(1, \ell) - s_1 \left(r_{D1} \frac{d\bar{p}_D}{dr_{D1}} \right)_{r_{D1} \rightarrow 0} \quad (3.28)$$

$$C_{D2} \ell \bar{p}_{wD2} - \left(r_{D2} \frac{d\bar{p}_D}{dr_{D2}} \right)_{r_{D2} \rightarrow 0} = \frac{1}{\ell} \quad (3.29)$$

and:

$$\bar{p}_{wD2} = \bar{p}_D(1, \ell) - s_2 \left(r_{D2} \frac{d\bar{p}_D}{dr_{D2}} \right)_{r_{D2} \rightarrow 0} \quad (3.30)$$

Performing the differentiation of Eq. 3.26 with respect to r_{D1} and r_{D2} provides:

$$\frac{d\bar{p}_D}{dr_{D1}} = -B_1 \sqrt{\ell} K_1(r_{D1} \sqrt{\ell}) - B_2 \sqrt{\ell} K_1(r_{D2} \sqrt{\ell}) \frac{dr_{D2}}{dr_{D1}} \quad (3.31)$$

and:

$$\frac{d\bar{p}_D}{dr_{D2}} = -B_1 \sqrt{\ell} K_1(r_{D1} \sqrt{\ell}) \frac{dr_{D1}}{dr_{D2}} - B_2 \sqrt{\ell} K_1(r_{D2} \sqrt{\ell}) \quad (3.32)$$

Multiplying Eq. 3.31 by r_{D1} and noting that $[dr_{D2}/dr_{D1}] = 0$, and that as $r_{D1} \rightarrow 0$, $K_1(r_{D1} \sqrt{\ell}) \rightarrow \frac{1}{r_{D1} \sqrt{\ell}}$, we obtain:

$$\left(r_{D1} \frac{d\bar{p}_D}{dr_{D1}} \right)_{r_{D1} \rightarrow 0} = -B_1 \left(\frac{r_{D1} \sqrt{\ell}}{r_{D1} \sqrt{\ell}} \right) - 0 = -B_1 \quad (3.33)$$

Similarly, using Eq. 3.32 and considering $r_{D2} \rightarrow 0$, we get:

$$\left(r_{D2} \frac{d\bar{p}_D}{dr_{D2}} \right)_{r_{D2} \rightarrow 0} = -B_2 \quad (3.34)$$

Substituting Eq. 3.33 into Eqs. 3.27 and 3.28 yields:

$$C_{D1} \bar{p}_{wD1} + B_1 = 0 \quad (3.35)$$

and

$$\bar{p}_{wD1} = \bar{p}_D(1, \ell) + B_1 s_1 \quad (3.36)$$

If we use Eq. 3.26 to substitute for $\bar{p}_D$ in Eq. 3.36 and rearrange, the result is:

$$\bar{p}_{wD1} = B_1 [s_1 + K_0(\sqrt{\ell})] + B_2 K_0(r_{D2} \sqrt{\ell}) \Big|_{r_{D1}=1} \quad (3.37)$$

From the system coordinate geometry (Fig. 3.2), It can be shown that if $r_{D1} = 1$, then $r_{D2} = r_D \pm 1$. But $r_D \gg 1$, thus $r_{D2} = r_D \pm 1 = r_D$. (The details of this approximation are shown in Appendix A.2.) Using this approximation, Eq. 3.37 becomes:

$$\bar{p}_{wD1} = B_1 [s_1 + K_0(\sqrt{x})] + B_2 K_0(r_D \sqrt{x}) \quad (3.38)$$

Substitution of Eq. 3.38 into Eq. 3.35 provides:

$$C_{D1} \{B_1 [s_1 + K_0(\sqrt{x})] + B_2 K_0(r_D \sqrt{x})\} + B_1 = 0 \quad (3.39)$$

and if we rearrange Eq. 3.39, the result is:

$$B_1 \{1 + C_{D1} [s_1 + K_0(\sqrt{x})]\} + B_2 [C_{D1} K_0(r_D \sqrt{x})] = 0 \quad (3.40)$$

Thus, we have developed one equation for B_1 and B_2 in terms of defined variables.

FIG. 3.2: A SCHEMATIC OF THE SYSTEM COORDINATE GEOMETRY

In a similar fashion, we can substitute Eq. 3.34 into Eq. 3.29 to yield:

$$C_{D2} \ell \bar{p}_{wD2} + B_2 = \frac{1}{\ell} \quad (3.41)$$

and into Eq. 3.30 to obtain:

$$\bar{p}_{wD2} = \bar{p}_D(1, \ell) + B_2 s_2 \quad (3.42)$$

If we set r_{D2} equal to 1 in Eq. 3.26 and observe from Fig. 3.2 that when $r_{D2} = 1$, $r_{D1} = r_D \pm 1$, then we can write $r_{D1} \approx r_D$ because $r_D \gg 1$. (See Appendix A.2 for details of this approximation.) When these substitutions are made in Eq. 3.26 and it, in turn is substituted into Eq. 3.42, the result is:

$$\bar{p}_{wD2} = B_1 K_0(r_D \sqrt{\ell}) + B_2 [s_2 + K_0(\sqrt{\ell})] \quad (3.43)$$

If we use the right hand side of Eq. 3.43 to replace $\bar{p}_{wD2}$ in Eq. 3.41, we obtain:

$$B_1 [C_{D2} \ell K_0(r_D \sqrt{\ell})] + B_2 \{1 + C_{D2} \ell [s_2 + K_0(\sqrt{\ell})]\} = \frac{1}{\ell} \quad (3.44)$$

Thus, Eqs. 3.40 and 3.44 are two equations which can be solved explicitly for two unknowns, B_1 and B_2 .

The solution for B_1 is:

$$B_1 = \frac{-C_{D1} \ell K_0(r_D \sqrt{\ell})}{\Delta} \quad (3.45)$$

and for B_2 is:

$$B_2 = \frac{\{1 + C_{D1} \ell[s_1 + K_0(\sqrt{\ell})]\}}{\Delta} \quad (3.46)$$

The Δ of Eqs. 3.45 and 3.46 is:

$$\begin{aligned} \Delta = & \ell\{[1 + C_{D1} \ell(s_1 + K_0(\sqrt{\ell}))][1 + C_{D2} \ell(s_2 + K_0(\sqrt{\ell}))] \\ & - C_{D1} C_{D2} [\ell K_0(r_D \sqrt{\ell})]^2\} \end{aligned} \quad (3.47)$$

Substituting Eqs. 3.45 and 3.46 into Eq. 3.26 provides the dimensionless pressure drop in Laplace space at any time and location in the reservoir. That is:

$$\begin{aligned} \bar{p}_D = & \frac{-C_{D1} \ell K_0(r_D \sqrt{\ell}) K_0(r_{D1} \sqrt{\ell})}{\Delta} \\ & + \frac{\{1 + C_{D1} \ell[s_1 + K_0(\sqrt{\ell})]\} K_0(r_{D2} \sqrt{\ell})}{\Delta} \end{aligned} \quad (3.48)$$

Similarly, from Eq. 3.38, the dimensionless pressure drop at the responding well in Laplace space is given by:

$$\bar{p}_{wD1} = \frac{K_0(r_D \sqrt{\ell})}{\Delta} \quad (3.49)$$

If we interchange the wellbore storage and skin terms at the responding well with the corresponding values at the pulsing well, Eq. 3.49 will yield the same results. This is obvious from an inspection of the wellbore storage terms in Eq. 3.47. This behavior is in accordance with

the reciprocity principles as was originally mentioned by McKinley [1968] and has been observed in other interference and pulse testing models [Tongpenyai and Raghavan, 1981; Falade, 1974].

Another interesting observation from Eq. 3.49 is the long time approximation. Recall that for small arguments [Abramowitz and Stegun, 1970], the modified Bessel function, $K_0(\sqrt{\ell})$ becomes:

$$\lim_{\ell \rightarrow 0} \ell K_0(\sqrt{\ell}) = 0 \quad (3.50)$$

Thus, as $\ell \rightarrow 0$, if we consider that all terms involving ℓ^2 are negligibly small, then Eq. 3.49 can be simplified and the result is:

$$\bar{p}_{wD1} = \frac{K_0(r_D \sqrt{\ell})}{\ell} \quad (3.51)$$

which is the line source solution in Laplace space. This result is expected because at long times, the effects of wellbore storage have dissipated and our model should behave like the line source.

Using Eq. 3.43, we can also write the dimensionless pressure drop at the pulsing well:

$$\begin{aligned} \bar{p}_{wD2} = & \frac{-C_{D1} \ell K_0(r_D \sqrt{\ell}) K_0(r_D \sqrt{\ell})}{\Delta} \\ & + \frac{[1 + C_{D1} \ell (s_1 + K_0(\sqrt{\ell}))][s_2 + K_0(\sqrt{\ell})]}{\Delta} \end{aligned} \quad (3.52)$$

Note that equation 3.49 is the core of the model presented in this study. It will be used in the next section to compute the pressure response amplitude and time lags, two important characteristics of a pulse test.

3.3 DETERMINATION OF TIME LAG AND RESPONSE AMPLITUDE

The method of pulse testing assumes that two independent pulse-test characteristics, the response amplitude and time lag, can be related to two properties of the tested reservoir (i.e., transmissivity and storativity). This implies that the interpretation of a pulse test depends on the availability of the values of the response amplitude and time lag. In the following section, we shall use Eq. 3.49 to derive the expressions for obtaining these terms.

3.3.1 Superposition of the Pressure Response at the Responder

The pressure response in Laplace space at the responder when the pulser is subjected to continuous production (or injection) is given by Eq. 3.49. In pulse testing, we have a series of pulses generated by short-time changes in the production or injection rate. The superposition of Eq. 3.49 would simulate the multi-pulsed condition associated with pulse testing. Thus, if we consider N total periods of production (or injection) immediately followed by shut-in (Fig. 3.3), the pressure at the responding well is given by:

$$p_{wfl} = p_i - \frac{qB\mu}{2\pi kh} \left[p_{wDl}(t_D) + \sum_{m=1}^{N-1} (-1)^m p_{wDl}(t - t_m)_D \right] \quad (3.53)$$

where q denotes the pulse rate, p_i is the initial reservoir pressure, p_{wDl} is the dimensionless pressure drop at the responder obtained from the Laplace transform inversion of Eq. 3.49, and N is the total number of pulsing and shut-in periods from the beginning of the test.

FIG. 3.3: PULSE TEST CHARACTERISTICS FOR THE DETERMINATION OF TIME LAG AND PULSE-RESPONSE AMPLITUDE

An inspection of Eq. 3.53 would suggest that we define a dimensionless pulse-response function as follows:

$$p_{rspD} = \frac{2\pi kh}{qB\mu} (p_i - p_{wfl}) \quad (3.54)$$

With the above definition, Eq. 3.53 can be expressed in terms of dimensionless variables:

$$p_{rspD} = p_{wD1}(t_D) + \sum_{m=1}^{N-1} (-1)^m p_{wD1}(t_D - t_{mD}) \quad (3.55)$$

Equation 3.55 is the pressure-response function at the responding well at any time. This equation and the slope of the pressure-response function, which will be derived in the next section, form the basis for the determination of the pressure-response amplitude and time lag.

3.3.2 Superposition of the Slope of the Response Function

The slope of the pressure-response function at the responding well is obtained by applying the derivative property of Laplace transforms to the dimensionless pressure drop, $\bar{p}_{wD1}$:

$$\frac{d\bar{p}_{wD1}}{dt_D} = \frac{2K_0(r_D\sqrt{k})}{\Delta} \quad (3.56)$$

Obviously, Eq. 3.56 describes the slope function for a single continuous pulse. Thus the superposition of Eq. 3.56 with respect to time provides

the slope of the pressure-response function at the responder due to a series of pulses at the pulser:

$$\frac{dp_{rspD}}{dt_D} = \frac{dp_{wD1}(t_D)}{dt_D} + \sum_{m=1}^{N-1} (-1)^m \{ [dp_{wD1}(t - t_{mD})] / dt_D \} \quad (3.57)$$

where the terms $[dp_{wD1}(t - t_{mD})] / dt_D$ and $[dp_{wD1}(t_D)] / dt_D$ are obtained from the Laplace transform inversion of Eq. 3.56.

Let us derive the equations to calculate the pulse-response amplitude and time lag on the pressure-response curve, such as the one shown in Fig. 3.3.

3.3.3 Calculation of the Response Amplitude and Time Lag from the Pressure-response Curve

To implement the graphical technique [Johnson et al., 1966] of analysis of pulse-test data on a digital computer, there is the need to derive general equations for calculating the pressure response amplitude and time lag. These equations will be in terms of the dimensionless pulse cycle length, $(\Delta t_c)_D$, and the ratio of the pulse period to the total cycle length (F').

The ratio of the production or injection time of the pulse (pulse length) to the sum of production time and shut-in time (total cycle length) is defined by:

$$\begin{aligned} F' &= \frac{[\text{Pulse Length}]}{[\text{Total Cycle Length}]} \\ &= \frac{[\text{Pulse Period}]}{[\text{Shut-In Period} + \text{Pulse Period}]} \end{aligned} \quad (3.58)$$

That is:

$$F' = \frac{\Delta t_{pD}}{(\Delta t_c)_D} \quad (3.59)$$

where the dimensionless pulse time is defined as:

$$\Delta t_{pD} = \left(\frac{k}{\phi \mu c_t r_w^2} \right) \Delta t_p \quad (3.60)$$

, and the dimensionless total cycle length is:

$$(\Delta t_c)_D = \left(\frac{k}{\phi \mu c_t r_w^2} \right) \Delta t_c \quad (3.61)$$

Note that the r_w in the above equations is the radius of the pulsing well.

Referring to Fig. 3.3, it can be shown that the dimensionless time associated with any particular production or shut-in period is given by:

$$t_{Dm} = \frac{m}{2} (\Delta t_c)_D, \quad \text{if } m = \text{even integer} \quad (3.62)$$

$$t_{Dm} = \left[\frac{1}{2} (m - 1) + F' \right] (\Delta t_c)_D, \quad \text{for } m = \text{odd integer} \quad (3.63)$$

Using Eqs. 3.62 and 3.63, we can write the expression for dimensionless time lag by inspection. For peak pulses, i.e., those pulses which usually occur immediately after a pulsing period, the general relation

for time lag is:

$$(t_L)_D = t_{Dk} - \left[\frac{1}{2} (m - 1) + F' \right] (\Delta t_c)_D \quad [\text{Peak Pulse}] \quad (3.64)$$

where t_{Dk} is the dimensionless time at the point of occurrence of the peak pulse on the response curve. Also, for the inverse pulses, which occur immediately following a shut-in period, the time lag is given by:

$$(t_L)_D = t_{Dk} - \frac{m}{2} (\Delta t_c)_D \quad [\text{Inverse Pulse (Valley)}] \quad (3.65)$$

and the t_{Dk} in Eq. 3.65 is the dimensionless time at the location of of the inverse pulse (or valley) on the response curve.

We shall use the definition of dimensionless time-lag presented by Earlougher [1975]. That is:

$$(t_L)_D = \left(\frac{k}{\phi \mu c_t r_w^2} \right) t_L \quad (3.66)$$

where r_w is the wellbore radius of the pulsing well. Note that this definition of dimensionless time lag is different from that presented by Brigham [1970], and Kamal and Brigham [1975; 1976]. Obviously, the combination of Eqs. 3.4 and 3.66 (i.e., the previous definitions of r_D and $(t_L)_D$) provides:

$$\frac{(t_L)_D}{r_D^2} = \left(\frac{k}{\phi \mu c_t r^2} \right) t_L \quad (3.67)$$

where r is the distance between the pulsing and the responding wells.

For the design and analysis of pulse tests, it is necessary to rewrite Eq. 3.67 in terms of transmissivity ($T = kh/\mu$) and storativity ($S = \phi c_t h$):

$$\frac{(t_L)_D}{r_D^2} = \left(\frac{kh}{\mu}\right) \left(\frac{1}{\phi c_t h}\right) \left(\frac{t_L}{r^2}\right) = \frac{T t_L}{S r^2} \quad (3.68)$$

The dimensionless response amplitude is defined as:

$$\Delta p_{Dm} = \frac{2\pi kh}{qB\mu} \Delta p_m = \frac{2\pi T}{qB} \Delta p_m \quad (3.69)$$

where Δp_m is the vertical distance between two parallel tangents on the pressure response curve. One tangent is drawn between two consecutive valleys (peaks) on either side of the subject pulse (i.e, the m th pulse) and the second tangent is constructed to the peak (valley) of the pulse to be analyzed. For example, for the first pulse shown in Fig. 3.3, the dimensionless response amplitude is given by:

$$\Delta p_{D1} = p_D(t_B)_D - p_D(t_A)_D - [(t_B)_D - (t_A)_D] \frac{p_D(t_C)_D - p_D(t_A)_D}{(t_C)_D - (t_A)_D} \quad (3.70)$$

In the foregoing section, we have: (1) formulated and solved the equations describing the pressure response obtainable in an interference test in which wellbore storage and skin effects are operating at both wells, and (2) shown how to superpose the interference test equations to obtain the mathematical model for multiple-pulse testing, and also applied the graphical method of Johnson et al [1966] to locate the pulse-response amplitude and time lag on the pressure response curve.

4. VALIDATION OF THE MATHEMATICAL MODEL

Most of the equations derived in the previous section include terms in Laplace space. We used the Stehfest algorithm [1968] for Laplace transforms to evaluate the numerical inversion of these equations. In the next section we shall discuss the Stehfest algorithm.

4.1 NUMERICAL INVERSION OF LAPLACE TRANSFORMS

To check the accuracy of the Stehfest algorithm, we generated a table of dimensionless pressure drops for the line-source well in an infinite reservoir: 1) by the numerical inversion of $\bar{p}_D$ from the Laplace space to real space, and 2) by direct evaluation of the exponential integral solution. Table 4.1 compares the results of the numerical inversion with the analytical solution. The results shown in Table 4.1 indicate that the numerical inverter is accurate to the fifth significant figure. The accuracy of the inverter depends on the parameter N , an even integer used to calculate the coefficients of the terms to be inverted. In this study, we have set the value of N equal to 16. This choice was based on the sensitivity analysis presented by Sandal (see Table 4.2 of Sandal, 1978). Sandal showed that for the range of t_D/r_D^2 expected in an interference test the value of N should be set equal to 16 to obtain the best results with the numerical inverter. In some cases the inverter gives meaningless results--negative pressure drop, p_D , especially when the values of p_D are less than 10^{-6} . Using a value of N equal to 16 minimizes the number of points with negative pressure drops.

TABLE 4.1

COMPARISON OF RESULTS OBTAINED BY STEHFEST NUMERICAL INVERTER WITH THOSE OBTAINED BY EVALUATION OF THE EXPONENTIAL INTEGRAL SOLUTION

t_D/r_D^2	DIMENSIONLESS PRESSURE (p_D at $r_D = 500$, $C_{D2}, C_{D1} = 0$)		DERIVATIVE OF p_D	
	(1)	(2)	(3)	(4)
	ANALYTICAL	STEHFEST	ANALYTICAL	STEHFEST
0.1	1.24575E-02	1.24635E-02	1.64170E-06	1.64142E-06
0.2	7.32067E-02	7.32135E-02	2.86505E-06	2.86552E-06
1	5.22141E-01	5.22147E-01	1.55760E-06	1.55763E-06
2	8.11713E-01	8.11716E-01	8.82497E-07	8.82501E-07
10	1.56825	1.56826	1.95062E-07	1.95061E-07
50	2.36305	2.36305	3.98005E-08	3.98005E-08
100	2.70837	2.70837	1.99501E-08	1.99501E-08
500	3.51209	3.51209	3.99800E-09	3.99800E-09
1000	3.85854	3.85854	1.99950E-09	1.99950E-09

(1) From the Exponential Integral Solution:
$$p_D = \frac{1}{2} E_1 \left(-\frac{r_D^2}{4t_D} \right)$$

(2) Numerical inversion (Stehfest Algorithm) of:
$$p_D = \frac{1}{\ell} K_0(r_D \sqrt{\ell})$$

(3) Evaluation of:
$$\frac{dp_D}{dt_D} = \frac{2t_D \exp\left[-\frac{r_D^2}{4t_D}\right]}{r_D^2}$$

(4) Numerical inversion of:
$$\frac{dp_D}{dt_D} = [K_0(r_D \sqrt{\ell})]$$

Because we are also interested in the determination of the slope of the pressure response using Eq. 3.57 (i.e., by the numerical inversion of the product of pressure and the Laplace transform variable, s), the derivatives of the pressure response function were computed by the above methods and are also presented in Table 4.1. As shown in Table 4.1, the algorithm gives consistent and accurate results. This level of accuracy is necessary in order to define the pulse-test parameters properly.

4.2 COMPARISON OF RESULTS OF THIS STUDY WITH PREVIOUSLY PUBLISHED DATA

A comparison of results of this study with previously published results for interference and pulse testing will now be presented.

4.2.1 Interference Test Data

The core of the mathematical model developed in Section 3 is Eq. 3.49 which describes the dimensionless pressure drop at the responding well, $\bar{p}_{wD1}$. It forms the basis for the superposition performed in subsequent equations to determine the pressure-response function.

To check the validity of Eq. 3.49, two computer runs were made. In the first run, we considered $C_{D1} = 0$ and $s_1 = 0$ and the results were compared with the interference test data presented by Sandal et al. [1978]. Their study considered a finite wellbore radius model and the wellbore storage and skin effects were operating at the active well only. The results presented in Fig. 4.1 and Tables C.1a and C.1b (Appendix C) show that we obtained a good match between their finite wellbore radius model and the vanishing radius model presented in this study. The second run was for the case of wellbore storage and skin

FIG. 4.1: COMPARISON OF THE RESULTS OF THIS STUDY WITH THOSE PRESENTED BY SANDAL *et al.* (1978)

effects at both the responding and pulsing wells. The dimensionless pressure drops at the responder were compared with the results predicted by a finite wellbore radius model (also an interference test model) developed by Tongpenyai and Raghavan [1979; 1981].

As illustrated in Fig. 4.2 and in Tables C.2a and C.2b, the agreement between the two results is good. Of all the cases tested, the maximum deviation between the results from the finite radius models and the vanishing radius model was less than 0.2 %, and most differed by less than 0.1 %. It is important to have accurate values of p_D from the interference test model because these values are the input data for determining pulse response amplitude and time lag.

Additionally, a third computer run was made which considered the case of $C_{D1} = 0$ and $s_1 = 0$ but the dimensionless pressure drops were calculated at the pulsing well. The results shown in Fig. 4.3 and in Table C.3 closely matched the analytical solution published by Agarwal et al. [1970] and by Ramey and Agarwal [1972].

4.2.2 Pulse-Test Data

A comprehensive study of pulse testing without considering wellbore storage and skin effects was conducted by Kamal and Brigham [1975; 1976]. In this section, we will discuss how the results of this study compare with the Kamal-Brigham data. Before we cross-check the results with the Kamal-Brigham data, let us outline the major steps of the algorithm of the computer program used to calculate the data. Secondly, we shall clarify the differences between the nomenclature used in the present study and that used by Kamal [1973].

FIG. 4.2: COMPARING THE RESULTS OF THIS STUDY WITH THE DATA PUBLISHED BY TONGPENYAI AND RAGHAVAN (1979, 1981)

FIG. 4.3: COMPARING THE RESULTS OF THIS STUDY WITH THE RESULTS PRESENTED BY AGARWAL et al. (1970) AND RAMEY AND AGARWAL (1972)

The Computer Program to Calculate Time Lag and Amplitude: A typical profile of the pressure response obtained from Eq. 3.55 is shown in Fig. 4.4. In this figure, the dimensionless pressure response is plotted as a function of the dimensionless time. The main purpose of the computer program is to calculate the time lag and amplitude associated with any pulse on the pressure response profile using the Johnson et al. [1966] tangent construction method. This involves locating the peaks and valleys of the response curve.

Based on the Johnson et al. method and the equations derived in Section 3, a computer program was developed. The following major steps are required to calculate the dimensionless time lag (e.g., (t_{L1}) and dimensionless amplitude (Δp_{D1}) of Fig. 4.4. The input parameters are,

- (1) Ratio of pulsing time to total cycle length, F' ,
- (2) Dimensionless total cycle length, $(\Delta t_c)_D$
- (3) Initial guess for the locations of $(t_D)_A$ and $(t_D)_C$,
- (4) Wellbore storage and skin effects $C_{D1}\exp(2s_1)$ and $C_{D2}\exp(2s_2)$,
- (5) Dimensionless radial distance between the pulsing well and the responding well, r_D ,
- (6) The number of pressure peaks and valleys to be analyzed,
- (7) The tolerance, a small number which determines the convergence of the iterative steps to locate the peaks and valleys.

The outline of the algorithm* is,

- (1) Guess a value for the dimensionless time at point A, $(t_D)_A$.
For example, in the program, $(t_D)_A = (t_c)_D/10$. That is, $(t_D)_A$ is one-tenth of the pulse cycle length,

* Note: This computer algorithm is a modified version of the algorithm presented by Falade [1974].

FIG. 4.4: A TYPICAL PRESSURE-RESPONSE CURVE WITH $F' = 0.5$

- (2) Use the sum of $(t_D)_A$ and the pulse cycle length to estimate the value of $(t_D)_C$,
- (3) Compute the pressure response at points $(t_D)_A$ and $(t_D)_C$ using Eq. 3.55,
- (4) Determine the slope of the estimated tangent line joining point A to point C (Fig. 4.4). That is:

$$[(\text{Slope})_{AC}] = [(p_D)_C - (p_D)_A] / [(t_D)_C - (t_D)_A],$$

- (5) Define a search interval around $(t_D)_A$ and using a root-finding routine, iterate until a value of $(t_D)_A$ can be found to satisfy the requirement:

$$[\text{Slope at A}] = [\text{Slope of the Tangent from A to C}],$$

- (6) Add the pulse cycle length to the new location of point A [i.e., $(t_D)_A$] to estimate a new value of $(t_D)_C$,
- (7) Define a search interval around $(t_D)_C$ and using a root-finding routine, iterate until a value of $(t_D)_C$ can be found to satisfy the requirement:

$$[\text{Slope at C}] = [\text{Slope of the Tangent from A to C}],$$

- (8) Calculate the slope of a new tangent line joining point A to point C. Essentially, we repeat Step 4 to get a new value for $(\text{Slope})_{AC}$.
- (9) If no convergence is obtained between the new $(\text{Slope})_{AC}$ and $[\text{Slopes at } (t_D)_C, \text{ and at } (t_D)_A]$, update the previous value of $(t_D)_A$ by subtracting the pulse cycle length from the location $(t_D)_C$, and then repeat Steps 3 through 8,

- (10) Upon convergence, the location of the pulse, $(t_D)_B$, is computed using the root-finding routine with the condition that:

$$[\text{Slope at B}] = [\text{Slope of the line joining A to C}],$$

- (11) Determine the response amplitude using Eq. 3.70 and the time lag either from Eq. 3.64, if the pulse is a peak, or from Eq. 3.65 for the inverse pulse.

The computer program using the above algorithm is shown in Appendix E.

4.2.1. Comparison of Results

Let us outline the differences between the nomenclature of this study and that used by Kamal [1973], and then cross-check the values of the response amplitude and time lag obtained from this work and those published by Kamal [1973] and Brigham [1970].

Nomenclature--the nomenclature used in this study is different from that used by Kamal [1973]. We have tried to keep to the nomenclature used by Earlougher in the SPE Monograph (Volume 5) because of its wide usage--the "de facto" standard. Table 4.2 compares the symbols used in this report with those presented by Kamal [1973], and Kamal and Brigham [1976].

Comparison of Response Amplitude and Time Lag Data--using the data collected by Kamal [1973], Earlougher [1975] replotted the response amplitude and time lag correlation curves which are shown later in this section. We have used the Earlougher charts for our comparison because the definitions of dimensionless response amplitude and time lag presented by Kamal are different from those used in this report and different from the standard SPE nomenclature. As a result of these differences, the data published by Kamal had to be modified by dividing

TABLE 4.2

COMPARISON OF THE SYMBOLS FOR DEFINING PULSE-TEST CHARACTERISTICS

PARAMETER	DEFINING SYMBOLS		REMARKS
	THIS STUDY	KAMAL AND BRIGAM	
Dimensionless Amplitude	$\Delta p_D = \frac{kh\Delta p}{141.2qB\mu}$	$\Delta p_D = \frac{kh\Delta p}{70.6qB\mu}$	
Pulse Cycle Length	Δt_c	Δt_{cyc}	
Dimensionless Cycle Length	$\frac{(\Delta t_c)_D}{r_D^2} = \frac{T(\Delta t_c)}{3792.2Sr^2}$	$\Delta t_{cycD} = \frac{T(\Delta t_{cyc})}{56900Sr_{bw}^2}$	Kamal's time is in minutes. In this work time is in hours.
Dimensionless Time Lag	$\frac{(t_L)_D}{r_D^2} = \frac{0.0002637kt_L}{\phi\mu c_t r^2}$	$t_{LD} = \frac{t_L}{\Delta t_{cyc}}$	
Ratio of time Lag to Cycle Length	$(t_L/\Delta t_c)_D$	t_{LD}	
Pulse Length Ratio	$F' = \frac{\Delta t}{\Delta t_c} P$	$R' = \frac{\Delta t}{\Delta t_{cyc}}$	
Response Amplitude Correlation	$\Delta p_D(t_L/\Delta t_c)^2$	$\Delta p_D(t_{LD})^2$	

his values of response amplitude by 2 and the time lag data by 4. In fact, these modifications have been included in the Earlougher curves. This is another reason for choosing Earlougher's charts.

After setting the wellbore storage and skin terms in our model equal to zero, we calculated the response amplitude and time lag for the first ten pulses. To have the same basis for comparison, the pulses were classified as odd (i.e. the inverse pulses--valleys) and even (peak) pulses.

Time Lag Data—Figure 4.5 is the plot of time lag for the first odd pulse. It compares the results obtained by Kamal in 1973 (also Kamal and Brigham, 1976) with the results obtained in this study. For the purpose of comparison, we have plotted our data points for values of F' varying from 0.3 to 0.7.

Kamal also presented the time lag correlations for the even pulses. Figures 4.6 shows the curves for the first even pulse. The results shown in Figs. 4.5 and 4.6 indicate a good agreement between Kamal's time lag data and our results.

Pulse Amplitude Data—the results for the response amplitudes are displayed on Figs. 4.7 and 4.8. The values of response amplitude for the odd pulses are higher than those presented by Kamal. However, the response amplitude data for the even pulses are lower than those of Kamal. In general, our data show a smaller range of $t_L/\Delta t_c$ at which the peaks of the response amplitude occur. We cannot readily explain this discrepancy between these two sets of results. It is possible that this discrepancy may be due to the convergence criteria used to calculate the derivatives of the pressure drops. The derivative of the pressure drop

FIG. 4.5: COMPARISON OF THE DIMENSIONLESS TIME LAG CORRELATIONS FOR THE FIRST ODD PULSE OF THIS STUDY WITH THOSE OF KAMAL AND BRIGHAM [1976]

FIG. 4.6: COMPARISON OF THE DIMENSIONLESS TIME LAG CORRELATIONS FOR THE FIRST EVEN PULSE OF THIS STUDY WITH THOSE OF KAMAL AND BRIGHAM [1976]

FIG. 4.7: COMPARISON OF THE DIMENSIONLESS RESPONSE AMPLITUDE CORRELATIONS FOR THE FIRST ODD PULSE OF THIS STUDY WITH THOSE OF KAMAL AND BRIGHAM [1976]

FIG. 4.8: COMPARISON OF THE DIMENSIONLESS RESPONSE AMPLITUDE CORRELATIONS FOR THE FIRST EVEN PULSE OF THIS STUDY WITH THOSE OF KAMAL AND BRIGHAM [1976]

is one of the parameters required to locate the peaks and valleys of the response curve, i.e. the response amplitude and time lag. It is important to compute these derivatives accurately because these are very small numbers ranging from 10^{-6} to 10^{-12} .

In view of the differences between our data and those of Kamal, we made a second comparison using the data presented by Brigham in 1970. In that work, Brigham assumed that the pulse period is equal to the shut-in period. This assumption is the same as setting the pulse cycle ratio (F') of this study equal to 0.5. Figures 4.9 and 4.10 show the comparison between our data and those of Brigham. The two results are nearly identical.

From these studies, we believe that the results calculated here are more accurate and these should be used, rather than Kamal's, in the analysis of pulse tests.

It has been shown from the preceeding discussion that the pulse testing model presented in this study can produce the correlation curves for time lag and response amplitude when wellbore storage and skin effects are set equal to zero. The next problem will be to include wellbore storage and skin effects in the pulse-testing model, and that is the subject of the Section 6.

FIG. 4.9 COMPARISON OF THE DIMENSIONLESS RESPONSE AMPLITUDE CORRELATIONS OF THIS STUDY WITH THOSE OF BRIGHAM [1970]

FIG. 4.10: COMPARISON OF THE DIMENSIONLESS TIME LAG CORRELATIONS OF THIS STUDY WITH THOSE OF BRIGHAM [1970].

5. INTERFERENCE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS AT BOTH WELLS

Although the main objective of this study is to determine the effects of wellbore storage and skin on pulse-test data, we have produced numerous type curves for analyzing interference test data dominated by storage and skin effects. It is worthwhile for us to mention some of the observations we have made regarding these type curves. In the following sections we shall briefly examine two categories of type curves: (1) those curves showing how the presence of wellbore storage and skin at either the observation well or at the active well would affect pressure response, and (2) those curves illustrating the effect of wellbore storage operating at both wells. In most of the following discussion we shall use the term wellbore storage interchangeably with wellbore storage and skin effects. This is commonly used in interference testing because the wellbore storage coefficient, C_D , and skin factor, s can be combined into one variable, $C_D \exp(2s)$. We shall validate the applicability of this coefficient later in this Section.

5.1 WELLBORE STORAGE AND SKIN EFFECTS AT ONE OF THE WELLS

Figures 5.1 and 5.2 are sample type curves of pressure response obtained using Eq. 3.49. In particular, Fig. 5.1 represents the case of wellbore storage effects existing only at the observation well while Fig. 5.2 is for the case of wellbore storage at the active well. As a result of the reciprocity principles exhibited by Eq. 3.49, the observed

FIG. 5.1: EFFECT OF WELLBORE STORAGE AND SKIN AT THE OBSERVATION WELL ON PRESSURE RESPONSE AT THE OBSERVATION WELL

FIG. 5.2: EFFECT OF WELLBORE STORAGE AND SKIN AT THE ACTIVE WELL ON PRESSURE RESPONSE AT THE OBSERVATION WELL

pressure response is identical on both figures for the same t_D/r_D^2 and corresponding values of $C_D \exp(2s)$ and C_D/r_D^2 . In fact, one needs only Figure 5.1 (or Figure 5.2) in order to interpret an interference test regardless of the location of the storage effects. The implication of this observation is that the various type curves which consider wellbore storage at the active well can be used interchangeably with the type curves presented for storage at the observation well with no change. The major operational problem for the well test analyst may be to determine what is the wellbore storage and skin coefficient at each well.

Fig. 5.1 shows that at early times, the influence of wellbore storage is significant. Consequently, the pressure response is consistently different from the pressure response seen from the line-source solution (i.e., the case of no storage and skin).

The tables of data necessary for developing other type curves similar to Figs 5.1 and 5.2 are shown in Appendix B.

5.2 WELLBORE STORAGE AND SKIN EFFECTS AT BOTH WELLS

Fig. 5.3 shows the effect of wellbore storage and skin at both wells on the pressure response at the observation well. In Fig. 5.3, the wellbore storage constant at the active well is equal to 10^6 , the dimensionless radial distance between the wells is 3162. The wellbore storage coefficient at the observation well varies from 10^7 to 10^{40} .

This figure shows that increasing the wellbore storage coefficient causes the observed pressure response to deviate more significantly from the case of no storage (line-source solution). Like the case of storage

FIG. 5.3: EFFECT OF WELLBORE STORAGE AND SKIN AT BOTH WELLS ON THE PRESSURE RESPONSE AT THE OBSERVATION WELL

in one well, the curves shift more to the right as the wellbore storage coefficient increases.

When wellbore storage is present in both wells, the deviation from the line-source solution is more evident. Consider the two cases presented in Fig. 5.4. (The data are also listed in Table 5.1.) In the first case, the storage-distance squared ratio, C_{D2}/r_D^2 was set equal to 0.1 in the active well but C_{D1}/r_D^2 was zero in the observation well. The solid curves represent values of $C_{D2}\exp(2s_2)$ varying from 10^5 to 10^{20} . For the second case both C_{D1}/r_D^2 and C_{D2}/r_D^2 are equal to 0.1; $C_{D1}\exp(2s_1)$ was fixed at 10^5 and $C_{D2}\exp(2s_2)$ was varied from 10^5 to 10^{20} . These cases are represented by the open circles, the squares and the winged-circles of Fig 5.4. Obviously, the curves do not agree. In fact, the slopes are different; the slopes of the curves for the case of storage in both wells are greater than the slopes of the curves indicating storage in only one of the wells. If we multiply the storage coefficients in both wells, we do not get the response equivalent to the product of the storage term operating in one well. For example, the response due to $C_{D1}\exp(2s_1) = 10^5$ and $C_{D2}\exp(2s_2)=10^5$ is lower than the response obtained from $C_{D2}\exp(2s_2) = 10^{10}$ operating at the active well only. We had hoped that a simple multiplier would be a good approximation for transforming the two-well storage data into an equivalent set of one-well storage data. It is clear that storage in both wells has a greater effect on the pressure response than a simple multiple of the individual storage terms. This implies that the pressure response for the case of wellbore storage and skin active at

FIG. 5.4: COMPARISON OF WELLBORE STORAGE AND SKIN EFFECTS IN BOTH WELLS WITH THE CASE OF WELLBORE STORAGE AND SKIN IN ONE OF THE WELLS.

TABLE 5.1

COMPARISON OF WELLBORE STORAGE EFFECTS IN ONE WELL
WITH THE CASE OF STORAGE IN BOTH WELLS.

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD
CD1*exp(2S1) = 1.00000D 05

= 1000.000
CD1/rD**2 = 0.10000
CD2/rD**2 = 0.10000

CD2*exp(2S2)

DIMENSIONLESS PRESSURE DROP

WELLBORE	1.00000D 05		1.00000D 10		1.00000D 20	
STORAGE IN:	ONE WELL	BOTH WELLS	ONE WELL	BOTH WELLS	ONE WELL	BOTH WELLS
td/rD**2						
1.00D-01	4.93186D-04	1.58476D-05	2.34014D-04	7.41674D-06	3.59120D-06	1.14006D-04
1.50D-01	2.67043D-03	1.43354D-04	1.32120D-03	6.97731D-05	3.44022D-05	6.56429D-04
2.00D-01	7.18528D-03	5.45849D-04	3.66623D-03	2.73336D-04	1.36635D-04	1.84940D-03
3.00D-01	2.31937D-02	2.80340D-03	1.24080D-02	1.46537D-03	7.48505D-04	6.41447D-03
5.00D-01	7.60987D-02	1.57874D-02	4.37034D-02	8.78934D-03	4.64566D-03	2.34948D-02
7.50D-01	1.62686D-01	4.97539D-02	1.00098D-01	2.94495D-02	1.61319D-02	5.60859D-02
1.00D 00	2.56128D-01	1.00512D-01	1.66817D-01	6.26310D-02	3.54289D-02	9.69841D-02
1.50D 00	4.35156D-01	2.32092D-01	3.10273D-01	1.57441D-01	9.43959D-02	1.92535D-01
2.00D 00	5.89835D-01	3.76650D-01	4.50439D-01	2.73561D-01	1.72838D-01	2.95753D-01
3.00D 00	8.28187D-01	6.41190D-01	6.94592D-01	5.15258D-01	3.56464D-01	5.00352D-01
5.00D 00	1.12988D 00	1.00838D 00	1.03879D 00	9.05786D-01	7.16185D-01	8.48567D-01
7.50D 00	1.35837D 00	1.27944D 00	1.30260D 00	1.21523D 00	1.06094D 00	1.16045D 00
1.00D 01	1.51506D 00	1.45682D 00	1.47707D 00	1.41399D 00	1.30178D 00	1.37571D 00
1.50D 01	1.73065D 00	1.69211D 00	1.70776D 00	1.66735D 00	1.60543D 00	1.65107D 00
2.00D 01	1.88100D 00	1.85201D 00	1.86461D 00	1.83464D 00	1.79436D 00	1.82689D 00
3.00D 01	2.09036D 00	2.07079D 00	2.07991D 00	2.05994D 00	2.03639D 00	2.05732D 00
5.00D 01	2.35126D 00	2.33922D 00	2.34520D 00	2.33302D 00	2.32010D 00	2.33252D 00
7.50D 01	2.55685D 00	2.54863D 00	2.55287D 00	2.54459D 00	2.53632D 00	2.54473D 00
1.00D 02	2.70217D 00	2.69589D 00	2.69921D 00	2.69290D 00	2.68681D 00	2.69319D 00
1.50D 02	2.90643D 00	2.90213D 00	2.90447D 00	2.90016D 00	2.89617D 00	2.90052D 00
2.00D 02	3.05106D 00	3.04777D 00	3.04960D 00	3.04630D 00	3.04334D 00	3.04665D 00
3.00D 02	3.25460D 00	3.25235D 00	3.25364D 00	3.25138D 00	3.24942D 00	3.25169D 00
5.00D 02	3.51070D 00	3.50930D 00	3.51012D 00	3.50872D 00	3.50755D 00	3.50896D 00
7.50D 02	3.71379D 00	3.71283D 00	3.71340D 00	3.71244D 00	3.71167D 00	3.71263D 00
1.00D 03	3.85781D 00	3.85709D 00	3.85752D 00	3.85679D 00	3.85621D 00	3.85694D 00
1.50D 03	4.06073D 00	4.06023D 00	4.06054D 00	4.06004D 00	4.05965D 00	4.06015D 00
2.00D 03	4.20467D 00	4.20429D 00	4.20453D 00	4.20414D 00	4.20385D 00	4.20424D 00
3.00D 03	4.40750D 00	4.40724D 00	4.40741D 00	4.40714D 00	4.40695D 00	4.40721D 00
5.00D 03	4.66300D 00	4.66284D 00	4.66294D 00	4.66278D 00	4.66266D 00	4.66283D 00
7.50D 03	4.86577D 00	4.86556D 00	4.86574D 00	4.86563D 00	4.86555D 00	4.86566D 00
1.00D 04	5.00964D 00	5.00955D 00	5.00961D 00	5.00952D 00	5.00947D 00	5.00955D 00

both wells is a function of the following dimensionless terms: C_{D1} , C_{D2} , s_1 , s_2 , r_D , t_D . Using the $C_{Dexp}(2s)$ correlation, which will be discussed in the next sub-section, the six variables can be reduced to five groups of dimensionless terms that were discussed earlier when deriving the response equations. These terms are: C_{D1}/r_D^2 , C_{D2}/r_D^2 , $C_{D1exp}(2s_1)$, $C_{D2exp}(2s_2)$ and t_D/r_D^2 . It is because of this problem that we have produced numerous tables of data to cover the range of storage and skin terms expected in the practical analysis of interference tests. These results are presented in tables in Appendix B.

5.3 VALIDATION OF $C_{Dexp}(2S)$ CORRELATION

The combination of wellbore storage coefficient, C_D and skin factor, s is commonly used in interference testing. This relationship is based upon the work of Earlougher and Kersch [1974] and the observation of Ramey, Agarwal and Martin [1975]. In their work on Slug test, Ramey et al. showed that the dimensionless sandface flow rate $(qB)_{sf}$ can be related to the quotient, t_D/C_D for a fixed $C_{Dexp}(2s)$. Using this suggestion and the data presented by Ramey and Agarwal [1970], Chu et al. [1980] showed that the pressure response in an interference test can be obtained by three unique dimensionless groups: t_D/r_D^2 , C_D/r_D^2 and $C_{Dexp}(2s)$.

This combination is important because it reduces by one the number of variables required to describe the pressure response, thereby greatly reducing the number of curves to be plotted. The results in Table 5.2 illustrate that for a fixed value of C_D/r_D^2 we can vary r_D , C_D , and skin factor, s , and the pressure response does not change for the same value of $C_{Dexp}(2s)$. We have used this combination extensively in this work.

TABLE 5.2
VALIDATION OF $C_{D\text{exp}}(2s)$ CORRELATION

$C_{D\text{exp}}(2s)$	10^6				10^{12}			
C_D/r_D^2	0.01		1		0.1		1	
C_D	10^2	10^4	10^3	10^6	10^4	10^6	10^6	10^7
r_D	100	1000	31.6	1000	316.2	3162.3	1000	3162.3
Skin, s	4.61	2.3	3.45	0	9.21	6.91	6.91	5.76
t_D/r_D^2	DIMENSIONLESS PRESSURE DROP AT THE OBSERVATION WELL, p_{wD}							
0.1	2.84075E-3	2.84200E-3	5.04671E-5	5.07807E-5	1.93318E-4	1.93327E-4	2.14309E-5	2.14310E-5
0.2	3.41635E-2	3.41666E-2	7.68774E-4	7.70562E-4	3.06446E-3	3.06451E-3	3.44269E-4	3.44270E-4
0.5	2.22288E-1	2.22289E-1	9.27077E-3	9.27706E-3	3.73017E-2	3.73018E-2	4.42321E-3	4.42321E-3
1	4.80877E-1	4.80877E-1	3.81292E-2	3.81397E-2	1.45965E-1	1.45965E-1	1.90920E-2	1.90920E-2
2	7.87151E-1	7.87151E-1	1.22047E-1	1.22060E-1	4.08866E-1	4.08866E-1	6.46442E-2	6.46442E-2
5	1.22268	1.22268	4.24060E-1	4.24070E-1	9.99195E-1	9.99195E-1	2.49325E-1	2.49325E-1
10	1.56219	1.56219	8.78678E-1	8.78681E-1	1.45951	1.45951	5.81197E-1	5.81197E-1
50	2.36166	2.36166	2.21364	2.21364	2.34273	2.34273	2.04901	2.04901
100	2.70764	2.70764	2.63937	2.63937	2.69802	2.69802	2.58528	2.58528
500	3.51193	3.51193	3.49784	3.49784	3.50989	3.50989	3.49044	3.49044

6. RESULTS AND DISCUSSION

The results presented in this work show the dimensionless response amplitude and time lag for a wide range of values of wellbore storage and skin effects likely to be encountered in practice. The data are summarized in this section. Detailed tabular presentations are displayed in Appendix D. Attempts are made to discuss the observed trends and, when possible, the works of other researchers showing similar results are cited.

The following discussion will focus on: (1) the effects of wellbore storage and skin on pulse test data, and (2) the correlating parameters developed in this study to correct for the effects of wellbore storage* on pulse test data.

6.1 EFFECTS OF WELLBORE STORAGE AND SKIN ON RESPONSE AMPLITUDE AND TIME LAG

Figure 6.1 shows two typical pulse-test response profiles from the same reservoir. The dotted (upper) curve represents the pressure response assuming there is no wellbore storage effect and the solid (lower) curve is obtained with wellbore storage present in one of the wells.

As a result of wellbore storage, the response amplitude (Δp_2) of the solid curve is less than the amplitude (Δp_1) of the dotted curve.

---*---

* Note: Since we have shown in Section 5 that the wellbore storage constant (C_D) and the skin factor (s) can be combined into one variable, $C_D \exp(2s)$, the terminology, "wellbore storage," will also include the skin effect.

FIG. 6.1: EXAMPLE PRESSURE RESPONSE PROFILES WITH AND WITHOUT WELLBORE STORAGE AND SKIN EFFECTS AT ONE OF THE WELLS

FIG. 6.2: QUALITATIVE COMPARISON OF THE EFFECTS ON RESPONSE AMPLITUDE AND TIME LAG OF (1) WELLBORE STORAGE AND SKIN IN BOTH WELLS, (2) WELLBORE STORAGE AND SKIN IN ONE WELL, AND (3) NO WELLBORE STORAGE

In contrast to the amplitude, the time lag (t_{L2}) of the lower curve is greater than the time lag (t_{L1}) of the upper curve. If we analyze the pulse-test data from the two cases and assume no wellbore storage exists, we will observe that the transmissivity calculated from the solid curve will be smaller than the transmissivity computed from the dotted curve. On the other hand, the storativity calculated from the solid curve, assuming no wellbore storage exists, will be larger than the correct value. In other words, the effect of wellbore storage is to attenuate the response amplitude and to inflate the time lag.

As illustrated qualitatively in Fig. 6.2, the problem of amplitude attenuation and time lag inflation is more severe when wellbore storage effects exist at both wells than when wellbore storage is present at only one well. Of course, this situation is as expected. The interference test data presented in Section 5 earlier indicate that the pressure response at the observation well is much less with wellbore storage acting at the two wells than in the case of wellbore storage at one well.

Unlike the qualitative comparison discussed in the preceding paragraph (See Fig. 6.2), Figures 6.3a and 6.3b show, quantitatively, the influence of wellbore storage at both wells compared to wellbore storage at only one of the wells. To make this comparison, a specific set of wellbore storage and skin values were chosen for both wells and the responses were compared to the responses seen if only one well had wellbore storage and skin. These comparisons were made for two different pulse cycle lengths (times) to see if a simple relationship could be found between the cases. Both the response amplitudes and time lags were studied. For this study, we set $r_D = 1000$; $C_{D1}/r_D^2 = 0.01$;

FIG. 6.3a: PULSE RESPONSE AMPLITUDE COMPARISON

FIG. 6.3b: TIME LAG COMPARISON

FIG. 6.3: DETERMINATION OF THE WELLBORE STORAGE COEFFICIENT [$C_D \exp(2s)$] IN ONE WELL EQUIVALENT TO THE WELLBORE STORAGE COEFFICIENTS IN BOTH WELLS

$C_{D2}/r_D^2 = 0.01$; $C_{D1}\exp(2s_1) = 10^4$; $C_{D2}\exp(2s_2) = 10^4$, and calculated the dimensionless response amplitude and time lag using the computer program shown in Appendix E.3. The two dimensionless pulse cycle lengths used were 0.5 and 1.0. The dimensionless time lags obtained were 0.1957 and 0.1904, while the dimensionless response amplitudes were 4.589922×10^{-2} and 1.602253×10^{-1} as seen from the underlined values near the bottom of Table 6.1.

To compare these responses (calculated when wellbore storage exist at both wells) with the responses calculated from a pair of wells having wellbore storage and skin in only one of the wells, a number of single well wellbore storage cases were run where $C_D\exp(2s)$ ranged from 10^4 to 10^{18} . These results are also shown in Table 6.1, and the data are plotted in Figs. 6.3a and 6.3b.

Let us first consider the response amplitude data shown in Figure 6.3a. When the pulse cycle length was 0.5, the dimensionless response amplitude for the case with storage in both wells was 0.0459. From Fig. 6.3a, it can be seen that the single well equivalent storage [$C_D\exp(2s)$] was 8.91×10^7 or approximately 1×10^8 . When the pulse cycle length was doubled to 1.0, the case with storage in both wells gave a dimensionless response amplitude of 0.1602. If we enter Fig. 6.3a with a response amplitude of 0.1602, we will read a single-well equivalent storage [$C_D\exp(2s)$] of 1.6×10^8 , again an equivalent storage of about 1×10^8 . Thus from this cursory analysis it appears that the product of the wellbore storages in two wells gives an approximate single-well equivalent wellbore storage ($10^4 \times 10^4 = 10^8$). Of course, this concept breaks down completely if there is zero storage in one well. But one

TABLE 6.1

DATA FOR COMPARING THE RESPONSE AMPLITUDE AND TIME LAG DUE
TO WELLBORE STORAGE IN ONE WELL WITH THE CASE OF STORAGE
IN TWO WELLS: THE CONCEPT OF EQUIVALENT WELLBORE STORAGE

Dimensionless	Time Lag		Response Amplitude		Remarks
Pulse Cycle length	0.5	1.0	0.5	1.0	
CD2exp(2s2)					
(One Well)					
1E4	0.145528	0.136910	6.615352E-2	1.797042E-1	
1E6	0.159915	0.153041	5.297199E-2	1.707517E-1	
1E8	0.171528	0.167749	4.622181E-2	1.611926E-1	
1E9	0.176464	0.174613	4.312111E-2	1.563460E-1	
1E10	0.180902	0.181165	4.022279E-2	1.515173E-1	
1E12	0.188502	0.193370	3.503125E-2	1.420477E-1	
1E14	0.194705	0.204450	3.059528E-2	1.329812E-1	
1E15	0.197377	0.209596	2.863310E-2	1.286352E-1	
1E16	0.199805	0.214495	2.682528E-2	1.244251E-1	
1E18	0.204031	0.223601	2.362521E-2	1.164272E-1	
(Two wells)					
1E4, 1E4	0.195702	0.190454	4.589921E-2	1.502253E-1	The Base Case: Wellbore Storage in both wells

THE EQUIVALENT TWO-WELL STORAGE DATA IS :

$CD1/rD^{**2} = 0.01$
 $CD2/rD^{**2} = 0.01$
 $CD1exp(2s1) = 1.E4$
 $CD2exp(2s2) = 1.E4$
 $rD = 1000$
 Pulse Cycle Length
 used: 0.5 and 1.0

point is clear; the single-well equivalent of having storage in both wells is far greater than the sum of the two storage terms.

The time lag results are shown in Fig. 6.3b. For a pulse cycle length of 0.5 the dimensionless time lag was 0.196, and the equivalent single-well storage $[C_D \exp(2s)]$ which gives the same time lag was 2.5×10^{14} . When the pulse cycle length was doubled to 1.0, the dimensionless time lag with wellbore storage in both wells was 0.190. From Fig. 6.3b, the single well case which gives the same time lag is obtained when the wellbore storage $[C_D \exp(2s)]$ coefficient is 3.16×10^{11} . Thus in this case, it is not enough to multiply the wellbore storages together; the response is even more affected than one would have expected from this simple concept.

To summarize, no generalized correlation appeared possible when comparing these results or corresponding results seen from similar cases run with different wellbore storage and skin combinations. However, one conclusion is clear. Whenever there is significant wellbore storage and skin in both wells, the results will be highly attenuated compared to the results obtained when there is no storage and skin, and they are even greatly attenuated compared to the results expected when there is storage and skin at only one of the wells. In practice, then, it is wise to make an effort to reduce the wellbore storage and skin in either (or both) of the wells when running pulse tests.

To study the effects of wellbore storage and skin on pulse-test data (for example, the curves shown in Figs. 6.1 and 6.2), we computed the pulse response amplitudes and time lags as functions of the pulse cycle length $(\Delta t_c)_D / r_D^2$, interwell distance (r_D) , wellbore storage coefficient, $C_D \exp(2s)$, C_D / r_D^2 , and pulse ratios (F') . These variables

were sufficient to completely describe the pulse response when wellbore storage is active in one of the wells. However, it was observed that if we consider wellbore storage and skin at both wells, at least six groups of dimensionless variables are required to compute the pulse response amplitude and time lag. These dimensionless groups include: the ratios of wellbore storage to the interwell distance squared, C_{D1}/r_D^2 and C_{D2}/r_D^2 , the wellbore storage coefficients, $C_{D1}\exp(2s_1)$ and $C_{D2}\exp(2s_2)$, the pulse ratio (F'), and the pulse cycle length, $(\Delta t_c)_D/r_D^2$. Obviously, with six variables, one would have to plot many curves to cover the entire range required to analyze pulse tests. We were not successful in our attempts to combine some of these variables. As a result of this problem, the following discussion on the proposed method for correcting pulse-test data for wellbore storage will be limited to pulse testing with wellbore storage and skin effects at only one well.

6.2 CORRECTION OF PULSE-TEST DATA FOR WELLBORE STORAGE AND SKIN EFFECTS

From the foregoing discussion it is obvious, at least qualitatively, that the influence of storage is to reduce the expected amplitude and to increase the time lag. The next question is how to correct the observed time lag and response amplitude for storage. To resolve this problem, various combinations of the amplitude and time lag ratios were plotted as a function of the wellbore storage coefficient for selected values of pulse cycle length and for a pulse ratio (F') of 0.5. Figures 6.4a and 6.4b are examples of some of the useful plots obtained. The amplitude ratio is defined as the quotient of the response amplitude without storage (Δp_0) and the amplitude measured when

FIG. 6.4a: EFFECT OF WELLBORE STORAGE AND SKIN ON PRESSURE RESPONSE AMPLITUDE

FIG. 6.4b: EFFECT OF WELLBORE STORAGE AND SKIN ON TIME LAG

wellbore storage is present (Δp). Henceforth in this presentation, the response amplitude when wellbore storage is effective will be denoted by Δp , and the amplitude without storage will be represented by Δp_0 .

In Fig. 6.4a, the amplitude ratio is plotted as a function of the logarithm of the wellbore storage coefficient. The dimensionless pulse cycle lengths are 0.5, 1 and 2, and the $C_D \exp(2s)$ is varying from 10 to 10^{12} . Figure 6.4a shows that for a given value of C_D/r_D^2 , the observed amplitude ratio increases with pulse cycle length, i.e., with pulse time. When C_D/r_D^2 is large (e.g., $C_D/r_D^2 = 1$), indicating either the strong influence of wellbore storage or a short distance between the tested wells, the amplitude is significantly reduced. In fact, in this figure, when C_D/r_D^2 is equal to 1 the amplitude is so small that it is doubtful if a well can be pulse-tested under such severe wellbore storage conditions. For smaller values of C_D/r_D^2 (e.g. $C_D/r_D^2 = 0.01$), the amplitude ratio can be very close to unity.

Figure 6.4b illustrates the effect of wellbore storage on time lag. This figure also shows the increase of time lag with increasing wellbore storage. Unlike the plot of the amplitude ratio where the range of the scale of the ordinate is from 0 to 1, the time lag ratio shown in Fig. 6.4b is greater than unity. This is because the observed time lag is longer with storage than without storage. To obtain a ratio that will vary from 0 to 1, we shall redefine the time lag ratio as the ratio of the time lag expected without wellbore storage, t_{L0} , to the time lag measured when storage is active, t_L (i.e., the time lag ratio = t_{L0}/t_L).

Based on the observations of Figs 6.4a and 6.4b, and the existing pulse-test correlations published by Kamal and Brigham [1975, 1976], it became apparent that if the time lag and response amplitude ratios were

calculated for numerous conditions of wellbore storage, then it might be possible to use these ratios as wellbore storage correction factors. After several trial runs, it was concluded that, indeed, the time lag and amplitude ratios are good wellbore storage correction factors.

Since the proposed correction method uses the existing correlations, it is important to review the Kamal-Brigham method for analyzing and designing pulse tests.

6.2.1 Analysis of Pulse Tests without Wellbore Storage Effects

To analyze a pulse test is to determine the reservoir transmissivity and storativity from the pulse test parameters: response amplitude, time lag, pulse cycle ratio, and the pulse cycle length. Given that a pulse test has been run, and that the pressure profile is like the schematic shown in Fig. 6.5, then the first step to analyzing the test is to draw the tangents. For example, in Fig. 6.5, the tangent AC is first constructed and the line BD is drawn parallel to AC and tangent to the pulse to be analyzed. The pressure response amplitude (Δp_0) is then measured and the time lag, t_{L0} , is measured as well. With the pulse cycle length, indicated by Δt_c in Fig. 6.5, the ratio of the time lag to the pulse cycle length can be determined. This ratio is used to read the dimensionless pressure response and time lag from the Kamal-Brigham correlation curves. Because these curves are used extensively in the correction method proposed later in this study, we have re-plotted the charts more accurately and presented them in Figs. 6.6 through 6.9. It is suggested that these new curves be used for the analysis of pulse tests for there were some minor errors in the original Kamal-Brigham charts.

Using the dimensionless amplitude and time lag read from the Kamal-Brigham charts, one can determine the transmissivity from Eq. 6.1,

$$\text{Transmissivity, } T = \frac{kh}{\mu} = \frac{141.2qB}{\Delta p} \Delta p_D \quad (6.1)$$

and the storativity can be determined from the transmissivity and the transmissivity-storativity ratio given by Eq. 6.2:

$$\frac{T}{S} = \frac{kh}{\mu} \frac{1}{\phi c_t h} = \frac{k}{\phi \mu c_t} = \frac{3792.2r^2}{t_{LO}} \frac{(\tau_L)_D}{r_D^2} \quad (6.2)$$

We shall now briefly discuss how to design pulse tests without considering the influence of wellbore storage and skin effects.

FIG. 6.5: PRESSURE RESPONSE PROFILE FOR PULSE TEST ANALYSIS WITHOUT WELLBORE STORAGE AND SKIN EFFECTS

FIG. 6.6: THE KAMAL-BRIGHAM CORRELATIONS FOR RESPONSE AMPLITUDE OF THE FIRST PEAK (EVEN) PULSE

FIG. 6.7: THE KAMAL-BRIGHAM CORRELATIONS FOR RESPONSE AMPLITUDE OF THE FIRST INVERSE (ODD) PULSE

FIG. 6.8: THE KAMAL-BRIGHAM CORRELATIONS FOR THE TIME LAG OF THE FIRST PEAK (EVEN) PULSE

FIG. 6.9: THE KAMAL-BRIGHAM CORRELATIONS FOR THE TIME LAG OF THE FIRST INVERSE (ODD) PULSE

6.2.2 The Design of Pulse Tests without Wellbore Storage Effects

Designing a pulse test is the inverse problem of pulse test analysis. The first step in the design of pulse test is to specify a reasonable ratio of time lag to pulse cycle length [See Kamal and Brigham; 1976, for details on the selection of $t_L/\Delta t_c$]. Usually, a value of $t_L/\Delta t_c$ lying between 0.17 and 0.3 is suitable for most tests. Using the chosen value of $t_L/\Delta t_c$, the dimensionless time lag and response amplitude are read from the appropriate charts shown in Figs. 6.6 through 6.9. The expected time lag and response amplitude can now be determined and the pulse cycle length can be calculated. The length of time of the pulse and shut-in periods are then computed from the pulse cycle length and the pulse ratio (F').

Let us now discuss the procedure proposed for correcting pulse-test data for wellbore storage effects. We shall consider the procedure for pulse-test analysis, and then the design of pulse tests will be discussed.

6.2.3 Analysis of Pulse Tests with Corrections for Wellbore Storage Effects

Assuming that we have run a pulse test, the following method can be used to correct the results of the test for wellbore storage effects. After measuring the time lag (t_L) and response amplitude (Δp) as described in the previous section, we assume that $t_L = t_{L0}$ and $\Delta p = \Delta p_0$. That is, we assume no wellbore storage existed when the test was run and then proceed to determine the apparent transmissivity and storativity using the procedure outlined earlier. With the calculated values of storativity and transmissivity, we can estimate the dimensionless

wellbore storage coefficient (C_D) and the ratio of wellbore storage to interwell distance squared (C_D/r_D^2) from Eqs. 6.3 and 6.4., respectively:

$$C_D = \frac{5.615C}{2\pi\phi c_t h r_w^2} = \frac{5.615C}{2\pi S r_w^2} \quad (6.3)$$

$$C_D/r_D^2 = \frac{5.615C}{2\pi\phi c_t h r^2} = \frac{5.615C}{2\pi S r^2} \quad (6.4)$$

The first approximation for the correction factors for response amplitude and time lag are read from the appropriate charts such as those presented in Figs. 6.10 through 6.19. Note that the correction factors shown in Figs. 6.10 through 6.19 are valid only for a pulse ratio of 0.5, and for the first pulse (i.e. the first peak or even pulse). In particular, Figs. 6.10 through 6.14 are especially useful for the analysis of pulse tests, and Figs 6.15 through 6.19 are suitable for pulse-test design. The tables of the correction factors required for other pulses and for a pulse ratio of 0.5 are shown in Appendix D. Using the correction factors from these charts, new trial values of response amplitude (Δp_0) and time lag (t_{L0}) can be computed, and the transmissivity, storativity, and wellbore storage coefficient can then be updated. This iterative process is continued until the storativity and transmissivity converge within some pre-defined criteria. Usually, it takes about 2 to 3 iterations for the method to converge. Examples of usage of these charts will be given in Section 7.

FIG. 6.10a: PULSE-TEST ANALYSIS AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D / r_D^2 = 0.001$ AND $F' = 0.5$

FIG. 6.10b: PULSE-TEST ANALYSIS TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.001$ AND FOR $F' = 0.5$

FIG. 6.11a: PULSE-TEST ANALYSIS AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D / r_D^2 = 0.01$ AND FOR $F' = 0.5$

FIG. 6.11b: PULSE-TEST ANALYSIS TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.01$ AND FOR $F' = 0.5$.

FIG. 6.12a: PULSE-TEST ANALYSIS AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.02$ AND FOR $F' = 0.5$

FIG. 6.12b: PULSE-TEST ANALYSIS TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.02$ AND FOR $F' = 0.5$

FIG. 6.13a: PULSE-TEST ANALYSIS AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D / r_D^2 = 0.04$ AND $F' = 0.5$

FIG. 6.13b: PULSE-TEST ANALYSIS TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.04$ AND $F' = 0.5$

FIG. 6.14a: PULSE-TEST ANALYSIS AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D / r_D^2 = 0.1$ AND $F' = 0.5$

FIG. 6.14b: PULSE-TEST ANALYSIS TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.1$ AND $F' = 0.5$

FIG. 6.15a: PULSE-TEST DESIGN AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.001$ AND $F' = 0.5$

FIG. 6.15b: PULSE-TEST DESIGN TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.001$ AND $F' = 0.5$

FIG. 6.16a: PULSE-TEST DESIGN AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D / r_0^2 = 0.01$ AND $F' = 0.5$

FIG. 6.16b: PULSE-TEST DESIGN TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.01$ AND $F' = 0.5$

FIG. 6.17a: PULSE-TEST DESIGN AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.02$ AND $F' = 0.5$

FIG. 6.17b: PULSE-TEST DESIGN TIME LAG CORRECTION FACTORS FOR
 THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.02$
 AND $F' = 0.5$

FIG. 6.18a: PULSE-TEST DESIGN AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D / r_D^2 = 0.04$ AND $F' = 0.5$

FIG. 6.18b: PULSE-TEST DESIGN TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.04$ AND $F' = 0.5$

FIG. 6.19a: PULSE-TEST DESIGN AMPLITUDE CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.1$ AND $F' = 0.5$

FIG. 6.19b: PULSE-TEST DESIGN TIME LAG CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE WITH $C_D/r_D^2 = 0.1$ AND $F' = 0.5$

6.2.4 Design of Pulse Tests with Corrections for Wellbore Storage

Effects

In the design of pulse tests, we also start with the assumption of no wellbore storage. Essentially, we start with the method outlined by Kamal and Brigham [1976], and then we correct the response amplitude and time lag for wellbore storage and skin effects. First, we use the Kamal-Brigham design method to compute the pulse cycle length, Δt_c . Second, we calculate the dimensionless pulse cycle length, $(\Delta t_c)_D/r_D^2$, the wellbore storage coefficient, $C_{Dexp}(2s)$, and C_D/r_D^2 , from the best estimates of the reservoir and wellbore properties. Using these estimates of $(\Delta t_c)_D/r_D^2$, C_D/r_D^2 , and $C_{Dexp}(2s)$, the correction factors $(\Delta p/\Delta p_0)$ and t_{L0}/t_L are determined from the appropriate pulse-test design charts presented in Figs. 6.15 through 6.19 or from the tables shown in Appendix D. The amplitude and time lag which will be measured from the test can be estimated. Unlike the pulse-test analysis method, there is no need for iteration in the design procedure.

The detailed step-by step description of the proposed method for correcting pulse tests for wellbore effects, as well as numerical examples on applying these new techniques, are included in Section 7.

6.2.5 Use of the Response Amplitude and Time Lag Correction Factors

Even though in the field most pulse tests are run only long enough to obtain the first two or three pulses, we have presented in Appendix D the tables of the wellbore storage correction factors for the first four pulses. These pulses are: the first peak (even) pulse, the second (first inverse or odd) pulse, the third (second peak or even) pulse, and the fourth (second inverse or odd) pulse. The pulse ratio considered is

0.5 and the range of C_D/r_D^2 is from 0.001 to 0.4. The lower limit was set at 0.001 because it was observed, from the data for a pulse ratio (F') of 0.5, that the correction factors for values of C_D/r_D^2 below 0.001 are approximately equal to 1. In other words, there is no need to correct pulse-test data for wellbore storage effects when the C_D/r_D^2 is less than 0.001.

The upper limit was determined from two pulse-test design criteria: (1) the useful lower limit of amplitude correction factors ($\Delta p/\Delta p_0$), which was set at 0.2, and (2) a cut-off value of 0.05 for the ratio of time lag to pulse cycle length, for the case where there was no significant influence of wellbore storage on the pulse test was run. The first design criterion eliminates very large values of C_D/r_D^2 . As shown in Fig. 6.4a, it is difficult to measure the amplitude of a pulse test when there is a strong influence of wellbore storage and skin effects. Since the ratio of time lag to pulse cycle length is the abscissa of the Kamal-Brigham correlation charts, the second design criterion (i.e., $t_{L0}/\Delta t_c > 0.05$) ensures that the test results can be meaningfully analyzed with the available correlations shown in Figs. 6.6 through 6.9. In short, it is a criterion for the maximum time a pulse cycle should be run.

Let us briefly outline the steps required to obtain the amplitude and time lag correction factors from the charts and/or tables presented in this study. To determine the wellbore storage correction factors for the analysis or design of pulse-tests includes:

- (1) Selecting two to four values of C_D/r_D^2 (from the charts in Figs. 6.14 through 6.19 or tables shown in Appendix D) that are within the neighborhood of the value of C_D/r_D^2 calculated from

- the pulse test. For example, if the calculated $C_D/r_D^2 = 0.016$, we may select three values of C_D/r_D^2 , say, 0.01, 0.02, and 0.04. These data points are within the interval of the target C_D/r_D^2 (i.e., 0.016), and they can be used for interpolation.
- (2) Determining from each chart of the chosen C_D/r_D^2 , four to five values of $C_D \exp(2s)$ that are within the neighborhood of the $C_D \exp(2s)$ calculated from the pulse test. For example, if the calculated $C_D \exp(2s)$ is 3.5×10^5 , we may use the values of $C_D \exp(2s) = 10^3, 10^4, 10^5$, and 10^6 as the neighboring points in the interpolation interval.
 - (3) Reading the wellbore storage correction factors at the selected values of $C_D \exp(2s)$ for each chosen value of C_D/r_D^2 . Obviously, these results can best be presented in a tabular form. (For example, see Table 7.5, presented later in Section 7.)
 - (4) Performing two interpolations. First, for a fixed value of C_D/r_D^2 , we interpolate using the correction factors ($\Delta p/\Delta p_0$ and t_{L0}/t_L) as the dependent variables and the logarithmic values of $C_D \exp(2s)$ as the independent variables. This is analogous to cross-plotting $\Delta p/\Delta p_0$ and t_{L0}/t_L as functions of the logarithmic values of $C_D \exp(2s)$ for each C_D/r_D^2 . Examples of such cross-plots are presented later in Section 7. In short, for each C_D/r_D^2 , we will perform an interpolation to obtain one value for amplitude correction factor, $\Delta p/\Delta p_0$, and one for the time lag correction factor, t_{L0}/t_L . Second, we use the interpolated correction factors (i.e., $\Delta p/\Delta p_0$ and t_{L0}/t_L from the first interpolation) as the dependent variables and the

logarithmic values of the C_D/r_D^2 , which have been selected in Step 1, as the independent variables. This is similar to graphing $\Delta p/\Delta p_0$ and t_{L0}/t_L as functions of the logarithm of C_D/r_D^2 , and then reading the $\Delta p/\Delta p_0$ and t_{L0}/t_L at the target C_D/r_D^2 from the cross-plot.

The proposed method of cross-plotting is illustrated in the numerical examples presented in Section 7, and the interpolation scheme is implemented in the computer program shown in Appendix E.4.

7. DESIGN AND ANALYSIS OF PULSE TESTS WITH WELLBORE STORAGE

The most significant purpose of this study is to provide the well test analyst with practical tools to design pulse tests when wellbore storage is present and to interpret wellbore storage-dominated pulse-test data. Based on the results of Section 6, this section presents the procedure and guidelines required to analyze and/or design pulse tests correctly.

The step-by-step procedure for designing a pulse test is described in the first part of this section. An outline of some of the problems that should be considered when one is designing a pulse test is also included. How to analyze a pulse test is the subject of the the second part. Numerical examples are presented in each case to illustrate the application of the outlined procedures.

7.1 DESIGN OF PULSE TESTS

The primary objective of designing a pulse test is to estimate two parameters: the expected pressure response, and the pulse time necessary to run the test. The pressure response is determined so that one can estimate the sensitivity of the pressure gauge required to run the test. It is important to select proper pulse times so that the expected pressure response falls within the region of optimum resolution of the available correlations such as those presented by Kamal and Brigham [1973, 1975]. This is to ensure that the data from the test may be analyzed meaningfully. The problem of pulse-test design is stated in Table 7.1.

TABLE 7.1

AN OUTLINE OF PULSE-TEST DESIGN OBJECTIVES

A. GIVEN: The Following Known or Estimated Parameters:

Transmissivity, T , kh/μ
 Storativity, S , $\phi c_t h$
 Wellbore storage coefficient, C
 Distance between the two wells, r
 Wellbore radius, r_w
 Production or injection rate, q
 Formation volume factor, B
 Skin Factor, s

B. TO DETERMINE: Pulse-test Characteristics:

Pulse Time, t_p , and
 Response Amplitude, Δp .

7.1.1 Design Procedure

On the basis of the results presented in this work, the following step-by-step procedure is recommended for the design of pulse tests when wellbore storage and skin effects are active at either the pulsing well or the responding well.

Step 1. Calculate the wellbore storage and skin coefficient, $C_D \exp(2s)$ from Eq. 7.1,* and determine C_D/r_D^2 from Eq. 7.2 (See Table 7.2) using the best estimates of the wellbore storage constant (C) and skin factor (s) obtained from a previous test.

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* Note: For the purpose of convenience, the major equations used for the design and analysis of pulse tests with wellbore storage and skin effects are listed in one place, i.e., in Table 7.2.

TABLE 7.2

SUMMARY OF EQUATIONS FOR THE DESIGN AND ANALYSIS OF PULSE-TESTS*

1. Dimensionless Wellbore Storage Coefficient:

$$C_D = \frac{5.615C}{2\pi\phi c_t h r_w^2} = \frac{5.615C}{2\pi S r_w^2} \quad (7.1)$$

$$C_D / r_D^2 = \frac{5.615C}{2\pi S r^2} \quad (7.2)$$

2. Response Amplitude Without Wellbore Storage:

$$\Delta p = \frac{141.2qB\Delta p_D}{(kh/\mu)} = \frac{141.2qB\Delta p_D}{T} \quad (7.3)$$

where

$$\Delta p_D = \frac{[\Delta p_D (t_L / \Delta t_c)^2]}{(t_L / \Delta t_c)^2} \text{ K-B} \quad (7.4)$$

3. Time Lag for the case of no Storage

$$t_L = \frac{3792.2 S r^2}{T} [(t_L)_D / r_D^2] \text{ K-B} \quad (7.5)$$

4. Dimensionless Pulse Cycle Length

$$\frac{(\Delta t_c)_D}{r_D^2} = \frac{2.637 \times 10^{-4} T}{S r^2} (\Delta t_c) \quad (7.6)$$

5. Pulse Time

$$t_p = F' \Delta t_c \quad (7.7)$$

6. Wellbore Storage Corrections for Response Amplitude and Time Lag

$$\text{Amplitude, } \Delta p = \Delta p_0 \left[\frac{\Delta p}{\Delta p_0} \right]_{\text{This Model}} \quad (7.8)$$

$$\text{Time Lag, } t_L = t_{L0} \left[\frac{1}{t_{L0}/t_L} \right]_{\text{This model}} \quad (7.9)$$

* Note: All the equations are in English engineering field units.

K-B denotes from Kamal-Brigham correlation charts

Step 2. Assuming that wellbore storage coefficient is equal to zero, select a ratio of time lag to pulse cycle length ($t_{L0}/\Delta t_c$) appropriate for either the peak (even) or inverse (odd) pulse to be analyzed. Recall that the expected time lag with wellbore storage present will always be greater than the time lag for the no wellbore storage case. It is important to select a proper ratio because if the ratio $t_{L0}/\Delta t_c$ chosen is too large, the pulse time obtained would be too small for the response amplitude to have developed. On the other hand if the ratio is very small, the pulse time may be too long and we would be losing valuable production time. In no case should the $t_{L0}/\Delta t_c$ selected be less than 0.05 or greater than 0.3. For a pulse ratio of 0.5, we recommend that the ratio of time lag to pulse cycle length for the first pulse (i.e., a peak or even pulse) be estimated using:

$$0.12 < t_{L0}/\Delta t_c < 0.25 \quad \text{if } C_D/r_D^2 < 0.04$$

$$0.08 < t_{L0}/\Delta t_c < 0.12 \quad \text{if } C_D/r_D^2 > 0.04$$

Step 3. Determine response amplitude (Δp_0) and time lag (t_{L0}) using the Kamal-Brigham correlations corresponding to the appropriate pulse ratio (F') and pulse to be analyzed. For a given pulse and a given pulse ratio, we read $\Delta p [t_L/\Delta t_c]^2$ and $(t_L)_D/r_D^2$ at $t_L/\Delta t_c$ from the Kamal-Brigham charts, like the one shown in Fig. 7.1. (These data are also shown in Figs. 6.6 thru 6.9, and in the tables in Appendix D). Use Eq 7.4 to calculate Δp_D ; determine the response amplitude (Δp) from Eq. 7.3, and then compute the time lag (t_{L0}) from Eq. 7.5.

FIG. 7.1: THE KAMAL-BRIGHAM CORRELATIONS FOR THE FIRST PEAK (EVEN) PULSE FOR A PULSE RATIO, $F' = 0.5$

- Step 4. Calculate the pulse cycle length, and the dimensionless pulse cycle length, $(\Delta t_c)_D/r_D^2$ from Eq. 7.6; determine the pulse time from Eq. 7.7.
- Step 5. Using the above value of $(\Delta t_c)_D/r_D^2$ and the estimates of C_D/r_D^2 and $C_D \exp(2s)$, determine the wellbore storage correction factors (i.e., $\Delta p/\Delta p_0$ and t_{L0}/t_L) from the appropriate charts or tables presented in Appendix D. To determine these values accurately, we need to interpolate carefully between tabulated values and/or graph good cross-plots. (The numerical example presented later in Section 7.1.3 illustrates the concepts of interpolation and cross-plotting.) Calculate the corrected response amplitude (Δp) from Eq. 7.8, and the corrected time lag (t_L) from Eq. 7.9.
- Step 6. Calculate a new ratio of time lag to pulse cycle length ratio, $(t_L/\Delta t_c)$ which is corrected for wellbore storage effects.
- Step 7. First, check to see if both $t_{L0}/\Delta t_c$ and $t_L/\Delta t_c$ fall within the range that can be read from the Kamal-Brigham correlations. The first ratio ($t_{L0}/\Delta t_c$) is expected to fall within the range because we selected this value in Step 2. The second value ($t_L/\Delta t_c$) may fall outside the range if the initial estimate of $t_{L0}/\Delta t_c$ was too high so that the pulse time obtained would be too short for a meaningful amplitude to have developed in the presence of wellbore storage effects. Under such circumstances, adjust the estimate of $t_{L0}/\Delta t_c$ and repeat steps 1 through 6. Second, verify that the computed

response amplitude (Δp) can be detected with the available pressure gauge.

Before we present the numerical example on pulse-test design, let us examine some of the problems that may occur in the design of pulse-tests.

7.1.2 Common Problems Associated with Pulse-Test Design

A major goal for running a pulse test is to obtain the maximum amount of information about the tested reservoir between the two wells with a minimum of interference from extraneous pressure surges, and to do this in the shortest time. Sometimes this goal may not be achieved because of severe wellbore storage conditions. In designing a pulse test, one may need to increase the pulse time in order to accommodate the influence of wellbore storage. However, an excessive increase of the pulse time to compensate for the presence of wellbore storage may yield extremely long time lags. Associated with strong wellbore storage effects and long pulse times is the problem of amplitude attenuation. That is, the response amplitude observed from a test significantly affected by wellbore storage may be so small that it can hardly be detected. Such a problem is characterized by the appearance of spike-like amplitudes on the response curve for the case of no wellbore storage.* Figure 7.2 shows very large wellbore storage effects and amplitude attenuation due to excessively long pulse times.

---**---

* Note: With the aid of a hand-held programmable calculator, the pulse response curve can easily be generated using Eq. 3.56 with the $p_{wD1}(t_D)$ terms evaluated from the exponential integral solution.

In this example, the ratio of the time lag to the pulse cycle length ($t_{L0}/\Delta t_c$) for the case of no wellbore storage is less than 0.01 and cannot be read from the Kamal-Brigham chart of Fig. 7.1. In fact, these spikes can also be seen at the peaks of the curves for long production times shown in the combined Pressure Buildup-Drawdown type curves developed by Ramey in 1979, and have been displayed in Fig. 7.3.

To eliminate the occurrence of spike-like amplitudes, it is suggested that the estimates of $C_D \exp(2s)$ and C_D/r_D^2 be plotted on the pulse-test design feasibility curve, similar to the curve shown in Fig. 7.4, to check whether the plotted point falls below and to the left of the pulse-test design feasibility envelope. Note that Fig. 7.4 was developed for the first peak (or even) pulse and for a pulse ratio (F') of 0.5. This curve is the locus of all the pressure-response amplitude

FIG. 7.2: RESPONSE AMPLITUDE ATTENUATION DUE TO AN EXCESSIVELY LONG PULSE TIME.

DRAWDOWN AND BUILDUP INTERFERENCE TEST FOR A LINE SOURCE WELL

FIG. 7.3: PRESSURE BUILDUP-DRAWDOWN TYPE CURVES FOR A LINE SOURCE WELL (After Ramey, 1979)

FIG. 7.4: PULSE-TEST DESIGN FEASIBILITY CURVE FOR THE FIRST PEAK PULSE AND A PULSE RATIO, $F' = 0.5$

and time lag correction factors which satisfy two design requirements: (1) $t_{L0}/\Delta t_c > 0.05$, and (2) $\Delta p/\Delta p_0 > 0.2$. The pulse-test design feasibility curves for other pulse ratios can be plotted using the data presented in Appendix D. They would be similar to Fig. 7.4.

It is also possible to reduce wellbore storage effects before running a pulse test. This would normally require placing a packer between the annulus and the tubing. Furthermore, if it is observed that the skin factor is significant, a well clean-up operation might be helpful. This may not only help run the test but it may also increase the well production performance. Any of these remedies would involve economic costs and must be given careful consideration.

The numerical example to illustrate the preceeding step-by-step procedure for the design of pulse tests with wellbore storage will now be presented.

7.1.3 Numerical Example on Pulse-Test Design with Wellbore Storage

Let us assume that we wish to design a pulse test in a reservoir with the approximate properties listed in Table 7.3.

TABLE 7.3

DATA FOR PULSE-TEST DESIGN. NUMERICAL EXAMPLE

Permeability, k	= 20 md
Porosity, ϕ	= 0.18
Wellbore radius, r_w	= 0.333 ft
Compressibility, c_t	= 1.0×10^{-6} psi ⁻¹
Formation Thickness, h	= 11 ft
Distance Between the tested wells, r	= 500 ft
Viscosity, μ	= 2.2 cp
Wellbore storage coefficient, C	= 0.009 bbl/psi
Skin Factor, s	= 0

To design the pulse test, we need to calculate the transmissivity, storativity, and the quotient of transmissivity and storativity (T/S):

$$\text{Transmissivity, } T = \frac{kh}{\mu} = \frac{(20)(11)}{2.2} = 100 \text{ md ft/cp}$$

$$\begin{aligned} \text{Storativity, } S &= \phi c_t h = (0.18)(1 \times 10^{-6})(11) = 1.97 \times 10^{-6} \\ &\approx 2 \times 10^{-6} \text{ ft/psi} \end{aligned}$$

$$\text{and } \frac{T}{S} = \frac{100}{2 \times 10^{-6}} = 5 \times 10^7 \text{ md psi/cp}$$

We shall use the step-by-step format presented in the preceeding paragraphs. Note that the equations referred to in this worked example problem are listed in Table 7.2.

Step 1. Estimate dimensionless Wellbore Storage and Skin Coefficient: We need to estimate the wellbore storage constant (C) and skin factor (s) from a previous test or from well records. (See Chapter 2 of Earlougher [1977] Well Test Monograph for details.) Thus from Eq. 7.1:

$$C_D = \frac{(5.615)(0.009)}{(2\pi)(2 \times 10^{-6})(0.333)^2} = 36,193 \approx 3.62 \times 10^4$$

$$r_D = r/r_w = \frac{500}{0.333} = 1500$$

$$\text{and } C_D/r_D^2 = \frac{3.62 \times 10^4}{(1500)^2} = 0.016$$

Step 2. Select ratio of time lag to pulse cycle length:
 We wish to analyze the first pulse (peak). Since $C_D/r_D^2 < 0.04$ we select:

$$\frac{t_{L0}}{\Delta t_c} = 0.18$$

Step 3. Determine response amplitude and time lag assuming no storage:

At $t_{L0}/\Delta t_c = 0.18$, we read from the Kamal-Brigham chart presented in Fig. 7.1:

$$\Delta p_D [t_L/\Delta t_c]^2 = 0.00285,$$

and thus from Eq. 7.4:

$$\Delta p_D = 0.088.$$

Also from Eq. 7.3:

$$\Delta p = (141.2)(q)(B)(0.088)/100 = 0.1242qB$$

Let us assume that we plan to pulse the well at the rate of 50 B/D and the formation volume factor, $B = 1$. Thus, the response amplitude without wellbore storage is given by:

$$\Delta p_0 = (0.1242)(50)(1) = 6.2 \text{ psi.}$$

Also from Fig. 7.1., we read $(t_L)_D/r_D^2 = 0.0962$ at $t_{L0}/\Delta t_c = 0.18$, and then used Eq. 7.5 to obtain:

$$\begin{aligned} t_{L0} &= \frac{(3792.2)(500)^2(0.0962)}{(5 \times 10^7)} = 1.824 \text{ hr} = 1.8 \text{ hr} \\ &= 108 \text{ minutes.} \end{aligned}$$

Step 4. Compute pulse cycle length and dimensionless pulse cycle length, and the pulse time:

The pulse cycle length is:

$$\Delta t_c = 1.8/0.18 = 10 \text{ hr.}$$

From Eq. 7.6, the dimensionless pulse cycle length is:

$$\frac{(\Delta t_c)_D}{r_D^2} = \frac{(2.637 \times 10^{-4})(100)(10)}{(2 \times 10^{-6})(500)^2} = 0.5274$$

and from Eq. 7.7, the pulse time:

$$t_p = (0.5)(10) = 5 \text{ hr.}$$

If the well had no wellbore storage, the design procedure would have ended here. Then we would have decided to pulse the well for about 5 hours, followed by another 5-hour shut-in period, and the expected response amplitude would be about 6.2 psi.

Step 5. Correct the response amplitude and time lag for wellbore Storage:

Because for this problem the skin factor, $s = 0$, the wellbore storage and skin coefficient, $C_D \exp(2s) = C_D$. To determine the pressure-response amplitude and time lag correction factors we follow the procedure presented in Section 6.2. Using the calculated $C_D \exp(2s) = 3.62 \times 10^4$, $C_D/r_D^2 = 0.016$, and $(\Delta t_c)_D/r_D^2 = 0.5274$, we read data points from the appropriate curves shown in Figs. 7.5 through 7.8. These data points span the ranges above and below the C_D/r_D^2 and $C_D \exp(2s)$ values of the test. Note that we could have

FIG. 7.5: RESPONSE AMPLITUDE CORRECTION FACTORS FOR PULSE-TEST DESIGN FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D / r_D^2 = 0.01$

FIG. 7.6: TIME LAG CORRECTION FACTORS FOR PULSE-TEST DESIGN FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/\tau_D^2 = 0.01$

FIG. 7.7: RESPONSE AMPLITUDE CORRECTION FACTORS FOR PULSE-TEST DESIGN FOR THE FIRST FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.02$

FIG. 7.8: TIME LAG CORRECTION FACTORS FOR PULSE-TEST DESIGN FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.02$

read these results from the tables of response amplitude and time lag correction factors displayed in Appendix D. For example, at $C_D/r_D^2 = 0.01$, from Fig. 7.5 we read the amplitude correction factors, $\Delta p/\Delta p_0$: 0.846, 0.810, 0.765, and 0.720 using the curves showing $C_D \exp(2s) = 10^2, 10^3, 10^4$, and 10^5 , respectively. The corresponding time lag correction factors were read from Fig. 7.6. In a similar manner the amplitude correction factors at $C_D/r_D^2 = 0.02$ were read from Fig. 7.7; the time lag correction factors at $C_D/r_D^2 = 0.02$ were obtained from Fig. 7.8. These results are listed in the third and fourth columns of Table 7.4.

Figure 7.9 was plotted with the amplitude correction factors from the third column of Table 7.4. Entering Fig. 7.9 with the wellbore storage and skin coefficient [$C_D \exp(2s)$] of 3.62×10^4 , we read the amplitude correction factors, $\Delta p/\Delta p_0 = 0.74$ from the curve showing $C_D/r_D^2 = 0.01$, and we obtained $\Delta p/\Delta p_0 = 0.507$ at $C_D/r_D^2 = 0.02$. These numbers are listed in the fifth column of Table 7.4. To obtain the required amplitude correction factor (i.e., the underlined number, 0.583), we calculated the logarithm of the values: $C_D/r_D^2 = 0.01, 0.016, 0.02$, and then interpolated linearly using $\Delta p/\Delta p_0 = 0.074$ and 0.507 as the dependent variables.

Figure 7.10 is a plot of the time lag correction factors (t_{L0}/t_L) listed in the fourth column of Table 7.4. The time lag correction factor was obtained by first reading the values of t_{L0}/t_L at $C_D \exp(2s) = 3.62 \times 10^4$ from the curves showing

TABLE 7.4

DATA FOR CROSS-PLOTTING THE CORRECTION FACTORS FOR A PULSE-TEST DESIGN NUMERICAL
EXAMPLE

		Tabulated Values		Interpolated Values	
(1)	(2)	(3)	(4)	(5)	(6)
C_D / r_D^2	$C_D \exp(2s)$	$\frac{\Delta p}{\Delta p_0}$	$\frac{t_{L0}}{t_L}$	$\frac{\Delta p}{\Delta p_0}$	$\frac{t_{L0}}{t_L}$
0.01	10^2	0.846	0.752		
	10^3	0.810	0.700		
	10^4	0.765	0.660		
	3.62×10^4			0.740	0.638
	10^5	0.720	0.625		
0.016	3.62×10^4			<u>0.583</u>	<u>0.576</u>
0.02	10^2	0.700	0.656		
	10^3	0.624	0.601		
	10^4	0.550	0.564		
	3.62×10^4			0.507	0.547
	10^5	0.482	0.534

FIG. 7.9: AMPLITUDE CORRECTION FACTORS CROSS-PLOT FOR THE NUMERICAL EXAMPLE ON PULSE-TEST DESIGN

FIG. 7.10: TIME LAG CORRECTION FACTORS CROSS-PLOT FOR THE NUMERICAL EXAMPLE ON PULSE-TEST DESIGN

$C_D/r_D^2 = 0.01, 0.02$ in Fig. 7.10, and then applying the same interpolation scheme as was done for the amplitude correction factors. Thus, the final correction factors are: $\Delta p/\Delta p_0 = 0.583$ and $t_{L0}/t_L = 0.576$. Hence from Eq. 7.8, the corrected amplitude:

$$\Delta p = (0.583)(6.2) = 3.61 \text{ psi,}$$

and the corrected time lag:

$$t_L = 1.8/0.576 = 3.1 \text{ hr.}$$

Step 6. Calculate the new ratio of time lag to pulse cycle length:

$$\frac{t_L}{\Delta t_c} = \frac{3.1}{10} = 0.31$$

Step 7. Verifying the design data: (1) the values, $t_{L0}/\Delta t_c = 0.18$ and $t_L/\Delta t_c = 0.31$ are within the range of the Kamal-Brigham correlations; (2) the expected amplitude of about 3.6 psi can easily be measured with the available pressure gauges, and (3) the pressure response profile that would be expected if there had been no wellbore storage is shown as a solid line in Fig. 7.11. It shows a typical pressure response without the spike-like amplitudes associated with long pulse times.

We conclude from this design exercise that the well can be pulse-tested at the rate of 50 B/D for about 5 hours, shut-in for another 5 hours and pulsed again. The expected pressure response amplitude from such a test will be about 3.6 psi and the time lag will be about 3 hours. The expected pressure response curve with wellbore storage present is shown as the dashed line in Fig. 7.11.

FIG. 7.11: PULSE RESPONSE PROFILES TO VERIFY THE NUMERICAL EXAMPLE ON PULSE-TEST DESIGN WITH WELLBORE STORAGE AND SKIN EFFECTS

7.2 ANALYSIS OF PULSE TESTS INFLUENCED BY WELLBORE STORAGE

Analyzing a pulse test involves the use of the pulse-test characteristics, i.e., the time lag and response amplitude, to determine the reservoir transmissivity ($T = kh/\mu$) and storativity ($S = \phi c_t h$). This problem may be stated slightly differently as follows. If we are given: estimates of wellbore storage coefficient (C), skin factor (s), interwell distance (r), wellbore radius (r_w), pulse rate (q) and the formation volume factor (B), and the time lag (t_L) and response amplitude Δp , which can be measured from the pressure response profile of the test, then we are required to determine the reservoir transmissivity and storativity.

The method of pulse-test analysis developed in this work is a two-pass iterative technique. In the first pass, we assume that there is no wellbore storage so that we can calculate preliminary approximate values of transmissivity and storativity. This step is essentially the same as the procedure presented by Kamal and Brigham [1973; 1975] for the analysis of pulse tests assuming no wellbore storage is present. (See Chapter 9 of Earlougher [1977] for details.) During the second pass, the estimates of storativity and transmissivity are used to compute approximate values of wellbore storage and skin coefficient, $C_D \exp(2s)$, and C_D/r_D^2 . Using these estimates of $C_D \exp(2s)$ and C_D/r_D^2 , the wellbore storage correction factors for amplitude and time lag can be determined. With the correction factors, the measured response amplitude and time lag are corrected for wellbore storage to obtain the expected amplitude (Δp_0) and the time lag (t_{L0}) that would have existed if there were no wellbore storage effects. We can now repeat the first pass to obtain new estimates of transmissivity and storativity. With

these apparent values of transmissivity and storativity, the estimates of the wellbore storage and skin coefficient are updated, and the correction for wellbore storage of the second pass repeated. The iteration procedure is continued until the transmissivity and storativity converge within a predefined tolerance. Usually the method will converge in about two to three iterations for a convergence criterion of about 2-percent relative deviation between two consecutive iterative values of transmissivity and storativity. The following is the detailed description of the proposed method.

7.2.1 Analysis Procedure

After obtaining pulse-test data that were significantly influenced by wellbore storage effects, the following steps can be used to determine the transmissivity and storativity of the reservoir*.

Step 1. Plot the pressure response profile and measure the amplitude (Δp) and time lag (t_L). Note that due to wellbore storage, the measured amplitude (Δp) will be lower than the expected amplitude (Δp_0). Also the measured time lag (t_L) will be higher than the expected time lag (t_{L0}).

Step 2. Set $t_{L0} = t_L$ and $\Delta p_0 = \Delta p$ to begin the first pass. That is, we assume that there is no wellbore storage, and then calculate the ratio, $t_{L0}/\Delta t_c$.

-----*

* Note: Like the case of pulse test design, the equations referred to in this section on pulse-test analysis are listed in Table 7.2.

- Step 3. Use $t_{L0}/\Delta t_c$ to determine Δp_D and $(t_{L0})_D/r_D^2$ from the appropriate chart shown in Fig. 6.6 through Fig. 6.9. (We can also use the tables presented in Appendix D).
- Step 4. Calculate the transmissivity ($T = kh/\mu$) from Eq. 7.3, and compute the storativity ($S = \phi c_e h$) from Eq. 7.5.
- Step 5. Compute wellbore storage and skin coefficient, $C_D \exp(2s)$ and C_D/r_D^2 using Eqs. 7.1 and 7.2.
- Step 6. Use the estimates of C_D/r_D^2 , $C_D \exp(2s)$ to determine the response amplitude and time lag correction factors ($\Delta p/\Delta p_0$ and t_{L0}/t_L) from the tables in Appendix D. Note that good cross-plots and/or appropriate interpolation algorithm must be used to obtain accurate correction factors. The determination of the correction factors, including the interpolation scheme and the method of cross-plotting, has been discussed in Section 6.2.

To start the iteration procedure, we assumed in Step 2 that no wellbore storage effects had existed and set $t_{L0} = t_L$, and $\Delta p = \Delta p_0$. This assumption enabled us to calculate preliminary estimates of transmissivity and storativity. However, after the first iteration, it is expected that t_{L0} will be different from t_L , and Δp_0 will be different from Δp . Recall that we measured the time lag (t_L) and the response amplitude (Δp) from the pressure-response curve. In contrast to the computed parameters, t_{L0} , Δp_0 , and $t_{L0}/\Delta t_c$ which vary from one iteration to the other, the measured parameters: t_L , Δp and $t_L/\Delta t_c$ are fixed throughout the iterative procedure. To correct the response amplitude and time lag for wellbore

storage, we must use the measured ratio, $t_L/\Delta t_c$ to read the tables or charts of the correction factors. On the other hand, we use the varying ratio, $t_{L0}/\Delta t_c$ which is computed for every iteration level, to read the Kamal-Brigham correlation charts.

We emphasize this point because when testing this procedure with engineers that were not familiar with the process, it was observed that a common mistake is to use $t_{L0}/\Delta t_c$ to read the charts or tables of the wellbore storage correction factors.

Step 7. Calculate new estimates of t_{L0} and Δp_0 using the interpolated correction factors. Note that at each level of iteration, we do not correct the old values of Δp_0 and t_{L0} . We always correct the storage-dominated values, i.e., the t_L and Δp measured from the pressure-response profile in Step 1.

Step 8. Compute a new estimate of $t_{L0}/\Delta t_c$ and then determine new apparent values of transmissivity and storativity.

Step 9. Check to see if the old and new estimates of transmissivity and storativity have converged within an allowable tolerance. If there is no convergence, repeat the correction process described in Steps 5 through 8.

A numerical example describing how to apply the proposed method of pulse-test analysis will now be presented.

7.2.2 Numerical Example on Pulse Test Analysis with Wellbore Storage

Assume that we have pulse-tested the reservoir whose approximate properties are listed in Table 7.3, and that the pressure response profile from the test is shown in Fig. 7.12. We wish to analyze the

FIG. 7.12: PRESSURE-RESPONSE CURVE FOR THE NUMERICAL EXAMPLE ON PULSE-TEST ANALYSIS WITH WELLBORE STORAGE.

first pulse (peak). In the following worked example, we shall follow the step-by-step procedure described in the foregoing sub-sections. The equations referred to in this worked example are listed in Table 7.2.

Step 1. Measure the amplitude (Δp) and time lag (t_L) from the pressure response curve:

From Fig. 7.12, $\Delta p = 3.64$ psi; $t_L = 3.2$ hr, and $\Delta t_c = 10$ hr.

Step 2. Determine $t_{L0}/\Delta t_c$ assuming no wellbore storage effects:

That is, if $C_D = 0$ and $s = 0$, then $t_{L0} = t_L = 3.2$ hr, and $\Delta p_0 = \Delta p = 3.64$ psi. Thus:

$$t_{L0}/\Delta t_c = 3.2/10 = 0.32.$$

Step 3. Determine Δp_D and $[(t_L)_D/r_D^2]$:

Using the Kamal-Brigham charts shown in Fig 7.1 and the computed ratio, $t_{L0}/\Delta t_c = 0.32$, we read:

$$[(t_L)_D/r_D^2] = 0.095 \text{ and } \Delta p_D [t_L/\Delta t_c]^2 = 0.0032.$$

Equation 7.4 provides:

$$\Delta p_D = 0.0311.$$

Step 4. Calculate transmissivity and storativity:

From Eq. 7.3, the transmissivity ($T = kh/\mu$) is given by:

$$\begin{aligned} T &= \frac{(141.2)(50)}{\Delta p_0} \Delta p_D = 7060(\Delta p_D)/\Delta p_0 \quad (7.10)^* \\ &= (7060)(0.0311)/(3.64) = 60.3 \approx 60 \text{ md ft/cp.} \end{aligned}$$

From Eq. 7.5, the ratio of transmissivity to storativity is:

$$\begin{aligned} \frac{T}{S} &= \frac{(3792.2)(500)}{t_{L0}} [(t_L)_D/r_D^2] \\ &= \frac{9.4805 \times 10^8}{t_{L0}} [(t_L)_D/r_D^2] \quad (7.11)^* \end{aligned}$$

Thus from Eq. 7.11:

$$\frac{T}{S} = (9.4805)(10^8)(0.095)/(3.2) = 2.81 \times 10^7$$

and the storativity is given by:

$$S = \frac{60}{2.81 \times 10^7} = 2.14 \times 10^{-6} \text{ ft/psi.}$$

-----*

* Note: Equations 7.10 and 7.11 will be used in subsequent iterations to calculate transmissivity, T , and the ratio, $\frac{T}{S}$, respectively.

Step 5. Determine the wellbore storage and skin coefficient:

Equation 7.1 (from Table 7.2) provides:

$$C_D = \frac{(5.615)(0.009)}{(2\pi)(0.333)^2 S} = 7.239 \times 10^{-2}/S \quad (7.12)^*$$

Thus, from Eq. 7.12:

$$C_D = (7.239 \times 10^{-2}) / (2.14 \times 10^{-6}) = 3.39 \times 10^4.$$

And Eq. 7.2 yields:

$$C_D / r_D^2 = (3.39 \times 10^4) / (1500)^2 = 0.015.$$

Because the skin factor, $s = 0$, then $C_D \exp(2s) = C_D$ and so $C_D \exp(2s) = 3.39 \times 10^4$.

Step 6. Correct the measured amplitude and time lag for wellbore storage and skin effects:

The second pass includes the correction of the measured amplitude and time lag for wellbore storage effects. Using the suggestions presented in Section 6, the response-amplitude and time lag correction factors for the first iteration were determined in the following manner. For example, at $t_L / \Delta t_c = 0.32$ and $C_D / r_D^2 = 0.01$, the response-amplitude correction factors $\Delta p / \Delta p_0 = 0.794, 0.762, 0.729$ and 0.695 were read from Fig. 7.13a using the curves showing $C_D \exp(2s) = 10^2, 10^3, 10^4$, and 10^5 , respectively. The corresponding set of time lag correction factors t_{L0} / t_L were read from Fig. 7.13b.

* Note: We shall use Eq. 7.12 in the second and subsequent iterations in this analysis.

FIG. 7.13a: RESPONSE AMPLITUDE CORRECTION FACTORS FOR PULSE-TEST ANALYSIS FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.01$

FIG. 7.13b: TIME LAG CORRECTION FACTORS FOR PULSE-TEST ANALYSIS FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.01$

These results are listed in the third and fourth columns of Table 7.5. In the case of $C_D/r_D^2 = 0.02$, the amplitude correction factors were obtained from Fig. 7.14a, and the time lag correction factors determined from Fig. 7.14b. In a similar fashion, the amplitude correction factors for the case of $C_D/r_D^2 = 0.04$ were read from Fig. 7.15a, and the time lag correction factors obtained from Fig. 7.15b. The amplitude correction factors listed in the third column of Table 7.5 are cross-plotted in Figure 7.16a.

For the first iteration, we used the estimate of $C_D \exp(2s) = 3.39 \times 10^4$ to read (Fig. 7.16a) the amplitude correction factors $\Delta p/\Delta p_0 = 0.711, 0.538, \text{ and } 0.359$ from the curves labelled $C_D/r_D^2 = 0.01, 0.02, \text{ and } 0.04$, respectively. In short, we have used the cross-plot (Fig. 7.16a) to perform the first interpolation with $C_D \exp(2s)$ as the independent variable and $\Delta p/\Delta p_0$ as the dependent variable. Figure 7.16b was plotted using the time lag correction factors listed in the fourth column of Table 7.5. We also read the time lag correction factors $t_{L0}/t_L = 0.648, 0.545, \text{ and } 0.444$ from Fig. 7.16b using the curves labelled $C_D/r_D^2 = 0.01, 0.02, \text{ and } 0.04$, respectively. Note that to obtain these data points, we used the estimate of $C_D \exp(2s) = 3.39 \times 10^4$ to read Figs. 7.16a and 7.16b. The interpolated amplitude and time lag correction factors are listed as the underlined numbers in the fifth and sixth columns of Table 7.5, respectively; the results are also cross-plotted in Fig. 7.17.

TABLE 7.5

DATA FOR CROSS-PLOTTING THE CORRECTION FACTORS FOR A PULSE-TEST ANALYSIS NUMERICAL
EXAMPLE

(1)	(2)	<u>Tabulated Values</u>		<u>Interpolated Values</u>	
		(3)	(4)	(5)	(6)
C_D/r_D^2	$C_{Dexp}(2s)$	$\frac{\Delta p}{\Delta p_0}$	$\frac{t_{L0}}{t_L}$	$\frac{\Delta p}{\Delta p_0}$	$\frac{t_{L0}}{t_L}$
0.01	10^2	0.794	0.761		
	10^3	0.762	0.708		
	10^4	0.729	0.665		
	3.39×10^4			0.711	0.648
	10^5	0.695	0.630		
<u>0.015</u>	<u>3.39×10^4</u>			<u>0.610</u>	<u>0.587</u>
0.02	10^2	0.652	0.671		
	10^3	0.604	0.608		
	10^4	0.559	0.560		
	3.39×10^4			0.538	0.545
	10^5	0.520	0.522		
0.04	10^2	0.492	0.579		
	10^3	0.432	0.511		
	10^4	0.380	0.467		
	3.39×10^4			0.359	0.444
	10^5	0.345	0.434

FIG. 7.14a: RESPONSE AMPLITUDE CORRECTION FACTORS FOR PULSE-TEST ANALYSIS FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.02$

FIG. 7.14b: TIME LAG CORRECTION FACTORS FOR PULSE-TEST ANALYSIS FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.02$

FIG. 7.15a: RESPONSE AMPLITUDE CORRECTION FACTORS FOR PULSE-TEST ANALYSIS FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D / r_D^2 = 0.04$

FIG. 7.15b: TIME LAG CORRECTION FACTORS FOR PULSE-TEST ANALYSIS FOR THE FIRST PEAK (EVEN) PULSE WITH $F' = 0.5$ AND $C_D/r_D^2 = 0.04$

FIG. 7.16a: RESPONSE AMPLITUDE CORRECTION FACTORS CROSS-PLOT

FIG. 7.16b: TIME LAG CORRECTION FACTORS CROSS-PLOT

FIG. 7.16: CROSS-PLOTS OF RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS FOR THE FIRST ITERATION OF THE NUMERICAL EXAMPLE ON PULSE-TEST ANALYSIS WITH $P' = 0.5$

FIG. 7.17: INTERPOLATION OF AMPLITUDE AND TIME LAG CORRECTION FACTORS WITH RESPECT TO C_D/r_D^2 FOR THE FIRST ITERATION OF PULSE-TEST ANALYSIS

Upon entering Fig. 7.17 with the C_D/r_D^2 estimated for the first iteration of the analysis (i.e., $C_D/r_D^2 = 0.015$), we read the response amplitude correction factor, $\Delta p/\Delta p_0 = 0.610$, and the time lag correction factor, $t_{L0}/t_L = 0.587$. These numbers are underlined in Table 7.5. Therefore, for the first iteration the interpolated correction factors are: $\Delta p/\Delta p_0 = 0.610$ and $t_{L0}/t_L = 0.587$.

Step 7. Estimate new values of Δp_0 and t_{L0} from Δp and t_L :

From Eq. 7.8, the response amplitude expected if no wellbore storage had existed is:

$$\begin{aligned}\Delta p_0 &= \Delta p / [\Delta p/\Delta p_0] \text{ This Model} \\ &= 3.64/0.61 = 5.967 \text{ psi.}\end{aligned}$$

and from Eq. 7.9, the expected time lag is:

$$\begin{aligned}t_{L0} &= t_L [t_{L0}/t_L] \text{ This Model} \\ &= (3.2)(0.587) = 1.878 \text{ hr.}\end{aligned}$$

Step 8. Update the apparent values of $t_{L0}/\Delta t_c$, T and S :

$$t_{L0}/\Delta t_c = 1.878/10 = 0.1878$$

Using the Kamal-Brigham chart (Fig. 7.1), we read:

$$\begin{aligned}\Delta p[t_L/\Delta t_c]^2 &= 0.002925 \\ [(t_L)_D/r_D^2] &= 0.0966\end{aligned}$$

Equation 7.4 provides:

$$\Delta p_D = 0.002925/(0.1878)^2 = 0.0829$$

Therefore, from Eq. 7.10, the transmissivity is given by:

$$T = (7060)(0.0829)/5.967 = 98.1 \approx 98 \text{ md ft/cp}$$

and Eq. 7.11 provides:

$$\frac{T}{S} = (9.4805 \times 10^8)(0.0966)/1.878 = 4.877 \times 10^7$$

Hence, the storativity is:

$$S = 98/4.877 \times 10^7 = 2.01 \times 10^{-6} \text{ ft/psi.}$$

Step 9. Check for convergence after the first iteration:

For transmissivity, T:

Previous value of transmissivity, $T_{old} = 60 \text{ md ft /cp}$

New estimate of transmissivity, $T_{new} = 98 \text{ md ft /cp}$

Relative deviation = $[(98 - 60)/98] \times 100 = 39 \%$

For storativity, S:

Previous value of storativity, $S_{old} = 2.14 \times 10^{-6} \text{ ft/psi}$

New estimate of storativity, $S_{new} = 2.01 \times 10^{-6} \text{ ft/psi}$

Relative deviation = $[(2.14 - 2.01)/2.01] \times 100 = 6.5 \%$

Assuming that we are using a 5-percent convergence criterion, neither the transmissivity (T) nor the storativity (S) has converged and so we must perform another iteration.

The results obtained during the first four steps of the second iteration are summarized in Table 7.6. Let us continue from the fifth

TABLE 7.6

THE FIRST FOUR STEPS OF THE SECOND ITERATION OF PULSE TEST
ANALYSIS NUMERICAL EXAMPLE

STEP	DESCRIPTION	COMPUTED VALUES	REMARKS
1	Measure Δp and t_{L0}	$\Delta p = 3.64 \text{ psi}$ $t_{L0} = 3.2 \text{ hr}$	From Step 1 of the 1st iteration
2	Determine t_{L0}	$t_{L0} = 1.878 \text{ hr}$	From Step 1 of 1st iteration
3	Obtain $t_{L0}/\Delta t_c$	$t_{L0}/\Delta t_c = 1.878/10$ $= 0.1878$	
4	Calculate T and S	$T = 98 \text{ md ft/cp}$ $S = 2.01 \times 10^{-6} \text{ ft/psi}$	From Step 8 of 1st iteration

step of the second iteration and follow the step-by-step format established previously.

Step 5. Determine Wellbore Storage and Skin coefficient:

Using the estimates of T and S listed in Table 7.6, we can calculate from Eq. 7.12:

$$\begin{aligned}C_D &= 7.239 \times 10^{-2}/S \\&= 7.239 \times 10^{-2}/(2.01 \times 10^{-6}) \\&= 3.602 \times 10^4.\end{aligned}$$

But skin factor, $s = 0$. Hence $C_D \exp(2s) = C_D = 3.602 \times 10^4$ and:

$$C_D/r_D^2 = (3.602 \times 10^4)/(1500)^2 = 0.016.$$

Step 6. Determine the amplitude and time lag correction factors:

Because the $C_D \exp(2s)$ and C_D/r_D^2 estimated in the Step 6 are still within the range covered by the cross-plots made during the first iteration (i.e., Figs. 7.16a, and 7.16b) there is no need to graph any new cross-plots. To determine the correction factors, we enter Figs. 7.16a and 7.16b with $C_D \exp(2s) = 3.602 \times 10^4$ (i.e., the newly computed wellbore storage coefficient), and then read the corresponding amplitude and time lag correction factors. If these results are cross-plotted, as was done in Fig 7.17 and indicated in Table 7.5 during the first iteration, we will obtain $\Delta p/\Delta p_0 = 0.590$ and $t_{L0}/t_L = 0.573$ as the wellbore storage correction factors. These values compare with $\Delta p/\Delta p_0 = 0.610$ and $t_{L0}/t_L = 0.587$ found in the first iteration. Thus it is clear that the iterative process converges rapidly.

Step 7. Estimate new values of Δp_0 and t_{L0} :

Use Eq. 7.8 to obtain:

$$\Delta p_0 = 3.64/0.59 = 6.17 \text{ psi}$$

and Eq. 7.9 provides:

$$t_{L0} = (3.2)(0.573) = 1.834 \text{ hr.}$$

Let us use this worked example to emphasize the point we have made earlier: we have corrected Δp and t_L , two parameters measured in Step 1 (i.e., $\Delta p = 3.64$ psi and $t_L = 3.2$ hr). We did not correct Δp_0 (i.e., 5.976 psi) and t_{L0} (1.878 hr) calculated from the previous iteration.

Step 8. Update the approximate values of $t_{L0}/\Delta t_c$, T and S :

Using the last estimate of t_{L0} provides:

$$t_{L0}/\Delta t_c = 1.834/10 = 0.1834$$

If we enter the Kamal-Brigham chart shown in Fig. 7.1 with this ratio, $t_{L0}/\Delta t_c = 0.1834$, we read:

$$\Delta p[t_L/\Delta t_c]^2 = 0.00288$$

and:

$$[(t_L)_D/r_D^2] = 0.0964$$

Hence:

$$\Delta p_D = 0.0856 \text{ (from Eq. 7.4)}$$

Equation 7.10 provides the new value of transmissivity:

$$\begin{aligned} T &= (7060)(0.0856)/(6.17), \text{ (from Eq. 7.10)} \\ &= 98.3 \text{ md ft/cp} \end{aligned}$$

and the storativity is given by:

$$\begin{aligned} S &= 98.3/[(9.4805 \times 10^8)(0.0964)/1.834] \\ &= 1.97 \times 10^{-6} \text{ ft/psi.} \end{aligned}$$

Step 9. Check for convergence of T and S for the second iteration:

For transmissivity, T:

Previous value of transmissivity, $T_{old} = 98.1$ md ft/cp

New estimate of transmissivity, $T_{new} = 98.3$ md ft/cp

Relative deviation < 1%

For storativity, S:

Previous value of storativity, $S_{old} = 2.01 \times 10^{-6}$ ft/psi

New estimate of storativity, $S_{new} = 1.97 \times 10^{-6}$ ft/psi

Relative deviation between S_{old} and $S_{new} = 2\%$

After the second iteration we can terminate the analysis and conclude that the transmissivity of this reservoir is approximately equal to 98 md ft/cp and storativity is about 2×10^{-6} ft/psi.*

7.2.3 Use of Lagrange Interpolation as an Alternative to Cross-plots

To obtain the response-amplitude and time lag correction factors, the method of cross-plots was suggested in Section 6, it has been applied in the foregoing numerical examples. However, for the purpose of computer or hand-held calculator implementation of the proposed methods for analyzing and/or designing pulse tests, the 3-point or 4-point Lagrange interpolation algorithm seems to work well. This interpolation scheme may be used as an alternative to the method of cross-plotting. The Lagrange interpolation formulae [Wyllie, 1975] are:

1. Interpolating at x with 3 pairs of points $(x_1, y_1; x_2, y_2; x_3, y_3)$:

$$f(x) = \frac{(x - x_2)(x - x_3)}{(x_1 - x_2)(x_1 - x_3)} f(x_1) - \frac{(x - x_1)(x - x_3)}{(x_1 - x_2)(x_2 - x_3)} f(x_2) + \frac{(x - x_1)(x - x_2)}{(x_1 - x_3)(x_2 - x_3)} f(x_3) \quad (7.13)$$

* Note: A computer program implementing the proposed method for analyzing and designing pulse-tests is shown in Appendix F.4.

2. For 4 pairs of points $(x_1, y_1; x_2, y_2; x_3, y_3; x_4, y_4)$, we use:

$$\begin{aligned}
 f(x) = & \frac{(x - x_2)(x - x_3)(x - x_4)}{(x_1 - x_2)(x_1 - x_3)(x_1 - x_4)} f(x_1) \\
 & - \frac{(x - x_1)(x - x_3)(x - x_4)}{(x_1 - x_2)(x_2 - x_3)(x_2 - x_4)} f(x_2) \\
 & + \frac{(x_1 - x)(x_2 - x)(x_4 - x)}{(x_1 - x_3)(x_2 - x_3)(x_3 - x_4)} f(x_3) \\
 & - \frac{(x - x_1)(x - x_2)(x - x_3)}{(x_1 - x_4)(x_2 - x_4)(x_3 - x_4)} f(x_4)
 \end{aligned} \tag{7.14}$$

Recall that the suggested procedure for determining the wellbore storage correction factors involves reading the correction factors from the appropriate charts or tables, and then interpolating with the aid of cross-plots. For example, for a fixed value of C_D/r_D^2 , we interpolate using $\Delta p/\Delta p_0$ and t_{L0}/t_L as the dependent variables and the logarithmic values of $C_D \exp(2s)$ as the independent variables. This step is analogous to making the cross-plots shown in Figs. 7.16a and 7.16b. Instead of making those cross-plots, we could have calculated the logarithm of $C_D \exp(2s)$ and then applied one of the Lagrange formulae, say, Eq. 7.14 to perform the interpolation at each C_D/r_D^2 . Table 7.7 uses some of the data presented earlier in Table 7.5 to illustrate the Lagrange interpolation scheme. Compare the response amplitude correction factors, obtained by cross-plotting and shown in the fifth column of Table 7.7, with those calculated from the Lagrange interpolation formulae (marked with asterisks) and displayed in the sixth column of Table 7.7. The seventh and eighth columns of Table 7.7

compare the time lag correction factors obtained by cross-plotting with those calculated using the Lagrange interpolation formulae, e.g., Eqs. 7.13 and 7.14. The data comparison presented in Table 7.7 clearly shows that the Lagrange interpolation scheme is a good alternative to the method of cross-plotting.

The Lagrange interpolation equations (Eqs. 7.13 and 7.14) are implemented in the computer program for the design and analysis of pulse tests shown in Appendix E.4.

TABLE 7.7

COMPARISON OF THE RESULTS OBTAINED BY LAGRANGE INTERPOLATION
WITH THOSE OBTAINED BY METHOD OF CROSS-PLOTTING

(1)	(2)	Tabulated Values		(5) X-plot	Interpolated Values		(8)
		(3)	(4)		(6)	(7)	
		$\frac{\Delta p}{\Delta p_0}$	$\frac{t_{L0}}{t_L}$	$\frac{\Delta p}{\Delta p_0}$	Lagrange $\frac{\Delta p}{\Delta p_0}$	X-plot $\frac{t_{L0}}{t_L}$	Lagrange $\frac{t_{L0}}{t_L}$
0.010	10^2	0.794	0.761				
	10^3	0.762	0.708				
	10^4	0.729	0.665				
	3.39×10^4			0.711	0.710*	0.648	0.649*
	10^5	0.695	0.630				
<u>0.015</u>	<u>3.39×10^4</u>			<u>0.610</u>	<u>0.612*</u>	<u>0.587</u>	<u>0.584*</u>
0.020	10^2	0.652	0.671				
	10^3	0.604	0.608				
	10^4	0.559	0.560				
	3.39×10^4			0.538	0.541*	0.545	0.541*
	10^5	0.520	0.522				

* Note: (1) numbers with asterisk (*) are calculated using Lagrange Interpolation formulae similar to Eqs. 7.13 and 7.14.

(2) The underlined numbers are obtained after performing the second interpolation or cross-plotting.

8. CONCLUSIONS

The mathematical equations which describe the pressure response in an interference test were derived in this study. These equations take into account the effects of wellbore storage and skin at both responding and pulsing wells. The superposition of the pressure response equations with respect to time provided the mathematical model to study pulse testing with wellbore storage and skin effects. The equations apply to a homogeneous, infinitely large reservoir.

Numerical solutions to the pressure response equations were used to calculate the time lag and response amplitude for numerous cases which considered the influence of wellbore storage at either the pulsing well or the responding well. New techniques were proposed for correcting pulse test data for wellbore storage effects.

One unique feature of this study is that the proposed wellbore storage correction methods use the existing correlations presented by Kamal and Brigham [1976]. As a result of this continuity, those well test analysts already familiar with the existing pulse-test correlations will have little difficulty applying the proposed methods to the design and analysis of pulse tests.

The following conclusions can be drawn from the results of this study:

1. The effect of wellbore storage at the pulsing well and/or responding well is to reduce the expected response amplitude and to increase the time lag. Qualitatively, it was shown in

this work that the problem of amplitude attenuation and time lag inflation is more severe when the wellbore storage effects are active at both wells than when wellbore storage is present only in one well. The effect is greater than the multiple of the two individual storage values.

2. New techniques proposed for correcting pulse-test data for wellbore storage involve the use of the amplitude ratio $(\Delta p/\Delta p_0)$ and the time lag ratio t_{L0}/t_L . With these correction factors the attenuated amplitude and the inflated time lag can be corrected to within 2-3 percent of their expected values.

3. For the analysis of pulse tests, the curves (or tables) relating $(\Delta p/\Delta p_0)$ to $(t_L/\Delta t_c)$ should be used to correct the response amplitude for wellbore storage. The time lag wellbore storage correction curves relate t_{L0}/t_L to $(t_L/\Delta t_c)$. To use these tables, it is necessary to interpolate between values presented and to iterate on the values calculated. Interpolation can be accomplished either by cross-plotting or by using Lagrange formulae. Only two to three iterations are necessary for the process to converge.

4. In designing pulse tests, the curves (or tables) which relate $(\Delta p/\Delta p_0)$ to $(\Delta t_c)_D/r_D^2$, and t_{L0}/t_L to $(\Delta t_c)_D/r_D^2$, should be used for wellbore storage corrections.

5. To use the correction techniques proposed in this study, one also needs the Kamal-Brigham correlation curves. These curves have been recalculated and are plotted in this study. These new

curves are more accurate and should be used for the interpretation of pulse tests.

6. The solution to the equation derived for interference testing (Eq. 3.49) indicates that exactly the same pressure response will be observed at the responding well irrespective of the location at which the wellbore storage and skin are acting. As a consequence of this reciprocity principle, only one set of wellbore storage correction curves is needed for analyzing pulse tests whether wellbore storage is active at the responding well or at the pulsing well.
7. The results of this study show that the combination of dimensionless storage constant (C_D) and the skin factor (s) into one variable, $C_D \exp(2s)$, seems to work very well.
8. If wellbore storage is present in one well, four groups of dimensionless variables (C_D/r_D^2 , $C_D \exp(2s)$, $(\Delta t_c)_D/r_D^2$, and F') are required to compute the time lag and the response amplitude of pulse tests. However, if wellbore storage is operating at both wells, six groups of dimensionless variables [C_{D1}/r_D^2 , C_{D2}/r_D^2 , $C_{D1} \exp(2s_1)$, $C_{D2} \exp(2s_2)$, $(\Delta t_c)_D/r_D^2$, and F'] are required. We attempted to reduce the number of dimensionless variables for the case of wellbore storage in two wells without success.

9. RECOMMENDATIONS

As mentioned earlier, the mathematical equations derived in this study can model pulse testing or interference testing which takes into account the existence of wellbore storage effects in one well or in both wells. However, the results presented in this study are valid only for the conditions where the storage mechanism is active in one well. Future research might include storage in the two wells. Such a project might consider using the equations derived in this study to compute and compare the correction factors for the storage in both wells with the correction factors presented in this work. By applying statistical methods, e.g. regression techniques, it may be possible to derive the multipliers with which to determine the correction factors of two-well storage case from the one-well storage case.

Even though we could have applied the equations derived in this work to generate the correction factors for the case of negative skin, we have not done so. The extension of the wellbore storage correction technique to include negative skin factor is recommended as a project for the future.

As shown by Kamal and Brigham [1975, 1976], pulse tests can be run without assuming equal pulse and shut-in periods. That is, we can run a pulse test with a pulse cycle ratio other than $F' = 0.5$. Consequently, we will need the wellbore storage correction factors for the other pulse ratios. Note that the wellbore storage correction factors presented in this study are valid for a pulse ratio of 0.5 only. As a project for further research, we recommend that our computer program be used to produce the necessary wellbore storage correction factors for other

useful pulse ratios, such as $F' = 0.3, 0.4, 0.6$ and 0.7 . We have already presented the Kamal-Brigham charts (Figs. 6.6. through 6.9) to accompany the wellbore storage correction factors for these pulse ratios.

Finally, the computer program developed in this study is a general purpose program that can be applied to the study of pulse testing in other systems. The only modification will be to include a subroutine to calculate the pressure response equations of the particular system of interest. For example, horizontal pulse testing in fractured reservoirs and vertical pulse testing with wellbore storage and skin effects are obvious areas of application.

10. NOMENCLATURE

B	= formation volume factor, Res bbl/STB
c	= compressibility, psi^{-1}
c_t	= total system isothermal compressibility, psi^{-1}
C	= wellbore storage constant, bbl/psi
C_D	= dimensionless wellbore storage constant
F'	= ratio of pulse length to total cycle-length
h	= formation thickness
k	= effective formation permeability
K_0	= modified Bessel function of the second kind, zero order
K_1	= modified Bessel function of the second kind, and first order
N	= total number of pulse periods and shut-in periods from the start of pulse testing
$p(r,t)$	= reservoir pressure, psi
p_D	= dimensionless pressure drop on formation side of skin effect, Eq. 3.2
$\bar{p}_D$	= Laplace transform of p_D
p_i	= initial reservoir pressure, psi
p_{rspD}	= dimensionless pressure response at the responding well, Eq. 3.54
p_{wD}	= dimensionless pressure drop at the wellbore, Eq. 3.13
$\bar{p}_{wD}$	= Laplace transform of p_{wD}
p_{wf}	= flowing well bottom-hole pressure, psi
Δp	= pressure-response amplitude, psi, Eq. 3.69
Δp_D	= dimensionless pressure-response amplitude
Δp_{skin}	= pressure drop due to skin effect at the responding or pulsing well, psi

q	=	surface flow rate, bbl/D
q_a	=	wellbore depletion rate, bbl/D
q_{sf}	=	sandface flow rate, bbl/D
r	=	radial distance, ft
r_j	=	radial distance from the responding well or pulsing well to any other location
r_D	=	dimensionless distance between the responding and pulsing wells, r/r_w
r_{Dj}	=	dimensionless distance from the responding well or pulsing well to any other location
r_w	=	wellbore radius, ft
r_{w1}	=	responding well radius, ft
r_{w2}	=	pulsing well radius, ft
s_1	=	skin effect at the responding well
s_2	=	skin effect at the pulsing well
S	=	storativity or storage capacity, $\phi c_t h$, ft/psi
t	=	time, hr
t_D	=	dimensionless time, Eq. 3.3
t_L	=	response time lag, hr
$(t_L)_D$	=	dimensionless response time lag, Eq. 3.66
Δt_c	=	total pulse cycle length (time), hr
$(\Delta t_c)_D$	=	dimensionless total pulse cycle length, Eq. 3.61
Δt_p	=	pulse length or pulse period (time), hr
Δt_{pD}	=	dimensionless pulse length or pulse period, Eq. 3.60
T	=	transmissivity, kh/μ , md-ft/cp

l = variable of Laplace transform
 μ = viscosity, cp
 ϕ = porosity, fraction of bulk volume

Subscripts

c = cycle
 D = dimensionless quantity
 i = initial condition
 j = well, $j=1$ at responding well; $j=2$ at pulser
 m = pulse index number
 $rspD$ = dimensionless response quantity
 sf = condition at sandface
 w = wellbore condition
 wf = flowing wellbore condition
 0 = No wellbore storage condition ($C_D = 0$)
 1 = responding well
 2 = pulsing well

Superscripts

$-$ = quantity transformed into Laplace space,
e.g., $\bar{p}_D$ is the dimensionless pressure drop in Laplace space

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APPENDIX A

DERIVATIONS OF EQUATIONS

Appendix A.1: DERIVATION OF THE DIFFUSIVITY EQUATION FOR RADIAL FLOW IN A POROUS MEDIUM

In Appendix A.1, we shall combine the law of conservation of mass (i.e., the continuity equation) with a transport equation (e.g., Darcy's Law) and an equation of state to derive the diffusivity equation for radial flow.

A.1.1 The Continuity Equation--Conservation of Mass

If we perform a mass balance on the elemental volume shown in Fig. A-1, we can obtain the continuity equation for radial flow in a porous medium. (See Matthews and Russell, 1967 for details.) The continuity equation is:

$$\frac{1}{r} \frac{\partial}{\partial r} (r \rho u_r) = - \frac{\partial}{\partial t} (\phi \rho) \quad (\text{A.1.1})$$

where u_r is the Darcy's volumetric rate of flow per unit cross-sectional area, ϕ is the porosity of the porous medium, and ρ is the fluid density. Note that subscript r denotes flow in the radial direction.

Fig. A-1: An Elemental Volume for the Continuity Equation for Radial Flow. (After Matthews and Russell, 1967)

A.1.2 Transport Equation

The most widely used transport equation for the flow of fluids in a porous medium is based on the classical experiment of Darcy [1856]. Darcy's Law expresses the relationship between the volumetric flow rate per unit cross sectional area at any point in a porous medium and the potential gradient in the direction of flow at that point.

If we neglect gravitational forces, then we can write Darcy's Law for radial flow in terms of the volumetric flow rate per unit cross sectional area and the the pressure gradient in the direction of flow [Hubbert, 1956]. That is:

$$u_r = - \frac{k_r \partial p}{\mu_r \partial r} \quad (A.1.2)$$

In Eq. A.1.2, k_r denotes the absolute permeability of the medium and μ is the viscosity of the fluid.

A.1.3 Equation of State

For a single-phase liquid flow, the equation of state can be obtained from the isothermal compressibility of the fluid which is defined as:

$$c = - \frac{1}{V} \left(\frac{\partial V}{\partial p} \right)_T = \frac{1}{\rho} \left(\frac{\partial \rho}{\partial p} \right)_T \quad (A.1.3)$$

where p is pressure, T is temperature, V is the volume of the fluid and ρ is the density of the fluid.

If we assume that the compressibility, c , is constant and integrate Eq. A.1.3, then we can write:

$$\rho = \rho_0 e^{c(p - p_0)} \quad (A.1.4)$$

Note that ρ_0 is the fluid density at a specified reference pressure, p_0 .

Differentiating Eq. A.1.4:

$$\frac{1}{\rho} \frac{\partial \rho}{\partial r} = c \frac{\partial p}{\partial r} \quad (A.1.5)$$

and:

$$\frac{1}{\rho} \frac{\partial \rho}{\partial t} = c \frac{\partial p}{\partial t} \quad (A.1.6)$$

Let us now combine Eqs. A.1.1 through A.1.6 to derive the diffusivity equation. Substituting Eq. A.1.2 into Eq. A.1.1 yields:

$$\frac{1}{r} \frac{\partial}{\partial r} \left(\frac{r \rho k_r \partial p}{\mu \partial r} \right) = \frac{\partial}{\partial t} (\phi \rho) \quad (A.1.7)$$

Expanding Eq. A.1.7 provides:

$$\begin{aligned} \frac{1}{r} \left[\frac{\rho k_r}{\mu} \frac{\partial p}{\partial r} + \frac{r k_r}{\mu} \frac{\partial \rho}{\partial r} \frac{\partial p}{\partial r} + \frac{r \rho k_r}{\mu} \frac{\partial}{\partial r} \left(\frac{\partial p}{\partial r} \right) + r \rho \frac{\partial}{\partial r} \left(\frac{k_r}{\mu} \right) \frac{\partial p}{\partial r} \right] \\ = \phi c \frac{\partial p}{\partial t} + \rho \frac{\partial \phi}{\partial t} \end{aligned} \quad (A.1.8)$$

Noting (by the chain rule) that:

$$\frac{\partial \phi}{\partial t} = \phi \left(\frac{1}{\phi} \frac{\partial \phi}{\partial p} \right) \frac{\partial p}{\partial t} \quad (\text{A.1.9})$$

and defining the pure rock compressibility as, $c_f = \frac{1}{\phi} \frac{\partial \phi}{\partial p}$, then we can express Eq. A.1.9 as:

$$\frac{\partial \phi}{\partial t} = \phi c_f \frac{\partial p}{\partial t} \quad (\text{A.1.10})$$

If we substitute Eqs. A.1.5, A.1.6 and A.1.10 into Eq. A.1.8 and divide the result by ρ , we get:

$$\frac{1}{r} \left[\frac{k_r}{\mu} \frac{\partial p}{\partial r} + \frac{rk_r}{\mu} c \left(\frac{\partial p}{\partial r} \right)^2 + \frac{rk_r}{\mu} \frac{\partial}{\partial r} \left(\frac{\partial p}{\partial r} \right) + r \frac{\partial}{\partial r} \left(\frac{k_r}{\mu} \right) \frac{\partial p}{\partial r} \right] = \phi c_t \frac{\partial p}{\partial t} \quad (\text{A.1.11})$$

where $c_t = c + c_f$ is the total effective system compressibility. (Note that c is the fluid compressibility).

If we assume: (1) constant viscosity, (2) constant permeability, and (3) small and constant compressibility, in which case the terms containing $\left(\frac{\partial p}{\partial r} \right)^2$ can be neglected, then Eq. A.1.11 can be rearranged to obtain:

$$\frac{\partial^2 p}{\partial r^2} + \frac{1}{r} \frac{\partial p}{\partial r} = \frac{\phi \mu c_t}{k} \frac{\partial p}{\partial t} \quad (\text{A.1.12})$$

Equation A.1.12 is the same as Eq. 3.1 in the main text of this thesis.

APPENDIX A.2: DETERMINATION OF THE LIMITING VALUES OF r_{D1} AND r_{D2}

In this section, we shall use the system coordinate geometry (Fig. A-2) to derive the equations showing the limiting values of r_{D1} and r_{D2} .

Fig. A-2: SYSTEM COORDINATE GEOMETRY

Assuming that the wellbore radius of the responding well is equal to the wellbore radius of the pulsing well, that is $r_{w1} = r_{w2} = r_w$, and then applying the cosine law to Fig. A-2 provides:

$$r_{D1}^2 = r_D^2 + r_{D2}^2 - 2r_D r_{D2} \cos \theta_2 \quad (\text{A.2.1})$$

If we set $r_{D2} = 1$, then Eq. A.2.2 becomes:

$$r_{D1}^2 = 1 + r_D^2 - 2r_D \cos \theta_2 \quad (\text{A.2.2})$$

Noting that the values of $\cos \theta_2$ range from -1 to +1, then Eq. A.2.3 becomes:

$$r_{D1}^2 = r_D^2 \pm 2r_D + 1 = (r_D \pm 1)^2 \Big|_{r_{D2} = 1} \quad (\text{A.2.3})$$

Because $r_D \gg 1$, then we can write that $r_{D1} = r_D \pm 1 \approx r_D$ when $r_{D2} = 1$.

Similarly, the application of the cosine law to r_{D2} would provide:

$$r_{D2}^2 = r_D^2 + r_{D1}^2 - 2r_D r_{D1} \cos \theta_1 \quad (\text{A.2.4})$$

Obviously, with the same argument, we can use the previous logic to show that the limiting value of r_{D2} is given by

$$r_{D2} \Big|_{r_{D1} = 1} = r_D \pm 1 \approx r_D \quad (\text{A.2.5})$$

APPENDIX B

TABLES OF DATA FOR INTERFERENCE TESTING

APPENDIX B.1

TABLES OF DATA FOR INTERFERENCE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS IN ONE OF THE WELLS

Other tables of data for interference testing with wellbore storage and skin in one of the wells can be produced by running the computer program shown in Appendix E.1.

TABLE B.1a

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/r_D^2 = 0.001$ AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $RD = 1000.000$
 $CD \cdot \exp(292) = 0.000000-01$ $CD2/r_D^2 = 0.00000$
 $CD1/r_D^2 = 0.00100$

$CD \cdot \exp(291)$

	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 08	1.000000 10	1.000000 12	1.000000 15	1.000000 20
$1D/r_D^2$	DIMENSIONLESS PRESSURE DROP								
1.000-01	1.046150-02	1.008600-02	9.727970-03	9.367210-03	8.756010-03	8.188210-03	7.678340-03	7.009130-03	6.101770-03
1.500-01	3.565280-02	3.498500-02	3.432930-02	3.368380-02	3.242800-02	3.122210-02	3.006860-02	2.894000-02	2.599470-02
2.000-01	6.891210-02	6.811390-02	6.731900-02	6.653030-02	6.496640-02	6.342550-02	6.191100-02	5.969600-02	5.617890-02
3.000-01	1.415750-01	1.407420-01	1.399020-01	1.390730-01	1.374030-01	1.357310-01	1.340600-01	1.315550-01	1.273990-01
5.000-01	2.756150-01	2.749090-01	2.742020-01	2.734930-01	2.720700-01	2.706410-01	2.692050-01	2.670390-01	2.633980-01
7.500-01	4.108820-01	4.103250-01	4.097680-01	4.092090-01	4.080880-01	4.069630-01	4.058330-01	4.041280-01	4.012630-01
1.000 00	5.191250-01	5.186720-01	5.182180-01	5.177640-01	5.168520-01	5.159370-01	5.150180-01	5.136350-01	5.113120-01
1.500 00	6.849580-01	6.846310-01	6.843030-01	6.839740-01	6.833160-01	6.826560-01	6.819950-01	6.809990-01	6.793300-01
2.000 00	8.098520-01	8.095970-01	8.093400-01	8.090840-01	8.085710-01	8.080560-01	8.075410-01	8.067660-01	8.054680-01
3.000 00	9.933050-01	9.931280-01	9.929500-01	9.927730-01	9.924170-01	9.920610-01	9.917040-01	9.911680-01	9.902720-01
5.000 00	1.233060 00	1.232950 00	1.232840 00	1.232730 00	1.232510 00	1.232290 00	1.232070 00	1.231740 00	1.231190 00
7.500 00	1.427890 00	1.427820 00	1.427740 00	1.427670 00	1.427520 00	1.427370 00	1.427220 00	1.427000 00	1.426620 00
1.000 01	1.567770 00	1.567710 00	1.567650 00	1.567600 00	1.567480 00	1.567370 00	1.567260 00	1.567090 00	1.566810 00
1.500 01	1.766520 00	1.766480 00	1.766450 00	1.766410 00	1.766330 00	1.766260 00	1.766180 00	1.766070 00	1.765880 00
2.000 01	1.908370 00	1.908340 00	1.908310 00	1.908290 00	1.908230 00	1.908170 00	1.908120 00	1.908030 00	1.907890 00
3.000 01	2.109110 00	2.109090 00	2.109070 00	2.109060 00	2.109020 00	2.108980 00	2.108940 00	2.108880 00	2.108790 00
5.000 01	2.362930 00	2.362920 00	2.362910 00	2.362900 00	2.362870 00	2.362850 00	2.362830 00	2.362790 00	2.362740 00
7.500 01	2.564870 00	2.564860 00	2.564850 00	2.564850 00	2.564830 00	2.564820 00	2.564800 00	2.564780 00	2.564740 00
1.000 02	2.708310 00	2.708310 00	2.708300 00	2.708290 00	2.708280 00	2.708270 00	2.708260 00	2.708240 00	2.708210 00
1.500 02	2.910650 00	2.910640 00	2.910640 00	2.910640 00	2.910630 00	2.910620 00	2.910610 00	2.910600 00	2.910580 00
2.000 02	3.054290 00	3.054290 00	3.054290 00	3.054280 00	3.054270 00	3.054260 00	3.054260 00	3.054260 00	3.054240 00
3.000 02	3.256820 00	3.256820 00	3.256820 00	3.256820 00	3.256820 00	3.256810 00	3.256810 00	3.256800 00	3.256790 00
5.000 02	3.512080 00	3.512080 00	3.512080 00	3.512080 00	3.512070 00	3.512070 00	3.512070 00	3.512070 00	3.512060 00
7.500 02	3.714730 00	3.714730 00	3.714730 00	3.714730 00	3.714730 00	3.714730 00	3.714730 00	3.714720 00	3.714720 00
1.000 03	3.858530 00	3.858530 00	3.858530 00	3.858530 00	3.858530 00	3.858530 00	3.858530 00	3.858530 00	3.858520 00
1.500 03	4.061230 00	4.061230 00	4.061230 00	4.061230 00	4.061230 00	4.061230 00	4.061220 00	4.061220 00	4.061220 00
2.000 03	4.205050 00	4.205050 00	4.205050 00	4.205050 00	4.205050 00	4.205050 00	4.205050 00	4.205050 00	4.205040 00
3.000 03	4.407760 00	4.407760 00	4.407760 00	4.407760 00	4.407760 00	4.407760 00	4.407760 00	4.407760 00	4.407760 00
5.000 03	4.663160 00	4.663160 00	4.663160 00	4.663160 00	4.663160 00	4.663160 00	4.663160 00	4.663160 00	4.663160 00
7.500 03	4.865880 00	4.865880 00	4.865880 00	4.865880 00	4.865880 00	4.865880 00	4.865880 00	4.865880 00	4.865880 00
1.000 04	5.009720 00	5.009720 00	5.009720 00	5.009720 00	5.009720 00	5.009720 00	5.009720 00	5.009720 00	5.009720 00

TABLE B.1b

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/\tau_D^2 = 0.01$ AND $\tau_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $RD = 1000.000$
 $CD \cdot \exp(2S) = 0.000000-01$ $CD/\tau_D^2 = 0.00000$
 $CD1/\tau_D^2 = 0.01000$

$CD \cdot \exp(2S) =$

1.000000 04 1.000000 05 1.000000 06 1.000000 10 1.000000 12 1.000000 15 1.000000 20 1.000000 25

$\tau_D/\tau_D^2 =$

DIMENSIONLESS PRESSURE DROP

1.000-01	3.792830-03	3.250840-03	2.842300-03	1.885930-03	1.613400-03	1.325610-03	1.021930-03	8.308000-04
1.300-01	1.752540-02	1.562060-02	1.400570-02	0.060130-03	8.578230-03	7.174040-03	5.822510-03	4.634640-03
2.000-01	4.112590-02	3.736200-02	3.416560-02	2.527230-02	2.231680-02	1.896670-02	1.515270-02	1.260750-02
3.000-01	1.057070-01	9.738520-02	9.159240-02	7.319250-02	6.628340-02	5.794620-02	4.782400-02	4.059270-02
5.000-01	2.357370-01	2.294730-01	2.222590-01	1.953400-01	1.833270-01	1.672720-01	1.482210-01	1.278780-01
7.500-01	3.776480-01	3.715350-01	3.653250-01	3.399430-01	3.272930-01	3.088840-01	2.805850-01	2.557560-01
1.000 00	4.909400-01	4.859560-01	4.808770-01	4.596610-01	4.486210-01	4.318050-01	4.089870-01	3.774990-01
1.500 00	6.635840-01	6.600380-01	6.564400-01	6.414780-01	6.336260-01	6.213710-01	5.998350-01	5.773960-01
2.000 00	7.926440-01	7.899130-01	7.871510-01	7.757670-01	7.698540-01	7.606760-01	7.444840-01	7.271920-01
3.000 00	9.806620-01	9.790010-01	9.771250-01	9.694660-01	9.655390-01	9.595170-01	9.470940-01	9.381130-01
5.000 00	1.224960 00	1.223820 00	1.222680 00	1.210070 00	1.215730 00	1.212180 00	1.206120 00	1.199900 00
7.500 00	1.422180 00	1.421420 00	1.420660 00	1.417580 00	1.416030 00	1.413680 00	1.409710 00	1.405680 00
1.000 01	1.563330 00	1.562760 00	1.562190 00	1.559880 00	1.558720 00	1.556960 00	1.554010 00	1.551020 00
1.500 01	1.763430 00	1.763040 00	1.762660 00	1.761120 00	1.760350 00	1.759190 00	1.757240 00	1.755270 00
2.000 01	1.905980 00	1.905690 00	1.905410 00	1.904250 00	1.903670 00	1.902800 00	1.901340 00	1.899880 00
3.000 01	2.107450 00	2.107260 00	2.107070 00	2.106300 00	2.105920 00	2.105340 00	2.104370 00	2.103400 00
5.000 01	2.361890 00	2.361770 00	2.361660 00	2.361200 00	2.360970 00	2.360620 00	2.360040 00	2.359460 00
7.500 01	2.564150 00	2.564070 00	2.563990 00	2.563690 00	2.563530 00	2.563300 00	2.562920 00	2.562530 00
1.000 02	2.707760 00	2.707700 00	2.707640 00	2.707410 00	2.707300 00	2.707120 00	2.706840 00	2.706550 00
1.500 02	2.910270 00	2.910230 00	2.910190 00	2.910040 00	2.909960 00	2.909840 00	2.909650 00	2.909460 00
2.000 02	3.054000 00	3.053970 00	3.053940 00	3.053620 00	3.053770 00	3.053680 00	3.053540 00	3.053390 00
3.000 02	3.256620 00	3.256600 00	3.256590 00	3.256510 00	3.256470 00	3.256410 00	3.256320 00	3.256220 00
5.000 02	3.511950 00	3.511940 00	3.511930 00	3.511890 00	3.511860 00	3.511830 00	3.511770 00	3.511710 00
7.500 02	3.714650 00	3.714640 00	3.714630 00	3.714600 00	3.714590 00	3.714560 00	3.714520 00	3.714490 00
1.000 03	3.858470 00	3.858460 00	3.858460 00	3.858430 00	3.858420 00	3.858410 00	3.858380 00	3.858350 00
1.500 03	4.061180 00	4.061180 00	4.061180 00	4.061160 00	4.061150 00	4.061140 00	4.061120 00	4.061100 00
2.000 03	4.205010 00	4.205010 00	4.205010 00	4.205000 00	4.204990 00	4.204980 00	4.204970 00	4.204950 00
3.000 03	4.407740 00	4.407740 00	4.407730 00	4.407730 00	4.407720 00	4.407720 00	4.407710 00	4.407700 00
5.000 03	4.663140 00	4.663140 00	4.663140 00	4.663140 00	4.663140 00	4.663130 00	4.663130 00	4.663120 00
7.500 03	4.865870 00	4.865870 00	4.865870 00	4.865870 00	4.865870 00	4.865870 00	4.865860 00	4.865860 00
1.000 04	5.009710 00	5.009710 00	5.009710 00	5.009710 00	5.009710 00	5.009710 00	5.009700 00	5.009700 00

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/r_D^2 = 0.1$ AND $r_D = 100$

[illegible]

	1.000000 03	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 10	1.000000 12	1.000000 20
40/r0*P2	DIMENSIONLESS PRESSURE DROP								
1.000-01	8.800500-04	8.800500-04	6.322070-04	4.927780-04	4.035860-04	3.416760-04	2.339100-04	1.932600-04	1.139830-04
1.500-01	4.487990-03	4.487990-03	3.349990-03	2.669270-03	2.217470-03	1.896070-03	1.320900-03	1.098550-03	6.563540-04
2.000-01	1.158940-02	1.158940-02	8.876590-03	7.183320-03	6.092250-03	5.193300-03	3.665670-03	3.064120-03	1.849250-03
3.000-01	3.527560-02	3.527560-02	2.801340-02	2.319040-02	1.978900-02	1.722070-02	1.240770-02	1.045580-02	6.414100-02
5.000-01	1.069390-01	1.069390-01	6.905340-02	7.609440-02	6.634360-02	5.876770-02	4.370170-02	3.730050-02	2.349430-02
7.500-01	2.135750-01	2.135750-01	1.805020-01	1.626020-01	1.448550-01	1.304070-01	1.008960-01	8.657370-02	5.068520-02
1.000 00	3.198140-01	3.198140-01	2.851260-01	2.561250-01	2.319100-01	2.115640-01	1.668150-01	1.459630-01	9.698330-02
1.500 00	9.071470-01	9.071470-01	4.696220-01	4.351550-01	4.041220-01	3.764310-01	3.102710-01	2.796330-01	1.925340-01
2.000 00	6.580240-01	6.580240-01	6.235680-01	5.898350-01	5.576970-01	5.276070-01	4.504380-01	4.088650-01	2.975250-01
3.000 00	8.805930-01	8.805930-01	6.549930-01	6.201880-01	6.007730-01	7.733140-01	6.945920-01	6.471470-01	5.035510-01
5.000 00	1.160200 00	1.160200 00	1.145530 00	1.129800 00	1.113230 00	1.095650 00	1.036790 00	9.991950-01	8.405670-01
7.500 00	1.377050 00	1.377050 00	1.367920 00	1.358370 00	1.348350 00	1.337810 00	1.302800 00	1.276770 00	1.160450 00
1.000 01	1.528440 00	1.528440 00	1.521860 00	1.515060 00	1.508040 00	1.500760 00	1.477070 00	1.459510 00	1.375710 00
1.500 01	1.739160 00	1.739160 00	1.734950 00	1.730650 00	1.726280 00	1.721800 00	1.707760 00	1.697790 00	1.651070 00
2.000 01	1.887220 00	1.887220 00	1.886130 00	1.881000 00	1.877820 00	1.874590 00	1.864610 00	1.857680 00	1.826490 00
3.000 01	2.094410 00	2.094410 00	2.092390 00	2.090360 00	2.088310 00	2.086240 00	2.079910 00	2.075590 00	2.057320 00
5.000 01	2.353640 00	2.353640 00	2.352450 00	2.351260 00	2.350060 00	2.348850 00	2.345200 00	2.342730 00	2.332580 00
7.500 01	2.558420 00	2.558420 00	2.557630 00	2.556650 00	2.556060 00	2.555270 00	2.552870 00	2.551270 00	2.544730 00
1.000 02	2.703340 00	2.703340 00	2.702750 00	2.702170 00	2.701580 00	2.700990 00	2.699210 00	2.698020 00	2.693190 00
1.500 02	2.907200 00	2.907200 00	2.906810 00	2.906430 00	2.906040 00	2.905650 00	2.904470 00	2.903690 00	2.900520 00
2.000 02	3.051640 00	3.051640 00	3.051350 00	3.051060 00	3.050760 00	3.050470 00	3.049600 00	3.049010 00	3.046650 00
3.000 02	3.254990 00	3.254990 00	3.254800 00	3.254600 00	3.254410 00	3.254220 00	3.253640 00	3.253250 00	3.251690 00
5.000 02	3.510930 00	3.510930 00	3.510810 00	3.510700 00	3.510580 00	3.510470 00	3.510120 00	3.509890 00	3.508960 00
7.500 02	3.713940 00	3.713940 00	3.713860 00	3.713790 00	3.713710 00				

TABLE B.1d

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/r_D^2 = 0.1$ AND $r_D = 3162$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $RD = 3162.278$
 $CD \cdot \exp(292) = 0.000000 - C1$ $CD/r_D = 2$ $= 0.00000$
 $CD/r_D = 2$ $= 0.10000$

$CD \cdot \exp(291)$

$RD/r_D = 1$	1.000000 06	1.000000 07	1.000000 08	1.000000 10	1.000000 12	1.000000 15	1.000000 20	1.000000 25
	DIMENSIONLESS PRESSURE DROP							
1.000 -01	4.038270-04	3.418790-04	2.963620-04	2.340150-04	1.933270-04	1.533280-04	1.140070-04	9.073480-05
1.500 -01	2.218290-03	1.896680-03	1.656320-03	1.321200-03	1.098760-03	8.771530-04	6.864300-04	5.244390-04
2.000 -01	6.030690-03	5.194380-03	4.561110-03	3.666240-03	3.064510-03	2.458840-03	1.849400-03	1.481980-03
3.000 -01	1.977150-02	1.722260-02	1.525250-02	1.240880-02	1.045660-02	8.458630-03	6.414470-03	5.165590-03
5.000 -01	6.434710-02	5.877050-02	5.272590-02	4.370340-02	3.730180-02	3.057150-02	2.349480-02	1.907500-02
7.500 -01	1.448580-01	1.304100-01	1.185030-01	1.000980-01	8.657530-02	7.193970-02	5.608590-02	4.594110-02
1.000 00	2.319130-01	2.115670-01	1.943210-01	1.668170-01	1.459650-01	1.227900-01	9.698410-02	8.009330-02
1.500 00	4.041230-01	3.764330-01	3.517930-01	3.102730-01	2.769650-01	2.380980-01	1.925350-01	1.614140-01
2.000 00	5.576970-01	5.276080-01	4.997270-01	4.504390-01	4.088660-01	3.681420-01	2.957530-01	2.513890-01
3.000 00	8.097720-01	7.733140-01	7.462660-01	6.945920-01	6.471480-01	5.944980-01	5.003520-01	4.358390-01
5.000 00	1.113230 00	1.095650 00	1.077270 00	1.038790 00	9.991950-01	9.402280-01	8.485670-01	7.684040-01
7.500 00	1.348150 00	1.337810 00	1.326710 00	1.302800 00	1.278770 00	1.254650 00	1.160450 00	1.086660 00
1.000 01	1.508040 00	1.500760 00	1.493190 00	1.477070 00	1.459510 00	1.430410 00	1.375710 00	1.316380 00
1.500 01	1.726480 00	1.721800 00	1.717230 00	1.707760 00	1.697790 00	1.681660 00	1.651070 00	1.615660 00
2.000 01	1.877220 00	1.874590 00	1.871320 00	1.864610 00	1.857680 00	1.846770 00	1.826890 00	1.804300 00
3.000 01	2.088110 00	2.086240 00	2.084150 00	2.079910 00	2.075590 00	2.068930 00	2.057320 00	2.044910 00
5.000 01	2.350460 00	2.348850 00	2.347640 00	2.345200 00	2.342730 00	2.338980 00	2.332500 00	2.325970 00
7.500 01	2.556160 00	2.555270 00	2.554470 00	2.552870 00	2.551270 00	2.548830 00	2.544730 00	2.540540 00
1.000 02	2.731880 00	2.700990 00	2.700400 00	2.699210 00	2.698020 00	2.696220 00	2.693190 00	2.690120 00
1.500 02	2.926140 00	2.905650 00	2.905260 00	2.904470 00	2.903690 00	2.902500 00	2.900520 00	2.898510 00
2.000 02	3.050760 00	3.050470 00	3.050180 00	3.049600 00	3.049010 00	3.048130 00	3.046650 00	3.045170 00
3.000 02	3.254410 00	3.254220 00	3.254020 00	3.253640 00	3.253250 00	3.252660 00	3.251690 00	3.250710 00
5.000 02	3.510580 00	3.510470 00	3.510350 00	3.510120 00	3.509890 00	3.509540 00	3.508960 00	3.508370 00
7.500 02	3.713710 00	3.713630 00	3.713550 00	3.713400 00	3.713250 00	3.713010 00	3.712630 00	3.712240 00
1.000 03	3.857750 00	3.857690 00	3.857640 00	3.857320 00	3.857410 00	3.857230 00	3.856940 00	3.856650 00
1.500 03	4.050490 00	4.060650 00	4.060620 00	4.060540 00	4.060460 00	4.060350 00	4.060150 00	4.059960 00
2.000 03	4.204440 00	4.204410 00	4.204380 00	4.204330 00	4.204470 00	4.204380 00	4.204240 00	4.204090 00
3.000 03	4.407480 00	4.407460 00	4.407440 00	4.407410 00	4.407370 00	4.407310 00	4.407210 00	4.407120 00
5.000 03	4.662990 00	4.662980 00	4.662960 00	4.662940 00	4.662920 00	4.662880 00	4.662830 00	4.662770 00
7.500 03	4.865770 00	4.865760 00	4.865750 00	4.865740 00	4.865720 00	4.865700 00	4.865660 00	4.865620 00
1.000 04	5.309430 00	5.009630 00	5.009620 00	5.009610 00	5.009600 00	5.009580 00	5.009550 00	5.009520 00

TABLE B.1e

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/r_D^2 = 1$ AND $r_D = 31.6$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $RD = 31.623$
 $CD \cdot \exp(232) = 0.000000-01$ $CD/r_D^2 = 0.00000$
 $CD/r_D^2 = 1.00000$

$CD \cdot \exp(232)$

	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 10	1.000000 12	1.000000 15	1.000000 20
tD/r_D^2	DIMENSIONLESS PRESSURE DROP							
1.000-01	1.556710-04	9.211130-05	6.523440-05	5.046710-05	2.446030-05	2.137300-05	1.658820-05	1.208010-05
1.500-01	7.710600-04	4.874710-04	3.554360-04	2.795110-04	1.505770-04	1.223370-04	9.547240-05	6.988900-05
2.000-01	1.988560-03	1.303410-03	9.674810-04	7.687740-04	4.216170-04	3.438980-04	2.693900-04	1.979110-04
3.000-01	6.194750-03	4.241590-03	3.219120-03	2.592370-03	1.455820-03	1.193840-03	9.400260-04	6.940400-04
5.000-01	2.033210-02	1.457170-02	1.133600-02	9.270770-03	5.356370-03	4.421700-03	3.504140-03	2.603460-03
7.500-01	4.529370-02	3.351670-02	2.655580-02	2.197510-02	1.298530-02	1.077740-02	8.586430-03	6.412780-03
1.000 00	7.528770-02	5.693060-02	4.568970-02	3.812920-02	2.290690-02	1.908920-02	1.526960-02	1.144960-02
1.500 00	1.434470-01	1.118040-01	9.141200-02	7.724530-02	4.758690-02	3.990580-02	3.212190-02	2.423720-02
2.000 00	2.165460-01	1.725290-01	1.430480-01	1.220470-01	7.669250-02	6.464010-02	5.229780-02	3.966390-02
3.000 00	3.644460-01	2.999680-01	2.541130-01	2.201120-01	1.428330-01	1.214020-01	9.906520-02	7.578900-02
5.000 00	6.367380-01	5.477840-01	4.786220-01	4.240600-01	2.893560-01	2.493200-01	2.063320-01	1.601620-01
7.500 00	9.163800-01	8.179850-01	7.367580-01	6.649330-01	4.769310-01	4.168180-01	3.501410-01	2.760900-01
1.000 01	1.137000 00	1.041420 00	9.549980-01	8.786780-01	6.568620-01	5.811940-01	4.947200-01	3.956550-01
1.500 01	1.455130 00	1.377180 00	1.299440 00	1.224950 00	9.778570-01	8.834520-01	7.694840-01	6.311430-01
2.000 01	1.671840 00	1.612010 00	1.548460 00	1.483820 00	1.244430 00	1.143630 00	1.015690 00	8.517620-01
3.000 01	1.953180 00	1.917380 00	1.877250 00	1.833510 00	1.642910 00	1.549100 00	1.419040 00	1.235040 00
5.000 01	2.270390 00	2.253280 00	2.234450 00	2.213640 00	2.110120 00	2.049010 00	1.952030 00	1.790360 00
7.500 01	2.502680 00	2.492740 00	2.482250 00	2.471100 00	2.417390 00	2.384080 00	2.326470 00	2.216120 00
1.000 02	2.661070 00	2.654100 00	2.646800 00	2.639370 00	2.605440 00	2.585280 00	2.550030 00	2.478100 00
1.500 02	2.878380 00	2.874020 00	2.869570 00	2.865020 00	2.845680 00	2.835140 00	2.817780 00	2.783260 00
2.000 02	3.029590 00	3.026420 00	3.023210 00	3.019950 00	3.006360 00	2.999190 00	2.987860 00	2.966840 00
3.000 02	3.239840 00	3.237790 00	3.235720 00	3.233640 00	3.225100 00	3.220700 00	3.213910 00	3.202030 00
5.000 02	3.501460 00	3.500260 00	3.499050 00	3.497840 00	3.492930 00	3.490440 00	3.486660 00	3.480190 00
7.500 02	3.707410 00	3.706620 00	3.705830 00	3.705040 00	3.701830 00	3.700210 00	3.697760 00	3.693630 00
1.000 03	3.852910 00	3.852320 00	3.851730 00	3.851140 00	3.848760 00	3.847570 00	3.845760 00	3.842710 00
1.500 03	4.057350 00	4.056960 00	4.056570 00	4.056180 00	4.054610 00	4.053820 00	4.052640 00	4.050640 00
2.000 03	4.202070 00	4.201780 00	4.201490 00	4.201200 00	4.200030 00	4.199440 00	4.198560 00	4.197080 00
3.000 03	4.405710 00	4.405520 00	4.405330 00	4.405130 00	4.404360 00	4.403970 00	4.403380 00	4.402410 00
5.000 03	4.661880 00	4.661760 00	4.661650 00	4.661530 00	4.661070 00	4.660840 00	4.660490 00	4.659910 00
7.500 03	4.865000 00	4.864930 00	4.864850 00	4.864770 00	4.864470 00	4.864310 00	4.864080 00	4.863690 00
1.000 04	5.009050 00	5.008990 00	5.008930 00	5.008870 00	5.008640 00	5.008530 00	5.008350 00	5.008060 00

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/r_D^2 = 1$ AND $r_D = 100$

```

DISTANCE BETWEEN THE WELLS, RD      = 100.000
CD2=exp(2SE) = 0.000000D-01      CD2/rD==2      = 0.00000
CD1/rD==2      = 1.00000

```

1D/0=02	1.000000 04	1.000000 04	1.000000 05	1.000000 06	1.000000 10	1.000000 12	1.000000 15	1.000000 20
	DIMENSIONLESS PRESSURE DROP							
1.000-01	9.296870-05	9.296870-05	6.567790-05	5.073670-05	2.653620-05	2.142220-05	1.661820-05	1.289610-05
1.500-01	4.898960-04	4.898960-04	3.567670-04	2.803510-04	1.508280-04	1.225440-04	9.557430-05	6.994390-05
2.000-01	1.307630-03	1.307630-03	9.695880-04	7.703240-04	4.209900-04	3.442100-04	2.695890-04	1.980190-04
3.000-01	4.269200-03	4.269200-03	3.223600-03	2.595390-03	1.526810-03	1.194910-03	9.404440-04	6.962780-04
5.000-01	1.455340-02	1.455340-02	1.134900-02	9.276260-03	5.358290-03	4.423320-03	3.504980-03	2.603930-03
7.500-01	3.353320-02	3.353320-02	2.656670-02	2.198280-02	1.298820-02	1.077360-02	8.587900-03	6.413500-03
1.000 00	5.694920-02	5.694920-02	4.570240-02	3.813840-02	2.291040-02	1.909170-02	1.527120-02	1.165050-02
1.500 00	1.118240-01	1.118240-01	9.142650-01	7.725610-02	4.759130-02	3.998980-02	3.124000-02	2.423640-02
2.000 00	1.725490-01	1.725490-01	1.436300-01	1.220580-01	7.669750-02	6.464570-02	5.232020-02	3.965300-02
3.000 00	2.999850-01	2.999850-01	2.581420-01	2.201230-01	1.428380-01	1.214000-01	9.906800-02	7.579070-02
5.000 00	5.477950-01	5.477950-01	4.766320-01	4.268690-01	2.893610-01	2.493240-01	2.063350-01	1.601640-01
7.500 00	8.179890-01	8.179890-01	7.347640-01	6.669390-01	4.769360-01	4.168220-01	3.501440-01	2.760920-01
1.000 01	1.041420 00	1.041420 00	9.550000-01	8.786810-01	6.568660-01	5.811970-01	4.947220-01	3.956570-01
1.500 01	1.377180 00	1.377180 00	1.299460 00	1.224950 00	9.778590-01	8.834540-01	7.694860-01	6.311450-01
2.000 01	1.612010 00	1.612010 00	1.584660 00	1.483820 00	1.244430 00	1.143630 00	1.015960 00	8.517630-01
3.000 01	1.917380 00	1.917380 00	1.877250 00	1.833510 00	1.642910 00	1.549140 00	1.419040 00	1.235500 00
5.000 01	2.253260 00	2.253260 00	2.234450 00	2.213640 00	2.118120 00	2.049010 00	1.952030 00	1.790360 00
7.500 01	2.492740 00	2.492740 00	2.482250 00	2.471100 00	2.417390 00	2.384050 00	2.326470 00	2.216120 00
1.000 02	2.654100 00	2.654100 00	2.666880 00	2.659370 00	2.605440 00	2.505280 00	2.350030 00	2.478100 00
1.500 02	2.874020 00	2.874020 00	2.869570 00	2.865520 00	2.845560 00	2.835160 00	2.817780 00	2.783260 00
2.000 02	3.026420 00	3.026420 00	3.023210 00	3.019990 00	3.006360 00	2.999190 00	2.987660 00	2.966840 00
3.000 02	3.237790 00	3.237790 00	3.235720 00	3.233640 00	3.225160 00	3.226700 00	3.213910 00	3.202030 00
5.000 02	3.500260 00	3.500260 00	3.499950 00	3.497400 00	3.492930 00	3.490440 00	3.486660 00	3.480190 00
7.500 02	3.706620 00	3.706620 00	3.705830 00	3.705040 00	3.701830 00	3.708210 00	3.697760 00	3.693630 00
1.000 03	3.852320 00	3.852320 00	3.851730 00	3.851140 00	3.848760 00	3.847570 00	3.845760 00	3.842710 00
1.500 03	4.056960 00	4.056960 00	4.056570 00	4.056160 00	4.054610 00	4.053820 00	4.052640 00	4.050660 00
2.000 03	4.201780 00	4.201780 00	4.201490 00	4.201280 00	4.200830 00	4.199440 00	4	

TABLE B.1g

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH
WELLBORE STORAGE IN ONE WELL FOR $C_D/r_D^2 = 1$ AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE OBSERVING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 1000.000
C02*exp(252) = 0.000000-01 C07/C00*2 = 0.00000
C01/C00*2 = 1.00000

C02*exp(252) 11

	1.000000 04	1.000000 07	1.000000 09	1.000000 10	1.000000 12	1.000000 15	1.000000 20	1.000000 25
RD/C00*2	DIMENSIONLESS PRESSURE DROP							
1.000-01	5.070070-05	4.135250-05	3.487310-05	2.658060-05	2.181090-05	1.662120-05	1.209800-05	9.510110-06
1.500-01	2.804810-04	2.309770-04	1.942310-04	1.508680-04	1.225300-04	9.559030-05	6.975250-05	5.157400-05
2.000-01	7.735670-04	6.308790-04	5.455700-04	4.221710-04	3.442690-04	2.696200-04	1.980160-04	1.564950-04
3.000-01	2.495800-03	2.171080-03	1.866680-03	1.456960-03	1.198610-03	9.405070-04	6.943040-04	5.502480-04
5.000-01	9.277050-03	7.844630-03	6.704470-03	5.158570-03	4.023210-03	3.105010-03	2.604000-03	2.071380-03
7.500-01	2.194390-02	1.874310-02	1.613280-02	1.270880-02	1.077970-02	8.597190-03	6.813600-03	5.117630-03
1.000-00	3.813970-02	3.271280-02	2.863280-02	2.291070-02	1.909200-02	1.527140-02	1.185060-02	9.158560-03
1.500-00	7.725760-02	6.686210-02	5.821900-02	4.759200-02	3.970950-02	3.212810-02	2.423860-02	1.945700-02
2.000-00	1.229630-01	1.061780-01	9.428020-02	7.669920-02	6.468820-02	5.230050-02	3.966550-02	3.198810-02
3.000-00	2.201250-01	1.980060-01	1.711550-01	1.428390-01	1.218070-01	9.906880-02	7.579090-02	6.136030-02
5.000-00	8.240700-01	7.402220-01	6.443840-01	5.493670-01	4.893250-01	4.063350-01	3.401640-01	2.808110-01
7.500-00	6.649800-01	6.061750-01	5.563870-01	4.769160-01	4.168220-01	3.501340-01	2.760920-01	2.277880-01
1.000-01	8.746810-01	8.118860-01	7.531700-01	6.568660-01	5.811770-01	4.947230-01	3.956570-01	3.293150-01
1.500-01	1.224950-00	1.155280-00	1.070070-00	9.778590-01	8.818540-01	7.678760-01	6.311450-01	5.337640-01
2.000-01	1.881020-00	1.820080-00	1.759500-00	1.288810-00	1.181610-00	1.015690-00	8.517630-01	7.313070-01
3.000-01	1.831510-00	1.787220-00	1.739810-00	1.642910-00	1.589140-00	1.417040-00	1.235040-00	1.087990-00
5.000-01	2.217600-00	2.190710-00	2.165690-00	2.110120-00	2.049010-00	1.952030-00	1.790160-00	1.640670-00
7.500-01	2.471100-00	2.459150-00	2.445280-00	2.417170-00	2.388800-00	2.325870-00	2.216120-00	2.098160-00
1.000-02	2.639370-00	2.631510-00	2.623100-00	2.605840-00	2.585880-00	2.550030-00	2.479100-00	2.393510-00
1.500-02	2.865020-00	2.860170-00	2.855600-00	2.845680-00	2.835140-00	2.817780-00	2.783260-00	2.740800-00
2.000-02	3.017750-00	3.016680-00	3.013270-00	3.006360-00	2.999190-00	2.987860-00	2.964880-00	2.942000-00
3.000-02	3.213680-00	3.213580-00	3.229810-00	3.225100-00	3.227000-00	3.213910-00	3.202010-00	3.189240-00
5.000-02	3.477880-00	3.476620-00	3.495000-00	3.492910-00	3.490800-00	3.476560-00	3.460170-00	3.443510-00
7.500-02	3.705040-00	3.704240-00	3.701840-00	3.701810-00	3.700710-00	3.697760-00	3.693610-00	3.688820-00
1.000-03	3.951140-00	3.950550-00	3.949760-00	3.948760-00	3.947570-00	3.945760-00	3.942710-00	3.939630-00
1.500-03	4.056180-00	4.055790-00	4.055400-00	4.054810-00	4.053820-00	4.052640-00	4.050640-00	4.048630-00
2.000-03	4.231200-00	4.230910-00	4.230620-00	4.230030-00	4.229880-00	4.229450-00	4.229000-00	4.228590-00
3.000-03	4.435130-00	4.434980-00	4.434750-00	4.434360-00	4.433970-00	4.433390-00	4.432810-00	4.432420-00
5.000-03	4.661530-00	4.661420-00	4.661300-00	4.661170-00	4.660880-00	4.660480-00	4.659910-00	4.659320-00
7.500-03	4.858770-00	4.858700-00	4.858620-00	4.858470-00	4.858110-00	4.857680-00	4.857190-00	4.856710-00
1.000-04	5.000870-00	5.000820-00	5.000760-00	5.000680-00	5.000530-00	5.000350-00	5.000160-00	5.000070-00

APPENDIX B.2

TABLES OF DATA FOR INTERFERENCE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS AT BOTH WELLS

Other tables of data for interference testing with wellbore storage and skin at both wells can be produced by running the computer program shown in Appendix E.1.

TABLE B.2a

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.01$, AND $r_D = 31.6$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 31.623
CD2=exp(252) = 1.000000 01 CD2/rD**2 = 0.01000
CD1/rD**2 = 0.01000

CD=exp(231)

1.000000 02 1.000000 03 1.000000 04 1.000000 05 1.000000 06 1.000000 07 1.000000 08 1.000000 09 1.000000 10

td/rD**2

DIMENSIONLESS PRESSURE DROP

1.000-01	3.074590-03	2.456630-03	2.039280-03	1.740800-03	1.517490-03	1.344440-03	1.206530-03	1.094120-03	1.000760-03
1.500-01	1.566410-02	1.335920-02	1.159760-02	1.022470-02	9.131500-03	8.243680-03	7.509850-03	6.893950-03	6.370120-03
2.000-01	3.004970-02	3.303650-02	3.032750-02	2.740470-02	2.495500-02	2.280350-02	2.111500-02	1.959100-02	1.826610-02
3.000-01	9.899180-02	9.233550-02	8.618330-02	8.057080-02	7.549020-02	7.090700-02	6.677840-02	6.305360-02	5.968720-02
5.000-01	2.300960-01	2.229030-01	2.157160-01	2.085950-01	2.016030-01	1.947930-01	1.882060-01	1.818700-01	1.758020-01
7.500-01	3.702450-01	3.642600-01	3.581700-01	3.519810-01	3.457100-01	3.393780-01	3.330120-01	3.266380-01	3.202870-01
1.000-00	4.836080-01	4.787080-01	4.737180-01	4.686380-01	4.634640-01	4.581990-01	4.528470-01	4.474160-01	4.419150-01
1.500-00	6.569870-01	6.534740-01	6.499110-01	6.462970-01	6.426290-01	6.389050-01	6.351240-01	6.312810-01	6.273760-01
2.000-00	7.867990-01	7.840830-01	7.813370-01	7.785600-01	7.757500-01	7.729070-01	7.700300-01	7.671170-01	7.641670-01
3.000-00	9.761480-01	9.742900-01	9.724180-01	9.705320-01	9.686300-01	9.667130-01	9.647800-01	9.628310-01	9.608650-01
5.000-00	1.221540-00	1.220400-00	1.219260-00	1.218120-00	1.216970-00	1.215810-00	1.214650-00	1.213490-00	1.212310-00
7.500-00	1.419600-00	1.418840-00	1.418080-00	1.417310-00	1.416540-00	1.415770-00	1.415000-00	1.414220-00	1.413450-00
1.000-01	1.561240-00	1.560670-00	1.560090-00	1.559520-00	1.558940-00	1.558360-00	1.557780-00	1.557200-00	1.556620-00
1.500-01	1.761890-00	1.761510-00	1.761120-00	1.760740-00	1.760350-00	1.759970-00	1.759580-00	1.759200-00	1.758810-00
2.000-01	1.904750-00	1.904460-00	1.904180-00	1.903890-00	1.903600-00	1.903310-00	1.903020-00	1.902730-00	1.902440-00
3.000-01	2.106560-00	2.106370-00	2.106100-00	2.105990-00	2.105800-00	2.105600-00	2.105410-00	2.105220-00	2.105030-00
5.000-01	2.361300-00	2.361190-00	2.361070-00	2.360960-00	2.360840-00	2.360730-00	2.360610-00	2.360500-00	2.360380-00
7.500-01	2.563730-00	2.563650-00	2.563580-00	2.563500-00	2.563420-00	2.563350-00	2.563270-00	2.563190-00	2.563120-00
1.000-02	2.707430-00	2.707370-00	2.707320-00	2.707260-00	2.707200-00	2.707140-00	2.707090-00	2.707030-00	2.706970-00
1.500-02	2.910030-00	2.910000-00	2.909960-00	2.909920-00	2.909880-00	2.909840-00	2.909800-00	2.909770-00	2.909730-00
2.000-02	3.053820-00	3.053790-00	3.053760-00	3.053730-00	3.053700-00	3.053670-00	3.053640-00	3.053610-00	3.053590-00
3.000-02	3.256500-00	3.256480-00	3.256460-00	3.256440-00	3.256420-00	3.256400-00	3.256380-00	3.256360-00	3.256340-00
5.000-02	3.511870-00	3.511860-00	3.511850-00	3.511840-00	3.511830-00	3.511810-00	3.511800-00	3.511790-00	3.511780-00
7.500-02	3.714590-00	3.714580-00	3.714570-00	3.714560-00	3.714550-00	3.714540-00	3.714530-00	3.714520-00	3.714510-00
1.000-03	3.858420-00	3.858420-00	3.858410-00	3.858410-00	3.858400-00	3.858400-00	3.858390-00	3.858380-00	3.858380-00
1.500-03	4.061150-00	4.061150-00	4.061140-00	4.061140-00	4.061140-00	4.061130-00	4.061130-00	4.061120-00	4.061120-00
2.000-03	4.204990-00	4.204990-00	4.204980-00	4.204980-00	4.204980-00	4.204980-00	4.204970-00	4.204970-00	4.204970-00
3.000-03	4.407720-00	4.407720-00	4.407720-00	4.407720-00	4.407710-00	4.407710-00	4.407710-00	4.407710-00	4.407710-00
5.000-03	4.663130-00	4.663130-00	4.663130-00	4.663130-00	4.663130-00	4.663130-00	4.663130-00	4.663130-00	4.663130-00
7.500-03	4.865870-00	4.865870-00	4.865860-00	4.865860-00	4.865860-00	4.865860-00	4.865860-00	4.865860-00	4.865860-00
1.000-04	5.009710-00	5.009710-00	5.009710-00	5.009710-00	5.009710-00	5.009710-00	5.009710-00	5.009710-00	5.009710-00

TABLE B.2b

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.01$ AND $r_D = 316$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 316.228
CD2/rD=2 = 1.00000 03 CD2/rD=2 = 0.01000
CD1/rD=2 = 0.01000

CD=exp(231)

	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12
td/rD=2	DIMENSIONLESS PRESSURE DROP								
1.000-01	1.474690-03	1.217640-03	1.039560-03	9.002390-04	7.958910-04	7.130530-04	6.452370-04	5.899760-04	5.030020-04
1.500-01	9.399600-03	8.110310-03	7.120990-03	6.339960-03	5.709670-03	5.191200-03	4.757400-03	4.390500-03	3.801860-03
2.000-01	2.620440-02	2.335810-02	2.101740-02	1.907840-02	1.784380-02	1.686000-02	1.487340-02	1.384590-02	1.215820-02
3.000-01	7.954520-02	7.391930-02	6.884690-02	6.430030-02	6.023330-02	5.659350-02	5.322950-02	5.039410-02	4.534670-02
5.000-01	2.085080-01	2.013470-01	1.942950-01	1.874130-01	1.807500-01	1.743410-01	1.682200-01	1.623620-01	1.515310-01
7.500-01	3.521780-01	3.459830-01	3.396980-01	3.333390-01	3.269340-01	3.205100-01	3.140360-01	3.077220-01	2.951920-01
1.000 00	4.688130-01	4.637340-01	4.585620-01	4.532960-01	4.479400-01	4.424900-01	4.369300-01	4.313990-01	4.201010-01
1.500 00	6.463950-01	6.427820-01	6.391160-01	6.353950-01	6.316170-01	6.277800-01	6.238500-01	6.199160-01	6.117930-01
2.000 00	7.786190-01	7.758420-01	7.730330-01	7.701920-01	7.673160-01	7.644060-01	7.614590-01	7.584740-01	7.523840-01
3.000 00	9.705990-01	9.686730-01	9.667720-01	9.648550-01	9.629230-01	9.609740-01	9.590090-01	9.570280-01	9.530130-01
5.000 00	1.218130 00	1.216980 00	1.215830 00	1.214680 00	1.213520 00	1.212350 00	1.211180 00	1.210000 00	1.207630 00
7.500 00	1.417320 00	1.416550 00	1.415780 00	1.415010 00	1.414240 00	1.413470 00	1.412680 00	1.411900 00	1.410340 00
1.000 01	1.559520 00	1.558940 00	1.558370 00	1.557790 00	1.557210 00	1.556630 00	1.556050 00	1.555460 00	1.554290 00
1.500 01	1.760740 00	1.760360 00	1.759970 00	1.759590 00	1.759200 00	1.758810 00	1.758430 00	1.758040 00	1.757260 00
2.000 01	1.903890 00	1.903600 00	1.903310 00	1.903020 00	1.902730 00	1.902440 00	1.902160 00	1.901870 00	1.901280 00
3.000 01	2.105990 00	2.105800 00	2.105600 00	2.105410 00	2.105220 00	2.105030 00	2.104830 00	2.104640 00	2.104250 00
5.000 01	2.360960 00	2.360840 00	2.360730 00	2.360610 00	2.360500 00	2.360380 00	2.360270 00	2.360150 00	2.359920 00
7.500 01	2.563500 00	2.563420 00	2.563350 00	2.563270 00	2.563190 00	2.563120 00	2.563040 00	2.562960 00	2.562810 00
1.000 02	2.707260 00	2.707200 00	2.707140 00	2.707090 00	2.707030 00	2.706970 00	2.706910 00	2.706850 00	2.706740 00
1.500 02	2.909920 00	2.909880 00	2.909840 00	2.909800 00	2.909770 00	2.909730 00	2.909690 00	2.909650 00	2.909570 00
2.000 02	3.053730 00	3.053700 00	3.053670 00	3.053640 00	3.053610 00	3.053580 00	3.053550 00	3.053530 00	3.053470 00
3.000 02	3.256440 00	3.256420 00	3.256400 00	3.256380 00	3.256360 00	3.256340 00	3.256320 00	3.256300 00	3.256270 00
5.000 02	3.511840 00	3.511830 00	3.511810 00	3.511800 00	3.511790 00	3.511780 00	3.511770 00	3.511760 00	3.511730 00
7.500 02	3.714570 00	3.714560 00	3.714550 00	3.714540 00	3.714540 00	3.714530 00	3.714520 00	3.714510 00	3.714500 00
1.000 03	3.858410 00	3.858400 00	3.858400 00	3.858390 00	3.858380 00	3.858380 00	3.858370 00	3.858370 00	3.858360 00
1.500 03	4.061140 00	4.061140 00	4.061130 00	4.061130 00	4.061130 00	4.061120 00	4.061120 00	4.061110 00	4.061110 00
2.000 03	4.204980 00	4.204980 00	4.204980 00	4.204970 00	4.204970 00	4.204970 00	4.204960 00	4.204960 00	4.204960 00
3.000 03	4.407720 00	4.407710 00	4.407710 00	4.407710 00	4.407710 00	4.407710 00	4.407710 00	4.407700 00	4.407700 00
5.000 03	4.663130 00	4.663130 00	4.663130 00	4.663130 00	4.663130 00	4.663130 00	4.663120 00	4.663120 00	4.663120 00
7.500 03	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00
1.000 04	5.009710 00	5.009710 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00

TABLE B.2c

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE

AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.01$ AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 1000.000
CD2/exp(232) = 1.000000 04 CD2/rD**2 = 0.01000
CD1/rD**2 = 0.01000

CD=exp(231)

	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12
td/rD**2	DIMENSIONLESS PRESSURE DROP							
1.000-01	1.004470-03	0.536070-04	7.416480-04	6.554010-04	5.069870-04	5.314280-04	4.854290-04	4.137250-04
1.500-01	6.991510-03	6.132080-03	5.455140-03	4.909770-03	4.461790-03	4.087670-03	3.770760-03	3.263490-03
2.000-01	2.078500-02	1.867720-02	1.693310-02	1.547280-02	1.423590-02	1.317680-02	1.226090-02	1.075860-02
3.000-01	6.857290-02	6.377510-02	5.949140-02	5.567190-02	5.226260-02	4.921210-02	4.647370-02	4.177550-02
5.000-01	1.942100-01	1.872430-01	1.804460-01	1.738840-01	1.675900-01	1.615800-01	1.558640-01	1.453050-01
7.500-01	3.397410-01	3.334120-01	3.270170-01	3.205840-01	3.141410-01	3.077190-01	3.013460-01	2.888430-01
1.000 00	4.366090-01	4.533900-01	4.480770-01	4.426750-01	4.371890-01	4.316290-01	4.260090-01	4.146470-01
1.500 00	6.391420-01	6.354500-01	6.317020-01	6.278960-01	6.240290-01	6.200990-01	6.161050-01	6.079200-01
2.000 00	7.730500-01	7.702250-01	7.673660-01	7.644740-01	7.615460-01	7.585820-01	7.555790-01	7.494510-01
3.000 00	9.667790-01	9.648700-01	9.629460-01	9.610060-01	9.590500-01	9.570770-01	9.550870-01	9.510560-01
5.000 00	1.215240 00	1.214690 00	1.213530 00	1.212360 00	1.211200 00	1.210020 00	1.208840 00	1.206460 00
7.500 00	1.415780 00	1.415010 00	1.414240 00	1.413470 00	1.412690 00	1.411910 00	1.411130 00	1.409560 00
1.000 01	1.558370 00	1.557790 00	1.557210 00	1.556630 00	1.556050 00	1.555470 00	1.554880 00	1.553710 00
1.500 01	1.759970 00	1.759590 00	1.759200 00	1.758820 00	1.758430 00	1.758040 00	1.757650 00	1.756880 00
2.000 01	1.903390 00	1.903020 00	1.902740 00	1.902450 00	1.902160 00	1.901870 00	1.901580 00	1.900990 00
3.000 01	2.105600 00	2.105410 00	2.105220 00	2.105030 00	2.104830 00	2.104640 00	2.104450 00	2.104060 00
5.000 01	2.360730 00	2.360610 00	2.360500 00	2.360380 00	2.360270 00	2.360150 00	2.360030 00	2.359800 00
7.500 01	2.563350 00	2.563270 00	2.563190 00	2.563120 00	2.563040 00	2.562960 00	2.562880 00	2.562730 00
1.000 02	2.707140 00	2.707080 00	2.707030 00	2.706970 00	2.706910 00	2.706850 00	2.706800 00	2.706680 00
1.500 02	2.909840 00	2.909800 00	2.909760 00	2.909730 00	2.909690 00	2.909650 00	2.909610 00	2.909530 00
2.000 02	3.053670 00	3.053640 00	3.053610 00	3.053590 00	3.053560 00	3.053530 00	3.053500 00	3.053440 00
3.000 02	3.256400 00	3.256380 00	3.256360 00	3.256340 00	3.256320 00	3.256300 00	3.256280 00	3.256250 00
5.000 02	3.511810 00	3.511800 00	3.511790 00	3.511780 00	3.511770 00	3.511760 00	3.511750 00	3.511720 00
7.500 02	3.714550 00	3.714540 00	3.714540 00	3.714530 00	3.714520 00	3.714510 00	3.714510 00	3.714490 00
1.000 03	3.858400 00	3.858390 00	3.858380 00	3.858380 00	3.858370 00	3.858370 00	3.858360 00	3.858350 00
1.500 03	4.061130 00	4.061130 00	4.061130 00	4.061120 00	4.061120 00	4.061110 00	4.061110 00	4.061100 00
2.000 03	4.204980 00	4.204970 00	4.204970 00	4.204970 00	4.204960 00	4.204960 00	4.204960 00	4.204950 00
3.000 03	4.407770 00	4.407710 00	4.407710 00	4.407710 00	4.407710 00	4.407700 00	4.407700 00	4.407700 00
5.000 03	4.663130 00	4.663130 00	4.663130 00	4.663130 00	4.663120 00	4.663120 00	4.663120 00	4.663120 00
7.500 03	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00	4.865860 00
1.000 04	5.009710 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00	5.009700 00

TABLE B.2d

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 31.6$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, MD = 31.625
CO2=exp(232) = 1.000000 01 CO2/rD**2 = 0.01000
CO1/rD**2 = 0.10000

CO=exp(231)

	1.000000 02	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10
10./rD**2									
	DIMENSIONLESS PRESSURE DROP								
1.000-01	7.689990-04	4.672520-04	3.344380-04	2.601970-04	2.128640-04	1.800770-04	1.560310-04	1.376460-04	1.231330-04
1.500-01	4.395300-03	2.895570-03	2.151400-03	1.709810-03	1.418070-03	1.211160-03	1.055810-03	9.373440-04	8.421000-04
2.000-01	1.243100-02	8.338630-03	6.356540-03	5.129680-03	4.297700-03	3.697080-03	3.245310-03	2.888590-03	2.603670-03
3.000-01	3.847740-02	2.849790-02	2.252840-02	1.859710-02	1.582290-02	1.376420-02	1.217710-02	1.091690-02	9.892280-03
5.000-01	1.145550-01	9.501650-02	7.851330-02	6.716620-02	5.844900-02	5.170170-02	4.633350-02	4.196600-02	3.834500-02
7.500-01	2.318300-01	1.988360-01	1.717260-01	1.506030-01	1.330640-01	1.203490-01	1.092450-01	9.997540-02	9.213140-02
1.000 00	3.444800-01	3.044880-01	2.707240-01	2.426850-01	2.193880-01	1.998880-01	1.834050-01	1.693340-01	1.572040-01
1.500 00	5.345900-01	4.930500-01	4.557210-01	4.216170-01	3.900450-01	3.638600-01	3.390380-01	3.183090-01	2.992180-01
2.000 00	6.799430-01	6.457810-01	6.111700-01	5.774640-01	5.494480-01	5.155660-01	4.879490-01	4.625600-01	4.392750-01
3.000 00	8.955090-01	8.713080-01	8.454580-01	8.184440-01	7.908760-01	7.633250-01	7.362400-01	7.099390-01	6.846280-01
5.000 00	1.137960 00	1.154050 00	1.139240 00	1.123440 00	1.106650 00	1.088920 00	1.070400 00	1.051260 00	1.031690 00
7.500 00	1.381520 00	1.372690 00	1.363500 00	1.353880 00	1.343780 00	1.333160 00	1.321980 00	1.310220 00	1.297890 00
1.000 01	1.551470 00	1.525040 00	1.508420 00	1.511590 00	1.504520 00	1.497200 00	1.489580 00	1.481640 00	1.473360 00
1.500 01	1.790920 00	1.736770 00	1.732540 00	1.728230 00	1.723830 00	1.719340 00	1.714750 00	1.710050 00	1.705240 00
2.000 01	1.888420 00	1.885360 00	1.882260 00	1.879120 00	1.875930 00	1.872700 00	1.869410 00	1.866070 00	1.862680 00
3.000 01	2.095110 00	2.093110 00	2.091090 00	2.089050 00	2.086990 00	2.084920 00	2.082830 00	2.080710 00	2.078580 00
5.000 01	2.354000 00	2.352810 00	2.351620 00	2.350430 00	2.349220 00	2.348020 00	2.346800 00	2.345580 00	2.344360 00
7.500 01	2.558630 00	2.557840 00	2.557060 00	2.556270 00	2.555480 00	2.554690 00	2.553890 00	2.553090 00	2.552290 00
1.000 02	2.703480 00	2.702890 00	2.702310 00	2.701720 00	2.701130 00	2.700540 00	2.699950 00	2.699360 00	2.698760 00
1.500 02	2.907280 00	2.906890 00	2.906500 00	2.906110 00	2.905720 00	2.905330 00	2.904940 00	2.904550 00	2.904160 00
2.000 02	3.051690 00	3.051400 00	3.051110 00	3.050820 00	3.050530 00	3.050230 00	3.049940 00	3.049650 00	3.049360 00
3.000 02	3.255020 00	3.254820 00	3.254630 00	3.254440 00	3.254240 00	3.254050 00	3.253860 00	3.253660 00	3.253470 00
5.000 02	3.510940 00	3.510820 00	3.510710 00	3.510590 00	3.510480 00	3.510360 00	3.510250 00	3.510130 00	3.510010 00
7.500 02	3.713940 00	3.713870 00	3.713790 00	3.713710 00	3.713640 00	3.713560 00	3.713480 00	3.713400 00	3.713330 00
1.000 03	3.857930 00	3.857870 00	3.857810 00	3.857750 00	3.857700 00	3.857640 00	3.857580 00	3.857520 00	3.857470 00
1.500 03	4.060810 00	4.060770 00	4.060730 00	4.060690 00	4.060650 00	4.060620 00	4.060580 00	4.060540 00	4.060500 00
2.000 03	4.104730 00	4.104700 00	4.104670 00	4.104640 00	4.104610 00	4.104580 00	4.104550 00	4.104530 00	4.104500 00
3.000 03	4.107540 00	4.107520 00	4.107500 00	4.107480 00	4.107460 00	4.107440 00	4.107420 00	4.107410 00	4.107390 00
5.000 03	4.163020 00	4.163010 00	4.163000 00	4.162990 00	4.162970 00	4.162960 00	4.162950 00	4.162940 00	4.162930 00
7.500 03	4.165790 00	4.165780 00	4.165770 00	4.165760 00	4.165760 00	4.165750 00	4.165740 00	4.165730 00	4.165730 00
1.000 04	5.009650 00	5.009640 00	5.009640 00	5.009630 00	5.009630 00	5.009620 00	5.009610 00	5.009610 00	5.009600 00

TABLE B.2e

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
 AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 100$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
 IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
 AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 100.000
 $CD2 \times \exp(2S2) = 1.000000$ 02 $CD2/r_D^2 = 0.01000$
 $CD1/r_D^2 = 0.10000$

$CD \times \exp(2S1)$

	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12
td/r_D^2	DIMENSIONLESS PRESSURE DROP								
1.000-01	3.530730-04	2.513890-04	1.950000-04	1.592210-04	1.345170-04	1.164400-04	1.026420-04	9.176550-05	7.571520-05
1.500-01	2.388040-03	1.767800-03	1.401870-03	1.165990-03	9.905730-04	8.636960-04	7.655800-04	6.874710-04	5.709240-04
2.000-01	7.233950-03	5.497870-03	4.428530-03	3.705640-03	3.184890-03	2.792120-03	2.485410-03	2.239310-03	1.869010-03
3.000-01	2.610470-02	2.058760-02	1.696900-02	1.442240-02	1.253610-02	1.108400-02	9.932240-03	8.996660-03	7.569510-03
5.000-01	9.090540-02	7.526980-02	6.406840-02	5.570410-02	4.924090-02	4.410560-02	3.993120-02	3.647340-02	3.108110-02
7.500-01	1.940380-01	1.673580-01	1.466290-01	1.302350-01	1.170190-01	1.061730-01	9.712840-02	8.948000-02	7.726860-02
1.000 00	2.997620-01	2.662440-01	2.384780-01	2.154490-01	1.962000-01	1.799480-01	1.660850-01	1.541440-01	1.346660-01
1.500 00	4.890780-01	4.517530-01	4.177160-01	3.872470-01	3.601860-01	3.361970-01	3.149030-01	2.959450-01	2.637950-01
2.000 00	6.425690-01	6.078940-01	5.741290-01	5.421130-01	5.122600-01	4.846920-01	4.593670-01	4.361540-01	3.953840-01
3.000 00	8.691190-01	8.431760-01	8.160780-01	7.884430-01	7.608410-01	7.337220-01	7.074030-01	6.820850-01	6.348510-01
5.000 00	1.152770 00	1.137920 00	1.122080 00	1.105240 00	1.087470 00	1.068900 00	1.049720 00	1.030100 00	9.902720-01
7.500 00	1.371870 00	1.362650 00	1.353020 00	1.342900 00	1.332260 00	1.321050 00	1.309270 00	1.296920 00	1.270660 00
1.000 01	1.524430 00	1.517800 00	1.510960 00	1.503880 00	1.496550 00	1.488920 00	1.480970 00	1.472670 00	1.454970 00
1.500 01	1.734370 00	1.732140 00	1.727820 00	1.723420 00	1.718930 00	1.714330 00	1.709630 00	1.704810 00	1.694770 00
2.000 01	1.885070 00	1.881960 00	1.878820 00	1.875630 00	1.872390 00	1.869100 00	1.865760 00	1.862370 00	1.855400 00
3.000 01	2.092910 00	2.090890 00	2.088850 00	2.086790 00	2.084720 00	2.082630 00	2.080510 00	2.078380 00	2.074040 00
5.000 01	2.352690 00	2.351500 00	2.350310 00	2.349110 00	2.347900 00	2.346690 00	2.345470 00	2.344240 00	2.341770 00
7.500 01	2.557760 00	2.556980 00	2.556190 00	2.555400 00	2.554610 00	2.553810 00	2.553010 00	2.552210 00	2.550600 00
1.000 02	2.702830 00	2.702250 00	2.701660 00	2.701070 00	2.700480 00	2.699890 00	2.699300 00	2.698700 00	2.697510 00
1.500 02	2.906850 00	2.906460 00	2.906080 00	2.905690 00	2.905300 00	2.904900 00	2.904510 00	2.904120 00	2.903330 00
2.000 02	3.051370 00	3.051080 00	3.050790 00	3.050500 00	3.050200 00	3.049910 00	3.049620 00	3.049330 00	3.048740 00
3.000 02	3.254800 00	3.254610 00	3.254420 00	3.254220 00	3.254030 00	3.253840 00	3.253640 00	3.253450 00	3.253060 00
5.000 02	3.510810 00	3.510700 00	3.510580 00	3.510470 00	3.510350 00	3.510230 00	3.510120 00	3.510000 00	3.509770 00
7.500 02	3.713860 00	3.713760 00	3.713710 00	3.713630 00	3.713550 00	3.713470 00	3.713400 00	3.713320 00	3.713170 00
1.000 03	3.857860 00	3.857810 00	3.857750 00	3.857690 00	3.857630 00	3.857580 00	3.857520 00	3.857460 00	3.857340 00
1.500 03	4.060770 00	4.060730 00	4.060690 00	4.060650 00	4.060610 00	4.060570 00	4.060540 00	4.060500 00	4.060420 00
2.000 03	4.204700 00	4.204670 00	4.204640 00	4.204610 00	4.204580 00	4.204550 00	4.204520 00	4.204490 00	4.204440 00
3.000 03	4.407520 00	4.407500 00	4.407480 00	4.407460 00	4.407440 00	4.407420 00	4.407400 00	4.407380 00	4.407350 00
5.000 03	4.663010 00	4.663000 00	4.662980 00	4.662970 00	4.662960 00	4.662950 00	4.662940 00	4.662930 00	4.662900 00
7.500 03	4.865780 00	4.865770 00	4.865760 00	4.865760 00	4.865750 00	4.865740 00	4.865730 00	4.865730 00	4.865710 00
1.000 04	5.009640 00	5.009640 00	5.009630 00	5.009620 00	5.009620 00	5.009610 00	5.009610 00	5.009600 00	5.009590 00

TABLE B.2f

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 316$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $RD = 316.228$
 $CD2/exp(252) = 1.000000$ $CD1/r_D^2 = 0.010000$
 $CD1/r_D^2 = 0.100000$

$CD2/exp(252)$

	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12
tD/r_D^2	DIMENSIONLESS PRESSURE DROP							
1.00D-01	1.98551D-04	1.53840D-04	1.25523D-04	1.05995D-04	9.17183D-05	8.08277E-05	7.22471D-05	5.95918D-05
1.50D-01	1.48441D-03	1.17584D-03	9.73102D-04	8.29845D-04	7.23286D-04	6.40944E-04	5.75415D-04	4.77704D-04
2.00D-01	4.80242D-03	3.86398D-03	3.23084D-03	2.77534D-03	2.43212D-03	2.16429E-03	1.94952D-03	1.62655D-03
3.00D-01	1.88482D-02	1.55176D-02	1.31785D-02	1.14484D-02	1.01180D-02	9.06355E-03	8.29759D-03	6.90260D-03
5.00D-01	7.18415D-02	6.10843D-02	5.30668D-02	4.68844D-02	4.19761D-02	3.79899E-02	3.46901D-02	2.95486D-02
7.50D-01	1.63018D-01	1.42686D-01	1.26644D-01	1.13732D-01	1.03146D-01	9.43267D-02	8.58741D-02	7.49850D-02
1.00D 00	2.61744D-01	2.34261D-01	2.11509D-01	1.92517D-01	1.76501D-01	1.62851D-01	1.51101D-01	1.31951D-01
1.50D 00	4.47751D-01	4.13784D-01	3.83428D-01	3.56491D-01	3.32640D-01	3.11485D-01	2.92663D-01	2.60769D-01
2.00D 00	6.04571D-01	5.70767D-01	5.38752D-01	5.08930D-01	4.81414D-01	4.56155D-01	4.33017D-01	3.92408D-01
3.00D 00	8.40881D-01	8.13699D-01	7.85995D-01	7.58342D-01	7.31189D-01	7.04851D-01	6.79526D-01	6.32313D-01
5.00D 00	1.13660D 00	1.12072D 00	1.10383D 00	1.08601D 00	1.06739D 00	1.04817D 00	1.02851D 00	9.88614D-01
7.50D 00	1.36181D 00	1.35215D 00	1.34202D 00	1.33135D 00	1.32012D 00	1.30831D 00	1.29594D 00	1.28963D 00
1.00D 01	1.51718D 00	1.51033D 00	1.50324D 00	1.49590D 00	1.48826D 00	1.48029D 00	1.47198D 00	1.45425D 00
1.50D 01	1.73173D 00	1.72742D 00	1.72301D 00	1.71851D 00	1.71391D 00	1.70921D 00	1.70438D 00	1.69433D 00
2.00D 01	1.88166D 00	1.87852D 00	1.87533D 00	1.87209D 00	1.86880D 00	1.86545D 00	1.86206D 00	1.85509D 00
3.00D 01	2.09096D 00	2.08865D 00	2.08640D 00	2.08452D 00	2.08243D 00	2.08031D 00	2.07817D 00	2.07384D 00
5.00D 01	2.35139D 00	2.35019D 00	2.34899D 00	2.34778D 00	2.34657D 00	2.34535D 00	2.34412D 00	2.34165D 00
7.50D 01	2.55698D 00	2.55611D 00	2.55532D 00	2.55453D 00	2.55373D 00	2.55294D 00	2.55213D 00	2.55052D 00
1.00D 02	2.70219D 00	2.70160D 00	2.70101D 00	2.70042D 00	2.69983D 00	2.69924D 00	2.69864D 00	2.69745D 00
1.50D 02	2.90643D 00	2.90604D 00	2.90565D 00	2.90526D 00	2.90487D 00	2.90447D 00	2.90408D 00	2.90329D 00
2.00D 02	3.05105D 00	3.05076D 00	3.05047D 00	3.05017D 00	3.04988D 00	3.04959D 00	3.04930D 00	3.04871D 00
3.00D 02	3.25459D 00	3.25440D 00	3.25421D 00	3.25401D 00	3.25382D 00	3.25362D 00	3.25343D 00	3.25304D 00
5.00D 02	3.51069D 00	3.51057D 00	3.51045D 00	3.51034D 00	3.51022D 00	3.51011D 00	3.50999D 00	3.50976D 00
7.50D 02	3.71377D 00	3.71370D 00	3.71362D 00	3.71354D 00	3.71347D 00	3.71339D 00	3.71331D 00	3.71316D 00
1.00D 03	3.85788D 00	3.85774D 00	3.85768D 00	3.85763D 00	3.85757D 00	3.85751D 00	3.85745D 00	3.85734D 00
1.50D 03	4.06072D 00	4.06069D 00	4.06065D 00	4.06061D 00	4.06057D 00	4.06053D 00	4.06049D 00	4.06042D 00
2.00D 03	4.20466D 00	4.20463D 00	4.20461D 00	4.20458D 00	4.20455D 00	4.20452D 00	4.20449D 00	4.20443D 00
3.00D 03	4.40754D 00	4.40748D 00	4.40746D 00	4.40744D 00	4.40742D 00	4.40740D 00	4.40738D 00	4.40734D 00
5.00D 03	4.66308D 00	4.66298D 00	4.66297D 00	4.66296D 00	4.66295D 00	4.66294D 00	4.66293D 00	4.66290D 00
7.50D 03	4.86577D 00	4.86576D 00	4.86576D 00	4.86575D 00	4.86574D 00	4.86573D 00	4.86573D 00	4.86571D 00
1.00D 04	5.00963D 00	5.00963D 00	5.00962D 00	5.00962D 00	5.00961D 00	5.00961D 00	5.00960D 00	5.00959D 00

TABLE B.2g

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.1$, AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 1000.000
CD2=exp(252) = 1.000000 04 CD2/rD**2 = 0.01000
CD1/rD**2 = 0.10000

CD=exp(231)

1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12	1.000000 15	1.000000 20
10/rD**2	DIMENSIONLESS PRESSURE DROP							
1.000-01	1.265560-04	1.032240-04	8.714230-05	7.539070-05	6.642930-05	5.937050-05	4.896260-05	3.876650-05
1.500-01	1.008770-03	8.344560-04	7.113870-04	6.198960-04	5.492270-04	4.930060-04	4.092040-04	3.260460-04
2.000-01	3.414110-03	2.853190-03	2.450040-03	2.146460-03	1.909680-03	1.719880-03	1.434600-03	1.148670-03
3.000-01	1.424770-02	1.209260-02	1.050040-02	9.276990-03	8.308040-03	7.521840-03	6.324070-03	5.104040-03
5.000-01	5.825060-02	5.057230-02	4.465620-02	3.996550-02	3.615890-02	3.300980-02	2.810630-02	2.297790-02
7.500-01	1.388070-01	1.231210-01	1.105120-01	1.001860-01	9.158990-02	8.433100-02	7.275990-02	6.030560-02
1.000 00	2.300570-01	2.075900-01	1.888610-01	1.730830-01	1.596470-01	1.480900-01	1.292690-01	1.084690-01
1.500 00	4.098300-01	3.795840-01	3.527860-01	3.298770-01	3.080650-01	2.893810-01	2.577460-01	2.210450-01
2.000 00	5.673790-01	5.353690-01	5.055810-01	4.781210-01	4.529300-01	4.298690-01	3.894260-01	3.403560-01
3.000 00	8.113030-01	7.835300-01	7.558260-01	7.286400-01	7.022840-01	6.769570-01	6.297630-01	5.677630-01
5.000 00	1.119350 00	1.102410 00	1.084540 00	1.065880 00	1.046610 00	1.026910 00	9.869490-01	9.276590-01
7.500 00	1.351280 00	1.341130 00	1.330440 00	1.319190 00	1.307360 00	1.294950 00	1.268590 00	1.226030 00
1.000 01	1.509700 00	1.502600 00	1.495240 00	1.487590 00	1.479620 00	1.471290 00	1.453530 00	1.424110 00
1.500 01	1.727010 00	1.722600 00	1.718090 00	1.713490 00	1.708780 00	1.703950 00	1.693890 00	1.677630 00
2.000 01	1.878220 00	1.875020 00	1.871780 00	1.868490 00	1.865140 00	1.861740 00	1.854770 00	1.843800 00
3.000 01	2.088450 00	2.086400 00	2.084320 00	2.082220 00	2.080110 00	2.077970 00	2.073630 00	2.066950 00
5.000 01	2.350070 00	2.348870 00	2.347660 00	2.346450 00	2.345230 00	2.344000 00	2.341530 00	2.337770 00
7.500 01	2.556040 00	2.555240 00	2.554450 00	2.553660 00	2.552860 00	2.552060 00	2.550450 00	2.548010 00
1.000 02	2.701540 00	2.700960 00	2.700370 00	2.699770 00	2.699180 00	2.698580 00	2.697390 00	2.695590 00
1.500 02	2.906000 00	2.905610 00	2.905220 00	2.904830 00	2.904440 00	2.904040 00	2.903260 00	2.902070 00
2.000 02	3.050730 00	3.050440 00	3.050150 00	3.049850 00	3.049560 00	3.049270 00	3.048680 00	3.047800 00
3.000 02	3.254380 00	3.254190 00	3.253990 00	3.253800 00	3.253610 00	3.253410 00	3.253020 00	3.252440 00
5.000 02	3.510560 00	3.510440 00	3.510330 00	3.510210 00	3.510090 00	3.509980 00	3.509750 00	3.509400 00
7.500 02	3.713690 00	3.713610 00	3.713540 00	3.713460 00	3.713380 00	3.713300 00	3.713150 00	3.712920 00
1.000 03	3.857740 00	3.857680 00	3.857620 00	3.857560 00	3.857510 00	3.857450 00	3.857330 00	3.857160 00
1.500 03	4.060680 00	4.060640 00	4.060600 00	4.060570 00	4.060530 00	4.060490 00	4.060410 00	4.060300 00
2.000 03	4.204630 00	4.204600 00	4.204570 00	4.204540 00	4.204520 00	4.204490 00	4.204430 00	4.204340 00
3.000 03	4.407430 00	4.407460 00	4.407440 00	4.407420 00	4.407400 00	4.407380 00	4.407340 00	4.407280 00
5.000 03	4.662930 00	4.662970 00	4.662960 00	4.662950 00	4.662940 00	4.662920 00	4.662900 00	4.662870 00
7.500 03	4.865760 00	4.865760 00	4.865750 00	4.865740 00	4.865730 00	4.865710 00	4.865690 00	4.865650 00
1.000 04	5.009630 00	5.009620 00	5.009620 00	5.009610 00	5.009610 00	5.009600 00	5.009590 00	5.009540 00

TABLE B.2h

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.01$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 3162$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, MD $\square$ 3162.278
CO2*exp(2S) = 1.000000 05 CD2/rD**2 $\square$ 0.01000
CD1/rD**2 $\square$ 0.10000

CD*exp(2S1)

1.000000 06 1.000000 07 1.000000 08 1.000000 10 1.000000 12 1.000000 15 1.000000 20 1.000000 25

CD/rD**2

DIMENSIONLESS PRESSURE DROP

1.000-01	0.753410-05	7.388440-05	6.391280-05	5.032320-05	4.149690-05	3.285210-05	2.418430-05	1.938660-05
1.500-01	7.291440-04	6.214680-04	5.414530-04	4.305230-04	3.572900-04	2.846410-04	2.125830-04	1.696330-04
2.000-01	8.549430-03	2.188600-03	1.917020-03	1.635620-03	1.280660-03	1.025230-03	7.653850-04	6.157070-04
3.000-01	1.114780-02	9.676500-03	8.546800-03	6.927170-03	5.822610-03	4.698130-03	3.553620-03	2.857380-03
5.000-01	4.822230-02	4.256200-02	3.807810-02	3.143530-02	2.675660-02	2.186690-02	1.675660-02	1.358030-02
7.500-01	1.196740-01	1.073690-01	9.730040-02	8.185750-02	7.059870-02	5.849110-02	4.568180-02	3.716730-02
1.000 00	2.037060-01	1.852380-01	1.697010-01	1.451170-01	1.266240-01	1.062050-01	8.362390-02	6.892420-02
1.500 00	3.757320-01	3.490740-01	3.255110-01	2.861040-01	2.547350-01	2.183730-01	1.760440-01	1.472980-01
2.000 00	5.319630-01	5.022130-01	4.748120-01	4.267120-01	3.864390-01	3.376200-01	2.779940-01	2.358400-01
3.000 00	7.810460-01	7.532930-01	7.260750-01	6.743720-01	6.272020-01	5.652850-01	4.826780-01	4.197070-01
5.000 00	1.100980 00	1.083060 00	1.064360 00	1.025300 00	9.852750-01	9.239200-01	8.341640-01	7.543370-01
7.500 00	1.340240 00	1.329530 00	1.318250 00	1.293970 00	1.267550 00	1.224910 00	1.150060 00	1.075930 00
1.000 01	1.501560 00	1.494590 00	1.486930 00	1.470600 00	1.452810 00	1.423340 00	1.368050 00	1.308240 00
1.500 01	1.722140 00	1.717680 00	1.713070 00	1.703520 00	1.693450 00	1.677170 00	1.646240 00	1.610550 00
2.000 01	1.874720 00	1.871470 00	1.868180 00	1.861430 00	1.854450 00	1.843470 00	1.823450 00	1.800680 00
3.000 01	2.086200 00	2.084120 00	2.082020 00	2.077770 00	2.073430 00	2.066740 00	2.055080 00	2.042610 00
5.000 01	2.348750 00	2.347540 00	2.346330 00	2.343880 00	2.341410 00	2.337650 00	2.331230 00	2.324610 00
7.500 01	2.555170 00	2.554370 00	2.553580 00	2.551980 00	2.550370 00	2.547930 00	2.543870 00	2.539620 00
1.000 02	2.700980 00	2.700310 00	2.699710 00	2.698530 00	2.697330 00	2.695530 00	2.692580 00	2.689430 00
1.500 02	2.905570 00	2.905180 00	2.904790 00	2.904000 00	2.903220 00	2.902030 00	2.900040 00	2.898040 00
2.000 02	3.050090 00	3.050120 00	3.049820 00	3.049240 00	3.048650 00	3.047770 00	3.046670 00	3.045810 00
3.000 02	3.254170 00	3.253970 00	3.253780 00	3.253390 00	3.253000 00	3.252420 00	3.251440 00	3.250460 00
5.000 02	3.510430 00	3.510320 00	3.510200 00	3.509970 00	3.509740 00	3.509390 00	3.508870 00	3.508220 00
7.500 02	3.713640 00	3.713530 00	3.713450 00	3.713300 00	3.713140 00	3.712910 00	3.712520 00	3.712160 00
1.000 03	3.857670 00	3.857620 00	3.857560 00	3.857440 00	3.857330 00	3.857150 00	3.856860 00	3.856570 00
1.500 03	4.060640 00	4.060600 00	4.060560 00	4.060490 00	4.060410 00	4.060290 00	4.060180 00	4.059910 00
2.000 03	4.204600 00	4.204570 00	4.204540 00	4.204480 00	4.204430 00	4.204340 00	4.204200 00	4.204050 00
3.000 03	4.407460 00	4.407440 00	4.407420 00	4.407380 00	4.407340 00	4.407280 00	4.407170 00	4.407090 00
5.000 03	4.662970 00	4.662960 00	4.662950 00	4.662920 00	4.662900 00	4.662870 00	4.66280 00	4.662750 00
7.500 03	4.865740 00	4.865750 00	4.865740 00	4.865720 00	4.865710 00	4.865690 00	4.865650 00	4.865610 00
1.000 04	5.009620 00	5.009620 00	5.009610 00	5.009600 00	5.009590 00	5.009570 00	5.009540 00	5.009510 00

TABLE B.21

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 31.6$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 31.623
CD2*exp(252) = 1.000000 02 CD2/rD**2 = 0.10000
CD1/rD**2 = 0.10000

CD*exp(251)

	1.000000 02	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 08	1.000000 10	1.000000 12	1.000000 20
tD/rD**2	DIMENSIONLESS PRESSURE DROP								
1.000-01	1.429710-04	8.598420-05	6.128760-05	4.757570-05	3.886690-05	2.844310-05	2.242510-05	1.850800-05	1.089410-05
1.500-01	9.940410-04	6.465800-04	4.776370-04	3.783590-04	3.131430-04	2.327800-04	1.852130-04	1.537750-04	9.157370-05
2.000-01	3.186410-03	2.176420-03	1.647300-03	1.323820-03	1.106060-03	8.319240-04	6.665240-04	5.559330-04	3.340820-04
3.000-01	1.294690-02	9.424230-03	7.381500-03	6.058760-03	5.135210-03	3.932860-03	3.105610-03	2.676580-03	1.632300-03
5.000-01	5.416400-02	4.254640-02	3.486910-02	2.948250-02	2.551420-02	2.007950-02	1.654250-02	1.406090-02	8.781050-03
7.500-01	1.336530-01	1.113280-01	9.484710-02	8.239450-02	7.273070-02	5.879980-02	4.929040-02	4.240600-02	2.716680-02
1.000 00	2.262210-01	1.960950-01	1.719390-01	1.525690-01	1.368660-01	1.131950-01	9.633670-02	8.377920-02	5.493670-02
1.500 00	4.093700-01	3.732830-01	3.407580-01	3.121470-01	2.872180-01	2.466090-01	2.154200-01	1.909420-01	1.306550-01
2.000 00	5.675660-01	5.330170-01	4.994450-01	4.678490-01	4.387030-01	3.879990-01	3.463800-01	3.121240-01	2.219620-01
3.000 00	8.078300-01	7.815060-01	7.539510-01	7.258140-01	6.977420-01	6.437030-01	5.942080-01	5.499230-01	4.179920-01
5.000 00	1.109930 00	1.094750 00	1.078600 00	1.061430 00	1.043280 00	1.004640 00	9.641730-01	9.233680-01	7.737450-01
7.500 00	1.348760 00	1.331320 00	1.321460 00	1.311150 00	1.300310 00	1.276920 00	1.251210 00	1.223460 00	1.102660 00
1.000 01	1.499880 00	1.493090 00	1.486100 00	1.478870 00	1.471390 00	1.455540 00	1.438320 00	1.419580 00	1.331300 00
1.500 01	1.718910 00	1.714590 00	1.710200 00	1.705710 00	1.701130 00	1.691670 00	1.681740 00	1.671260 00	1.622140 00
2.000 01	1.871400 00	1.868240 00	1.865050 00	1.861810 00	1.858520 00	1.851780 00	1.844830 00	1.837630 00	1.805600 00
3.000 01	2.083250 00	2.081210 00	2.079140 00	2.077060 00	2.074960 00	2.070700 00	2.066360 00	2.061930 00	2.043170 00
5.000 01	2.346480 00	2.345280 00	2.344080 00	2.342860 00	2.341650 00	2.339190 00	2.336710 00	2.334210 00	2.323890 00
7.500 01	2.553400 00	2.552610 00	2.551820 00	2.551020 00	2.550220 00	2.548620 00	2.547000 00	2.545380 00	2.538770 00
1.000 02	2.699440 00	2.698850 00	2.698260 00	2.697670 00	2.697070 00	2.695800 00	2.694690 00	2.693480 00	2.680820 00
1.500 02	2.904470 00	2.904080 00	2.903690 00	2.903300 00	2.902910 00	2.902130 00	2.901340 00	2.900550 00	2.897360 00
2.000 02	3.049520 00	3.049230 00	3.048940 00	3.048650 00	3.048350 00	3.047770 00	3.047180 00	3.046590 00	3.044220 00
3.000 02	3.253510 00	3.253320 00	3.253130 00	3.252930 00	3.252740 00	3.252350 00	3.251960 00	3.251570 00	3.250010 00
5.000 02	3.509990 00	3.509880 00	3.509760 00	3.509650 00	3.509530 00	3.509300 00	3.509070 00	3.508830 00	3.507900 00
7.500 02	3.713290 00	3.713210 00	3.713140 00	3.713060 00	3.712980 00	3.712630 00	3.712670 00	3.712520 00	3.711900 00
1.000 03	3.857420 00	3.857370 00	3.857310 00	3.857250 00	3.857190 00	3.857000 00	3.856960 00	3.856850 00	3.856380 00
1.500 03	4.060460 00	4.060420 00	4.060380 00	4.060350 00	4.060310 00	4.060230 00	4.060150 00	4.060080 00	4.059770 00
2.000 03	4.204460 00	4.204430 00	4.204400 00	4.204370 00	4.204340 00	4.204290 00	4.204230 00	4.204170 00	4.203940 00
3.000 03	4.407360 00	4.407340 00	4.407320 00	4.407300 00	4.407280 00	4.407240 00	4.407200 00	4.407160 00	4.407010 00
5.000 03	4.662910 00	4.662890 00	4.662880 00	4.662870 00	4.662860 00	4.662840 00	4.662810 00	4.662790 00	4.662700 00
7.500 03	4.865710 00	4.865700 00	4.865690 00	4.865680 00	4.865660 00	4.865600 00	4.865560 00	4.865530 00	4.865370 00
1.000 04	5.009590 00	5.009580 00	5.009560 00	5.009570 00	5.009560 00	5.009550 00	5.009540 00	5.009530 00	5.009480 00

TABLE B.2j

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 100$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RO = 100.000
 $CD2/exp(232) = 1.000000$ 03 $CD2/r_D^2$ = 0.10000
 $CD1/r_D^2$ = 0.10000

$CD/exp(231)$

	1.000000 04	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12	1.000000 15
tD/r_D^2	DIMENSIONLESS PRESSURE DROP								
1.000-01	3.728920-05	2.886710-05	2.354140-05	1.987200-05	1.719110-05	1.514700-05	1.353710-05	1.116340-05	8.838360-06
1.500-01	3.118760-04	2.465730-04	2.038110-04	1.736620-04	1.512690-04	1.339860-04	1.202430-04	9.977080-05	7.946960-05
2.000-01	1.125620-03	9.030640-04	7.536830-04	6.465810-04	5.668720-04	5.033620-04	4.539430-04	3.777420-04	3.022700-04
3.000-01	8.357510-03	4.390520-03	3.717230-03	3.222070-03	2.844900-03	2.543350-03	2.300780-03	1.932020-03	1.557390-03
5.000-01	2.723180-02	2.298320-02	1.986410-02	1.748230-02	1.566640-02	1.409180-02	1.284370-02	1.090900-02	8.696300-03
7.500-01	7.841930-02	6.797410-02	5.998550-02	5.350970-02	4.832620-02	4.404570-02	4.065420-02	3.477010-02	2.870520-02
1.000 00	1.478380-01	1.308580-01	1.177710-01	1.059660-01	9.665480-02	8.881010-02	8.211950-02	7.132920-02	5.954410-02
1.500 00	3.082690-01	2.816200-01	2.585730-01	2.386340-01	2.215170-01	2.061950-01	1.925080-01	1.707200-01	1.454050-01
2.000 00	4.658860-01	4.352830-01	4.072870-01	3.819200-01	3.598260-01	3.383830-01	3.197500-01	2.876140-01	2.494140-01
3.000 00	7.263820-01	6.979550-01	6.698070-01	6.424300-01	6.161380-01	5.911170-01	5.674510-01	5.241970-01	4.687490-01
5.000 00	1.062440 00	1.044750 00	1.026110 00	1.006660 00	9.866060-01	9.661530-01	9.455840-01	9.043100-01	8.446260-01
7.500 00	1.311610 00	1.301060 00	1.289970 00	1.278300 00	1.266040 00	1.253180 00	1.239760 00	1.211470 00	1.166480 00
1.000 01	1.479100 00	1.471750 00	1.464150 00	1.456250 00	1.448030 00	1.439450 00	1.430490 00	1.411410 00	1.379970 00
1.500 01	1.705800 00	1.701270 00	1.696640 00	1.691920 00	1.687080 00	1.682130 00	1.677040 00	1.666440 00	1.649270 00
2.000 01	1.861850 00	1.858590 00	1.855270 00	1.851910 00	1.848490 00	1.845020 00	1.841480 00	1.834230 00	1.822800 00
3.000 01	2.077080 00	2.074990 00	2.072850 00	2.070750 00	2.068600 00	2.066430 00	2.064240 00	2.059790 00	2.052920 00
5.000 01	2.342070 00	2.341660 00	2.340430 00	2.339210 00	2.337970 00	2.336740 00	2.335490 00	2.332960 00	2.329160 00
7.500 01	2.551020 00	2.550230 00	2.549430 00	2.548620 00	2.547820 00	2.547010 00	2.546200 00	2.544580 00	2.542110 00
1.000 02	2.697670 00	2.697080 00	2.696430 00	2.695890 00	2.695290 00	2.694690 00	2.694090 00	2.692890 00	2.691070 00
1.500 02	2.903300 00	2.902910 00	2.902520 00	2.902130 00	2.901730 00	2.901340 00	2.900940 00	2.900150 00	2.898960 00
2.000 02	3.046650 00	3.046350 00	3.046050 00	3.045770 00	3.045480 00	3.045180 00	3.044890 00	3.043000 00	3.045410 00
3.000 02	3.252930 00	3.252740 00	3.252550 00	3.252350 00	3.252160 00	3.251960 00	3.251770 00	3.251380 00	3.250790 00
5.000 02	3.509650 00	3.509530 00	3.509410 00	3.509300 00	3.509180 00	3.509070 00	3.508950 00	3.508720 00	3.508370 00
7.500 02	3.713060 00	3.712980 00	3.712930 00	3.712830 00	3.712750 00	3.712670 00	3.712600 00	3.712440 00	3.712210 00
1.000 03	3.857250 00	3.857190 00	3.857140 00	3.857080 00	3.857020 00	3.856960 00	3.856900 00	3.856790 00	3.856610 00
1.500 03	4.060350 00	4.060310 00	4.060270 00	4.060230 00	4.060190 00	4.060150 00	4.060110 00	4.060040 00	4.059920 00
2.000 03	4.204370 00	4.204340 00	4.204320 00	4.204290 00	4.204260 00	4.204230 00	4.204200 00	4.204140 00	4.204060 00
3.000 03	4.407300 00	4.407280 00	4.407260 00	4.407240 00	4.407220 00	4.407200 00	4.407180 00	4.407140 00	4.407090 00
5.000 03	4.662070 00	4.662060 00	4.662050 00	4.662040 00	4.662030 00	4.662020 00	4.662010 00	4.662000 00	4.662740 00
7.500 03	4.865690 00	4.865680 00	4.865670 00	4.865660 00	4.865660 00	4.865650 00	4.865640 00	4.865630 00	4.865600 00
1.000 04	5.009570 00	5.009560 00	5.009550 00	5.009550 00	5.009550 00	5.009540 00	5.009540 00	5.009520 00	5.009510 00

TABLE B.2k

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 316$.

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $WD = 316.228$
 $CD2 \cdot \exp(2S2) = 1.000000 \ 04$ $CD2/r_D^2 = 0.10000$
 $CD1/r_D^2 = 0.10000$

$CD \cdot \exp(2S1)$

	1.000000 04	1.000000 05	1.000000 06	1.000000 08	1.000000 10	1.000000 12	1.000000 20	1.000000 07
tD/r_D^2	DIMENSIONLESS PRESSURE DROP							
1.000-01	2.648833-05	2.648820-05	1.670010-05	1.218810-05	9.594180-06	7.910170-06	4.646740-06	1.409230-05
1.500-01	2.296963-04	1.814780-04	1.499390-04	1.112250-04	8.038460-05	7.332120-05	4.359170-05	1.277190-04
2.000-01	8.494283-04	6.810190-04	5.681120-04	4.264570-04	3.412680-04	2.844200-04	1.706520-04	4.872250-04
3.000-01	4.182450-03	3.424900-03	2.898150-03	2.215020-03	1.791910-03	1.504310-03	9.158330-04	2.511160-03
5.000-01	2.222510-02	1.873790-02	1.618300-02	1.270210-02	1.044730-02	8.869940-03	5.526350-03	1.423490-02
7.500-01	6.646830-02	5.753420-02	5.065350-02	4.080680-02	3.412980-02	2.931670-02	1.871920-02	4.521080-02
1.000 00	1.288810-01	1.138850-01	1.016440-01	8.386520-02	7.117210-02	6.177060-02	4.033140-02	9.201540-02
1.500 00	2.796840-01	2.549790-01	2.337350-01	1.995910-01	1.736930-01	1.535380-01	1.044280-01	2.154340-01
2.000 00	4.340620-01	4.046880-01	3.780000-01	3.323240-01	2.954090-01	2.653450-01	1.873200-01	3.539430-01
3.000 00	6.980150-01	6.695260-01	6.415210-01	5.885770-01	5.409660-01	4.989290-01	3.760220-01	6.144450-01
5.000 00	1.045260 00	1.027060 00	1.007940 00	9.676410-01	9.260050-01	8.845330-01	7.356200-01	9.880650-01
7.500 00	1.301310 00	1.290510 00	1.279160 00	1.254640 00	1.227780 00	1.198950 00	1.075300 00	1.267200 00
1.000 01	1.471880 00	1.464410 00	1.456680 00	1.440260 00	1.422390 00	1.402950 00	1.311950 00	1.448640 00
1.500 01	1.701320 00	1.696740 00	1.692060 00	1.682400 00	1.672250 00	1.661520 00	1.611130 00	1.687290 00
2.000 01	1.858610 00	1.855320 00	1.851980 00	1.845150 00	1.838090 00	1.830780 00	1.798170 00	1.848590 00
3.000 01	2.075000 00	2.072900 00	2.070780 00	2.066480 00	2.062100 00	2.057620 00	2.038670 00	2.068640 00
5.000 01	2.341660 00	2.340440 00	2.339220 00	2.336750 00	2.334260 00	2.331740 00	2.321370 00	2.337990 00
7.500 01	2.550230 00	2.549430 00	2.548630 00	2.547020 00	2.545400 00	2.543770 00	2.537140 00	2.547830 00
1.000 02	2.697080 00	2.696480 00	2.695890 00	2.694700 00	2.693500 00	2.692290 00	2.687410 00	2.695290 00
1.500 02	2.902910 00	2.902520 00	2.902130 00	2.901340 00	2.900550 00	2.899760 00	2.896570 00	2.901730 00
2.000 02	3.048350 00	3.048060 00	3.047770 00	3.047180 00	3.046590 00	3.046010 00	3.043630 00	3.047480 00
3.000 02	3.252740 00	3.252550 00	3.252350 00	3.251960 00	3.251570 00	3.251180 00	3.249620 00	3.252160 00
5.000 02	3.509530 00	3.509410 00	3.509300 00	3.509070 00	3.508830 00	3.508600 00	3.507670 00	3.509180 00
7.500 02	3.712980 00	3.712900 00	3.712830 00	3.712670 00	3.712520 00	3.712360 00	3.711740 00	3.712750 00
1.000 03	3.857190 00	3.857130 00	3.857080 00	3.856960 00	3.856850 00	3.856730 00	3.856270 00	3.857020 00
1.500 03	4.060310 00	4.060270 00	4.060230 00	4.060150 00	4.060080 00	4.060000 00	4.059690 00	4.060190 00
2.000 03	4.204340 00	4.204320 00	4.204290 00	4.204230 00	4.204170 00	4.204110 00	4.203880 00	4.204260 00
3.000 03	4.407280 00	4.407260 00	4.407240 00	4.407200 00	4.407160 00	4.407130 00	4.406970 00	4.407220 00
5.000 03	4.662860 00	4.662850 00	4.662840 00	4.662810 00	4.662790 00	4.662770 00	4.662670 00	4.662820 00
7.500 03	4.865680 00	4.865670 00	4.865660 00	4.865630 00	4.865620 00	4.865620 00	4.865560 00	4.865660 00
1.000 04	5.009560 00	5.009560 00	5.009550 00	5.009540 00	5.009530 00	5.009520 00	5.009470 00	5.009550 00

TABLE B.21

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 0.1$, AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, MD = 1000.000
 $C_{D2} = \exp(2.32) = 1.000000$ 05 $C_{D2}/r_D^2 = 0.10000$
 $C_{D1}/r_D^2 = 0.10000$

$C_D = \exp(2.31)$

	1.000000 05	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12	1.000000 15	1.000000 20
10/r_D^2	DIMENSIONLESS PRESSURE DROP								
1.000-01	1.584760-05	1.291480-05	1.089660-05	9.423250-06	8.300570-06	7.416740-06	6.114380-06	4.839440-06	3.591200-06
1.500-01	1.433540-04	1.184150-04	1.008510-04	8.781760-05	7.776360-05	6.971310-05	5.787590-05	4.608540-05	3.440220-05
2.000-01	5.458490-04	4.552410-04	3.903580-04	3.416280-04	3.036960-04	2.733360-04	2.277780-04	1.822070-04	1.366350-04
3.000-01	2.803400-03	2.371500-03	2.054380-03	1.811800-03	1.628320-03	1.462370-03	1.229930-03	9.910550-04	7.485050-04
5.000-01	4.578740-02	1.362840-02	1.198350-02	1.069040-02	9.647650-03	8.783940-03	7.460370-03	6.079830-03	4.645660-03
7.500-01	4.975390-02	4.377340-02	3.984970-02	3.523150-02	3.208510-02	2.944950-02	2.528610-02	2.085370-02	1.613190-02
1.000 00	1.005120-01	8.980490-02	8.108220-02	7.386030-02	6.779340-02	6.263100-02	5.432710-02	4.528650-02	3.542890-02
1.500 00	2.320920-01	2.124940-01	1.956650-01	1.811330-01	1.685000-01	1.574410-01	1.390580-01	1.181780-01	9.439590-02
2.000 00	3.766500-01	3.513160-01	3.285760-01	3.082090-01	2.899550-01	2.735610-01	2.454470-01	2.122640-01	1.728380-01
3.000 00	6.411900-01	6.135160-01	5.869060-01	5.615970-01	5.377050-01	5.152580-01	4.745640-01	4.229240-01	3.564640-01
5.000 00	1.006380 00	9.688180-01	9.405600-01	9.478270-01	9.268350-01	9.057660-01	8.641650-01	8.045840-01	7.161850-01
7.500 00	1.279440 00	1.267800 00	1.255550 00	1.242690 00	1.229230 00	1.215270 00	1.185870 00	1.139550 00	1.060940 00
1.000 01	1.456820 00	1.448940 00	1.440750 00	1.432210 00	1.423300 00	1.413990 00	1.394170 00	1.361620 00	1.301780 00
1.500 01	1.692110 00	1.687390 00	1.682560 00	1.677620 00	1.672550 00	1.667350 00	1.656500 00	1.638870 00	1.605430 00
2.000 01	1.852810 00	1.848650 00	1.845230 00	1.841760 00	1.838230 00	1.834640 00	1.827270 00	1.815650 00	1.794360 00
3.000 01	2.078790 00	2.068660 00	2.066510 00	2.064350 00	2.062150 00	2.059940 00	2.055440 00	2.048510 00	2.036390 00
5.000 01	2.339220 00	2.337990 00	2.336760 00	2.335520 00	2.334280 00	2.333020 00	2.330500 00	2.326660 00	2.320100 00
7.500 01	2.548630 00	2.547830 00	2.547020 00	2.546220 00	2.545410 00	2.544590 00	2.542960 00	2.540490 00	2.536320 00
1.000 02	2.695390 00	2.695290 00	2.694700 00	2.694100 00	2.693500 00	2.692900 00	2.691640 00	2.689870 00	2.686810 00
1.500 02	2.902130 00	2.901740 00	2.901340 00	2.900950 00	2.900550 00	2.900160 00	2.899370 00	2.898170 00	2.896170 00
2.000 02	3.047770 00	3.047480 00	3.047180 00	3.046890 00	3.046600 00	3.046300 00	3.045710 00	3.044820 00	3.043340 00
3.000 02	3.252350 00	3.252160 00	3.251960 00	3.251770 00	3.251570 00	3.251380 00	3.250990 00	3.250400 00	3.249420 00
5.000 02	3.509300 00	3.509180 00	3.509070 00	3.508950 00	3.508830 00	3.508720 00	3.508490 00	3.508140 00	3.507550 00
7.500 02	3.712530 00	3.712750 00	3.712670 00	3.712600 00	3.712520 00	3.712440 00	3.712290 00	3.712050 00	3.711670 00
1.000 03	3.857080 00	3.857020 00	3.856960 00	3.856900 00	3.856850 00	3.856790 00	3.856670 00	3.856500 00	3.856210 00
1.500 03	4.062230 00	4.060190 00	4.060150 00	4.060110 00	4.060080 00	4.060040 00	4.059960 00	4.059840 00	4.059650 00
2.000 03	4.204290 00	4.204260 00	4.204230 00	4.204200 00	4.204170 00	4.204140 00	4.204030 00	4.204000 00	4.203850 00
3.000 03	4.407240 00	4.407220 00	4.407200 00	4.407180 00	4.407160 00	4.407140 00	4.407110 00	4.407050 00	4.406950 00
5.000 03	4.662840 00	4.662820 00	4.662810 00	4.662800 00	4.662790 00	4.662780 00	4.662750 00	4.662720 00	4.662660 00
7.500 03	4.865660 00	4.865660 00	4.865650 00	4.865640 00	4.865630 00	4.865630 00	4.865610 00	4.865590 00	4.865550 00
1.000 04	5.009550 00	5.009550 00	5.009540 00	5.009540 00	5.009530 00	5.009520 00	5.009510 00	5.009490 00	5.009470 00

TABLE B.2m

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 0.1$ AND $r_D = 3162$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, $RQ = 3162.278$
 $CD2=exp(252) = 1.000000 06$ $CD2/r_D^2 = 0.10000$
 $CD1/r_D^2 = 0.10000$

$CD=exp(231)$

	1.000000 06	1.000000 07	1.000000 08	1.000000 09	1.000000 10	1.000000 12	1.000000 15	1.000000 20
t_D/r_D^2	DIMENSIONLESS PRESSURE DROP							
1.000-01	1.052390-05	8.878560-06	7.677630-06	6.762620-06	6.042340-06	4.981070-06	3.942240-06	2.925280-06
1.500-01	9.780290-05	8.328880-05	7.251990-05	6.421390-05	5.761330-05	4.778650-05	3.804920-05	2.840160-05
2.000-01	3.796180-04	3.254770-04	2.848230-04	2.531830-04	2.278610-04	1.898680-04	1.518710-04	1.138780-04
3.000-01	2.005730-03	1.737260-03	1.531960-03	1.369940-03	1.238840-03	1.039740-03	8.376750-04	6.326650-04
5.000-01	1.176080-02	1.033890-02	9.221460-03	8.320750-03	7.579590-03	6.432390-03	5.241120-03	4.004050-03
7.500-01	3.849270-02	3.432600-02	3.096070-02	2.818920-02	2.586860-02	2.220500-02	1.830720-02	1.415760-02
1.000 00	8.018510-02	7.236000-02	6.588840-02	6.045670-02	5.583810-02	4.841470-02	4.034060-02	3.154540-02
1.500 00	1.943660-01	1.788380-01	1.654550-01	1.538370-01	1.436800-01	1.268130-01	1.077010-01	8.596280-02
2.000 00	3.273120-01	3.058400-01	2.866590-01	2.695060-01	2.541270-01	2.278080-01	1.968200-01	1.600950-01
3.000 00	5.863230-01	5.602970-01	5.356400-01	5.124380-01	4.906980-01	4.514110-01	4.017540-01	3.381100-01
5.000 00	9.688710-01	9.483010-01	9.273280-01	9.061710-01	8.850240-01	8.433850-01	7.841100-01	6.967090-01
7.500 00	1.255860 00	1.243300 00	1.230130 00	1.216370 00	1.202090 00	1.172210 00	1.125290 00	1.046160 00
1.000 01	1.440920 00	1.432560 00	1.423850 00	1.414750 00	1.405250 00	1.385040 00	1.351920 00	1.291270 00
1.500 01	1.682620 00	1.677730 00	1.672730 00	1.667610 00	1.662350 00	1.651350 00	1.633480 00	1.599570 00
2.000 01	1.845260 00	1.841810 00	1.838310 00	1.834760 00	1.831140 00	1.823710 00	1.811980 00	1.790480 00
3.000 01	2.066520 00	2.064370 00	2.062190 00	2.059980 00	2.057760 00	2.053240 00	2.046270 00	2.034080 00
5.000 01	2.336760 00	2.335530 00	2.334290 00	2.333040 00	2.331780 00	2.329250 00	2.325400 00	2.318820 00
7.500 01	2.547020 00	2.546220 00	2.545410 00	2.544600 00	2.543790 00	2.542150 00	2.539680 00	2.535500 00
1.000 02	2.694700 00	2.694100 00	2.693500 00	2.692900 00	2.692300 00	2.691090 00	2.689270 00	2.686200 00
1.500 02	2.901340 00	2.900950 00	2.900550 00	2.900160 00	2.899760 00	2.898970 00	2.897780 00	2.895770 00
2.000 02	3.047180 00	3.046890 00	3.046600 00	3.046300 00	3.046010 00	3.045420 00	3.044530 00	3.043040 00
3.000 02	3.251960 00	3.251770 00	3.251570 00	3.251380 00	3.251180 00	3.250790 00	3.250210 00	3.249230 00
5.000 02	3.509070 00	3.508950 00	3.508830 00	3.508720 00	3.508600 00	3.508370 00	3.508020 00	3.507440 00
7.500 02	3.712670 00	3.712600 00	3.712520 00	3.712440 00	3.712360 00	3.712210 00	3.711980 00	3.711590 00
1.000 03	3.856960 00	3.856900 00	3.856850 00	3.856790 00	3.856730 00	3.856610 00	3.856440 00	3.856150 00
1.500 03	4.060150 00	4.060110 00	4.060080 00	4.060040 00	4.060000 00	4.059920 00	4.059810 00	4.059610 00
2.000 03	4.204230 00	4.204200 00	4.204170 00	4.204140 00	4.204110 00	4.204060 00	4.203970 00	4.203830 00
3.000 03	4.407200 00	4.407180 00	4.407160 00	4.407140 00	4.407130 00	4.407090 00	4.407030 00	4.406930 00
5.000 03	4.662810 00	4.662800 00	4.662790 00	4.662780 00	4.662770 00	4.662740 00	4.662710 00	4.662650 00
7.500 03	4.865650 00	4.865640 00	4.865630 00	4.865620 00	4.865620 00	4.865600 00	4.865580 00	4.865540 00
1.000 04	5.009540 00	5.009540 00	5.009530 00	5.009520 00	5.009520 00	5.009510 00	5.009490 00	5.009460 00

TABLE B.2n

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 31.6$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 31.623
CO2*exp(252) = 1.000000 02
CD2/rD**2 = 0.10000
CD1/rD**2 = 1.00000

CO*exp(231)

1.000000 03 1.000000 04 1.000000 05 1.000000 06 1.000000 07 1.000000 08 1.000000 09 1.000000 10 1.000000 11 1.000000 12 1.000000 13 1.000000 14 1.000000 15 1.000000 16 1.000000 17 1.000000 18 1.000000 19 1.000000 20

CD/rD**2

DIMENSIONLESS PRESSURE DROP

1.000-01	1.557510-05	9.024330-06	6.337700-06	4.861080-06	3.968120-06	2.841100-06	2.049530-06	1.588500-06	1.155320-06
1.500-01	1.126750-04	6.977960-05	5.044160-05	3.967560-05	3.241990-05	2.109730-05	1.711130-05	1.333220-05	9.744780-06
2.000-01	3.753790-04	2.415490-04	1.777530-04	1.405520-04	1.162020-04	7.643740-05	6.225270-05	4.866450-05	3.569270-05
3.000-01	1.641930-03	1.105580-03	8.320900-04	6.667540-04	5.561210-04	3.711620-04	3.037760-04	2.387390-04	1.759460-04
5.000-01	1.665620-03	5.555180-03	4.287880-03	3.489700-03	2.941410-03	1.998150-03	1.668230-03	1.302000-03	9.654500-04
7.500-01	1.256340-02	1.647860-02	1.296020-02	1.067440-02	9.071760-03	6.251760-03	5.177800-03	4.116620-03	3.068250-03
1.000-00	4.363630-02	3.259780-02	2.597710-02	2.157920-02	1.844990-02	1.284970-02	1.068520-02	8.529130-02	6.382030-02
1.500-00	9.887360-02	7.621830-02	6.190270-02	5.207730-02	4.492820-02	3.179260-02	2.660850-02	2.137160-02	1.609070-02
2.000-00	1.642240-01	1.295180-01	1.067050-01	9.064640-02	7.875500-02	5.646150-02	4.748260-02	3.833060-02	2.900580-02
3.000-00	3.056050-01	2.493280-01	2.099920-01	1.811550-01	1.591800-01	1.165650-01	9.883520-02	8.046630-02	6.141760-02
5.000-00	5.790620-01	4.948360-01	4.302960-01	3.798970-01	3.396960-01	2.571540-01	2.210980-01	1.825630-01	1.413790-01
7.500-00	8.662800-01	7.695150-01	6.886300-01	6.213670-01	5.651360-01	4.425490-01	3.859800-01	3.235350-01	2.545280-01
1.000-01	1.094430-00	9.988160-01	1.132100-01	0.381910-01	7.728910-01	6.227180-01	5.499350-01	4.671560-01	3.727870-01
1.500-01	1.423820-00	1.344710-00	1.266370-00	1.191750-00	1.122280-00	9.467520-01	8.519840-01	7.424760-01	6.077600-01
2.000-01	1.647730-00	1.586690-00	1.522200-00	1.456900-00	1.392770-00	1.217220-00	1.117100-00	9.905490-01	8.291530-01
3.000-01	1.937070-00	1.900470-00	1.859550-00	1.815070-00	1.768130-00	1.622540-00	1.508460-00	1.398390-00	1.215220-00
5.000-01	2.260820-00	2.243400-00	2.224240-00	2.203060-00	2.179750-00	2.098020-00	2.036250-00	1.938510-00	1.776170-00
7.500-01	2.496280-00	2.486230-00	2.475600-00	2.464300-00	2.452190-00	2.409840-00	2.376140-00	2.317910-00	2.206660-00
1.000-02	2.656240-00	2.649200-00	2.641910-00	2.634320-00	2.626400-00	2.600040-00	2.579650-00	2.544020-00	2.471440-00
1.500-02	2.875090-00	2.870710-00	2.866230-00	2.861650-00	2.856970-00	2.842130-00	2.831550-00	2.814060-00	2.779260-00
2.000-02	3.027090-00	3.023900-00	3.020670-00	3.017400-00	3.014070-00	3.003740-00	2.996530-00	2.985130-00	2.963990-00
3.000-02	3.238120-00	3.236070-00	3.233990-00	3.231900-00	3.229790-00	3.223340-00	3.218920-00	3.212110-00	3.200180-00
5.000-02	3.500390-00	3.499190-00	3.497980-00	3.496760-00	3.495540-00	3.490850-00	3.489350-00	3.485560-00	3.479080-00
7.500-02	3.706680-00	3.705890-00	3.705090-00	3.704300-00	3.703500-00	3.701047-00	3.699470-00	3.697010-00	3.692870-00
1.000-03	3.852350-00	3.851760-00	3.851170-00	3.850580-00	3.849980-00	3.846150-00	3.844990-00	3.845160-00	3.842140-00
1.500-03	4.056960-00	4.056370-00	4.055790-00	4.055200-00	4.054600-00	4.054220-00	4.053430-00	4.052240-00	4.050250-00
2.000-03	4.201780-00	4.201480-00	4.201190-00	4.200900-00	4.200610-00	4.199730-00	4.199140-00	4.198260-00	4.196780-00
3.000-03	4.405510-00	4.405320-00	4.405120-00	4.404930-00	4.404730-00	4.404150-00	4.403760-00	4.403180-00	4.402200-00
5.000-03	4.661750-00	4.661640-00	4.661520-00	4.661410-00	4.661290-00	4.660190-00	4.660710-00	4.660360-00	4.659780-00
7.500-03	4.864920-00	4.864840-00	4.864760-00	4.864690-00	4.864610-00	4.864360-00	4.864220-00	4.863990-00	4.863600-00
1.000-04	5.008960-00	5.008920-00	5.008870-00	5.008810-00	5.008750-00	5.008580-00	5.008440-00	5.008290-00	5.008000-00

TABLE B.2o

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 100$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 100.000
CD2*exp(252) = 1.00000D 03 CD2/rD**2 = 0.10000
CD1/rD**2 = 1.00000

CD*exp(231)

	1.00000D 04	1.00000D 05	1.00000D 06	1.00000D 07	1.00000D 10	1.00000D 12	1.00000D 15	1.00000D 20	1.00000D 22
td/rD**2	DIMENSIONLESS PRESSURE DROP								
1.000-01	5.51531D-06	3.85436D-06	2.96042D-06	2.40256D-06	1.53436D-06	1.23637D-06	9.57407D-07	6.95739D-07	6.27171D-07
1.500-01	4.56638D-05	3.29052D-05	2.57049D-05	2.10857D-05	1.36955D-05	1.11005D-05	8.64335D-06	6.31375D-06	5.69927D-06
2.000-01	1.65212D-04	1.21283D-04	9.57590D-05	7.90941D-05	5.19469D-05	4.22697D-05	3.30362D-05	2.42178D-05	2.18813D-05
3.000-01	8.01828D-04	6.02329D-04	4.82090D-04	4.01788D-04	2.67818D-04	2.19088D-04	1.72105D-04	1.26782D-04	1.14699D-04
5.000-01	4.32289D-03	3.33136D-03	2.70851D-03	2.28141D-03	1.54815D-03	1.27480D-03	1.00781D-03	7.47003D-04	6.76923D-04
7.500-01	1.35313D-02	1.06260D-02	8.74331D-03	7.42563D-03	5.11136D-03	4.23144D-03	3.36277D-03	2.50532D-03	2.27342D-03
1.000 00	2.77560D-02	2.20854D-02	1.83286D-02	1.56599D-02	1.08936D-02	9.05444D-03	7.22416D-03	5.40317D-03	4.90820D-03
1.500 00	6.79848D-02	5.51338D-02	4.63370D-02	3.99479D-02	2.82392D-02	2.36177D-02	1.89603D-02	1.42683D-02	1.29829D-02
2.000 00	1.18839D-01	9.77633D-02	8.29678D-02	7.20320D-02	5.15745D-02	4.33507D-02	3.49773D-02	2.64548D-02	2.41047D-02
3.000 00	2.36132D-01	1.98594D-01	1.71153D-01	1.50283D-01	1.09881D-01	9.31351D-02	7.57845D-02	5.78124D-02	5.28008D-02
5.000 00	4.81170D-01	4.17889D-01	3.68606D-01	3.29373D-01	2.49018D-01	2.13979D-01	1.76585D-01	1.36671D-01	1.25325D-01
7.500 00	7.57605D-01	6.77262D-01	6.10650D-01	5.55050D-01	4.34119D-01	3.78430D-01	3.17033D-01	2.49270D-01	2.29590D-01
1.000 01	9.88891D-01	9.03396D-01	8.28639D-01	7.63678D-01	6.14607D-01	5.42515D-01	4.60613D-01	3.67362D-01	3.39731D-01
1.500 01	1.33787D 00	1.25927D 00	1.18452D 00	1.11503D 00	9.39816D-01	8.47366D-01	7.36383D-01	6.02465D-01	5.61265D-01
2.000 01	1.58180D 00	1.51698D 00	1.45145D 00	1.38716D 00	1.21147D 00	1.11143D 00	9.85122D-01	8.24229D-01	7.72954D-01
3.000 01	1.89760D 00	1.85646D 00	1.81177D 00	1.76464D 00	1.61866D 00	1.52440D 00	1.39426D 00	1.21116D 00	1.14890D 00
5.000 01	2.24194D 00	2.22270D 00	2.20145D 00	2.17805D 00	2.09604D 00	2.03409D 00	1.93613D 00	1.77357D 00	1.71170D 00
7.500 01	2.48533D 00	2.47468D 00	2.46335D 00	2.45121D 00	2.40877D 00	2.37496D 00	2.31659D 00	2.20514D 00	2.15795D 00
1.000 02	2.64855D 00	2.64125D 00	2.63365D 00	2.62572D 00	2.59930D 00	2.57887D 00	2.54318D 00	2.47045D 00	2.43750D 00
1.500 02	2.87029D 00	2.86581D 00	2.86123D 00	2.85654D 00	2.84173D 00	2.81310D 00	2.81358D 00	2.77873D 00	2.76247D 00
2.000 02	3.02360D 00	3.02037D 00	3.01709D 00	3.01376D 00	3.00342D 00	2.99620D 00	2.98480D 00	2.96363D 00	2.95415D 00
3.000 02	3.23587D 00	3.23379D 00	3.23170D 00	3.22959D 00	3.22313D 00	3.21872D 00	3.21190D 00	3.19996D 00	3.19495D 00
5.000 02	3.49907D 00	3.49786D 00	3.49665D 00	3.49543D 00	3.49173D 00	3.48923D 00	3.48544D 00	3.47895D 00	3.47630D 00
7.500 02	3.70581D 00	3.70501D 00	3.70422D 00	3.70342D 00	3.70101D 00	3.69939D 00	3.69693D 00	3.69279D 00	3.69112D 00
1.000 03	3.85170D 00	3.85111D 00	3.85052D 00	3.84993D 00	3.84814D 00	3.84694D 00	3.84512D 00	3.84208D 00	3.84085D 00
1.500 03	4.05654D 00	4.05614D 00	4.05575D 00	4.05536D 00	4.05418D 00	4.05339D 00	4.05221D 00	4.05021D 00	4.04941D 00
2.000 03	4.20146D 00	4.20116D 00	4.20087D 00	4.20058D 00	4.19978D 00	4.19911D 00	4.19823D 00	4.19675D 00	4.19615D 00
3.000 03	4.40530D 00	4.40510D 00	4.40491D 00	4.40471D 00	4.40413D 00	4.40374D 00	4.40316D 00	4.40218D 00	4.40179D 00
5.000 03	4.66163D 00	4.66151D 00	4.66139D 00	4.66128D 00	4.66093D 00	4.66070D 00	4.66035D 00	4.65977D 00	4.65953D 00
7.500 03	4.86483D 00	4.86475D 00	4.86468D 00	4.86460D 00	4.86437D 00	4.86422D 00	4.86398D 00	4.86360D 00	4.86344D 00
1.000 04	5.00892D 00	5.00886D 00	5.00880D 00	5.00874D 00	5.00857D 00	5.00845D 00	5.00828D 00	5.00799D 00	5.00788D 00

TABLE B.2p

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 316$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 316.228
CD2*exp(2S2) = 1.000000 04 CD2/rD**2 = 0.10000
CD1/rD**2 = 1.00000

CR=exp(2S1)

1.000000 05 1.000000 06 1.000000 07 1.000000 10 1.000000 02 1.000000 15 1.000000 20 1.000000 25

10./rD**2

DIMENSIONLESS PRESSURE DROP

1.000-01	2.734870-04	2.100590-06	1.703980-06	1.087450-06	8.760450-07	6.782230-07	4.927570-07	3.869360-07
1.500-01	2.422070-05	1.894000-05	1.550610-05	1.006560-05	8.156680-06	6.349950-06	4.637620-06	3.652590-06
2.000-01	9.144900-05	7.215260-05	5.958410-05	3.911160-05	3.181950-05	2.486420-05	1.822390-05	1.438260-05
3.000-01	4.694930-04	3.755840-04	3.129200-04	2.084680-04	1.705030-04	1.359140-04	9.863080-05	7.806140-05
5.000-01	2.718300-03	2.202400-03	1.854440-03	1.257650-03	1.035360-03	8.183940-04	6.064390-04	4.816920-04
7.500-01	8.958220-03	7.365680-03	6.253930-03	4.301830-03	3.560350-03	2.818770-03	2.106920-03	1.678540-03
1.000-03	1.918700-02	1.581660-02	1.353330-02	9.406890-03	7.816460-03	6.234620-03	4.661730-03	3.722440-03
1.500-03	4.944670-02	4.152730-02	3.578300-02	2.527200-02	2.112880-02	1.675620-02	1.275580-02	1.022270-02
2.000-03	8.979530-02	7.611600-02	6.407240-02	4.725970-02	3.970830-02	3.282530-02	2.421300-02	1.946290-02
3.000-03	1.877580-01	1.615760-01	1.418740-01	1.036150-01	8.778410-02	7.139750-02	5.444090-02	4.398670-02
5.000-03	4.055370-01	3.574080-01	3.191620-01	2.410040-01	2.069890-01	1.787290-01	1.320690-01	1.076540-01
7.500-03	6.658170-01	5.995590-01	5.449190-01	4.256950-01	3.709020-01	3.185650-01	2.440510-01	2.008890-01
1.000-01	8.934420-01	8.189770-01	7.543790-01	6.064670-01	5.350760-01	4.540650-01	3.619470-01	3.006270-01
1.500-01	1.252050-00	1.172200-00	1.107700-00	9.328120-01	8.407060-01	7.382630-01	6.191580-01	5.042100-01
2.000-01	1.511700-00	1.445920-00	1.381470-00	1.205660-00	1.105710-00	9.796630-01	8.192850-01	7.021150-01
3.000-01	1.853340-00	1.803440-00	1.761120-00	1.614720-00	1.520320-00	1.390130-00	1.207110-00	1.061670-00
5.000-01	2.221160-00	2.192820-00	2.176330-00	2.094040-00	2.031920-00	1.923730-00	1.770960-00	1.620990-00
7.500-01	2.473750-00	2.462400-00	2.450230-00	2.407680-00	2.373770-00	2.315210-00	2.203600-00	2.084700-00
1.000-02	2.640590-00	2.632980-00	2.625030-00	2.598570-00	2.578100-00	2.542330-00	2.469450-00	2.383990-00
1.500-02	2.865390-00	2.863810-00	2.856110-00	2.841290-00	2.830640-00	2.813100-00	2.778210-00	2.734680-00
2.000-02	3.020060-00	3.015780-00	3.013440-00	3.003100-00	2.995880-00	2.984450-00	2.963280-00	2.938220-00
3.000-02	3.233590-00	3.231500-00	3.229390-00	3.222930-00	3.216510-00	3.211180-00	3.199750-00	3.186890-00
5.000-02	3.497740-00	3.496530-00	3.495310-00	3.491610-00	3.489110-00	3.482530-00	3.478830-00	3.472130-00
7.500-02	3.704940-00	3.704140-00	3.703340-00	3.700930-00	3.699310-00	3.696850-00	3.692710-00	3.688500-00
1.000-05	3.851050-00	3.853460-00	3.849870-00	3.848880-00	3.846880-00	3.845070-00	3.842020-00	3.838930-00
1.500-05	4.056110-00	4.055720-00	4.055320-00	4.054140-00	4.053360-00	4.052170-00	4.050170-00	4.048160-00
2.000-05	4.261140-00	4.263840-00	4.260550-00	4.199670-00	4.199080-00	4.198230-00	4.196720-00	4.195230-00
3.000-05	4.405080-00	4.404890-00	4.404700-00	4.404110-00	4.403720-00	4.403140-00	4.402160-00	4.401180-00
5.000-05	4.661500-00	4.661380-00	4.661270-00	4.660920-00	4.660690-00	4.660340-00	4.659750-00	4.659170-00
7.500-05	4.864750-00	4.864670-00	4.864590-00	4.864360-00	4.864210-00	4.863950-00	4.863590-00	4.863200-00
1.000-06	5.008850-00	5.008800-00	5.008740-00	5.008560-00	5.008450-00	5.008250-00	5.007990-00	5.007700-00

TABLE B.2q

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 1$, AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 1000.000
CD2*exp(232) = 1.000000 05 CD2/rD**2 = 0.10000
CD1/rD**2 = 1.00000

CD*exp(231)

10/rD**2	1.000000 06	1.000000 07	1.000000 08	1.000000 10	1.000000 12	1.000000 15	1.000000 20	1.000000 22	1.000000 24
DIMENSIONLESS PRESSURE DROP									
1.000-01	1.624550-06	1.317590-06	1.108090-06	8.406330-07	6.771430-07	5.241930-07	3.808140-07	3.432560-07	3.124410-07
1.500-01	1.493330-05	1.224320-05	1.037340-05	7.945330-06	6.437930-06	5.011460-06	3.659770-06	3.303350-06	3.010190-06
2.000-01	5.781490-05	4.772900-05	4.063560-05	3.132120-05	2.547890-05	1.990770-05	1.458990-05	1.318130-05	1.202080-05
3.000-01	3.071860-04	2.558870-04	2.192480-04	1.704190-04	1.393690-04	1.094490-04	8.060350-05	7.291610-05	6.656710-05
5.000-01	1.052460-03	1.559430-03	1.346310-03	1.057170-03	8.702020-04	6.877080-04	5.095640-04	4.617180-04	4.220840-04
7.500-01	6.350800-03	5.390030-03	4.681230-03	3.705850-03	3.066550-03	2.435900-03	1.814090-03	1.645990-03	1.506390-03
1.000 00	1.392150-02	1.188540-02	1.036760-02	8.256910-03	6.859480-03	5.470200-03	4.089340-03	3.714250-03	3.402160-03
1.500 00	3.751220-02	3.231080-02	2.837140-02	2.280410-02	1.906040-02	1.529230-02	1.150110-02	1.046330-02	9.597160-03
2.000 00	7.015230-02	6.084450-02	5.370590-02	4.348550-02	3.652580-02	2.945000-02	2.225860-02	2.027740-02	1.861980-02
3.000 00	1.526080-01	1.340210-01	1.193100-01	9.778510-02	8.281350-02	6.732910-02	5.131850-02	4.685900-02	4.311190-02
5.000 00	3.463670-01	3.091210-01	2.789430-01	2.331620-01	2.001620-01	1.650210-01	1.275930-01	1.169680-01	1.079730-01
7.500 00	5.890160-01	5.347650-01	4.891920-01	4.172930-01	3.634100-01	3.041410-01	2.388790-01	2.199540-01	2.037940-01
1.000 01	8.092130-01	7.450020-01	6.893120-01	5.982970-01	5.276250-01	4.475260-01	3.565460-01	3.296300-01	3.064590-01
1.500 01	1.169770 00	1.100280 00	1.036590 00	9.257540-01	8.340060-01	7.241180-01	5.918410-01	5.512080-01	5.156880-01
2.000 01	1.440330 00	1.375720 00	1.313730 00	1.199800 00	1.099960 00	9.741730-01	8.143230-01	7.634580-01	7.183370-01
3.000 01	1.805070 00	1.757550 00	1.708730 00	1.610740 00	1.516200 00	1.385920 00	1.203030 00	1.140910 00	1.084250 00
5.000 01	2.198180 00	2.174610 00	2.148920 00	2.092030 00	2.029730 00	1.931340 00	1.768340 00	1.706370 00	1.646970 00
7.500 01	2.461440 00	2.449240 00	2.436090 00	2.406580 00	2.372580 00	2.313930 00	2.202040 00	2.154710 00	2.106900 00
1.000 02	2.632310 00	2.624350 00	2.615990 00	2.597830 00	2.577320 00	2.541470 00	2.468460 00	2.435390 00	2.400700 00
1.500 02	2.860380 00	2.855680 00	2.850870 00	2.840840 00	2.830190 00	2.812620 00	2.777680 00	2.761360 00	2.743660 00
2.000 02	3.016470 00	3.013130 00	3.009740 00	3.002780 00	2.995550 00	2.984130 00	2.962920 00	2.953430 00	2.943220 00
3.000 02	3.231300 00	3.229180 00	3.227050 00	3.222720 00	3.218300 00	3.211480 00	3.199530 00	3.194510 00	3.189330 00
5.000 02	3.496410 00	3.495190 00	3.493960 00	3.491490 00	3.488990 00	3.485190 00	3.478710 00	3.476050 00	3.473360 00
7.500 02	3.704060 00	3.703260 00	3.702460 00	3.700850 00	3.699230 00	3.696770 00	3.692630 00	3.690960 00	3.689270 00
1.000 03	3.850400 00	3.849810 00	3.849210 00	3.848020 00	3.846820 00	3.845010 00	3.841960 00	3.840730 00	3.839490 00
1.500 03	4.055680 00	4.055280 00	4.054890 00	4.054110 00	4.053320 00	4.052130 00	4.050130 00	4.049330 00	4.048520 00
2.000 03	4.200810 00	4.200520 00	4.200230 00	4.199640 00	4.199050 00	4.198170 00	4.196690 00	4.196090 00	4.195500 00
3.000 03	4.404870 00	4.404680 00	4.404480 00	4.404090 00	4.403700 00	4.403120 00	4.402140 00	4.401750 00	4.401360 00
5.000 03	4.661370 00	4.661250 00	4.661140 00	4.660910 00	4.660670 00	4.660330 00	4.659740 00	4.659510 00	4.659280 00
7.500 03	4.864660 00	4.864590 00	4.864510 00	4.864350 00	4.864200 00	4.863970 00	4.863580 00	4.863430 00	4.863270 00
1.000 04	5.008790 00	5.008730 00	5.008670 00	5.008560 00	5.008440 00	5.008270 00	5.007980 00	5.007860 00	5.007750 00

TABLE B.2r

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 0.1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 3162$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 3162.278
 $CD2 \times \exp(252) = 1.000000$ 06 $CD2/r_D^2 = 0.10000$
 $CD1/r_D^2 = 1.00000$

$CD \times \exp(251)$

	1.000000 07	1.000000 10	1.000000 12	1.000000 15	1.000000 20	1.000000 25	1.000000 30	1.000000 40
RD/r_D^2	DIMENSIONLESS PRESSURE DROP							
1.000-01	1.073570-06	6.048410-07	8.518210-07	4.270030-07	3.101930-07	2.435600-07	2.004910-07	1.481090-07
1.500-01	1.011060-05	6.560270-06	9.315340-06	4.137390-06	3.021300-06	2.379330-06	1.962430-06	1.453130-06
2.000-01	3.979110-05	2.610760-05	2.123650-05	1.659190-05	1.215910-05	9.595330-06	7.924390-06	5.877350-06
3.000-01	2.163240-04	1.440410-04	1.177800-04	9.249470-05	6.011310-05	5.390290-05	4.459810-05	3.315220-05
5.000-01	1.344370-03	9.111380-04	7.499210-04	5.925960-04	4.390500-04	3.486940-04	2.891730-04	2.155770-04
7.500-01	4.730730-03	3.251450-03	2.490200-03	2.136760-03	1.591070-03	1.267360-03	1.053090-03	7.869680-04
1.000 00	1.058090-02	7.347640-03	6.103160-03	4.866320-03	3.637370-03	2.903670-03	2.416520-03	1.809210-03
1.500 00	2.940070-02	2.073920-02	1.733100-02	1.390200-02	1.045330-02	8.375170-03	6.986100-03	5.245830-03
2.000 00	5.627240-02	4.019200-02	3.375100-02	2.720590-02	2.055740-02	1.651900-02	1.380640-02	1.039260-02
3.000 00	1.267480-01	9.240260-02	7.822900-02	6.358170-02	4.844640-02	3.912650-02	3.281210-02	2.480420-02
5.000 00	2.993040-01	2.255270-01	1.935280-01	1.594840-01	1.232590-01	1.004160-01	8.470650-02	6.451030-02
7.500 00	5.246110-01	4.089330-01	3.559690-01	2.977740-01	2.337650-01	1.923070-01	1.632940-01	1.254130-01
1.000 01	7.355540-01	5.901040-01	5.201680-01	4.409920-01	3.511650-01	2.914810-01	2.490460-01	1.927940-01
1.500 01	1.092770 00	9.186410-01	8.272660-01	7.179490-01	5.865140-01	4.949090-01	4.277220-01	3.360700-01
2.000 01	1.369900 00	1.193880 00	1.096160 00	9.606520-01	8.093430-01	6.931780-01	6.054180-01	4.823400-01
3.000 01	1.753950 00	1.606730 00	1.512050 00	1.361700 00	1.198930 00	1.053910 00	9.380270-01	7.665880-01
5.000 01	2.172870 00	2.090800 00	2.027530 00	1.928920 00	1.765700 00	1.615570 00	1.482610 00	1.265100 00
7.500 01	2.448250 00	2.405470 00	2.371390 00	2.312580 00	2.200480 00	2.081260 00	1.963400 00	1.747190 00
1.000 02	2.623660 00	2.597890 00	2.576540 00	2.540610 00	2.467450 00	2.381720 00	2.289230 00	2.181690 00
1.500 02	2.855250 00	2.840400 00	2.829730 00	2.812140 00	2.777150 00	2.733700 00	2.682040 00	2.560720 00
2.000 02	3.012820 00	3.002460 00	2.995230 00	2.983790 00	2.962570 00	2.937450 00	2.907430 00	2.832090 00
3.000 02	3.228980 00	3.222520 00	3.218490 00	3.211270 00	3.199310 00	3.186440 00	3.172280 00	3.138240 00
5.000 02	3.495070 00	3.491370 00	3.488470 00	3.485870 00	3.478590 00	3.471080 00	3.464930 00	3.450160 00
7.500 02	3.703180 00	3.700770 00	3.699150 00	3.696700 00	3.692550 00	3.688340 00	3.684030 00	3.675130 00
1.000 03	3.849750 00	3.847960 00	3.846760 00	3.844950 00	3.841900 00	3.838810 00	3.835690 00	3.829300 00
1.500 03	4.055250 00	4.054070 00	4.053280 00	4.052090 00	4.050090 00	4.048080 00	4.046050 00	4.041950 00
2.000 03	4.200490 00	4.199610 00	4.199430 00	4.198140 00	4.196660 00	4.195170 00	4.193670 00	4.190640 00
3.000 03	4.404660 00	4.404070 00	4.403480 00	4.403100 00	4.402120 00	4.401140 00	4.400150 00	4.398170 00
5.000 03	4.661240 00	4.660900 00	4.660460 00	4.660310 00	4.659730 00	4.659150 00	4.658560 00	4.657390 00
7.500 03	4.864580 00	4.864350 00	4.864190 00	4.863960 00	4.863570 00	4.863190 00	4.862800 00	4.862020 00
1.000 04	5.008730 00	5.008550 00	5.008440 00	5.008260 00	5.007970 00	5.007680 00	5.007390 00	5.006810 00

TABLE B.2a

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 31.623$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 31.623
CD2*exp(232) = 1.000000 03 CD2/rD**2 = 1.00000
CD1/rD**2 = 1.00000

CD*exp(231)

	1.000000 03	1.000000 04	1.000000 05	1.000000 06	1.000000 08	1.000000 10	1.000000 15	1.000000 20	1.000000 22
td/rD**2	DIMENSIONLESS PRESSURE DROP								
1.000-01	1.695770-06	9.809750-07	6.885060-07	5.300920-07	3.628080-07	2.758270-07	1.723920-07	1.253690-07	1.130360-07
1.500-01	1.275300-05	7.880870-06	5.691610-06	4.452010-06	3.099910-06	2.377370-06	1.501850-06	1.097560-06	9.908590-07
2.000-01	4.410090-05	2.830250-05	2.080300-05	1.643750-05	1.157350-05	8.929230-06	5.682140-06	4.166610-06	3.764920-06
3.000-01	2.069310-04	1.388400-04	1.043150-04	8.350390-05	5.966350-05	4.640400-05	2.982500-05	2.197270-05	1.987900-05
5.000-01	1.123990-03	7.698330-04	6.080560-04	4.940780-04	3.592050-04	2.821190-04	1.835730-04	1.360390-04	1.232700-04
7.500-01	3.691960-03	2.678510-03	2.099040-03	1.724920-03	1.271040-03	1.006030-03	6.611580-04	4.923230-04	4.466900-04
1.000 00	8.028320-03	5.949160-03	4.719520-03	3.909260-03	2.908570-03	2.315190-03	1.532780-03	1.145490-03	1.040330-03
1.500 00	2.209920-02	1.685650-02	1.360610-02	1.140030-02	8.603760-03	6.906770-03	4.624130-03	3.476970-03	3.160720-03
2.000 00	4.292930-02	3.342590-02	2.732680-02	2.309540-02	1.762150-02	1.423960-02	9.618340-03	7.260240-03	6.611690-03
3.000 00	1.014690-01	8.143060-02	6.787630-02	5.814190-02	4.513690-02	3.686370-02	2.526580-02	1.921280-02	1.753210-02
5.000 00	2.622500-01	2.194840-01	1.882070-01	1.645170-01	1.312060-01	1.090040-01	7.650110-02	5.889460-02	5.392600-02
7.500 00	4.942050-01	4.293160-01	3.780910-01	3.371260-01	2.763260-01	2.337090-01	1.682810-01	1.313290-01	1.207090-01
1.000 01	7.209630-01	6.440880-01	5.794030-01	5.251710-01	4.406680-01	3.786460-01	2.790810-01	2.205830-01	2.034750-01
1.500 01	1.103640 00	1.024960 00	9.516870-01	8.851340-01	7.720440-01	6.817600-01	5.240390-01	4.241070-01	3.938740-01
2.000 01	1.388590 00	1.320980 00	1.253250 00	1.187710 00	1.067710 00	9.644360-01	7.690820-01	6.360570-01	5.944680-01
3.000 01	1.763110 00	1.719280 00	1.671780 00	1.621820 00	1.519430 00	1.419690 00	1.201870 00	1.032290 00	9.758270-01
5.000 01	2.162220 00	2.141580 00	2.118940 00	2.094110 00	2.038050 00	1.975080 00	1.804620 00	1.638870 00	1.577160 00
7.500 01	2.433020 00	2.421650 00	2.409590 00	2.396730 00	2.368090 00	2.334960 00	2.233320 00	2.114510 00	2.065170 00
1.000 02	2.609480 00	2.601760 00	2.593740 00	2.585380 00	2.567410 00	2.547350 00	2.465420 00	2.406680 00	2.371540 00
1.500 02	2.844060 00	2.839410 00	2.834640 00	2.829770 00	2.819640 00	2.808940 00	2.778660 00	2.741100 00	2.723630 00
2.000 02	3.003690 00	3.000360 00	2.996980 00	2.993550 00	2.986510 00	2.979210 00	2.959600 00	2.937180 00	2.927120 00
3.000 02	3.222270 00	3.220160 00	3.218020 00	3.215870 00	3.211490 00	3.207030 00	3.195420 00	3.180360 00	3.177870 00
5.000 02	3.490600 00	3.489380 00	3.488150 00	3.486910 00	3.484420 00	3.481900 00	3.475490 00	3.468890 00	3.466180 00
7.500 02	3.699980 00	3.699180 00	3.698370 00	3.697570 00	3.695950 00	3.694320 00	3.690190 00	3.686000 00	3.684300 00
1.000 03	3.847220 00	3.846630 00	3.846030 00	3.845430 00	3.844230 00	3.843030 00	3.839990 00	3.836910 00	3.835670 00
1.500 03	4.053440 00	4.053050 00	4.052660 00	4.052260 00	4.051470 00	4.050680 00	4.048690 00	4.046680 00	4.045880 00
2.000 03	4.199080 00	4.198790 00	4.198490 00	4.198200 00	4.197610 00	4.197020 00	4.195540 00	4.194050 00	4.193450 00
3.000 03	4.403650 00	4.403460 00	4.403270 00	4.403070 00	4.402680 00	4.402290 00	4.401310 00	4.400330 00	4.399940 00
5.000 03	4.660600 00	4.660480 00	4.660370 00	4.660250 00	4.660020 00	4.659780 00	4.659200 00	4.658620 00	4.658380 00
7.500 03	4.864120 00	4.864050 00	4.863970 00	4.863890 00	4.863740 00	4.863580 00	4.863200 00	4.862810 00	4.862650 00
1.000 04	5.008370 00	5.008310 00	5.008260 00	5.008200 00	5.008080 00	5.007970 00	5.007680 00	5.007390 00	5.007270 00

TABLE B.2t

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 100$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS AT BOTH THE RESPONDING AND PULSING WELLS

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DISTANCE BETWEEN THE WELLS, RD      * 100.000
CD2/rD==R                            * 1.00000
CD1/rD==R                            * 1.00000

```

GE 228P(231)

1.000000 04 1.000000 05 1.000000 06 1.000000 10 1.000000 12 1.000000 15 1.000000 20 1.000000 22 1.000000 24

ID/CDS#?

DIMENSIONLESS PRESSURE DROP

1.000-01	5.784980-07	4.041010-07	3.103050-07	1.607700-07	1.295370-07	1.003020-07	7.285420-08	6.570000-08	5.980490-08
1.500-01	4.919500-06	3.942650-06	2.766490-06	1.473060-06	1.193800-06	9.294400-06	6.702560-07	6.127690-07	5.504700-07
2.000-01	1.027970-05	1.340700-05	1.058020-05	5.734690-06	4.665540-06	3.645770-06	2.672160-06	2.412450-06	2.201740-06
3.000-01	3.345090-05	7.010830-05	5.607030-05	3.110800-05	2.544050-05	1.997920-05	1.471400-05	1.331700-05	1.215100-05
5.000-01	5.556180-04	4.272900-04	3.469640-04	1.978710-04	1.628510-04	1.286790-04	9.532700-05	8.367800-05	7.896100-05
7.500-01	1.943650-33	1.521810-03	1.249660-03	7.281690-04	6.023310-04	4.783040-04	3.568790-04	3.230460-04	2.956270-04
1.000-00	4.407640-03	3.493810-03	2.892460-03	1.711270-03	1.420810-03	1.132390-03	8.456620-04	7.603410-04	7.036940-04
1.500-00	1.285070-32	1.036500-02	0.800420-03	5.253800-03	4.386630-03	3.515740-03	2.841390-03	2.402360-03	2.202990-03
2.000-00	6.600740-02	2.124650-02	1.794770-02	1.105470-02	9.270910-03	7.463290-03	5.632110-03	5.128650-03	4.707770-03
3.000-00	6.528190-02	5.437160-02	4.654880-02	2.948060-02	2.970910-02	2.019250-02	1.335300-02	1.400630-02	1.287860-02
5.000-00	1.633790-01	1.370620-01	1.371790-01	9.073340-02	7.753240-02	6.362010-02	4.695520-02	4.481940-02	4.132700-02
7.500-00	3.720090-01	3.270540-01	2.912550-01	2.013620-01	1.741930-01	1.447780-01	1.129010-01	1.037500-01	9.966300-02
1.000-01	5.736250-01	5.148730-01	4.659160-01	3.346870-01	2.927450-01	2.461740-01	1.943640-01	1.792350-01	1.662790-01
1.500-01	9.426530-01	8.703870-01	8.012250-01	6.246750-01	5.572400-01	4.786770-01	3.867450-01	3.590050-01	3.349300-01
2.000-01	1.252750-00	1.185480-00	1.110920-00	9.049140-01	8.211090-01	7.188970-01	5.932660-01	5.541550-01	5.197420-01
3.000-01	1.673410-00	1.626200-00	1.572970-00	1.369550-00	1.272740-00	1.154640-00	9.891930-01	9.348400-01	8.849210-01
5.000-01	1.220080-00	1.063320-00	2.070400-00	1.947330-00	1.878660-00	1.773930-00	1.607370-00	1.545720-00	1.487310-00
7.500-01	2.409950-00	2.397540-00	2.384270-00	2.320550-00	2.281740-00	2.216230-00	2.095340-00	2.045380-00	1.975500-00
1.000-02	2.593900-00	2.585720-00	2.567180-00	2.538920-00	2.515100-00	2.474670-00	2.394510-00	2.358770-00	2.321620-00
1.500-02	2.834700-00	2.829880-00	2.824950-00	2.803860-00	2.792290-00	2.773140-00	2.734960-00	2.717200-00	2.698010-00
2.000-02	2.947010-00	2.993360-00	2.990150-00	2.975690-00	2.968030-00	2.955890-00	2.933230-00	2.923050-00	2.912110-00
3.000-02	3.218030-00	3.315880-00	3.321370-00	3.294850-00	3.200260-00	3.193170-00	3.180740-00	3.175520-00	3.170110-00
5.000-02	3.488150-00	3.486920-00	3.485580-00	3.480660-00	3.478110-00	3.474230-00	3.467600-00	3.464890-00	3.462140-00
7.500-02	3.698370-00	3.697570-00	3.696760-00	3.693500-00	3.691860-00	3.689370-00	3.685170-00	3.683470-00	3.681760-00
1.000-03	3.046030-00	3.045430-00	3.044830-00	3.042430-00	3.041210-00	3.039380-00	3.036300-00	3.035060-00	3.033810-00
1.500-03	4.052660-00	4.052260-00	4.051870-00	4.05					

TABLE B.2u

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 1$, $C_{D1}/r_D^2 = 1$ AND $r_D = 316$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, r_D = 316.228
 $CD2 \times exp(252) = 1.000000$ 05 $CD2/r_D^2 = 1$ 1.00000
 $CD1/r_D^2 = 1$ 1.00000

$CD \times exp(251)$

1.000000 05 1.000000 06 1.000000 08 1.000000 10 1.000000 15 1.000000 20 1.000000 22 1.000000 24

$t_D/r_D^2 = 2$

DIMENSIONLESS PRESSURE DROP

1.000-01	2.027650-07	2.169890-07	1.480230-07	1.123020-07	7.003370-08	5.087950-08	4.586200-08	4.174510-08
1.500-01	2.553040-06	1.992700-06	1.384210-06	1.060210-06	6.687190-07	4.883510-07	4.437920-07	4.016720-07
2.000-01	3.037080-06	7.759800-06	5.453350-06	4.203070-06	2.671260-06	1.957630-06	1.768620-06	1.612890-06
3.000-01	5.259900-05	4.205280-05	3.000380-05	2.331730-05	1.497170-05	1.102470-05	9.972960-05	9.104390-05
5.000-01	3.285480-04	2.667070-04	1.936820-04	1.520200-04	9.883740-05	7.321560-05	6.633630-05	6.063860-05
7.500-01	1.191220-03	9.780750-04	7.199800-04	5.695310-04	3.740090-04	2.783980-04	2.525690-04	2.311240-04
1.000 00	2.768610-03	2.291450-03	1.703230-03	1.354980-03	8.964000-04	6.696600-04	6.081220-04	5.569410-04
1.500 00	8.357280-03	6.997040-03	5.275570-03	4.232610-03	2.831610-03	2.127120-03	1.934560-03	1.773950-03
2.000 00	1.735040-02	1.465230-02	1.116040-02	9.019630-03	6.087560-03	4.593250-03	4.182400-03	3.839130-03
3.000 00	4.526300-02	3.873670-02	3.003760-02	2.451600-02	1.678590-02	1.275830-02	1.164070-02	1.070300-02
5.000 00	1.344210-01	1.173410-01	9.341730-02	7.752490-02	5.432650-02	4.179120-02	3.825740-02	3.527390-02
7.500 00	2.871940-01	2.555420-01	2.088730-01	1.763480-01	1.266680-01	9.872780-02	9.071220-02	8.389690-02
1.000 01	4.614150-01	4.170590-01	3.486190-01	2.988140-01	2.194710-01	1.731490-01	1.596380-01	1.480730-01
1.500 01	8.116930-01	7.521030-01	6.524670-01	5.740560-01	4.388670-01	3.541340-01	3.286170-01	3.064880-01
2.000 01	1.119200 00	1.056400 00	9.438490-01	8.488280-01	6.723040-01	5.539000-01	5.171160-01	4.848050-01
3.000 01	1.573720 00	1.521660 00	1.417510 00	1.318480 00	1.107560 00	9.467740-01	8.937340-01	8.459500-01
5.000 01	2.071540 00	2.044500 00	1.984140 00	1.917510 00	1.741620 00	1.574690 00	1.513240 00	1.455160 00
7.500 01	2.584740 00	2.371050 00	2.340480 00	2.305180 00	2.198130 00	2.075200 00	2.024670 00	1.974340 00
1.000 02	2.577370 00	2.568650 00	2.549870 00	2.528820 00	2.463800 00	2.381790 00	2.345440 00	2.307730 00
1.500 02	2.825010 00	2.820020 00	2.809640 00	2.798660 00	2.767470 00	2.728640 00	2.710580 00	2.691080 00
2.000 02	2.990170 00	2.986690 00	2.979530 00	2.972100 00	2.952120 00	2.929210 00	2.918900 00	2.907820 00
3.000 02	3.213730 00	3.211560 00	3.207140 00	3.202640 00	3.190900 00	3.178400 00	3.173140 00	3.167700 00
5.000 02	3.485680 00	3.484440 00	3.481940 00	3.479410 00	3.472960 00	3.466320 00	3.463590 00	3.460830 00
7.500 02	3.696760 00	3.695950 00	3.694330 00	3.692690 00	3.688550 00	3.684350 00	3.682640 00	3.680930 00
1.000 03	3.844040 00	3.844240 00	3.843030 00	3.841830 00	3.838760 00	3.835690 00	3.834450 00	3.833200 00
1.500 03	4.051870 00	4.051480 00	4.050690 00	4.049890 00	4.047980 00	4.045890 00	4.045080 00	4.044270 00
2.000 03	4.197910 00	4.197610 00	4.197020 00	4.196430 00	4.194950 00	4.193460 00	4.192860 00	4.192260 00
3.000 03	4.402880 00	4.402680 00	4.402290 00	4.401900 00	4.400920 00	4.399940 00	4.399550 00	4.399150 00
5.000 03	4.660130 00	4.660020 00	4.659780 00	4.659550 00	4.658970 00	4.658390 00	4.658150 00	4.657920 00
7.500 03	4.863810 00	4.863740 00	4.863580 00	4.863430 00	4.863040 00	4.862650 00	4.862500 00	4.862340 00
1.000 04	5.008140 00	5.008080 00	5.007970 00	5.007850 00	5.007560 00	5.007270 00	5.007160 00	5.007040 00

TABLE B.2v

DIMENSIONLESS PRESSURE RESPONSE AT THE OBSERVATION WELL WITH WELLBORE STORAGE
AT BOTH WELLS FOR $C_{D2}/r_D^2 = 1$, $C_{D1}/r_D^2 = 1$, AND $r_D = 1000$

DIMENSIONLESS PRESSURE RESPONSE AT THE RESPONDING WELL
IN THE PRESENCE OF WELLBORE STORAGE AND SKIN EFFECTS
AT BOTH THE RESPONDING AND PULSING WELLS

DISTANCE BETWEEN THE WELLS, RD = 1000.000
CD2/exp(232) = 1.000000 06 CD2/rD**2 = 1.00000
CD1/rD**2 = 1.00000

CD=exp(231)

	1.000000 06	1.000000 07	1.000000 10	1.000000 12	1.000000 15	1.000000 20	1.000000 22	1.000000 24	1.000000 30
tD/rD**2	DIMENSIONLESS PRESSURE DROP								
1.000-01	1.665200-07	1.350440-07	8.614780-08	6.939030-08	5.371460-08	3.902490-08	3.397210-08	3.201430-08	2.922110-08
1.500-01	1.555230-06	1.274910-06	8.271790-07	6.701940-07	5.216610-07	3.809120-07	3.438280-07	3.133100-07	2.474240-07
2.000-01	6.120640-06	5.051880-06	3.314140-06	2.695660-06	2.106910-06	1.543380-06	1.394260-06	1.271470-06	1.005750-06
3.000-01	3.361730-05	2.799420-05	1.063420-05	1.523620-05	1.196310-05	8.808730-06	7.968250-06	7.274170-06	5.767080-06
5.000-01	2.164760-04	1.821290-04	1.233520-04	1.015000-04	8.018710-05	5.939610-05	5.321430-05	4.919140-05	3.911140-05
7.500-01	8.029480-04	6.808660-04	4.674060-04	3.865550-04	3.068990-04	2.284280-04	2.012300-04	1.896320-04	1.511290-04
1.000 00	1.896230-03	1.616920-03	1.020900-03	9.304580-04	7.414290-04	5.538450-04	5.029400-04	4.606030-04	3.677320-04
1.500 00	5.857160-03	5.035340-03	3.941820-03	2.956550-03	2.369060-03	1.779490-03	1.618360-03	1.483980-03	1.188010-03
2.000 00	1.237140-02	1.070170-02	7.612600-03	6.382650-03	5.136910-03	3.875580-03	3.528900-03	3.239130-03	2.598850-03
3.000 00	1.314380-02	2.895030-02	2.096610-02	1.770430-02	1.435180-02	1.090590-02	9.951090-03	9.149210-03	7.367770-03
5.000 00	1.023940-01	9.076530-02	6.759610-02	5.773270-02	4.734920-02	3.641580-02	3.353500-02	3.073390-02	2.490240-02
7.500 00	2.272410-01	2.043820-01	1.566120-01	1.353670-01	1.124120-01	8.750420-02	8.046510-02	7.441340-02	6.070660-02
1.000 01	3.766460-01	3.429190-01	2.693450-01	2.353010-01	1.976170-01	1.558290-01	1.456400-01	1.332170-01	1.093770-01
1.500 01	1.968100-01	6.464600-01	5.896380-01	4.715190-01	4.041870-01	3.298340-01	3.022740-01	2.818540-01	2.342550-01
2.000 01	9.956570-01	9.393400-01	7.969590-01	7.212680-01	6.297050-01	5.181810-01	4.855090-01	4.531490-01	3.810360-01
3.000 01	1.469210 00	1.416820 00	1.167610 00	1.178440 00	1.061490 00	9.056900-01	8.544670-01	8.083970-01	6.947890-01
5.000 01	2.016130 00	1.984050 00	1.685720 00	1.814640 00	1.787890 00	1.541040 00	1.479950 00	1.422330 00	1.269440 00
7.500 01	2.356870 00	2.341620 00	2.188730 00	2.247600 00	2.178920 00	2.054020 00	2.003000 00	1.952280 00	1.805810 00
1.000 02	2.559730 00	2.550370 00	2.518870 00	2.499440 00	2.452170 00	2.368920 00	2.331510 00	2.293250 00	2.174600 00
1.500 02	2.814950 00	2.809770 00	2.793320 00	2.781410 00	2.761630 00	2.722120 00	2.703750 00	2.683920 00	2.616580 00
2.000 02	2.983170 00	2.979590 00	2.968450 00	2.960660 00	2.948280 00	2.925180 00	2.914660 00	2.903440 00	2.864580 00
3.000 02	3.209370 00	3.207160 00	3.200410 00	3.195770 00	3.188610 00	3.176030 00	3.170740 00	3.165260 00	3.147400 00
5.000 02	3.483190 00	3.481940 00	3.478150 00	3.475590 00	3.471690 00	3.465810 00	3.462290 00	3.459520 00	3.450960 00
7.500 02	3.645140 00	3.644330 00	3.641880 00	3.640230 00	3.637730 00	3.633510 00	3.631810 00	3.630090 00	3.624840 00
1.000 03	3.843640 00	3.843040 00	3.841220 00	3.840010 00	3.838170 00	3.835080 00	3.833840 00	3.832580 00	3.828790 00
1.500 03	4.051980 00	4.050690 00	4.049500 00	4.048700 00	4.047500 00	4.045940 00	4.044680 00	4.043870 00	4.041410 00
2.000 03	4.197320 00	4.197020 00	4.196140 00	4.195550 00	4.194660 00	4.193160 00	4.192560 00	4.191960 00	4.190150 00
3.000 03	4.402490 00	4.402290 00	4.401710 00	4.401320 00	4.400730 00	4.399750 00	4.399350 00	4.398960 00	4.397770 00
5.000 03	4.659900 00	4.659780 00	4.659440 00	4.659200 00	4.658850 00	4.658270 00	4.658030 00	4.657800 00	4.657160 00
7.500 03	4.863860 00	4.863580 00	4.863350 00	4.863200 00	4.862960 00	4.862580 00	4.862420 00	4.862270 00	4.861800 00
1.000 04	5.008030 00	5.007970 00	5.007790 00	5.007680 00	5.007500 00	5.007210 00	5.007100 00	5.006980 00	5.006630 00

APPENDIX C

TABLES OF DATA FOR THE VALIDATION OF THE MATHEMATICAL MODEL FOR INTERFERENCE TESTING

TABLE C.1a

COMPARISON OF RESULTS OBTAINED IN THIS STUDY WITH THE RESULTS PRESENTED BY SANDAL ET AL.FOR $C_D/r_D^2 = 1$, AND $C_D \exp(2S) = 10^2, 10^3, 10^6$ DIMENSIONLESS PRESSURE DROP AT THE OBSERVATION WELL CONSIDERING
WELLBORE STORAGE AND SKIN EFFECTS AT THE ACTIVE WELL ONLY

CD2/RD**2 = 1.000 00										
RD	1.000D 01			3.162D 01			1.000D 03			
CD2*EXP(2*S2)	1.000D 02			1.000D 03			1.000D 06			
TD/RD**2	(1)	(2)	% DEV	(1)	(2)	% DEV	(1)	(2)	% DEV	LINE SOURCE
1.00D-01	3.78121D-04	3.81140D-04	0.80	1.55621D-04	1.55770D-04	0.10	5.07593D-05	5.07810D-05	0.04	1.24575D-02
2.00D-01	3.85877D-03	3.88480D-03	0.67	1.98858D-03	1.98980D-03	0.06	7.70553D-04	7.70560D-04	0.00	7.32067D-02
5.00D-01	3.27715D-02	3.29630D-02	0.58	2.03321D-02	2.03430D-02	0.05	9.27707D-03	9.27710D-03	0.00	2.79887D-01
1.00D 00	1.09487D-01	1.10050D-01	0.51	7.52877D-02	7.53270D-02	0.05	3.81397D-02	3.81400D-02	0.00	5.22141D-01
2.00D 00	2.87271D-01	2.88510D-01	0.43	2.16547D-01	2.16650D-01	0.05	1.22060D-01	1.22060D-01	0.00	8.11713D-01
5.00D 00	7.50657D-01	7.52760D-01	0.28	6.36739D-01	6.36950D-01	0.03	4.24070D-01	4.24070D-01	0.00	1.23395D 00
1.00D 01	1.23733D 00	1.23930D 00	0.16	1.13700D 00	1.13720D 00	0.02	8.78683D-01	8.78680D-01	0.00	1.56825D 00
2.00D 01	1.72540D 00	1.72660D 00	0.07	1.67184D 00	1.67200D 00	0.01	1.48381D 00	1.48380D 00	0.00	1.90864D 00
5.00D 01	2.28611D 00	2.28660D 00	0.02	2.27039D 00	2.27040D 00	0.00	2.21367D 00	2.21360D 00	0.00	2.36305D 00
1.00D 02	2.66792D 00	2.66800D 00	0.01	2.66106D 00	2.66110D 00	0.00	2.63935D 00	2.63940D 00	0.00	2.70837D 00
2.00D 02	3.03272D 00	3.03280D 00	0.00	3.02959D 00	3.02960D 00	0.00	3.01994D 00	3.01990D 00	0.00	3.05432D 00
5.00D 02	3.50265D 00	3.50270D 00	0.00	3.50146D 00	3.50150D 00	0.00	3.49784D 00	3.49780D 00	0.00	3.51209D 00
1.00D 03	3.85350D 00	3.85350D 00	0.00	3.85291D 00	3.85290D 00	0.00	3.85114D 00	3.85110D 00	0.00	3.85854D 00
2.00D 03	4.20237D 00	4.20240D 00	0.00	4.20207D 00	4.20210D 00	0.00	4.20120D 00	4.20120D 00	0.00	4.20505D 00
5.00D 03	4.66200D 00	4.66200D 00	0.00	4.66188D 00	4.66190D 00	0.00	4.66153D 00	4.65150D 00	0.22	4.66316D 00
1.00D 04	5.00911D 00	5.00910D 00	0.00	5.00905D 00	5.00900D 00	0.00	5.00887D 00	5.00890D 00	0.00	5.00972D 00
2.00D 04	5.35596D 00	5.35600D 00	0.00	5.35594D 00	5.35590D 00	0.00	5.35585D 00	5.35580D 00	0.00	5.35629D 00
5.00D 04	5.81429D 00	5.81430D 00	0.00	5.81428D 00	5.81430D 00	0.00	5.81425D 00	5.81420D 00	0.00	5.81443D 00
1.00D 05	6.16093D 00	6.16090D 00	0.00	6.16092D 00	6.16090D 00	0.00	6.16051D 00	6.16090D 00	0.00	6.16100D 00
2.00D 05	6.50754D 00	6.50750D 00	0.00	6.50754D 00	6.50750D 00	0.00	6.50753D 00	6.50750D 00	0.00	6.50758D 00

(1) RESULTS OBTAINED FROM THIS STUDY

(2) RESULTS OBTAINED BY SANDAL ET AL.NOTE: THE DEVIATION BETWEEN THE TWO RESULTS IS:
$$\frac{P_D^{(1)} - P_D^{(2)}}{P_D^{(1)}} \times 100$$

TABLE C.1b

COMPARISON OF RESULTS OBTAINED IN THIS STUDY WITH THE RESULTS PRESENTED BY SANDAL ET AL.

FOR $C_D/r_D^2 = 1$, AND $C_D \exp(2S) = 10^{10}, 10^{20}, 10^{40}$ DIMENSIONLESS PRESSURE DROP AT THE OBSERVATION WELL CONSIDERING
WELLBORE STORAGE AND SKIN EFFECTS AT THE ACTIVE WELL ONLY

CD2/RD**2 = 1.000 00										
RD	1.000D 05			1.000D 10			1.000D 20			
CD2*EXP(2*S2)	1.000D 10			1.000D 20			1.000D 40			
TD/RD**2	(1)	(2)	% DEV	(1)	(2)	% DEV	(1)	(2)	% DEV	LINE SOURCE
1.000-01	2.65379D-05	2.65490D-05	0.04	1.20939D-05	1.20990D-05	0.04	5.78978D-06	5.79210D-06	0.04	1.24575D-02
2.000-01	4.22167D-04	4.22170D-04	0.00	1.98032D-04	1.98940D-04	0.46	9.60299D-05	9.60320D-05	0.00	7.32067D-02
5.000-01	5.35857D-03	5.35860D-03	0.00	2.60400D-03	2.60400D-03	0.00	1.28363D-03	1.28350D-03	0.01	2.79887D-01
1.000 00	2.29109D-02	2.29110D-02	0.00	1.14506D-02	1.14510D-02	0.00	5.72184D-03	5.72180D-03	0.00	5.22141D-01
2.000 00	7.66982D-02	7.66980D-02	0.00	3.96655D-02	3.96660D-02	0.00	2.01637D-02	2.01640D-02	0.00	8.11713D-01
5.000 00	2.89362D-01	2.89360D-01	0.00	1.60164D-01	1.60160D-01	0.00	8.43951D-02	8.43950D-02	0.00	1.23395D 00
1.000 01	6.56867D-01	6.55890D-01	0.15	3.95657D-01	3.95660D-01	0.00	2.18757D-01	2.18760D-01	0.00	1.56825D 00
2.000 01	1.24443D 00	1.24440D 00	0.00	8.51765D-01	8.51760D-01	0.00	5.10955D-01	5.10950D-01	0.00	1.90064D 00
5.000 01	2.11010D 00	2.11010D 00	0.00	1.79035D 00	1.79040D 00	0.00	1.28867D 00	1.28870D 00	0.00	2.36305D 00
1.000 02	2.60549D 00	2.60540D 00	0.00	2.47809D 00	2.47810D 00	0.00	2.11558D 00	2.11560D 00	0.00	2.70837D 00
2.000 02	3.00632D 00	3.00640D 00	0.00	2.96689D 00	2.96680D 00	0.00	2.83770D 00	2.83770D 00	0.00	3.05432D 00
5.000 02	3.49294D 00	3.49290D 00	0.00	3.48017D 00	3.48020D 00	0.00	3.45184D 00	3.45190D 00	0.00	3.51209D 00
1.000 03	3.84876D 00	3.84880D 00	0.00	3.84272D 00	3.84270D 00	0.00	3.83012D 00	3.83010D 00	0.00	3.85854D 00
2.000 03	4.20003D 00	4.20000D 00	0.00	4.19708D 00	4.19710D 00	0.00	4.19107D 00	4.19110D 00	0.00	4.20505D 00
5.000 03	4.66107D 00	4.66110D 00	0.00	4.65991D 00	4.65990D 00	0.00	4.65756D 00	4.65760D 00	0.00	4.66316D 00
1.000 04	5.00864D 00	5.00860D 00	0.00	5.00806D 00	5.00810D 00	0.00	5.00690D 00	5.00690D 00	0.00	5.00972D 00
2.000 04	5.35573D 00	5.35570D 00	0.00	5.35544D 00	5.35540D 00	0.00	5.35487D 00	5.35490D 00	0.00	5.35629D 00
5.000 04	5.81420D 00	5.81420D 00	0.00	5.81408D 00	5.81410D 00	0.00	5.81385D 00	5.81390D 00	0.00	5.81443D 00
1.000 05	6.16088D 00	6.16090D 00	0.00	6.16083D 00	6.16080D 00	0.00	6.16071D 00	6.16070D 00	0.00	6.16100D 00
2.000 05	6.50752D 00	6.50750D 00	0.00	6.50749D 00	6.50750D 00	0.00	6.50743D 00	6.50740D 00	0.00	6.50758D 00

(1) RESULTS OBTAINED FROM THIS STUDY

(2) RESULTS OBTAINED BY SANDAL ET AL. [1978]

NOTE: THE DEVIATION BETWEEN THE TWO RESULTS IS: $\% \text{ Dev} = \frac{p_D(1) - p_D(2)}{p_D(1)} \times 100$

TABLE C.2a

COMPARISON OF THE RESULTS OF THIS STUDY WITH THE DATA PUBLISHED BY

TONGPENYAI AND RAGHAVAN FOR $C_{D2}/r_D^2 = 1$, $C_{D1}/r_D^2 = 10$,
 $C_{D2} \exp(2s_2) = 10^{10}$, AND $C_{D1} \exp(2s_1) = 10^2, 10^3, 10^5$

DIMENSIONLESS PRESSURE DROP AT THE OBSERVATION WELL CONSIDERING
 WELLBORE STORAGE AND SKIN EFFECTS AT BOTH ACTIVE AND OBSERVATION WELLS

$CD2=EXP(2*S2) = 1.000 10$
 $CD2/RD**2 = 1.000 00$
 $CD1/RD**2 = 1.000 01$

RD	5.0000 02			5.0000 02			5.0000 02			
CD1=EXP(2*S1)	1.0000 02			1.0000 01			1.0000 05			
TD/RD**2	(1)	(2)	X DEV	(1)	(2)	X DEV	(1)	(2)	X DEV	LINE SOURCE
1.000 00				4.040180-04	4.037700-04	-0.00	1.006940-04	1.006930-04	0.00	5.021410-01
1.500 00	2.498640-03	2.498710-03	0.00	1.191960-03	1.191920-03	0.00	5.695030-04	5.695050-04	0.00	6.072580-01
2.000 00	4.026670-03	4.026480-03	0.00	2.469970-03	2.469930-03	0.00	1.229250-03	1.229260-03	0.00	8.117130-01
3.000 00	1.178830-02	1.178800-02	0.00	6.572250-03	6.572180-03	0.00	3.443080-03	3.443080-03	0.00	9.946600-01
4.000 00	2.172130-02	2.172060-02	0.00	1.274710-02	1.274680-02	0.00	6.903980-03	6.903910-03	0.00	1.128450 00
5.000 00	3.440960-02	3.444550-02	0.10	2.093180-02	2.095120-02	0.09	1.161980-02	1.163000-02	0.09	1.233950 00
6.000 00	4.961370-02	4.954520-02	0.14	3.102240-02	3.098530-02	0.12	1.756350-02	1.754430-02	0.11	1.321040 00
7.000 00	6.769240-02	6.694860-02	0.21	4.289690-02	4.282660-02	0.18	2.468970-02	2.465050-02	0.16	1.395190 00
8.000 00	8.661260-02	8.669160-02	0.09	5.642620-02	5.646860-02	0.08	3.294300-02	3.296500-02	0.07	1.459760 00
1.000 01	1.309070-01	1.309070-01	0.00	8.793140-02	8.793120-02	0.00	5.258550-02	5.258550-02	0.00	1.868250 00
1.500 01	2.636460-01	2.636480-01	0.00	1.070340-01	1.070350-01	0.00	1.170710-01	1.170720-01	0.00	1.766860 00
2.000 01	4.136330-01	4.136300-01	0.00	3.051570-01	3.051550-01	0.00	1.978240-01	1.978230-01	0.00	1.908640 00
3.000 01	7.221020-01	7.221110-01	0.00	5.639610-01	5.639670-01	0.00	3.063120-01	3.063160-01	0.00	2.109300 00
4.000 01	1.008360 00	1.008360 00	0.00	8.209430-01	8.209440-01	0.00	5.076180-01	5.076110-01	0.00	2.252100 00
5.000 01	1.259280 00	1.259280 00	0.00	1.058820 00	1.058820 00	0.00	7.063250-01	7.063250-01	0.00	2.363050 00
6.000 01	1.474910 00	1.474910 00	0.00	1.272460 00	1.272460 00	0.00	9.753060-01	9.753070-01	0.00	2.453790 00
7.000 01	1.659460 00	1.659460 00	0.00	1.461940 00	1.461940 00	0.00	1.151660 00	1.151660 00	0.00	2.530570 00
8.000 01	1.817900 00	1.817900 00	0.00	1.629310 00	1.629310 00	0.00	1.314600 00	1.314600 00	0.00	2.597110 00
1.000 02	2.073920 00	2.073920 00	0.00	1.908200 00	1.908200 00	0.00	1.601830 00	1.601830 00	0.00	2.708370 00
1.500 02	2.493660 00	2.493660 00	0.00	2.382180 00	2.382180 00	0.00	2.136270 00	2.136270 00	0.00	2.910690 00
2.000 02	2.750430 00	2.750430 00	0.00	2.675070 00	2.675070 00	0.00	2.491850 00	2.491850 00	0.00	3.054320 00
3.000 02	3.062070 00	3.062070 00	0.00	3.022470 00	3.022470 00	0.00	2.920980 00	2.920980 00	0.00	3.256850 00
4.000 02	3.256970 00	3.256970 00	0.00	3.232040 00	3.232040 00	0.00	3.170270 00	3.170270 00	0.00	3.400560 00
5.000 02	3.397890 00	3.397890 00	0.00	3.380100 00	3.380100 00	0.00	3.338180 00	3.338180 00	0.00	3.512090 00
6.000 02	3.508130 00	3.508130 00	0.00	3.494390 00	3.494390 00	0.00	3.463290 00	3.463290 00	0.00	3.603210 00
7.000 02	3.598630 00	3.598630 00	0.00	3.587460 00	3.587460 00	0.00	3.562870 00	3.562870 00	0.00	3.680260 00
8.000 02	3.675380 00	3.675380 00	0.00	3.665980 00	3.665980 00	0.00	3.645660 00	3.645660 00	0.00	3.747000 00
1.000 03	3.800820 00	3.800830 00	0.00	3.793700 00	3.793710 00	0.00	3.778630 00	3.778640 00	0.00	3.858540 00
1.500 03	4.022800 00	4.021560 00	0.01	4.017590 00	4.017160 00	0.01	4.008450 00	4.008060 00	0.01	4.061230 00
2.000 03	4.175120 00	4.174920 00	0.00	4.171920 00	4.171720 00	0.00	4.165380 00	4.165190 00	0.00	4.205050 00
3.000 03	4.367270 00	4.367270 00	0.00	4.385200 00	4.385200 00	0.00	4.381030 00	4.381030 00	0.00	4.407760 00
4.000 03	4.535900 00	4.535900 00	0.00	4.534380 00	4.534330 00	0.00	4.531310 00	4.531310 00	0.00	4.551680 00
5.000 03	4.650400 00	4.650400 00	0.00	4.649200 00	4.649200 00	0.00	4.646770 00	4.646770 00	0.00	4.663160 00
6.000 03	4.743540 00	4.743540 00	0.00	4.742540 00	4.742540 00	0.00	4.740540 00	4.740540 00	0.00	4.754320 00
7.000 03	4.822850 00	4.822850 00	0.00	4.821800 00	4.821200 00	0.00	4.819490 00	4.819490 00	0.00	4.831390 00
8.000 03	4.889900 00	4.889900 00	0.00	4.889150 00	4.889150 00	0.00	4.887670 00	4.887670 00	0.00	4.898150 00
1.000 04	5.003000 00	5.003000 00	0.00	5.002420 00	5.002420 00	0.00	5.001230 00	5.001230 00	0.00	5.009720 00

(1) RESULTS OBTAINED FROM THIS STUDY

(2) RESULTS PUBLISHED BY TONGPENYAI AND RAGHAVAN [1979, 1981]

NOTE: THE DEVIATION BETWEEN THE TWO RESULTS IS:

$$\% \text{ Dev} = \frac{P_D(1) - P_D(2)}{P_D(1)} \times 100$$

TABLE C.2b

COMPARISON OF THE RESULTS OF THIS STUDY WITH THE DATA PUBLISHED BY
 TONGPENYAI AND RAGHAVAN FOR $C_{D2}/r_D^2 = 1$, $C_{D1}/r_D^2 = 10$,
 $C_{D2\text{exp}}(2s_2) = 10^{10}$, AND $C_{D1\text{exp}}(2s_1) = 10^{10}, 10^{20}, 10^{40}$

DIMENSIONLESS PRESSURE DROP AT THE OBSERVATION WELL CONSIDERING
 WELLBORE STORAGE AND SKIN EFFECTS AT BOTH ACTIVE AND OBSERVATION WELLS

$CD2=EXP(2*52) = 1.000\ 10$
 $CD2/RD**2 = 1.000\ 00$
 $CD1/RD**2 = 1.000\ 01$

RD	5.0000 02			5.0000 02			5.0000 02			
CD1=EXP(2*52)	1.0000 10			1.0000 20			1.0000 40			
TD/RD**2	(1)	(2)	X DEV	(1)	(2)	X DEV	(1)	(2)	X DEV	LINE SOURCE
1.000 00	7.541570-05	7.541720-05	0.00	3.479620-05	3.479740-05	0.00	1.674860-05	1.674930-05	0.00	5.221410-01
1.500 00	2.457680-04	2.457700-04	0.00	1.149040-04	1.149050-04	0.00	5.563540-05	5.563640-05	0.00	6.872580-01
2.000 00	5.424080-04	5.424100-04	0.00	2.559170-04	2.559200-04	0.00	1.244290-04	1.244310-04	0.00	8.117130-01
3.000 00	1.565330-03	1.565320-03	0.00	7.479960-04	7.479960-04	0.00	3.658260-04	3.658260-04	0.00	9.946600-01
4.000 00	3.204040-03	3.203990-03	0.00	1.544980-03	1.544970-03	0.00	7.588310-04	7.588230-04	0.00	1.128450 00
5.000 00	5.478930-03	5.483520-03	0.08	2.660910-03	2.663110-03	0.08	1.311370-03	1.312450-03	0.08	1.233950 00
6.000 00	8.390520-03	8.381720-03	0.10	4.099480-03	4.095270-03	0.10	2.026140-03	2.024080-03	0.10	1.321040 00
7.000 00	1.192810-02	1.191030-02	0.15	5.858450-03	5.849960-03	0.14	2.902600-03	2.898650-03	0.14	1.395190 00
8.000 00	1.607420-02	1.608410-02	0.06	7.931860-03	7.936610-03	0.06	3.939080-03	3.941410-03	0.06	1.459760 00
1.000 01	2.610350-02	2.610340-02	0.00	1.298740-02	1.298740-02	0.00	6.475730-03	6.475720-03	0.00	1.568250 00
1.500 01	6.013580-02	6.013600-02	0.00	3.042870-02	3.042880-02	0.00	1.529940-02	1.529950-02	0.00	1.766860 00
2.000 01	1.044750-01	1.044750-01	0.00	5.361830-02	5.361800-02	0.00	2.715180-02	2.715160-02	0.00	1.908640 00
3.000 01	2.137140-01	2.137180-01	0.00	1.124160-01	1.124170-01	0.00	5.764900-02	5.764990-02	0.00	2.109300 00
4.000 01	3.382670-01	3.382720-01	0.00	1.819010-01	1.819030-01	0.00	9.436660-02	9.436750-02	0.00	2.252100 00
5.000 01	4.690520-01	4.690550-01	0.00	2.574610-01	2.574630-01	0.00	1.350370-01	1.350380-01	0.00	2.363050 00
6.000 01	6.009250-01	6.009240-01	0.00	3.363080-01	3.363080-01	0.00	1.782620-01	1.782620-01	0.00	2.453790 00
7.000 01	7.309940-01	7.309890-01	0.00	4.167310-01	4.167290-01	0.00	2.231610-01	2.231600-01	0.00	2.530570 00
8.000 01	8.576460-01	8.576400-01	0.00	4.976550-01	4.976520-01	0.00	2.691600-01	2.691590-01	0.00	2.597110 00
1.000 02	1.097620 00	1.097620 00	0.00	6.584500-01	6.584480-01	0.00	3.630280-01	3.630270-01	0.00	2.708370 00
1.500 02	1.612180 00	1.612180 00	0.00	1.040640 00	1.040640 00	0.00	5.999560-01	5.999570-01	0.00	2.910690 00
2.000 02	2.015920 00	2.015920 00	0.00	1.384400 00	1.384410 00	0.00	8.314610-01	8.314630-01	0.00	3.054320 00
3.000 02	2.580550 00	2.580520 00	0.00	1.954620 00	1.954620 00	0.00	1.262490 00	1.262490 00	0.00	3.256850 00
4.000 02	2.938710 00	2.938670 00	0.00	2.391330 00	2.391330 00	0.00	1.644310 00	1.644310 00	0.00	3.400580 00
5.000 02	3.178720 00	3.178170 00	0.02	2.725590 00	2.725570 00	0.00	1.977930 00	1.977930 00	0.00	3.512090 00
6.000 02	3.349450 00	3.349480 00	0.00	2.983500 00	2.983460 00	0.00	2.267700 00	2.267710 00	0.00	3.603210 00
7.000 02	3.477920 00	3.478000 00	0.00	3.184980 00	3.184930 00	0.00	2.518810 00	2.518810 00	0.00	3.680260 00
8.000 02	3.579430 00	3.579520 00	0.00	3.344800 00	3.344750 00	0.00	2.736330 00	2.736330 00	0.00	3.747000 00
1.000 03	3.733660 00	3.733730 00	0.00	3.579520 00	3.579530 00	0.00	3.088860 00	3.088840 00	0.00	3.858540 00
1.500 03	3.983560 00	3.983170 00	0.01	3.915260 00	3.915110 00	0.00	3.647550 00	3.647310 00	0.01	4.061230 00
2.000 03	4.148050 00	4.147820 00	0.01	4.186690 00	4.186610 00	0.00	3.956000 00	3.955920 00	0.00	4.205050 00
3.000 03	4.370220 00	4.370220 00	0.00	4.346660 00	4.346570 00	0.00	4.282180 00	4.282320 00	0.00	4.407760 00
4.000 03	4.523450 00	4.523470 00	0.00	4.506830 00	4.506760 00	0.00	4.467500 00	4.467550 00	0.00	4.551600 00
5.000 03	4.640590 00	4.640610 00	0.00	4.627720 00	4.627710 00	0.00	4.598970 00	4.598900 00	0.00	4.663160 00
6.000 03	4.735450 00	4.735460 00	0.00	4.724940 00	4.724950 00	0.00	4.782090 00	4.781980 00	0.00	4.754320 00
7.000 03	4.815160 00	4.815160 00	0.00	4.806270 00	4.806290 00	0.00	4.787280 00	4.787190 00	0.00	4.831390 00
8.000 03	4.883900 00	4.883900 00	0.00	4.876200 00	4.876220 00	0.00	4.859930 00	4.859850 00	0.00	4.898150 00
1.000 04	4.998250 00	4.998250 00	0.00	4.992160 00	4.992180 00	0.00	4.979530 00	4.979520 00	0.00	5.009720 00

(1) RESULTS OBTAINED FROM THIS STUDY

(2) RESULTS PUBLISHED BY TONGPENYAI AND RAGHAVAN [1979, 1981]

NOTE: THE DEVIATION BETWEEN THE TWO RESULTS IS:

$$\% \text{ Dev} = \frac{p_D(1) - p_D(2)}{p_D(1)} \times 100$$

TABLE C.3

COMPARING THE RESULTS OBTAINED IN THIS STUDY WITH THE RESULTS PRESENTED BY AGARWAL ET AL.,
AND RAMEY AND AGARWAL FOR SKIN FACTOR, $s = 20$, AND $C_D = 10^2, 10^3, 10^4$

DIMENSIONLESS PRESSURE DROP AT THE ACTIVE WELL CONSIDERING
WELLBORE STORAGE AND SKIN EFFECTS AT THE ACTIVE WELL ONLY

SKIN, S2 = 2.000 01										
CD	1.0000 02			1.0000 03			1.0000 04			
TD/RD**2	(1)	(2)	% DEV	(1)	(2)	% DEV	(1)	(2)	% DEV	LINE SOURCE
1.000 02	9.775950-01	9.777000-01	0.01	9.977280-02	9.978000-02	0.01	9.997720-03	1.000000-02	0.02	2.708370 00
2.000 02	1.913040 00	1.913200 00	0.01	1.991060-01	1.991000-01	0.00	1.999100-02	1.999000-02	0.01	3.054320 00
5.000 02	4.489610 00	4.490000 00	0.01	4.945510-01	4.946000-01	0.01	4.994510-02	4.990000-02	0.09	3.512090 00
1.000 03	8.121210 00	8.122000 00	0.01	9.786820-01	9.787000-01	0.00	9.973400-02	9.980000-02	0.02	3.858540 00
2.000 03	1.347810 01	1.347900 01	0.01	1.917150 00	1.917200 00	0.00	1.991500-01	1.992000-01	0.03	4.205050 00
5.000 03	2.110070 01	2.110200 01	0.01	4.512410 00	4.512500 00	0.00	4.943100-01	4.948000-01	0.00	4.663160 00
1.000 04	2.424110 01	2.424100 01	0.00	8.198500 00	8.198700 00	0.00	9.796770-01	9.797000-01	0.00	5.009720 00
2.000 04	2.518570 01	2.518600 01	0.00	1.370920 01	1.371000 01	0.01	1.920920 00	1.920900 00	0.00	5.356290 00
5.000 04	2.575860 01	2.575800 01	0.00	2.178560 01	2.178600 01	0.00	4.533320 00	4.533300 00	0.00	5.814430 00
1.000 05	2.613380 01	2.613400 01	0.00	2.527120 01	2.527100 01	0.00	8.269810 00	8.269800 00	0.00	6.161000 00
2.000 05	2.649400 01	2.649400 01	0.00	2.632360 01	2.632400 01	0.00	1.392500 01	1.392500 01	0.00	6.507580 00
5.000 05	2.696030 01	2.696000 01	0.00	2.690710 01	2.690700 01	0.00	2.244330 01	2.244300 01	0.00	6.965720 00
1.000 06	2.730960 01	2.731000 01	0.00	2.728390 01	2.728400 01	0.00	2.628620 01	2.628600 01	0.00	7.312290 00
2.000 06	2.765750 01	2.765700 01	0.00	2.764470 01	2.764500 01	0.00	2.746000 01	2.746000 01	0.00	7.658870 00
5.000 06	2.811650 01	2.811600 01	0.00	2.811130 01	2.811200 01	0.00	2.805550 01	2.805500 01	0.00	8.117010 00
1.000 07	2.846330 01	2.846300 01	0.00	2.846070 01	2.846100 01	0.00	2.843390 01	2.843400 01	0.00	8.463590 00
2.000 07	2.881000 01	2.881000 01	0.00	2.880870 01	2.880900 01	0.00	2.879540 01	2.879500 01	0.00	8.810160 00
5.000 07	2.926820 01	2.926800 01	0.00	2.926770 01	2.926800 01	0.00	2.926240 01	2.926200 01	0.00	9.268310 00
1.000 08	2.961490 01	2.961500 01	0.00	2.961460 01	2.961500 01	0.00	2.961190 01	2.961200 01	0.00	9.614880 00

(1) RESULTS OBTAINED FROM THIS STUDY

(2) RESULTS PRESENTED BY AGARWAL ET AL. [1970] AND RAMEY AND AGARWAL [1972]

NOTE: THE DEVIATION BETWEEN THE TWO RESULTS IS: $\% \text{ Dev} = \frac{P_D(1) - P_D(2)}{P_D(1)} \times 100$

APPENDIX D

TABLES OF DATA FOR PULSE TESTING

Appendix D.1: TABLES OF DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG
FOR THE ANALYSIS AND DESIGN OF PULSE TESTS WITHOUT
WELLBORE STORAGE

To validate the mathematical model developed for pulse testing, we computed numerous values of dimensionless response amplitude and time lag. The results, presented in Tables D.1a through D.1j, can be used to analyze and/or design pulse tests without wellbore storage and skin effects. Of course, these results permit the analysis and design of pulse tests with the procedures presented in Section 6 of this work.*

The pulse ratio (F') considered in these tables range from 0.3 to 0.7, and the dimensionless distance between the two wells is equal to 1000. In particular, Tables D.1a through D.1e were produced by superposing the exponential integral solution in our pulse testing mathematical model. (See the computer program shown in Appendix E.3 for details.) On the other hand, Tables D.1f through D.1j were produced by setting all the wellbore storage and skin terms in our mathematical model equal to zero, and superposing the pressure response. To compute the pressure response, we used the Stehfest algorithm to invert the equations from Laplace space to real space. Thus the same data were calculated using two different methods. For example, Tables D.1a and D.1f are directly comparable, as are Tables D.1b and D.1g, etc.

Note that these result were plotted as the Kamal-Brigham charts shown earlier in Figs. 6.6 through 6.9. The results were also used (1) to validate our mathematical model by means of data comparison (see

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* Note: If there is no wellbore storage, our method for the design and analysis of pulse tests is similar to that of Kamal and Brigham [1976].

Section 4) with the data published by Brigham [1970], Kamal [1973], and Kamal and Brigham [1975; 1976], and (2) to validate the computer programs shown in Appendix E.

TABLE D.1a

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG COMPUTED WITH THE EXPONENTIAL INTEGRAL SOLUTION FOR A PULSE RATIO, $F' = 0.3$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.30$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$
CD1 = 0.0 S1 = 0.0 CD1/rD**2 = 0.0 CD1*exp(2S1) = 0.0
CD2 = 0.0 S2 = 0.0 CD2/rD**2 = 0.0 CD2*exp(2S2) = 0.0

----- 1st PULSE ----- AVERAGE OF SUBSEQUENT PULSES -----

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
$R1 = \frac{1}{2} \frac{L}{\sqrt{CYC}} (\frac{1}{2} \frac{L}{r_D})^{0.5}$	DPD	$DPD \cdot (R1)^{0.5}$	$R1 = \frac{1}{2} \frac{L}{\sqrt{CYC}} (\frac{1}{2} \frac{L}{r_D})^{0.5}$	DPD	$DPD \cdot (R1)^{0.5}$
INVERSE (ODD) PULSES OR VALLEYS					
0.438677	0.065802	-9.978621D-03	0.441288	0.066193	-4.767179D-03
0.390375	0.068316	-7.043832D-03	0.391856	0.068375	-7.056860D-03
0.363029	0.069702	-6.446331D-03	0.363922	0.069673	-6.010651D-03
0.319055	0.071787	-1.215719D-02	0.319082	0.071794	-1.266599D-02
0.268471	0.073629	-1.031665D-02	0.267674	0.073618	-1.928391D-02
0.248285	0.074486	-2.170687D-02	0.247224	0.074167	-2.290678D-02
0.201304	0.075489	-3.281873D-02	0.199795	0.074923	-3.467448D-02
0.171809	0.075596	-4.329047D-02	0.170158	0.074869	-4.565631D-02
0.150648	0.075324	-5.342607D-02	0.148967	0.074884	-5.621478D-02
0.112408	0.073858	-7.987210D-02	0.118827	0.072837	-8.355959D-02
0.080618	0.070944	-1.214370D-01	0.079333	0.069613	-1.260759D-01
0.062031	0.068235	-1.605626D-01	0.069987	0.067086	-1.656495D-01
0.050790	0.066028	-1.949247D-01	0.064999	0.064894	-2.006481D-01
0.035158	0.061877	-2.685929D-01	0.034554	0.060815	-2.749950D-01
0.026021	0.058548	-3.388613D-01	0.025585	0.057867	-3.457108D-01
PEAK (EVEN) PULSES					
0.648363	0.097254	4.456372D-03	0.635530	0.095330	5.620429D-03
0.584476	0.102283	7.138429D-03	0.575185	0.100657	8.121354D-03
0.548196	0.105254	9.212862D-03	0.540524	0.103781	1.001366D-02
0.489611	0.110163	1.371349D-02	0.484088	0.108902	1.406716D-02
0.421382	0.115680	2.145550D-02	0.417468	0.114802	2.099013D-02
0.393744	0.118123	2.564136D-02	0.390311	0.117093	2.473414D-02
0.328031	0.123012	3.905997D-02	0.325394	0.122023	3.679965D-02
0.285393	0.125574	5.137480D-02	0.283086	0.124949	4.797914D-02
0.253904	0.126952	6.306180D-02	0.251739	0.125869	5.068398D-02
0.196410	0.127666	9.280763D-02	0.194589	0.126431	6.629223D-02
0.141765	0.124754	1.380497D-01	0.140219	0.123393	1.290485D-01
0.109317	0.120249	1.796819D-01	0.108079	0.118887	1.689582D-01
0.089113	0.115047	2.157530D-01	0.088105	0.114537	2.038397D-01
0.068494	0.106469	2.921221D-01	0.059850	0.105336	2.783046D-01
0.043722	0.098374	3.642060D-01	0.043296	0.097416	3.498934D-01

TABLE D.1b

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG COMPUTED WITH THE EXPONENTIAL INTEGRAL SOLUTION FOR A PULSE RATIO, $F' = 0.4$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.40$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$

CD1 = 0.0 S1 = 0.0 CD1/rD**2 = 0.0 CD1*exp(2S1) = 0.0
CD2 = 0.0 S2 = 0.0 CD2/rD**2 = 0.0 CD2*exp(2S2) = 0.0

<----- 1st PULSE -----> <----- AVERAGE OF SUBSEQUENT PULSES ----->

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
R1 = $tL/tCYC$ (tL/rD)**2	DPD	DPD*(R1**2)	R1 = $tL/tCYC$ (tL/rD)**2	DPD	DPD*(R1**2)
INVERSE (1000) PULSES OR VALLEYS					
0.530616	0.070080	-4.8333630-03	0.543978	0.070717	-3.7216950-03
0.487964	0.073195	-5.7779800-03	0.491583	0.073737	-5.4693180-03
0.436422	0.076374	-6.1077330-03	0.438562	0.076748	-6.1175340-03
0.406959	0.078136	-9.9191080-03	0.408360	0.078405	-1.0141090-02
0.359273	0.080837	-1.3096130-02	0.359643	0.080920	-1.4541490-02
0.303922	0.083578	-2.0896040-02	0.303359	0.083424	-2.2187070-02
0.229456	0.086046	-3.7456520-02	0.228125	0.085547	-3.9967000-02
0.196346	0.086392	-4.9459020-02	0.194868	0.085742	-5.2682810-02
0.172418	0.086209	-6.1095480-02	0.170911	0.085455	-6.4918640-02
0.130196	0.084628	-9.1801500-02	0.128805	0.083723	-9.6595720-02
0.092188	0.081126	-1.3908200-01	0.091081	0.080151	-1.4562550-01
0.070688	0.077756	-1.8354530-01	0.069810	0.076792	-1.9108340-01
0.057678	0.074981	-2.2224970-01	0.056960	0.074049	-2.3047050-01
0.039628	0.069745	-3.0409480-01	0.039150	0.068903	-3.1339460-01
0.029137	0.065559	-3.8082700-01	0.028802	0.064804	-3.9084710-01
PEAK (EVEN) PULSES					
0.661719	0.086024	3.0152490-03	0.645421	0.083905	4.6145120-03
0.600899	0.090134	5.0777750-03	0.587703	0.088155	6.6315140-03
0.539106	0.094344	8.2009210-03	0.529006	0.092576	9.5436850-03
0.503925	0.096754	1.0624870-02	0.495402	0.095117	1.1743610-02
0.447054	0.100587	1.5903360-02	0.440826	0.099106	1.6451720-02
0.380957	0.104763	2.5023200-02	0.376979	0.103669	2.4490310-02
0.291422	0.109283	4.5869300-02	0.289655	0.108621	4.2864220-02
0.251135	0.110500	6.0496070-02	0.250033	0.110015	5.5870670-02
0.221725	0.110863	7.4386750-02	0.220988	0.110492	6.8327960-02
0.169001	0.109851	1.0970260-01	0.168671	0.109636	1.0042260-01
0.120336	0.105896	1.6307540-01	0.120183	0.105761	1.4986470-01
0.092217	0.101439	2.1163460-01	0.092114	0.101325	1.9557660-01
0.075011	0.097515	2.5321240-01	0.074931	0.097410	2.3512750-01
0.050996	0.089752	3.3971560-01	0.050945	0.089463	3.1829670-01
0.037056	0.083376	4.1964640-01	0.037022	0.083301	3.9590540-01

TABLE D.1c

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG COMPUTED WITH THE EXPONENTIAL
INTEGRAL SOLUTION FOR A PULSE RATIO, $F' = 0.5$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.50$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$

CD1 = 0.0 S1 = 0.0 CD1/rD**2 = 0.0 CD1*exp(2S1) = 0.0
CD2 = 0.0 S2 = 0.0 CD2/rD**2 = 0.0 CD2*exp(2S2) = 0.0

----- 1st PULSE -----> ----- AVERAGE OF SUBSEQUENT PULSES -----

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
R1 = t_L/t_{CYC} (t_L/r_D)	DPD	DPD*(R1**2)	R1 = t_L/t_{CYC} (t_L/r_D)	DPD	DPD*(R1**2)
INVERSE (ODD) PULSES OR VALLEYS					
0.617932	0.074152	-3.824441D-03	0.627476	0.075297	-3.035413D-03
0.334963	0.080244	-6.019830D-03	0.560034	0.081005	-5.646413D-03
0.449568	0.086317	-1.020455D-02	0.451773	0.086740	-1.046843D-02
0.398753	0.089719	-1.424769D-02	0.399789	0.089953	-1.504084D-02
0.366238	0.091709	-1.768325D-02	0.367304	0.091826	-1.888216D-02
0.315178	0.094553	-2.535480D-02	0.314959	0.094488	-2.735591D-02
0.258246	0.096842	-3.840792D-02	0.257573	0.096590	-4.154847D-02
0.221790	0.097588	-5.078835D-02	0.220974	0.097228	-5.483263D-02
0.195246	0.097623	-6.281803D-02	0.194393	0.097196	-6.762206D-02
0.147954	0.096170	-9.430611D-02	0.147163	0.095656	-1.007342D-01
0.104850	0.092268	-1.436218D-01	0.104238	0.091730	-1.519096D-01
0.080262	0.088288	-1.896427D-01	0.079791	0.087770	-1.992121D-01
0.065334	0.084934	-2.296134D-01	0.064958	0.084446	-2.400646D-01
0.044613	0.078520	-3.138209D-01	0.044373	0.078097	-3.256686D-01
0.032686	0.073362	-3.923923D-01	0.032442	0.072995	-4.051732D-01
PEAK (EVEN) PULSES					
0.645669	0.077480	2.105210D-03	0.628167	0.075380	3.991775D-03
0.553596	0.083039	5.136478D-03	0.539759	0.080964	7.082295D-03
0.460723	0.088459	1.100901D-02	0.451049	0.086601	1.248480D-02
0.406085	0.091369	1.664517D-02	0.398975	0.089769	1.744629D-02
0.372022	0.093006	2.137877D-02	0.366483	0.091621	2.154925D-02
0.317346	0.095204	3.175709D-02	0.314186	0.094256	3.047599D-02
0.257840	0.096690	4.888636D-02	0.256915	0.096343	4.521302D-02
0.220241	0.096906	6.466805D-02	0.220412	0.096981	5.087345D-02
0.193118	0.096559	7.964894D-02	0.193907	0.096954	7.195221D-02
0.145369	0.094490	1.176734D-01	0.146819	0.095432	1.056176D-01
0.102498	0.090198	1.748648D-01	0.104021	0.091538	1.573515D-01
0.078303	0.086133	2.265632D-01	0.079641	0.087605	2.050051D-01
0.063695	0.082803	2.705694D-01	0.064845	0.084299	2.460868D-01
0.043494	0.076549	3.614024D-01	0.044307	0.077980	3.320388D-01
0.031812	0.071577	4.445793D-01	0.032399	0.072898	4.117632D-01

TABLE D.1d

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG COMPUTED WITH THE EXPONENTIAL
INTEGRAL SOLUTION FOR A PULSE RATIO, $F' = 0.6$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.60$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$
 $CD1 = 0.0$ $S1 = 0.0$ $CD1/r_D = 0.0$ $CD1 \cdot \exp(2S1) = 0.0$
 $CD2 = 0.0$ $S2 = 0.0$ $CD2/r_D = 0.0$ $CD2 \cdot \exp(2S2) = 0.0$

<----- 1st PULSE -----> <----- AVERAGE OF SUBSEQUENT PULSES ----->

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
$R1 = tL/tCYC (tL)/r_D = 2$	DPD	$DPD/(R1 = 2)$	$R1 = tL/tCYC (tL)/r_D = 2$	DPD	$DPD/(R1 = 2)$
INVERSE (ODD) PULSES OR VALLEYS					
0.664504	0.079750	-2.755448D-03	0.679006	0.081481	-2.779279D-03
0.580344	0.084052	-5.695142D-03	0.587699	0.080149	-5.226533D-03
0.491600	0.094367	-9.487912D-03	0.495118	0.095063	-9.782724D-03
0.438124	0.098578	-1.319297D-02	0.440378	0.099085	-1.412015D-02
0.404330	0.101883	-1.635911D-02	0.406044	0.101511	-1.777020D-02
0.349302	0.104791	-2.346647D-02	0.350444	0.105133	-2.503211D-02
0.288158	0.108059	-3.563471D-02	0.288959	0.108360	-3.934940D-02
0.248679	0.109419	-4.723389D-02	0.249351	0.109714	-5.200951D-02
0.219732	0.109866	-5.853892D-02	0.220336	0.110168	-6.420367D-02
0.167639	0.108965	-8.626910D-02	0.168134	0.109287	-9.580429D-02
0.119418	0.105008	-1.351128D-01	0.119799	0.105423	-1.447616D-01
0.091537	0.100691	-1.790899D-01	0.091834	0.101017	-1.901764D-01
0.074477	0.096820	-2.174682D-01	0.074715	0.097130	-2.295363D-01
0.050665	0.089171	-2.988070D-01	0.050816	0.089437	-3.124205D-01
PEAK (EVEN) PULSES					
0.591900	0.071028	1.757776D-03	0.575919	0.069110	3.936618D-03
0.505638	0.075846	4.631152D-03	0.491087	0.073663	6.965702D-03
0.417595	0.080255	1.035000D-02	0.406870	0.078119	1.222371D-02
0.366187	0.082392	1.591061D-02	0.357857	0.080518	1.702910D-02
0.333509	0.083477	2.060473D-02	0.327468	0.081867	2.099244D-02
0.282275	0.084682	3.092550D-02	0.278927	0.083678	2.959371D-02
0.226566	0.084962	4.796474D-02	0.226388	0.084895	4.375333D-02
0.191251	0.084414	6.368194D-02	0.193300	0.085052	5.685289D-02
0.167657	0.083528	7.854107D-02	0.169497	0.084748	6.938214D-02
0.124216	0.080741	1.162599D-01	0.127715	0.083015	1.016159D-01
0.086694	0.076291	1.727098D-01	0.090327	0.079488	1.512013D-01
0.068582	0.072581	2.234880D-01	0.069257	0.076182	1.970053D-01
0.053636	0.069727	2.670033D-01	0.056527	0.073485	2.366175D-01
0.036727	0.064639	3.565788D-01	0.038878	0.068425	3.198813D-01

TABLE D.1e

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG COMPUTED WITH THE EXPONENTIAL INTEGRAL SOLUTION FOR A PULSE RATIO, $F' = 0.7$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.70$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$

CD1 = 0.0 S1 = 0.0 CD1/rD**2 = 0.0 CD1*exp(2S1) = 0.0
CD2 = 0.0 S2 = 0.0 CD2/rD**2 = 0.0 CD2*exp(2S2) = 0.0

----- 1st PULSE -----> ----- AVERAGE OF SUBSEQUENT PULSES -----

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
R1 = t_L/t_{CYC} (t_L)/rD**2	DPD	DPD*(R1**2)	R1 = t_L/t_{CYC} (t_L)/rD**2	DPD	DPD*(R1**2)

INVERSE (ODD) PULSES OR VALLEYS

0.623955	0.093593	-4.0242600-03	-1.0701800-03	0.635265	0.095290	-4.2459960-03	-1.7136120-03
0.609286	0.095049	-5.1050660-03	-1.9251460-03	0.619346	0.096610	-4.7301300-03	-1.8145250-03
0.595187	0.096420	-5.5682680-03	-1.9725470-03	0.604233	0.097886	-5.2382910-03	-1.9125960-03
0.581711	0.097727	-5.9738280-03	-2.0214680-03	0.589869	0.099098	-5.7694900-03	-2.0075860-03
0.566672	0.099168	-6.4727780-03	-2.0785170-03	0.573985	0.100447	-6.4169360-03	-2.1142540-03
0.552959	0.102328	-7.7943750-03	-2.2139590-03	0.558047	0.103459	-8.1062610-03	-2.3538920-03
0.477165	0.107362	-1.0767090-02	-2.4515200-03	0.481741	0.106392	-1.1009800-02	-2.7410460-03
0.441679	0.110420	-1.3336900-02	-2.6017720-03	0.445858	0.111465	-1.4935000-02	-2.9692840-03
0.383654	0.115096	-1.9168010-02	-2.8213440-03	0.387584	0.116275	-2.1852060-02	-3.2831060-03
0.338155	0.118354	-2.5750790-02	-2.9445650-03	0.342021	0.119707	-2.9458880-02	-3.4465640-03
0.318882	0.119581	-2.9270500-02	-2.9763900-03	0.322723	0.121021	-3.3463300-02	-3.4857250-03
0.301471	0.120588	-3.2918500-02	-2.9917900-03	0.305278	0.122111	-3.7576270-02	-3.5024280-03
0.276255	0.121816	-3.6984070-02	-2.9688010-03	0.280587	0.123458	-4.4344590-02	-3.4916930-03
0.245894	0.122947	-4.0507800-02	-2.9329780-03	0.249468	0.124734	-5.4830090-02	-3.4127670-03
0.189680	0.123292	-7.3748970-02	-2.6533800-03	0.192742	0.125282	-6.2047480-02	-3.0483470-03
0.136732	0.120324	-1.1400550-01	-2.1314080-03	0.139026	0.122343	-1.2445350-01	-2.4056640-03
0.118077	0.118077	-1.3501140-01	-1.8823450-03	0.120036	0.120036	-1.4628150-01	-2.1078770-03
0.105515	0.116067	-1.5231950-01	-1.6958480-03	0.107238	0.117962	-1.6416770-01	-1.8880530-03
0.086131	0.111970	-1.8614940-01	-1.3809630-03	0.087476	0.113719	-1.9893140-01	-1.5223240-03
0.072009	0.108014	-2.1871770-01	-1.1341290-03	0.073077	0.109616	-2.3221920-01	-1.2401720-03
0.058683	0.103282	-2.5900990-01	-8.9194300-04	0.059494	0.104710	-2.7323020-01	-9.6715540-04

PEAK (EVEN) PULSES

0.456081	0.068412	3.6045480-03	7.4978140-04	0.440745	0.066112	6.3080770-03	1.2254310-03
0.442624	0.069049	4.2196840-03	8.2670280-04	0.427474	0.066686	6.9211480-03	1.2647950-03
0.429277	0.069640	4.8742380-03	9.0073210-04	0.414983	0.067227	7.5544220-03	1.3010230-03
0.417773	0.070186	5.5665450-03	9.7155280-04	0.403192	0.067736	8.2070340-03	1.3342260-03
0.404385	0.070767	6.4198070-03	1.0498160-03	0.390231	0.068290	8.9918880-03	1.3693230-03
0.374732	0.071949	6.6815500-03	1.2190970-03	0.361827	0.069471	1.0996860-02	1.4396480-03
0.326478	0.073458	1.3728500-02	1.4632920-03	0.316465	0.071205	1.5244330-02	1.5264610-03
0.296395	0.074099	1.8831900-02	1.5840990-03	0.288546	0.072137	1.8729710-02	1.5590210-03
0.248317	0.074495	2.7532140-02	1.6976620-03	0.244325	0.073297	2.6255910-02	1.5667550-03
0.211899	0.074165	3.7891530-02	1.7013750-03	0.210880	0.073808	3.4356650-02	1.5271910-03
0.196868	0.073826	4.3284430-02	1.6775820-03	0.177051	0.073894	3.8572980-02	1.4970780-03
0.183525	0.073410	4.8782660-02	1.6430620-03	0.164738	0.073895	4.2878670-02	1.4626990-03
0.165055	0.072624	5.7722680-02	1.5725410-03	0.167634	0.073759	4.9920940-02	1.4021940-03
0.142568	0.071284	7.1332760-02	1.4498930-03	0.146656	0.073328	6.0752140-02	1.3060690-03
0.104222	0.067745	1.0555780-01	1.1466810-03	0.110218	0.071642	8.0593900-02	1.0758150-03
0.071450	0.062876	1.5649430-01	7.9891980-04	0.078008	0.068647	1.3157460-01	8.0040510-04
0.060745	0.060745	1.0195070-01	6.7138360-04	0.067152	0.067152	1.5360110-01	6.9245840-04
0.053777	0.059185	2.0246410-01	5.8552830-04	0.059981	0.065979	1.7161990-01	6.1729240-04

TABLE D.1f

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG WITHOUT WELLBORE STORAGE
 COMPUTED WITH THE STEHFEST'S LAPLACE TRANSFORM NUMERICAL INVERTER
 FOR A PULSE RATIO, $F' = 0.3$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
 SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.30$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$
 $CD1 = 0.0$ $S1 = 0.0$ $CD1/r_D = 0.0$ $CD1 \exp(2S1) = 0.0$
 $CD2 = 0.0$ $S2 = 0.0$ $CD2/r_D = 0.0$ $CD2 \exp(2S2) = 0.0$

1st PULSE				AVERAGE OF SUBSEQUENT PULSES			
TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT		TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	
$RI = tL/\tau_{CYC} (tL/D/r_D = 2)$	DPD	DPD*(RI=2)		$RI = tL/\tau_{CYC} (tL/D/r_D = 2)$	DPD	DPD*(RI=2)	
INVERSE (ODD) PULSES OR VALLEYS							
0.438634	0.065795	-4.9784190-03	-9.3785480-04	0.441261	0.066189	-4.7668950-03	-9.2817060-04
0.398381	0.068317	-7.0418440-03	-1.0731570-03	0.391860	0.068576	-7.0548530-03	-1.0832910-03
0.363051	0.069706	-8.6435980-03	-1.1392790-03	0.363934	0.069875	-8.6159810-03	-1.1676360-03
0.319100	0.071798	-1.2153350-02	-1.2375130-03	0.319115	0.071801	-1.2642290-02	-1.2873800-03
0.268511	0.073840	-1.8312110-02	-1.3202660-03	0.267704	0.073619	-1.9279540-02	-1.3816240-03
0.248319	0.074496	-2.1702270-02	-1.3382080-03	0.247249	0.074175	-2.2902360-02	-1.4000090-03
0.201319	0.075495	-3.2814560-02	-1.3299560-03	0.199807	0.074928	-3.4676440-02	-1.3840830-03
0.171818	0.075999	-4.3286990-02	-1.2778550-03	0.170162	0.074871	-4.5652910-02	-1.3218290-03
0.150649	0.075324	-5.3423240-02	-1.2124440-03	0.148967	0.074483	-5.6212040-02	-1.2473460-03
0.113624	0.073856	-7.9890630-02	-1.0314230-03	0.112053	0.072834	-8.3558210-02	-1.0491070-03
0.080612	0.070939	-1.2143660-01	-7.8913720-04	0.079326	0.069807	-1.2687550-01	-7.9333020-04
0.062025	0.068228	-1.6056260-01	-6.1770310-04	0.069880	0.067078	-1.6584960-01	-6.1671020-04
0.038783	0.066019	-1.9492470-01	-8.0270310-04	0.049911	0.064884	-2.0064830-01	-4.9982630-04
0.035150	0.061864	-2.6859280-01	-3.3184820-04	0.034844	0.060800	-2.7499480-01	-3.2817770-04
0.026014	0.058530	-3.3886100-01	-2.2930800-04	0.025577	0.057349	-3.4571040-01	-2.2615850-04
PEAK (EVEN) PULSES							
0.648707	0.097306	4.4551080-03	1.8748040-03	0.635725	0.095359	5.6204420-03	2.2715060-03
0.584802	0.102340	7.1358250-03	2.4404020-03	0.575423	0.100699	8.1194240-03	2.6884810-03
0.548497	0.105312	9.2096780-03	2.7707270-03	0.540773	0.103828	1.0011010-02	2.9276330-03
0.489859	0.110218	1.3709660-02	3.2898010-03	0.488248	0.108956	1.4063500-02	3.2979110-03
0.421559	0.115929	2.1451420-02	3.8121760-03	0.417655	0.114853	2.0985820-02	3.6607830-03
0.393893	0.118168	2.5637370-02	3.9776770-03	0.390481	0.117144	2.4729770-02	3.7708100-03
0.328117	0.123844	3.9056580-02	4.2040530-03	0.375500	0.122063	3.6795670-02	3.8986780-03
0.285448	0.125597	5.1371700-02	4.1837940-03	0.283134	0.124579	4.7795830-02	3.8481480-03
0.253938	0.126949	6.3059700-02	4.0663610-03	0.251703	0.125892	5.8681320-02	3.7202580-03
0.196420	0.127673	9.2806700-02	3.5805670-03	0.194525	0.126441	8.6290900-02	3.2653760-03
0.141770	0.124758	1.3804970-01	2.7746340-03	0.140225	0.123398	1.2904830-01	2.5375830-03
0.109324	0.120257	1.7968230-01	2.1475260-03	0.108086	0.118895	1.6895840-01	1.9739220-03
0.089122	0.115859	2.1575410-01	1.7134740-03	0.088114	0.114549	2.0384000-01	1.5826770-03
0.060504	0.106488	2.9212210-01	1.0693950-03	0.059861	0.105355	2.7830450-01	9.9726610-04
0.043731	0.098395	3.6420570-01	6.9651320-04	0.043308	0.097437	3.4909310-01	6.5468440-04

TABLE D.1g

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG WITHOUT WELLBORE STORAGE
 COMPUTED WITH THE STEHFEST'S LAPLACE TRANSFORM NUMERICAL INVERTER
 FOR A PULSE RATIO, $F' = 0.4$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
 SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.40$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$

CD1 = 0.0 S1 = 0.0 CD1/rD**2 = 0.0 CD1*exp(2S1) = 0.0
 CD2 = 0.0 S2 = 0.0 CD2/rD**2 = 0.0 CD2*exp(2S2) = 0.0

----- 1st PULSE -----> ----- AVERAGE OF SUBSEQUENT PULSES ----->

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
R1 = $\{L/\{CYC (\{L\}/rD**2)$	DPD	DPD*(R1**2)	R1 = $\{L/\{CYC (\{L\}/rD**2)$	DPD	DPD*(R1**2)

INVERSE (ODD) PULSES OR VALLEYS

0.530512	0.070007	-4.234131D-03	-1.227879D-03	0.843952	0.070714	-3.721969D-03	-1.101280D-03
0.467959	0.073194	-5.776943D-03	-1.375514D-03	0.491604	0.073741	-5.468100D-03	-1.326334D-03
0.436512	0.076390	-8.104888D-03	-1.544327D-03	0.438647	0.076763	-8.114643D-03	-1.561331D-03
0.407074	0.078158	-9.915278D-03	-1.643049D-03	0.408461	0.078424	-1.013732D-02	-1.491279D-03
0.359398	0.080864	-1.389098D-02	-1.794252D-03	0.359748	0.080943	-1.453650D-02	-1.881237D-03
0.304025	0.083607	-2.089002D-02	-1.930891D-03	0.303447	0.083448	-2.218125D-02	-2.042375D-03
0.229511	0.086067	-3.745098D-02	-1.972736D-03	0.228174	0.085565	-3.996155D-02	-2.080462D-03
0.196382	0.086408	-4.945429D-02	-1.907249D-03	0.154901	0.085756	-5.267809D-02	-2.000979D-03
0.172443	0.086222	-6.109151D-02	-1.816653D-03	0.170935	0.085467	-6.491463D-02	-1.896661D-03
0.130209	0.084636	-9.149901D-02	-1.551320D-03	0.128817	0.083731	-9.659316D-02	-1.602818D-03
0.092196	0.081132	-1.390806D-01	-1.182196D-03	0.091088	0.080157	-1.456240D-01	-1.208213D-03
0.070692	0.077761	-1.835442D-01	-9.172345D-04	0.069814	0.076796	-1.910822D-01	-9.313230D-04
0.057680	0.074984	-2.222487D-01	-7.394181D-04	0.056962	0.074050	-2.304695D-01	-7.477819D-04
0.039626	0.069742	-3.040938D-01	-4.774915D-04	0.039147	0.068899	-3.133937D-01	-4.802742D-04
0.029133	0.065550	-3.008263D-01	-3.232259D-04	0.028797	0.064794	-3.908464D-01	-3.241213D-04

PEAK (EVEN) PULSES

0.661985	0.086058	3.014336D-03	1.320955D-03	0.645452	0.083909	4.615025D-03	1.922606D-03
0.601191	0.090179	5.075575D-03	1.834468D-03	0.587832	0.088175	6.630340D-03	2.291118D-03
0.539387	0.094393	8.197142D-03	2.384864D-03	0.529195	0.092609	9.540882D-03	2.671956D-03
0.504185	0.096803	1.062043D-02	2.699737D-03	0.495607	0.095157	1.173991D-02	2.883680D-03
0.447268	0.100635	1.589811D-02	3.180395D-03	0.441028	0.099231	1.644679D-02	3.199028D-03
0.381110	0.104805	2.501758D-02	3.633679D-03	0.377147	0.103716	2.448454D-02	3.482708D-03
0.291500	0.109312	4.586505D-02	3.897245D-03	0.289752	0.108657	4.285879D-02	3.598296D-03
0.251188	0.110523	6.049212D-02	3.816761D-03	0.250099	0.110044	5.586595D-02	3.494436D-03
0.221763	0.110882	7.438346D-02	3.658096D-03	0.221032	0.110516	6.832398D-02	3.338017D-03
0.169022	0.109865	1.097005D-01	3.133988D-03	0.168696	0.109652	1.004201D-01	2.857831D-03
0.120353	0.105910	1.630742D-01	2.362085D-03	0.120199	0.105775	1.498632D-01	2.165222D-03
0.092232	0.101456	2.116337D-01	1.800324D-03	0.092129	0.101342	1.955755D-01	1.660007D-03
0.075025	0.097533	2.532116D-01	1.425273D-03	0.074945	0.097428	2.351265D-01	1.320649D-03
0.051006	0.089770	3.397148D-01	8.837938D-04	0.050955	0.089681	3.182958D-01	8.264287D-04
0.037062	0.083390	4.196459D-01	5.764235D-04	0.037029	0.083314	3.959047D-01	5.428336D-04

TABLE D.1h

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG WITHOUT WELLBORE STORAGE
COMPUTED WITH THE STEHFEST'S LAPLACE TRANSFORM. NUMERICAL INVERTER
FOR A PULSE RATIO, $F' = 0.5$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.50$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$
CD1 = 0.0 S1 = 0.0 CD1/ r_D^2 = 0.0 CD1=exp(231) = 0.0
CD2 = 0.0 S2 = 0.0 CD2/ r_D^2 = 0.0 CD2=exp(232) = 0.0

----- 1st PULSE -----> ----- AVERAGE OF SUBSEQUENT PULSES ----->

TIME LAG			AMPLITUDE		AMPLITUDE COEFFICIENT		TIME LAG			AMPLITUDE		AMPLITUDE COEFFICIENT																																																																																																							
R1 = tL/tCYC (tL)D/rD==2			DPO		DPO/(R1+2)		R1 = tL/tCYC (tL)D/rD==2			DPO		DPO/(R1+2)																																																																																																							
INVERSE (ODD) PULSES OR VALLEYS																																																																																																																			
0.617720	0.074126	-3.826315D-03	-1.460039D-03	0.627425	0.075291	-3.036342D-03	-1.195304D-03	0.535041	0.080256	-6.018704D-03	-1.722969D-03	0.449764	0.086355	-1.020034D-02	-2.063401D-03	0.451949	0.086774	-1.066425D-02	-2.137379D-03	0.396951	0.089764	-1.424206D-02	-2.266790D-03	0.399959	0.089991	-1.503538D-02	-2.405116D-03	0.367019	0.091755	-1.767701D-02	-2.381147D-03	0.367459	0.091865	-1.887614D-02	-2.548713D-03	0.319217	0.094595	-2.534818D-02	-2.520243D-03	0.315079	0.094524	-2.734946D-02	-2.715046D-03	0.258333	0.096875	-3.840187D-02	-2.562786D-03	0.257650	0.096619	-4.154252D-02	-2.757683D-03	0.221248	0.097252	-5.082743D-02	-2.670443D-03	0.195288	0.097644	-6.281165D-02	-2.395462D-03	0.194433	0.097216	-6.761761D-02	-2.556176D-03	0.147577	0.096185	-9.430327D-02	-2.064966D-03	0.147186	0.095671	-1.007312D-01	-2.182185D-03	0.104265	0.092282	-1.436200D-01	-1.579354D-03	0.104254	0.091743	-1.519076D-01	-1.651044D-03	0.080274	0.088301	-1.896412D-01	-1.222029D-03	0.079803	0.087784	-1.992105D-01	-1.268675D-03	0.065344	0.084947	-2.296120D-01	-9.804055D-04	0.064968	0.084458	-2.400632D-01	-1.013257D-03	0.044618	0.078528	-3.138196D-01	-6.247435D-04	0.044377	0.078184	-3.256674D-01	-4.413525D-04	0.032607	0.073365	-3.923915D-01	-4.171856D-04	0.032443	0.072996	-4.051724D-01	-4.264556D-04				
PEAK (EVEN) PULSES																																																																																																																			
0.645274	0.077505	2.105191D-03	8.781879D-04	0.620051	0.075366	3.992745D-03	1.574740D-03	0.553234	0.083075	5.133724D-03	1.574677D-03	0.460929	0.088498	1.100402D-02	2.337864D-03	0.451197	0.086630	1.248073D-02	2.540834D-03	0.406253	0.091407	1.663931D-02	2.746175D-03	0.399129	0.089804	1.744890D-02	2.776371D-03	0.372164	0.093041	2.137272D-02	2.960259D-03	0.366628	0.091657	2.154327D-02	2.895684D-03	0.317447	0.095234	3.175118D-02	3.199640D-03	0.314303	0.094291	3.046950D-02	3.009852D-03	0.257500	0.096713	4.888121D-02	3.251215D-03	0.256993	0.096372	4.520706D-02	2.985570D-03	0.220283	0.096924	6.466380D-02	3.137783D-03	0.220467	0.097005	6.886823D-02	3.261184D-03	0.193150	0.096575	7.964540D-02	2.971317D-03	0.193948	0.096974	7.194772D-02	2.706246D-03	0.145390	0.094503	1.176711D-01	2.487353D-03	0.146843	0.095446	1.056146D-01	2.277251D-03	0.102512	0.090211	1.748633D-01	1.837600D-03	0.104036	0.091552	1.573496D-01	1.703035D-03	0.078315	0.086146	2.265619D-01	1.389542D-03	0.079653	0.087618	2.050035D-01	1.300626D-03	0.063704	0.082815	2.705683D-01	1.098003D-03	0.064855	0.084311	2.460854D-01	1.035048D-03	0.043497	0.076555	3.614015D-01	6.837697D-04	0.044311	0.077987	3.320356D-01	6.519304D-04	0.031812	0.071577	4.445790D-01	4.499112D-04	0.032400	0.072899	4.117625D-01	4.322397D-04

TABLE D.11
 DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG WITHOUT WELLBORE STORAGE
 COMPUTED WITH THE STEHFEST'S LAPLACE TRANSFORM: NUMERICAL INVERTER
 FOR A PULSE RATIO, $F' = 0.6$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
 SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.60$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$
 $CD1 = 0.0$ $S1 = 0.0$ $CD1/r_D^{**2} = 0.0$ $CD1 \cdot \exp(2S1) = 0.0$
 $CD2 = 0.0$ $S2 = 0.0$ $CD2/r_D^{**2} = 0.0$ $CD2 \cdot \exp(2S2) = 0.0$

<----- 1st PULSE ----->				<----- AVERAGE OF SUBSEQUENT PULSES ----->			
TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT		TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	
$R1 = t_L/t_{CYC} (t_L)/r_D^{**2}$	DPD	$DPD \cdot R1 ^{**2}$		$R1 = t_L/t_{CYC} (t_L)/r_D^{**2}$	DPD	$DPD \cdot R1 ^{**2}$	
INVERSE (ODD) PULSES OR VALLEYS							
0.664407	0.079729	-3.757858D-03	-1.658856D-03	0.679010	0.081481	-2.781020D-03	-1.282213D-03
0.580481	0.087072	-5.694346D-03	-1.918760D-03	0.587858	0.088179	-5.225252D-03	-1.805762D-03
0.491870	0.094439	-9.484071D-03	-2.294539D-03	0.495360	0.095109	-9.778905D-03	-2.399586D-03
0.438391	0.099638	-1.318775D-02	-2.534511D-03	0.440602	0.099135	-1.411512D-02	-2.740199D-03
0.404573	0.101143	-1.635329D-02	-2.676700D-03	0.406245	0.101561	-1.776464D-02	-2.931831D-03
0.349487	0.104846	-2.346028D-02	-2.865467D-03	0.350598	0.105179	-2.582619D-02	-3.174583D-03
0.288271	0.108101	-3.562905D-02	-2.960771D-03	0.289057	0.108396	-3.934396D-02	-3.287401D-03
0.248752	0.109451	-4.722907D-02	-2.922429D-03	0.249417	0.109743	-5.200477D-02	-3.235220D-03
0.219782	0.109891	-5.853489D-02	-2.827487D-03	0.220383	0.110192	-6.419964D-02	-3.118165D-03
0.167663	0.108981	-8.026658D-02	-2.481264D-03	0.168159	0.109303	-9.580173D-02	-2.709090D-03
0.119434	0.105102	-1.351113D-01	-1.927293D-03	0.119816	0.105438	-1.447601D-01	-2.078180D-03
0.091551	0.100707	-1.790887D-01	-1.501060D-03	0.101033	0.101033	-1.901753D-01	-1.604367D-03
0.074491	0.096838	-2.174670D-01	-1.206690D-03	0.074729	0.097148	-2.295352D-01	-1.281837D-03
0.050675	0.089188	-2.988059D-01	-7.673216D-04	0.050826	0.089454	-3.124195D-01	-8.070851D-04
PEAK (EVEN) PULSES							
0.592026	0.071043	1.758971D-03	6.165106D-04	0.575776	0.069093	3.937981D-03	1.305262D-03
0.505803	0.075870	4.628625D-03	1.184173D-03	0.491069	0.073660	6.964620D-03	1.679550D-03
0.418136	0.080282	1.034526D-02	1.808741D-03	0.406950	0.078134	1.222009D-02	2.023731D-03
0.366300	0.082417	1.590531D-02	2.134105D-03	0.357951	0.080539	1.702423D-02	2.181152D-03
0.334002	0.083501	2.059929D-02	2.298007D-03	0.327560	0.081890	2.098701D-02	2.251589D-03
0.282335	0.084701	3.092016D-02	2.464742D-03	0.279002	0.083701	2.958789D-02	2.302357D-03
0.226599	0.084974	4.796050D-02	2.462623D-03	0.226437	0.084914	4.374792D-02	2.242727D-03
0.191872	0.084423	6.367875D-02	2.344313D-03	0.193333	0.085067	5.684819D-02	2.124481D-03
0.167071	0.083535	7.853878D-02	2.192288D-03	0.169521	0.084760	6.937818D-02	1.993394D-03
0.124223	0.080745	1.162586D-01	1.794034D-03	0.127727	0.083023	1.016134D-01	1.657496D-03
0.086697	0.076293	1.727093D-01	1.298134D-03	0.090333	0.079493	1.511998D-01	1.233658D-03
0.065982	0.072580	2.236476D-01	9.736750D-04	0.069260	0.076185	1.970042D-01	9.449105D-04
0.053634	0.069724	2.670030D-01	7.680575D-04	0.056528	0.073486	2.366166D-01	7.560169D-04
0.036721	0.064629	3.365786D-01	4.808257D-04	0.036875	0.068420	3.198804D-01	4.833980D-04

TABLE D.1j

DIMENSIONLESS RESPONSE AMPLITUDE AND TIME LAG WITHOUT WELLBORE STORAGE
COMPUTED WITH THE STEHFEST'S LAPLACE TRANSFORM/ NUMERICAL INVERTER

FOR A PULSE RATIO, $F' = 0.7$ AND $r_D = 1000$

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.70$

DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$
 $CD1 = 0.0$ $S1 = 0.0$ $CD1/r_D = 0.0$ $CD1 \exp(2S1) = 0.0$
 $CD2 = 0.0$ $S2 = 0.0$ $CD2/r_D = 0.0$ $CD2 \exp(2S2) = 0.0$

----- 1st PULSE -----> ----- AVERAGE OF SUBSEQUENT PULSES ----->

TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT
$R1 = tL/(\tau_{CYC} (tL)/r_D = 2$	DPD	DPD*(R1=2)	$R1 = tL/(\tau_{CYC} (tL)/r_D = 2$	DPD	DPD*(R1=2)
INVERSE (ODD) PULSES OR VALLEYS					
0.624129	0.093619	-4.824193D-03	0.639541	0.095331	-4.245968D-03
0.609505	0.095083	-5.185267D-03	0.619620	0.096661	-4.729694D-03
0.595443	0.096462	-5.567236D-03	0.604519	0.097932	-5.237440D-03
0.581596	0.097775	-5.972367D-03	0.590167	0.099140	-5.768083D-03
0.566983	0.099222	-6.470886D-03	0.574290	0.100501	-6.415029D-03
0.553303	0.102394	-7.791532D-03	0.559150	0.103517	-8.103492D-03
0.477503	0.107438	-1.076307D-02	0.462013	0.108453	-1.180605D-02
0.441987	0.110497	-1.333235D-02	0.446099	0.111525	-1.493082D-02
0.383687	0.115166	-1.916315D-02	0.367755	0.116329	-2.184758D-02
0.338322	0.118413	-2.574615D-02	0.342152	0.119753	-2.945457D-02
0.319022	0.119633	-2.926607D-02	0.322834	0.121063	-3.345919D-02
0.301588	0.120635	-3.291433D-02	0.305372	0.122149	-3.757239D-02
0.276943	0.121855	-3.898036D-02	0.280658	0.123489	-4.434113D-02
0.245951	0.122975	-4.850476D-02	0.249515	0.124757	-5.482728D-02
0.189700	0.123305	-7.374723D-02	0.192759	0.125293	-8.204601D-02
0.136740	0.129331	-1.140048D-01	0.139033	0.122349	-1.244531D-01
0.118084	0.118084	-1.350110D-01	0.120043	0.120043	-1.462814D-01
0.105524	0.116076	-1.523192D-01	0.107246	0.117971	-1.641677D-01
0.086141	0.111983	-1.861492D-01	0.087486	0.113732	-1.989316D-01
0.072620	0.108030	-2.187174D-01	0.073088	0.109632	-2.322192D-01
0.058694	0.103301	-2.590095D-01	0.059505	0.104729	-2.732301D-01
PEAK (EVEN) PULSES					
0.456176	0.068026	3.603927D-03	0.440686	0.066103	6.307966D-03
0.442730	0.069066	4.218138D-03	0.427434	0.066680	6.920494D-03
0.429987	0.069658	4.871990D-03	0.414955	0.067223	7.553327D-03
0.417280	0.070204	5.563767D-03	0.403170	0.067733	8.265593D-03
0.404482	0.070784	6.416629D-03	0.390212	0.068287	8.990124D-03
0.374796	0.071961	8.677849D-03	0.361826	0.069471	1.099443D-02
0.326528	0.073469	1.372467D-02	0.316490	0.071210	1.524087D-02
0.296429	0.074107	1.802802D-02	0.288575	0.072144	1.872578D-02
0.248329	0.074499	2.752850D-02	0.249348	0.073305	2.625168D-02
0.211899	0.074165	3.788867D-02	0.210895	0.073813	3.435259D-02
0.196864	0.073824	4.328223D-02	0.197062	0.073898	3.856913D-02
0.183517	0.073407	4.878083D-02	0.184745	0.073970	4.287503D-02
0.168043	0.072619	5.772143D-02	0.167637	0.073760	4.991773D-02
0.142555	0.071277	7.133249D-02	0.146655	0.073327	6.074959D-02
0.104207	0.067735	1.055590D-01	0.110212	0.071638	8.859271D-02
0.071435	0.062863	1.564964D-01	0.077999	0.068640	1.315745D-01
0.060730	0.060730	1.819524D-01	0.067144	0.067144	1.536012D-01
0.053763	0.059139	2.024658D-01	0.059973	0.065970	1.716202D-01
0.043394	0.056412	2.417899D-01	0.049103	0.063834	2.065886D-01
0.036116	0.054175	2.786676D-01	0.041309	0.061964	2.400267D-01
0.029438	0.051810	3.235478D-01	0.034817	0.059870	2.811832D-01

Appendix D.2: RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS FOR
WELLBORE STORAGE AND SKIN EFFECTS ONLY IN ONE WELL

Tables D.2a through D.2dx presented in the following section are the response amplitude and time lag correction factors for the first four pulses, and for a pulse ratio (F') of 0.5. The values of C_D/r_D^2 considered in these tables range from 0.001 to 1. The range of $C_D \exp(2s)$ is from 10 to 10^{40} depending on the C_D/r_D^2 . For all four pulses the dimensionless interwell distance (r_D) increases from 31.6 to 1000 depending on the values of C_D/r_D^2 and $C_D \exp(2s)$ used. The combination of r_D , C_D/r_D^2 , and $C_D \exp(2s)$ was always chosen to ensure that the skin factor (s) was not negative.

As discussed in Section 6, the correction factors presented in this work are the response amplitude ratios ($\Delta p/\Delta p_0$) and the time lag ratios (t_{L0}/t_L). To compute these ratios requires the calculation of dimensionless response amplitude (Δp_0) and time lag (t_{L0}), where the subscript "0" represents the condition of no wellbore storage and skin. Table D.2 shows values of Δp_0 and t_{L0} used to compute the wellbore storage correction factors presented in this Appendix.

To read the tables of response amplitude and time lag correction factors, we need to define the following symbols:

(1) $(\Delta t_c)_D/r_D^2$ = denotes dimensionless pulse cycle length. This term is used as the independent variable to read the amplitude and time lag correction factors for the design of pulse tests.

(2) $t_L/\Delta t_c$ = denotes the ratio of time lag (influenced by wellbore storage) to the pulse cycle length. This term is used as the independent variable to read the amplitude and time lag correction

factors for the analysis of pulse tests.

(3) $\Delta p / \Delta p_0$ = represents the amplitude correction factor, one of the dependent variables used for analyzing and designing of pulse tests with wellbore storage and skin.

(4) t_{L0} / t_L = represents the time lag correction factor, the other dependent variable.

TABLE D.2
VALUES OF RESPONSE AMPLITUDE (Δp_0) AND TIME LAG (t_{L0})
USED TO COMPUTE THE WELLBORE STORAGE CORRECTION FACTORS

PULSE TESTING WITH WELLBORE STORAGE AND SKIN EFFECTS									
SUMMARY OF DIMENSIONLESS AMPLITUDE AND TIME LAG DATA FOR $F' = 0.50$									
DIMENSIONLESS DISTANCE BETWEEN THE WELLS, $r_D = 1000.00$									
CD1 = 0.0		S1 = 0.0		CD1/r _D =0.0		CD1=exp(2S1) = 0.0			
CD2 = 0.0		S2 = 0.0		CD2/r _D =0.0		CD2=exp(2S2) = 0.0			
1st PULSE					AVERAGE OF SUBSEQUENT PULSES				
TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	TIME LAG	AMPLITUDE	AMPLITUDE COEFFICIENT	
$R1 = t_L/t_{CYC}$ ($t_{L0}/r_D=0.02$)	DPD	DPD=(R1=0.02)	$R1 = t_L/t_{CYC}$ ($t_{L0}/r_D=0.02$)	DPD	DPD=(R1=0.02)	$R1 = t_L/t_{CYC}$ ($t_{L0}/r_D=0.02$)	DPD	DPD=(R1=0.02)	
INVERSE (ODD) PULSES OR VALLEYS									
0.602233	0.075279	-4.137373D-03	-1.508544D-03	0.610057	0.076261	-3.376661D-03	-1.256070D-03		
0.535041	0.009294	-0.018704D-03	-1.722969D-03	0.539873	0.009081	-5.469257D-03	-1.594084D-03		
0.436377	0.007275	-1.112416D-02	-2.118314D-03	0.438342	0.007672	-1.107889D-02	-2.126929D-03		
0.347019	0.011753	-1.767701D-02	-2.381147D-03	0.347726	0.011931	-1.020425D-02	-2.461623D-03		
0.315317	0.004595	-2.534610D-02	-2.520243D-03	0.315374	0.004612	-2.647039D-02	-2.632758D-03		
0.243162	0.007265	-0.306636D-02	-2.544625D-03	0.242481	0.007072	-4.534749D-02	-2.670694D-03		
0.195288	0.007644	-0.201165D-02	-2.395462D-03	0.194457	0.007329	-6.613954D-02	-2.506125D-03		
0.161397	0.006836	-0.345941D-02	-2.179255D-03	0.160758	0.006455	-0.790639D-02	-2.271763D-03		
0.136326	0.005428	-1.050190D-01	-1.951750D-03	0.135725	0.005007	-1.100646D-01	-2.027526D-03		
0.117160	0.003720	-1.265007D-01	-1.736525D-03	0.116414	0.003291	-1.322443D-01	-1.790352D-03		
0.098888	0.000888	-1.409835D-01	-1.571213D-03	0.098449	0.000449	-1.750181D-01	-1.412970D-03		
0.072182	0.004563	-2.090730D-01	-1.092895D-03	0.071799	0.004159	-2.175889D-01	-1.121705D-03		
0.059571	0.003399	-0.408397D-01	-0.305010D-04	0.059204	0.002997	-2.572274D-01	-9.040400D-04		
0.050352	0.000563	-2.057400D-01	-7.424935D-04	0.050119	0.000185	-2.946784D-01	-7.400448D-04		
0.043361	0.00049	-3.206419D-01	-6.020494D-04	0.043161	0.007691	-3.300026D-01	-6.147656D-04		
0.037989	0.0075017	-5.536305D-01	-5.081098D-04	0.037739	0.0075478	-3.633524D-01	-5.175032D-04		
PEAK (EVEN) PULSES									
0.628448	0.078356	2.530126D-03	0.992664D-04	0.613771	0.076721	4.315150D-03	1.625517D-03		
0.553834	0.003075	5.133724D-03	1.576677D-03	0.541104	0.001166	7.152555D-03	2.094226D-03		
0.446477	0.009295	1.229764D-02	2.451668D-03	0.437603	0.007521	1.414477D-02	2.700675D-03		
0.372164	0.013041	2.137272D-02	2.960259D-03	0.366390	0.011597	2.246448D-02	3.015661D-03		
0.317447	0.005234	3.175118D-02	3.199440D-03	0.313914	0.004174	3.175040D-02	3.128788D-03		
0.242091	0.006836	5.400751D-02	3.212154D-03	0.241355	0.006342	5.225788D-02	3.044151D-03		
0.193150	0.005575	7.964540D-02	2.971317D-03	0.193555	0.006777	7.426501D-02	2.702977D-03		
0.158064	0.003310	1.049850D-01	2.649582D-03	0.159853	0.005912	0.701517D-02	2.479036D-03		
0.133741	0.003416	1.303024D-01	3.306870D-03	0.134900	0.004406	1.199430D-01	2.105159D-03		
0.114679	0.001743	1.552714D-01	2.042050D-03	0.115994	0.002795	1.427490D-01	1.920430D-03		
0.087951	0.007951	2.034798D-01	1.573966D-03	0.089205	0.008205	1.872721D-01	1.490290D-03		
0.070360	0.004432	2.409249D-01	1.232307D-03	0.071469	0.005762	2.297421D-01	1.173469D-03		
0.058067	0.001294	2.915061D-01	0.020980D-04	0.059028	0.002639	2.699010D-01	9.404109D-04		
0.049020	0.007520	3.313521D-01	7.001750D-04	0.049911	0.007857	3.077501D-01	7.666330D-04		
0.042272	0.006090	3.606466D-01	6.507930D-04	0.042995	0.007391	3.434034D-01	6.348026D-04		
0.036968	0.007336	4.036910D-01	5.517043D-04	0.037600	0.0075201	3.770160D-01	5.330160D-04		

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	100.00		316.23		1000.00			
C_D/r_D^2	=	0.001		0.001		0.001			
$C_{Dexp}(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.328556	0.980268	0.986187	0.332435	0.978493	0.954913	0.336333	0.976235	0.943846
0.400	0.250865	0.987044	0.985020	0.253789	0.985940	0.953904	0.256731	0.984545	0.942971
0.500	0.200178	0.988603	0.984893	0.202519	0.987818	0.953739	0.204875	0.986628	0.942769
0.600	0.164747	0.990353	0.984287	0.166696	0.989747	0.953011	0.168857	0.988982	0.941930
0.800	0.118558	0.984740	0.987282	0.120047	0.984866	0.955279	0.121543	0.984874	0.943523
1.000	0.091413	0.993941	0.982126	0.092570	0.993620	0.950105	0.093729	0.993215	0.938349
1.200	0.073203	0.995041	0.981167	0.074160	0.994778	0.948783	0.075117	0.994446	0.936668
1.400	0.060461	0.995745	0.980410	0.061275	0.995522	0.947645	0.062088	0.995241	0.935233
1.600	0.051138	0.996284	0.959756	0.051846	0.996091	0.946657	0.052551	0.995848	0.933956
1.800	0.044072	0.996725	0.959164	0.044697	0.996554	0.945759	0.045318	0.996339	0.932795
2.000	0.038556	0.996837	0.958806	0.039115	0.996684	0.945116	0.039669	0.996492	0.931910

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00					
C_D/r_D^2	=	0.001	0.001	0.001					
$C_D \exp(2s)$	=	1.00E+04	1.00E+05	1.00E+06					
0.300	0.340243	0.973471	0.932998	0.344158	0.970203	0.922386	0.348068	0.966444	0.912023
0.400	0.259688	0.982841	0.932234	0.262654	0.980831	0.921706	0.265625	0.978519	0.911399
0.500	0.207244	0.985620	0.931994	0.209621	0.984195	0.921426	0.212001	0.982558	0.911079
0.600	0.170628	0.988050	0.931052	0.172604	0.986952	0.920392	0.174582	0.985691	0.909962
0.800	0.123042	0.984758	0.932027	0.124542	0.984515	0.920801	0.128040	0.984149	0.909857
1.000	0.094890	0.992722	0.928672	0.096049	0.992144	0.915686	0.097205	0.991483	0.904798
1.200	0.076073	0.994043	0.924896	0.077026	0.993572	0.913456	0.077874	0.993034	0.902355
1.400	0.062898	0.994901	0.923189	0.063704	0.994503	0.911519	0.064503	0.994050	0.900227
1.600	0.053251	0.995553	0.921666	0.053946	0.995209	0.909792	0.054634	0.994818	0.898334
1.800	0.045934	0.996080	0.920286	0.046543	0.995776	0.908232	0.047146	0.995432	0.896629
2.000	0.040218	0.996260	0.919200	0.040759	0.995990	0.906984	0.041293	0.995683	0.895253

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D \sqrt{D} = 0.001$ AND $C_D \sqrt{D} \exp(2s) = 10^7$ TO 10^{14}

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, F' = 0.50

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

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TABLE D.2c

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10^{18}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.001			0.001			0.001		
$C_D \exp(2s)$ =	1.00E+16			1.00E+20			1.00E+25		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$			TIME LAG FACTOR t_{L0}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.385525	0.908281	0.823415	0.399152	0.873985	0.795302	0.414932	0.830227	0.785058
0.400	0.294810	0.940987	0.821729	0.305502	0.920285	0.792433	0.318414	0.891340	0.780300
0.500	0.235337	0.955908	0.820738	0.244203	0.941054	0.790939	0.254832	0.920085	0.757950
0.600	0.193954	0.965216	0.819079	0.201329	0.953792	0.789075	0.210209	0.937598	0.755739
0.800	0.140633	0.975571	0.815449	0.146019	0.987862	0.785369	0.152508	0.956948	0.751961
1.000	0.108307	0.981002	0.812055	0.112484	0.975281	0.782035	0.117453	0.987168	0.748820
1.200	0.086977	0.984815	0.808847	0.090314	0.980055	0.779059	0.094300	0.973658	0.746128
1.400	0.072018	0.987042	0.806304	0.074774	0.983281	0.776570	0.078054	0.978030	0.743935
1.600	0.061042	0.988827	0.804037	0.063372	0.985840	0.774473	0.068133	0.981209	0.742136
1.800	0.052704	0.990211	0.802073	0.054708	0.987458	0.772687	0.057075	0.983639	0.740642
2.000	0.046181	0.991065	0.800508	0.047830	0.988645	0.771298	0.049989	0.985305	0.739528

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00			1000.00		
C_D/r_D^2 =	0.001			0.001		
$C_D \exp(2s)$ =	1.00E+30			1.00E+40		
0.300	0.429300	0.784399	0.739452	0.454138	0.892418	0.899013
0.400	0.330524	0.860109	0.732442	0.352395	0.794213	0.888984
0.500	0.264950	0.897092	0.729005	0.283680	0.847264	0.880873
0.600	0.218725	0.919708	0.726314	0.234717	0.880358	0.876829
0.800	0.158750	0.944866	0.722386	0.170813	0.918003	0.872157
1.000	0.122243	0.958232	0.718476	0.131351	0.938353	0.869590
1.200	0.098113	0.966624	0.717129	0.105339	0.951038	0.867936
1.400	0.081180	0.972279	0.715287	0.087079	0.959591	0.866834
1.600	0.068756	0.976374	0.713828	0.073684	0.965747	0.866089
1.800	0.059318	0.979486	0.712658	0.063511	0.970394	0.865585
2.000	0.051933	0.981683	0.711846	0.055559	0.973781	0.865380

TABLE D.2d

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10 \text{ TO } 10^8$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	100.00		316.23		1000.00			
C_D/r_D^2	=	0.001		0.001		0.001			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)				
0.300	0.326263	0.979568	0.966450	0.330134	0.977432	0.955116	0.334023	0.974712	0.943997
0.400	0.251743	0.984147	0.965915	0.254668	0.982782	0.954822	0.257812	0.981053	0.943911
0.500	0.202305	0.986953	0.965313	0.204650	0.985971	0.954255	0.207010	0.984732	0.943373
0.600	0.167306	0.988897	0.964678	0.169259	0.988137	0.953546	0.171228	0.987178	0.942595
0.800	0.121597	0.991390	0.963513	0.123057	0.990870	0.952083	0.124524	0.990215	0.940860
1.000	0.093602	0.993033	0.962459	0.094763	0.992635	0.950665	0.095929	0.992134	0.939113
1.200	0.075035	0.994146	0.961581	0.075997	0.993824	0.949415	0.076960	0.993418	0.937531
1.400	0.062000	0.994966	0.960823	0.062818	0.994695	0.948302	0.063637	0.994354	0.936104
1.600	0.052441	0.995596	0.960165	0.053152	0.995362	0.947313	0.053862	0.995068	0.934826
1.800	0.045187	0.996093	0.959588	0.045815	0.995868	0.946429	0.046441	0.995629	0.933677
2.000	0.039526	0.996495	0.959069	0.040088	0.996312	0.945628	0.040647	0.996060	0.932635

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.001		0.001		0.001			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.300	0.337922	0.971384	0.933106	0.341822	0.967453	0.922460	0.345714	0.962938	0.912074
0.400	0.260371	0.978939	0.933193	0.263539	0.976442	0.922681	0.266512	0.973569	0.912390
0.500	0.209384	0.983319	0.932676	0.211768	0.981434	0.922179	0.214157	0.979380	0.911894
0.600	0.173203	0.986010	0.931836	0.175187	0.984632	0.921280	0.177176	0.983048	0.910940
0.800	0.125998	0.989418	0.929854	0.127475	0.988479	0.919079	0.128953	0.987402	0.908546
1.000	0.097097	0.991525	0.927814	0.098285	0.990811	0.916782	0.099432	0.989992	0.906026
1.200	0.077923	0.992926	0.925941	0.078885	0.992349	0.914858	0.079843	0.991689	0.903685
1.400	0.064454	0.993941	0.924342	0.065267	0.993456	0.912725	0.066075	0.992803	0.901580
1.600	0.054569	0.994711	0.922716	0.055272	0.994294	0.910991	0.055968	0.993818	0.899654
1.800	0.047062	0.995315	0.921344	0.047679	0.994949	0.909434	0.048289	0.994532	0.897946
2.000	0.041200	0.995801	0.920100	0.041748	0.995474	0.908025	0.042289	0.995103	0.896406

**CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D \wedge D^2 = 0.001$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}**

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =			1000.00			1000.00		
C_D/r_D^2 =			0.001			0.001		
$C_D \exp(2s)$ =			1.00E+07			1.00E+08		
CYCLE			AMPLITUDE		TIME LAG	AMPLITUDE		TIME LAG
LENGTH			FACTOR		FACTOR	FACTOR		FACTOR
$(\Delta t_c)_D/r_D^2$			$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{LO}/t_L	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{LO}/t_L
(DESIGN)			(ANALYSIS)		(ANALYSIS)	(ANALYSIS)		
0.300	0.349591	0.957661	0.901960	0.353443	0.952248	0.882128	0.357266	0.946130
0.400	0.269483	0.970329	0.902331	0.272448	0.966734	0.882511	0.275402	0.962798
0.500	0.216546	0.977063	0.901830	0.218933	0.974490	0.891998	0.221314	0.971671
0.600	0.179165	0.981283	0.900827	0.181152	0.979281	0.890948	0.183133	0.977110
0.800	0.130431	0.986219	0.898250	0.131903	0.984873	0.888225	0.133370	0.983400
1.000	0.100595	0.989072	0.895553	0.101752	0.988055	0.885366	0.102903	0.986946
1.200	0.080795	0.990949	0.893031	0.081741	0.990133	0.882895	0.082680	0.989244
1.400	0.066877	0.992285	0.890746	0.067672	0.991604	0.880280	0.068460	0.990864
1.600	0.056658	0.993288	0.888701	0.057340	0.992704	0.878126	0.058014	0.992071
1.800	0.048891	0.994067	0.886874	0.049487	0.993557	0.876207	0.050074	0.993005
2.000	0.042823	0.994690	0.885231	0.043349	0.994238	0.874487	0.043868	0.993749

Distance, r_D = 1000.00				1000.00			1000.00		
C_D/r_D^2 = 0.001				0.001			0.001		
$C_D^{\text{exp}}(2s)$ = 1.00E+10				1.00E+12			1.00E+14		
0.300	0.361051	0.939537	0.873331	0.368490	0.925080	0.855700	0.375726	0.909085	0.839220
0.400	0.278341	0.958536	0.873615	0.284161	0.949095	0.855721	0.289887	0.938541	0.838819
0.500	0.223687	0.968615	0.873042	0.228396	0.961827	0.855042	0.233046	0.954207	0.837981
0.600	0.185108	0.974756	0.871907	0.189028	0.969529	0.853825	0.192901	0.963657	0.836880
0.800	0.134829	0.981806	0.868953	0.137721	0.978274	0.850704	0.140574	0.974314	0.833412
1.000	0.104046	0.985746	0.865849	0.108306	0.983097	0.847444	0.108527	0.980137	0.830094
1.200	0.083610	0.988286	0.862961	0.085445	0.986174	0.844429	0.087244	0.983823	0.827021
1.400	0.069239	0.990067	0.860366	0.070771	0.988316	0.841739	0.072368	0.986374	0.824301
1.600	0.058661	0.991390	0.858068	0.059987	0.989899	0.839374	0.061261	0.988250	0.821926
1.800	0.050653	0.992412	0.856033	0.051786	0.991116	0.837295	0.052888	0.989687	0.819855
2.000	0.044378	0.993225	0.854222	0.045375	0.992082	0.835457	0.046341	0.990824	0.818037

TABLE D.2f

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D r_D^2 = 0.001$ AND $C_D \exp(2s) = 10^{18}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.001		0.001		0.001			
$C_D \exp(2s)$	=	1.00E+18		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.382737	0.891880	0.823848	0.398022	0.854772	0.798210	0.411187	0.805545	0.786844
0.400	0.295503	0.927004	0.822877	0.306384	0.901491	0.793705	0.319184	0.886233	0.761826
0.500	0.237827	0.945833	0.821828	0.248580	0.927132	0.792049	0.257287	0.900810	0.759087
0.600	0.196722	0.957196	0.820430	0.204193	0.942720	0.790413	0.213203	0.922191	0.757010
0.800	0.143384	0.969985	0.817109	0.148873	0.960230	0.786979	0.155502	0.946404	0.753431
1.000	0.110710	0.978898	0.813728	0.114961	0.969869	0.783641	0.120075	0.959448	0.750262
1.200	0.089008	0.981258	0.810649	0.092425	0.975556	0.780662	0.098521	0.967533	0.747533
1.400	0.073731	0.984360	0.807948	0.078560	0.979582	0.778091	0.079935	0.973028	0.745238
1.600	0.062502	0.986459	0.805805	0.064895	0.982512	0.775904	0.067738	0.977004	0.743332
1.800	0.053959	0.988140	0.803580	0.056018	0.984739	0.774042	0.058457	0.980011	0.741751
2.000	0.047278	0.989465	0.801815	0.049076	0.986488	0.772446	0.051198	0.982362	0.740430

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00
C_D/r_D^2	=	0.001		0.001
$C_D \exp(2s)$	=	1.00E+30		1.00E+40
0.300	0.424764	0.755879	0.742334	0.447516
0.400	0.331124	0.828720	0.734354	0.352370
0.500	0.267441	0.872120	0.730211	0.286184
0.600	0.221849	0.899555	0.727507	0.238089
0.800	0.161897	0.931063	0.723671	0.174078
1.000	0.124999	0.948127	0.720707	0.134391
1.200	0.100450	0.958885	0.718296	0.107918
1.400	0.083160	0.965829	0.716337	0.089284
1.600	0.070446	0.970978	0.714781	0.075549
1.800	0.060772	0.974853	0.713497	0.065118
2.000	0.053207	0.977874	0.712479	0.056984

TABLE D.2g

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$	100.00			316.23			1000.00		
$C_D/r_D^2 =$	0.001			0.001			0.001		
$C_D \exp(2s) =$	1.00E+01			1.00E+02			1.00E+03		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$			TIME LAG FACTOR t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$		
	$\Delta p/\Delta p_0$			$\Delta p/\Delta p_0$			$\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.324864	0.982552	0.986292	0.328731	0.980830	0.954925	0.332614	0.978640	0.943777
0.400	0.249913	0.986375	0.985757	0.252834	0.985241	0.954599	0.255773	0.983804	0.943629
0.500	0.200546	0.988692	0.985134	0.202888	0.987856	0.953997	0.205244	0.986799	0.943042
0.600	0.165736	0.990287	0.984508	0.167686	0.989626	0.953289	0.169649	0.988792	0.942259
0.800	0.120410	0.992389	0.983325	0.121867	0.991923	0.951804	0.123332	0.991337	0.940500
1.000	0.092700	0.993743	0.982299	0.093859	0.993382	0.950413	0.095022	0.992929	0.938779
1.200	0.074336	0.994700	0.981425	0.075296	0.994405	0.949169	0.076257	0.994034	0.937205
1.400	0.061444	0.995415	0.980678	0.062261	0.995165	0.948070	0.063078	0.994851	0.935795
1.600	0.051989	0.995969	0.980022	0.052699	0.995753	0.947085	0.053408	0.995480	0.934524
1.800	0.044812	0.996411	0.959454	0.045439	0.996219	0.946213	0.046063	0.995978	0.933390
2.000	0.039210	0.996770	0.958947	0.039771	0.996599	0.945426	0.040328	0.996383	0.932364

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, $r_D =$	1000.00			1000.00			1000.00		
$C_D/r_D^2 =$	0.001			0.001			0.001		
$C_D \exp(2s) =$	1.00E+04			1.00E+05			1.00E+06		
0.300	0.336506	0.975961	0.932862	0.340398	0.972799	0.922196	0.344281	0.969168	0.911795
0.400	0.258726	0.982049	0.932859	0.261688	0.979976	0.922302	0.264652	0.977591	0.911972
0.500	0.207614	0.985510	0.932280	0.209991	0.983988	0.921725	0.212373	0.982239	0.911389
0.600	0.171622	0.987777	0.931427	0.173601	0.986580	0.920808	0.175583	0.985205	0.910414
0.800	0.124802	0.990624	0.929421	0.126275	0.989785	0.918582	0.127747	0.988823	0.907993
1.000	0.096187	0.992578	0.927408	0.097352	0.991730	0.916313	0.098514	0.990990	0.905503
1.200	0.077218	0.993564	0.925545	0.078176	0.993058	0.914201	0.079130	0.992453	0.903180
1.400	0.063892	0.994470	0.923867	0.064703	0.994024	0.912295	0.065508	0.993515	0.901082
1.600	0.054112	0.995160	0.923351	0.054812	0.994764	0.910574	0.055506	0.994333	0.899194
1.800	0.046683	0.995687	0.920997	0.047297	0.995348	0.909038	0.047905	0.994959	0.897510
2.000	0.040680	0.996122	0.919772	0.041426	0.995818	0.907651	0.041965	0.995472	0.895995

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.001		0.001		0.001			
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09			
CYCLE LENGTH (Δt_c) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.348147	0.985087	0.901870	0.351988	0.980578	0.891830	0.355798	0.955885	0.882281
0.400	0.267813	0.974904	0.901879	0.270567	0.971925	0.892033	0.273509	0.968864	0.882439
0.500	0.214754	0.980266	0.901282	0.217132	0.978078	0.891413	0.219502	0.975682	0.881785
0.600	0.177585	0.983658	0.900252	0.179543	0.981937	0.890332	0.181516	0.980055	0.880657
0.800	0.129217	0.987741	0.897663	0.130683	0.986544	0.887597	0.132142	0.985234	0.877797
1.000	0.099872	0.990158	0.894984	0.100824	0.989239	0.884760	0.101969	0.988237	0.874828
1.200	0.080078	0.991777	0.892484	0.081019	0.991033	0.882114	0.081953	0.990222	0.872086
1.400	0.066306	0.992946	0.890230	0.067097	0.992320	0.879735	0.067880	0.991640	0.869588
1.600	0.056193	0.993833	0.888207	0.056871	0.993293	0.877605	0.057542	0.992709	0.867378
1.800	0.048505	0.994528	0.886407	0.049097	0.994055	0.875716	0.049681	0.993543	0.865424
2.000	0.042496	0.995087	0.884791	0.043020	0.994667	0.874026	0.043535	0.994212	0.863681

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.001		0.001		0.001			
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
0.300	0.359569	0.950374	0.873028	0.366979	0.938760	0.855400	0.374183	0.925954	0.838930
0.400	0.276435	0.965136	0.873099	0.282225	0.957327	0.855186	0.287917	0.948809	0.838281
0.500	0.231863	0.973085	0.872402	0.238647	0.967334	0.854367	0.231187	0.960865	0.837280
0.600	0.183480	0.978017	0.871229	0.187378	0.973494	0.853106	0.191227	0.968420	0.835937
0.800	0.133593	0.983818	0.868262	0.136467	0.980683	0.849974	0.139300	0.977173	0.832689
1.000	0.103105	0.987155	0.865187	0.105350	0.984767	0.846748	0.107556	0.982103	0.829382
1.200	0.082878	0.989348	0.862332	0.084701	0.987424	0.843774	0.086486	0.985287	0.826356
1.400	0.068855	0.990909	0.859780	0.070177	0.989303	0.841133	0.071663	0.987524	0.823889
1.600	0.058204	0.992081	0.857512	0.059502	0.990708	0.838803	0.060766	0.989188	0.821355
1.800	0.050256	0.992993	0.855513	0.051383	0.991794	0.836764	0.052476	0.990473	0.819327
2.000	0.044042	0.993725	0.853736	0.045032	0.992663	0.834964	0.045992	0.991497	0.817549

TABLE D.2i

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.001			0.001			0.001		
$C_D \exp(2s)$ =	1.00E+16			1.00E+20			1.00E+25		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.381160	0.912169	0.823574	0.394378	0.882451	0.795970	0.409474	0.843022	0.766628
0.400	0.293495	0.939091	0.822349	0.304270	0.918078	0.793227	0.316989	0.889107	0.761447
0.500	0.235716	0.953777	0.821131	0.244577	0.937975	0.791362	0.255179	0.915789	0.758502
0.600	0.195020	0.962844	0.819678	0.202429	0.950374	0.789678	0.211352	0.932731	0.756335
0.800	0.142089	0.973324	0.816348	0.147531	0.964721	0.788231	0.154096	0.952528	0.752735
1.000	0.109722	0.979189	0.813013	0.113935	0.972702	0.782947	0.119000	0.963545	0.749625
1.200	0.088234	0.982955	0.809986	0.091823	0.977787	0.780028	0.095679	0.970524	0.748963
1.400	0.073114	0.985590	0.807340	0.075918	0.981317	0.777521	0.079280	0.975341	0.744735
1.600	0.061997	0.987541	0.805043	0.064369	0.983916	0.775381	0.067185	0.978865	0.742881
1.800	0.053539	0.989044	0.803063	0.055580	0.985908	0.773568	0.057996	0.981554	0.741350
2.000	0.046922	0.990238	0.801341	0.048704	0.987483	0.772018	0.050806	0.983671	0.740075

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00			1000.00		
C_D/r_D^2 =	0.001			0.001		
$C_D \exp(2s)$ =	1.00E+30			1.00E+40		
0.300	0.423009	0.802984	0.742096	0.445829	0.728225	0.704111
0.400	0.328779	0.858352	0.734094	0.349787	0.795450	0.690046
0.500	0.265237	0.891670	0.729740	0.283703	0.840340	0.682243
0.600	0.219903	0.913322	0.728926	0.235909	0.871041	0.677606
0.800	0.160423	0.939026	0.723049	0.172456	0.909040	0.672597
1.000	0.123871	0.953423	0.720144	0.133153	0.930887	0.669944
1.200	0.099565	0.962528	0.717803	0.106948	0.944778	0.668256
1.400	0.082451	0.968786	0.715914	0.088485	0.954297	0.667094
1.600	0.069865	0.973345	0.714391	0.074910	0.961194	0.666278
1.800	0.060287	0.976810	0.713178	0.064584	0.966406	0.665723
2.000	0.052795	0.979529	0.712204	0.056511	0.970473	0.665363

TABLE D.2j

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	100.00		316.23		1000.00				
C_D/r_D^2	=	0.001		0.001		0.001				
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03				
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)				(ANALYSIS)		
0.300	0.326344	0.979567	0.966383	0.330215	0.977502	0.955054	0.334103	0.974874	0.943940	
0.400	0.251281	0.984448	0.965847	0.254185	0.983139	0.954737	0.257128	0.981484	0.943812	
0.500	0.201670	0.987331	0.965232	0.204013	0.986392	0.954145	0.206372	0.985206	0.943237	
0.600	0.166658	0.989265	0.964599	0.166610	0.988536	0.953432	0.170575	0.987617	0.942448	
0.800	0.121043	0.991739	0.963409	0.122501	0.991236	0.951937	0.123968	0.990603	0.940677	
1.000	0.093153	0.993285	0.962382	0.094314	0.992901	0.950542	0.095478	0.992417	0.938949	
1.200	0.074674	0.994356	0.961495	0.075635	0.994044	0.949283	0.076597	0.993651	0.937358	
1.400	0.061706	0.995144	0.960742	0.062524	0.994881	0.948175	0.063341	0.994551	0.935937	
1.600	0.052198	0.995749	0.960094	0.052909	0.995522	0.947196	0.053618	0.995236	0.934669	
1.800	0.044983	0.996227	0.959517	0.045610	0.996027	0.946314	0.046235	0.995776	0.933523	
2.000	0.039353	0.996613	0.958997	0.039914	0.996435	0.945512	0.040472	0.996210	0.932461	

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00				
C_D/r_D^2	=	0.001		0.001		0.001				
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06				
0.300	0.338001	0.971660	0.933054	0.341900	0.967863	0.922413	0.345792	0.963502	0.912031	
0.400	0.260085	0.979461	0.933080	0.263051	0.977072	0.922558	0.266021	0.974323	0.912257	
0.500	0.208745	0.983759	0.932517	0.211126	0.982050	0.921999	0.213512	0.980085	0.911695	
0.600	0.172551	0.986497	0.931658	0.174533	0.985177	0.921076	0.176519	0.983659	0.910714	
0.800	0.125440	0.989834	0.929637	0.126915	0.988928	0.918633	0.128391	0.987689	0.908274	
1.000	0.096645	0.991830	0.927614	0.097811	0.991140	0.916550	0.098976	0.990349	0.905767	
1.200	0.077569	0.993175	0.925732	0.078519	0.992617	0.914416	0.079475	0.991979	0.903419	
1.400	0.064157	0.994150	0.924040	0.064969	0.993681	0.912494	0.065775	0.993145	0.901303	
1.600	0.054324	0.994690	0.922525	0.055025	0.994485	0.910772	0.055720	0.994024	0.899412	
1.800	0.046856	0.995471	0.921157	0.047471	0.995115	0.909220	0.048080	0.994711	0.897711	
2.000	0.041024	0.995938	0.919915	0.041571	0.995621	0.907815	0.042111	0.995261	0.896175	

TABLE D.2:

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.001			0.001			0.001		
$C_D \exp(2s)$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.349868	0.958598	0.901921	0.353521	0.953176	0.892093	0.357343	0.947264	0.882551
0.400	0.288990	0.971223	0.902190	0.271952	0.967784	0.892364	0.274902	0.964019	0.882786
0.500	0.215899	0.977889	0.901616	0.218283	0.975409	0.891770	0.220860	0.972714	0.882162
0.600	0.178505	0.981948	0.900580	0.180489	0.980050	0.890684	0.182467	0.977971	0.881028
0.800	0.129884	0.986720	0.897989	0.131333	0.985428	0.887924	0.132796	0.984010	0.878142
1.000	0.100136	0.989482	0.895271	0.101291	0.988482	0.885065	0.102439	0.987411	0.875148
1.200	0.080425	0.991283	0.892743	0.081369	0.990475	0.882389	0.082305	0.989616	0.872354
1.400	0.066576	0.992546	0.890469	0.067369	0.991887	0.879988	0.068154	0.991171	0.869852
1.600	0.056408	0.993510	0.888441	0.057088	0.992944	0.877851	0.057761	0.992330	0.867633
1.800	0.048881	0.994260	0.886622	0.049275	0.993765	0.875942	0.049860	0.993229	0.865657
2.000	0.042644	0.994860	0.884985	0.043168	0.994421	0.874229	0.043685	0.993946	0.863891

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.001			0.001			0.001		
$C_D \exp(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.300	0.361128	0.940893	0.873301	0.368568	0.926899	0.855673	0.375806	0.911451	0.839191
0.400	0.277838	0.959942	0.873460	0.283650	0.950913	0.855563	0.289366	0.940822	0.838662
0.500	0.223028	0.969791	0.872795	0.227728	0.963304	0.854782	0.232368	0.956024	0.837716
0.600	0.184437	0.975717	0.871616	0.188348	0.970714	0.853516	0.192212	0.965096	0.836361
0.800	0.134252	0.982478	0.868821	0.137136	0.979085	0.850353	0.139970	0.975284	0.833070
1.000	0.103578	0.986256	0.865519	0.105831	0.983703	0.847096	0.106045	0.980853	0.829737
1.200	0.083233	0.988690	0.862630	0.085062	0.986651	0.844084	0.086853	0.984383	0.826670
1.400	0.068930	0.990400	0.860052	0.070457	0.988707	0.841414	0.071849	0.986831	0.823972
1.600	0.058425	0.991672	0.857773	0.059727	0.990228	0.839071	0.060995	0.988633	0.821623
1.800	0.050437	0.992655	0.855751	0.051567	0.991400	0.837007	0.052664	0.990017	0.819569
2.000	0.044193	0.993438	0.853950	0.045187	0.992330	0.835182	0.046149	0.991111	0.817765

TABLE D.2

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.001$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.001			0.001			0.001		
$C_D \exp(2s)$	= 1.00E+16			1.00E+20			1.00E+25		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$			TIME LAG FACTOR t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.382821	0.894802	0.823813	0.398128	0.858847	0.798145	0.411342	0.811017	0.786894
0.400	0.294971	0.929794	0.822725	0.305808	0.905413	0.793569	0.318597	0.871728	0.781715
0.500	0.236937	0.948029	0.821560	0.245844	0.930183	0.791798	0.258511	0.905087	0.758868
0.600	0.198021	0.958918	0.820106	0.203467	0.945087	0.790095	0.212441	0.925495	0.756720
0.800	0.142779	0.971111	0.818741	0.148247	0.961779	0.788615	0.154847	0.948539	0.753090
1.000	0.110220	0.977736	0.813368	0.114452	0.970789	0.783290	0.119542	0.960973	0.749936
1.200	0.088608	0.981909	0.810298	0.092012	0.976419	0.780325	0.096087	0.968700	0.747228
1.400	0.073405	0.984790	0.807820	0.078221	0.980278	0.777783	0.078579	0.973083	0.744985
1.600	0.062231	0.986903	0.805307	0.064612	0.983091	0.775625	0.067441	0.977776	0.743091
1.800	0.053730	0.988519	0.803300	0.055780	0.985232	0.773785	0.058200	0.980866	0.741633
2.000	0.047083	0.989796	0.801550	0.048872	0.986916	0.772200	0.050983	0.983928	0.740230

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	= 1000.00			1000.00		
C_D/r_D^2	= 0.001			0.001		
$C_D \exp(2s)$	= 1.00E+30			1.00E+40		
0.300	0.425009	0.762309	0.742039	0.448003	0.868598	0.703813
0.400	0.330509	0.835880	0.734261	0.351730	0.782285	0.689961
0.500	0.286841	0.877759	0.730037	0.285273	0.819439	0.682358
0.600	0.221047	0.903914	0.727280	0.237175	0.856814	0.677804
0.800	0.161210	0.933865	0.723364	0.173322	0.901242	0.672816
1.000	0.124441	0.950116	0.720417	0.133778	0.925925	0.670132
1.200	0.099995	0.960195	0.718029	0.107420	0.941305	0.668400
1.400	0.082786	0.967032	0.716105	0.088854	0.951704	0.667205
1.600	0.070134	0.971966	0.714583	0.075208	0.959167	0.666371
1.800	0.060508	0.975689	0.713324	0.064827	0.964768	0.665794
2.000	0.052980	0.978594	0.712324	0.056715	0.969114	0.665411

TABLE D.2m

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_{Dexp}(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_{Dexp}(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.473347	0.931678	0.943230	0.484344	0.917684	0.921814	0.495180	0.900720	0.901643
0.300	0.337117	0.959422	0.941650	0.344774	0.952924	0.920737	0.352421	0.945015	0.900759
0.400	0.257624	0.971833	0.939701	0.263441	0.967756	0.918951	0.269273	0.962812	0.899050
0.500	0.205714	0.976531	0.938924	0.210382	0.973613	0.918092	0.215064	0.970084	0.898104
0.600	0.169401	0.980282	0.937795	0.173285	0.978022	0.916773	0.177179	0.975294	0.896825
0.800	0.122117	0.978608	0.939090	0.125068	0.978046	0.916934	0.128323	0.981665	0.893672
1.000	0.094126	0.987593	0.934396	0.096419	0.986616	0.912178	0.098692	0.985189	0.891167
1.200	0.075419	0.989903	0.932923	0.077294	0.988938	0.910288	0.079157	0.987783	0.888870
1.400	0.062313	0.991337	0.931866	0.063899	0.990527	0.908740	0.065468	0.989559	0.886953
1.600	0.052718	0.992433	0.930983	0.054088	0.991736	0.907414	0.055439	0.990903	0.885302
1.800	0.045444	0.993312	0.930213	0.046645	0.992700	0.906247	0.047827	0.991971	0.883850
2.000	0.039763	0.993777	0.929709	0.040832	0.993233	0.905379	0.041879	0.992586	0.882725

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.002			0.002			0.002		
$C_{Dexp}(2s)$ =	1.00E+04			1.00E+05			1.00E+06		
0.200	0.505722	0.880452	0.882848	0.515891	0.857312	0.865448	0.525631	0.831844	0.849408
0.300	0.360000	0.935437	0.881796	0.367463	0.924294	0.863886	0.374775	0.911753	0.847033
0.400	0.275065	0.956822	0.880054	0.280848	0.949829	0.861996	0.286537	0.941914	0.844881
0.500	0.219737	0.965811	0.879006	0.224377	0.960820	0.860827	0.228969	0.965164	0.843564
0.600	0.181063	0.971995	0.877382	0.184919	0.968146	0.859096	0.188735	0.963786	0.841728
0.800	0.131193	0.978399	0.874124	0.134034	0.976765	0.855595	0.136838	0.973791	0.838059
1.000	0.100943	0.983476	0.871289	0.103184	0.981491	0.852533	0.105349	0.979257	0.834852
1.200	0.080994	0.986400	0.868707	0.082799	0.984803	0.849768	0.084569	0.983011	0.831984
1.400	0.067010	0.988403	0.866541	0.068520	0.987072	0.847449	0.069995	0.985584	0.829389
1.600	0.056761	0.989912	0.864678	0.058051	0.988774	0.845465	0.059307	0.987504	0.827552
1.800	0.048980	0.991104	0.863047	0.050101	0.990112	0.843737	0.051190	0.989007	0.825791
2.000	0.042896	0.991817	0.861765	0.043885	0.990939	0.842376	0.044842	0.989964	0.824407

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.002		0.002		0.002		0.002	
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09		1.00E+09	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.534913	0.804590	0.834668	0.543724	0.776045	0.821142	0.552063	0.746648	0.808740
0.300	0.381907	0.897992	0.831215	0.388841	0.883191	0.816392	0.395565	0.887518	0.802514
0.400	0.292135	0.933167	0.828691	0.297629	0.923677	0.813394	0.303011	0.913532	0.798947
0.500	0.233500	0.948899	0.827195	0.237962	0.942081	0.811683	0.242351	0.934765	0.796984
0.600	0.192501	0.958956	0.825258	0.196214	0.953697	0.809642	0.199871	0.948048	0.794830
0.800	0.139602	0.970506	0.821470	0.142322	0.966937	0.805769	0.144999	0.963109	0.790894
1.000	0.107496	0.978795	0.818182	0.109603	0.974127	0.802449	0.111672	0.971272	0.787580
1.200	0.086302	0.981044	0.815273	0.088000	0.978918	0.799548	0.089662	0.976647	0.784722
1.400	0.071436	0.983953	0.812859	0.072843	0.982198	0.797157	0.074218	0.980323	0.782387
1.600	0.060531	0.986116	0.810820	0.061724	0.984624	0.795156	0.062887	0.983038	0.780451
1.800	0.052248	0.987803	0.809072	0.053276	0.986511	0.793454	0.054277	0.985139	0.778820
2.000	0.045769	0.988903	0.807708	0.046669	0.987767	0.792138	0.047543	0.986583	0.777575

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.002		0.002		0.002		0.002	
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14		1.00E+14	
0.200	0.559935	0.718779	0.797370	0.574340	0.858858	0.777371	0.587089	0.598236	0.790409
0.300	0.402073	0.851131	0.789528	0.414451	0.810903	0.765944	0.426945	0.781411	0.745275
0.400	0.308275	0.902812	0.785306	0.318435	0.879951	0.760250	0.328096	0.855644	0.737884
0.500	0.246663	0.927001	0.783051	0.255052	0.910313	0.757298	0.263121	0.892357	0.734074
0.600	0.203470	0.942043	0.780772	0.210494	0.929095	0.754717	0.217290	0.915085	0.731111
0.800	0.147633	0.959043	0.776783	0.152778	0.950277	0.750622	0.157772	0.940771	0.726866
1.000	0.113705	0.968244	0.773502	0.117667	0.961731	0.747457	0.121505	0.964680	0.723845
1.200	0.091292	0.974246	0.770715	0.094460	0.969095	0.744866	0.097520	0.963536	0.721493
1.400	0.075563	0.978347	0.768460	0.078171	0.974118	0.742821	0.080683	0.969568	0.719698
1.600	0.064022	0.981366	0.766610	0.066218	0.977798	0.741184	0.068327	0.973970	0.718307
1.800	0.055253	0.983696	0.765067	0.057136	0.980623	0.739651	0.058940	0.977334	0.717210
2.000	0.048393	0.985298	0.763907	0.050032	0.982611	0.738892	0.051597	0.979741	0.716471

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^{18}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.002			0.002			0.002		
$C_D \exp(2s)$	= 1.00E+18			1.00E+20			1.00E+25		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.598354	0.542203	0.746173	0.617095	0.440844	0.723512	0.634933	0.335570	0.703184
0.300	0.436598	0.745382	0.727092	0.455555	0.674031	0.698834	0.475380	0.589941	0.667775
0.400	0.337259	0.830357	0.717816	0.354140	0.778343	0.683600	0.372712	0.713374	0.649537
0.500	0.270872	0.873430	0.713068	0.285436	0.833643	0.676683	0.301959	0.782263	0.639656
0.600	0.223864	0.900211	0.709642	0.236366	0.868549	0.672106	0.250835	0.826790	0.633338
0.800	0.162626	0.930636	0.705169	0.171960	0.908634	0.666894	0.182995	0.879455	0.626676
1.000	0.125235	0.947166	0.702287	0.132420	0.930968	0.664181	0.140978	0.908975	0.623865
1.200	0.100487	0.957625	0.700190	0.106192	0.944910	0.662572	0.112990	0.927640	0.622711
1.400	0.083112	0.964743	0.698664	0.087768	0.954390	0.661595	0.093302	0.940359	0.622356
1.600	0.070362	0.969918	0.697535	0.074251	0.961250	0.661003	0.078855	0.949538	0.622408
1.800	0.060676	0.973860	0.696687	0.063985	0.966447	0.660659	0.067888	0.956461	0.622678
2.000	0.053101	0.976715	0.696176	0.055960	0.970277	0.660609	0.059321	0.961630	0.623183

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00		
C_D/r_D^2	= 0.002			0.002		
$C_D \exp(2s)$	= 1.00E+30			1.00E+40		
0.200	0.648256	0.253451	0.688733			
0.300	0.491629	0.514051	0.645704	0.516021	0.388984	0.615181
0.400	0.388783	0.650990	0.622687	0.414731	0.538985	0.583728
0.500	0.316780	0.731168	0.609768	0.341783	0.634397	0.565125
0.600	0.264084	0.784146	0.601564	0.287261	0.700625	0.553027
0.800	0.193387	0.848578	0.593002	0.212380	0.785115	0.540021
1.000	0.149141	0.885541	0.589716	0.164427	0.838078	0.534892
1.200	0.119504	0.909156	0.588767	0.131865	0.869595	0.533578
1.400	0.098604	0.925337	0.588891	0.108718	0.892984	0.534106
1.600	0.083256	0.937020	0.589509	0.091654	0.910020	0.535493
1.800	0.071606	0.945812	0.590343	0.078686	0.922870	0.537228
2.000	0.062513	0.952434	0.591369	0.068568	0.932668	0.539147

TABLE D.2p

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.82		100.00		316.23			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.462304	0.941648	0.943914	0.473111	0.927795	0.922352	0.483700	0.911060	0.902162
0.300	0.334629	0.957902	0.942288	0.342248	0.950210	0.921310	0.349847	0.940844	0.901299
0.400	0.258438	0.967297	0.940901	0.264253	0.962280	0.920188	0.270085	0.958181	0.900318
0.500	0.207834	0.973137	0.939636	0.212513	0.969497	0.918945	0.217211	0.965084	0.899072
0.600	0.171981	0.977167	0.938456	0.175881	0.974337	0.917646	0.179796	0.970914	0.897667
0.800	0.125111	0.982375	0.938451	0.128016	0.980437	0.915196	0.130928	0.978129	0.894842
1.000	0.098371	0.985716	0.934804	0.098670	0.984242	0.913023	0.100966	0.982470	0.892263
1.200	0.077293	0.988010	0.933493	0.079185	0.986824	0.911187	0.081069	0.985402	0.890018
1.400	0.063889	0.989099	0.932411	0.065490	0.988708	0.909616	0.067078	0.987521	0.888075
1.600	0.054054	0.990994	0.931508	0.055437	0.990144	0.908265	0.056805	0.989128	0.886392
1.800	0.046587	0.992016	0.930738	0.047802	0.991273	0.907092	0.048999	0.990386	0.884923
2.000	0.040759	0.992842	0.930068	0.041839	0.992183	0.906056	0.042901	0.991396	0.883627

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.493920	0.891256	0.883494	0.503687	0.888952	0.866363	0.512946	0.844806	0.850723
0.300	0.357362	0.929536	0.882346	0.364743	0.916440	0.864489	0.371952	0.901786	0.847735
0.400	0.275897	0.948785	0.881351	0.281658	0.940153	0.863324	0.287343	0.930392	0.846245
0.500	0.221902	0.959733	0.880062	0.226566	0.953477	0.861948	0.231183	0.946381	0.844733
0.600	0.183705	0.966769	0.878563	0.187592	0.961924	0.860358	0.191444	0.956428	0.843051
0.800	0.133827	0.975303	0.875456	0.136704	0.972009	0.857037	0.139548	0.968281	0.839569
1.000	0.103245	0.980338	0.872565	0.105498	0.977861	0.853927	0.107720	0.975065	0.836316
1.200	0.082931	0.983694	0.870028	0.084766	0.981717	0.851195	0.086569	0.979493	0.833467
1.400	0.068644	0.986101	0.867826	0.070180	0.984461	0.848831	0.071684	0.982621	0.831015
1.600	0.058148	0.987914	0.865921	0.059462	0.986517	0.846793	0.060744	0.984954	0.828914
1.800	0.050171	0.989328	0.864262	0.051313	0.988114	0.845027	0.052425	0.986759	0.827104
2.000	0.043936	0.990461	0.862803	0.044943	0.989390	0.843482	0.045920	0.988196	0.825531

TABLE D.27

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00				
C_D/r_D^2	=	0.002		0.002		0.002				
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09				
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)				(ANALYSIS)		
0.200	0.521870	0.819446	0.836496	0.529850	0.793428	0.823582	0.537490	0.767225	0.811876	
0.300	0.378958	0.885824	0.832061	0.385743	0.868796	0.817428	0.392291	0.850930	0.803784	
0.400	0.292932	0.919825	0.830100	0.298411	0.907974	0.814857	0.303771	0.895556	0.800479	
0.500	0.235742	0.938520	0.828398	0.240233	0.929967	0.812910	0.244651	0.920793	0.798230	
0.600	0.195250	0.950333	0.826617	0.199005	0.943692	0.811018	0.202707	0.936554	0.796208	
0.800	0.142355	0.964153	0.823014	0.145122	0.959660	0.807319	0.147849	0.954832	0.792430	
1.000	0.109907	0.971979	0.819677	0.112057	0.968628	0.803947	0.114172	0.965035	0.789057	
1.200	0.088338	0.977044	0.816774	0.090074	0.974393	0.801035	0.091777	0.971556	0.786174	
1.400	0.073157	0.980602	0.814290	0.074597	0.978420	0.798565	0.076007	0.976091	0.783749	
1.600	0.061996	0.983242	0.812178	0.063218	0.981397	0.796480	0.064412	0.979432	0.781722	
1.800	0.053507	0.985278	0.810372	0.054561	0.983686	0.794713	0.055589	0.981993	0.780018	
2.000	0.046869	0.986896	0.808813	0.047792	0.985499	0.793199	0.048690	0.984017	0.778572	

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00				
C_D/r_D^2	=	0.002		0.002		0.002				
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14				
0.200	0.544605	0.741224	0.801269	0.557342	0.690994	0.782958	0.568261	0.844418	0.767913	
0.300	0.398594	0.832441	0.791072	0.410455	0.794330	0.768212	0.421330	0.755768	0.748384	
0.400	0.309005	0.882487	0.786922	0.319073	0.854818	0.762090	0.328593	0.825740	0.740011	
0.500	0.248992	0.911068	0.784315	0.257431	0.890220	0.758603	0.265537	0.867898	0.735445	
0.600	0.206352	0.928965	0.782141	0.213474	0.912605	0.756049	0.220367	0.894928	0.732398	
0.800	0.150535	0.949697	0.778288	0.155792	0.938604	0.752029	0.160902	0.926557	0.728144	
1.000	0.116252	0.961220	0.774940	0.120313	0.952997	0.748779	0.124256	0.944076	0.725018	
1.200	0.093448	0.968551	0.772114	0.096703	0.962090	0.746124	0.099854	0.955103	0.722580	
1.400	0.077389	0.973829	0.769760	0.080072	0.968350	0.743965	0.082661	0.962657	0.720659	
1.600	0.065578	0.977358	0.767811	0.067840	0.972921	0.742217	0.070016	0.968150	0.719149	
1.800	0.056592	0.980209	0.766190	0.058532	0.976401	0.740797	0.060394	0.972317	0.717959	
2.000	0.049565	0.982468	0.764827	0.051253	0.979136	0.739633	0.052870	0.975581	0.717015	

TABLE D.2*

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.002			0.002			0.002		
$C_D \exp(2s)$ =	1.00E+16			1.00E+20			1.00E+25		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.577586	0.802349	0.755515	0.592298	0.532524	0.736749	0.805118	0.489781	0.721140
0.300	0.431253	0.717722	0.731164	0.448465	0.645735	0.703102	0.465715	0.586801	0.677080
0.400	0.337580	0.795911	0.720354	0.353861	0.736043	0.687169	0.371368	0.684438	0.654776
0.500	0.273304	0.844524	0.714545	0.287814	0.796038	0.678520	0.304069	0.735011	0.642248
0.600	0.227035	0.876214	0.710890	0.239693	0.836640	0.673348	0.254263	0.785209	0.634764
0.800	0.165878	0.913700	0.706303	0.175461	0.886044	0.667727	0.186803	0.848894	0.627185
1.000	0.128095	0.934554	0.703290	0.135508	0.913997	0.664818	0.144383	0.886062	0.624040
1.200	0.102915	0.947858	0.701089	0.108815	0.931607	0.663075	0.115868	0.909752	0.622713
1.400	0.085170	0.956608	0.699429	0.089992	0.943599	0.661954	0.095740	0.925918	0.622213
1.600	0.072119	0.963092	0.698175	0.076148	0.952246	0.661234	0.080933	0.937549	0.622141
1.800	0.062190	0.967998	0.697230	0.065619	0.958754	0.660791	0.069676	0.946270	0.622316
2.000	0.054426	0.971826	0.696517	0.057390	0.963815	0.660546	0.060883	0.953026	0.622643

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D =	1000.00			1000.00		
C_D/r_D^2 =	0.002			0.002		
$C_D \exp(2s)$ =	1.00E+30			1.00E+40		
0.200	0.613647	0.428593	0.711117			
0.300	0.479180	0.501357	0.658061	0.497936	0.406084	0.633261
0.400	0.386042	0.599310	0.629886	0.408544	0.492029	0.595193
0.500	0.318344	0.676291	0.613450	0.341657	0.571738	0.571591
0.600	0.267468	0.733837	0.603425	0.290042	0.637258	0.556481
0.800	0.197470	0.810147	0.593304	0.216816	0.732061	0.540366
1.000	0.152829	0.856344	0.589469	0.168690	0.794097	0.534044
1.200	0.122649	0.886326	0.588285	0.135559	0.836251	0.532260
1.400	0.101266	0.906941	0.588262	0.111851	0.868001	0.532590
1.600	0.085521	0.921799	0.588768	0.094314	0.887725	0.533877
1.800	0.073552	0.932925	0.589520	0.080963	0.904074	0.535562
2.000	0.064209	0.941521	0.590388	0.070544	0.916708	0.537374

TABLE D.2s

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10$ TO 10^8

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 31.62			100.00			316.23		
C_D/r_D^2	= 0.002			0.002			0.002		
$C_D \exp(2s)$	= 1.00E+01			1.00E+02			1.00E+03		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.463816	0.947431	0.943489	0.474650	0.936211	0.921953	0.485277	0.922667	0.901784
0.300	0.333236	0.964081	0.942015	0.340841	0.957881	0.920997	0.348422	0.950341	0.900958
0.400	0.256582	0.971948	0.940653	0.262386	0.967786	0.919848	0.268200	0.962729	0.899906
0.500	0.208045	0.978734	0.939377	0.210713	0.973638	0.918569	0.215395	0.969887	0.898601
0.600	0.170381	0.980030	0.938212	0.174270	0.977577	0.917273	0.178171	0.974612	0.897190
0.800	0.123898	0.984376	0.936205	0.126794	0.982649	0.914818	0.129693	0.980569	0.894371
1.000	0.095448	0.987172	0.934592	0.097740	0.985841	0.912880	0.100026	0.984242	0.891817
1.200	0.078577	0.989145	0.933292	0.078462	0.988064	0.910860	0.080338	0.986767	0.889594
1.400	0.063319	0.990617	0.932228	0.064915	0.989707	0.909312	0.066497	0.988617	0.887680
1.600	0.053591	0.991757	0.931330	0.054969	0.990973	0.907973	0.056332	0.990035	0.886015
1.800	0.046203	0.992665	0.930574	0.047413	0.991976	0.906818	0.048605	0.991154	0.884571
2.000	0.040434	0.993403	0.929917	0.041511	0.992790	0.905802	0.042568	0.992059	0.883298

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.002			0.002			0.002		
$C_D \exp(2s)$	= 1.00E+04			1.00E+05			1.00E+06		
0.200	0.495552	0.906618	0.883065	0.505394	0.888490	0.865869	0.514752	0.868782	0.850128
0.300	0.355915	0.941245	0.881989	0.363272	0.930720	0.864127	0.370454	0.918952	0.847376
0.400	0.273990	0.958804	0.880889	0.278725	0.949461	0.862831	0.285378	0.941394	0.845737
0.500	0.220067	0.965341	0.879523	0.224707	0.960032	0.861360	0.229298	0.954018	0.844116
0.600	0.182064	0.971023	0.878007	0.185931	0.966633	0.859747	0.189758	0.962085	0.842404
0.800	0.132579	0.978059	0.874905	0.135439	0.975137	0.856430	0.138265	0.971834	0.838926
1.000	0.102294	0.982320	0.872044	0.104534	0.980088	0.853355	0.106741	0.977572	0.835713
1.200	0.082191	0.985211	0.869538	0.084015	0.983412	0.850639	0.085806	0.981390	0.832908
1.400	0.068054	0.987314	0.867371	0.069581	0.985811	0.848337	0.071075	0.984126	0.830501
1.600	0.057868	0.988915	0.865489	0.058973	0.987628	0.846328	0.060247	0.986188	0.828434
1.800	0.049771	0.990174	0.863880	0.050906	0.989051	0.844596	0.052010	0.987798	0.826662
2.000	0.043598	0.991190	0.862429	0.044599	0.990195	0.843083	0.045570	0.989088	0.825124

TABLE D.2

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00		
C_D/r_D^2	=	0.002		0.002		0.002		0.002		
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+08		1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)				(ANALYSIS)		
0.200	0.523602	0.847969	0.835760	0.531936	0.826466	0.822666	0.539761	0.804624	0.810738	
0.300	0.377431	0.908138	0.831710	0.384186	0.892473	0.817087	0.390705	0.878138	0.803454	
0.400	0.290932	0.932505	0.829591	0.296374	0.922895	0.814360	0.301693	0.912665	0.800002	
0.500	0.233827	0.947362	0.827787	0.238285	0.940128	0.812279	0.242668	0.932379	0.797610	
0.600	0.193539	0.956825	0.825950	0.197266	0.951101	0.810343	0.200937	0.944954	0.795537	
0.800	0.141052	0.968180	0.822350	0.143797	0.964208	0.808647	0.146501	0.959943	0.791760	
1.000	0.108912	0.974798	0.819059	0.111045	0.971789	0.803324	0.113141	0.968565	0.788439	
1.200	0.087562	0.979186	0.816202	0.089284	0.976760	0.800465	0.090971	0.974189	0.785613	
1.400	0.072536	0.982279	0.813771	0.073965	0.980285	0.798050	0.076363	0.978158	0.783247	
1.600	0.061489	0.984614	0.811696	0.062701	0.982919	0.796006	0.063885	0.981114	0.781262	
1.800	0.053085	0.986430	0.809830	0.054131	0.984961	0.794281	0.055150	0.983400	0.779603	
2.000	0.046512	0.987883	0.808409	0.047427	0.986590	0.792807	0.048317	0.985219	0.778197	

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00		
C_D/r_D^2	=	0.002		0.002		0.002		0.002		
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+12		1.00E+14		
0.200	0.547094	0.782726	0.799872	0.560373	0.739608	0.780918	0.571980	0.698309	0.765071	
0.300	0.398982	0.863301	0.790750	0.408799	0.832703	0.767893	0.419648	0.801869	0.748040	
0.400	0.306883	0.901908	0.786473	0.316858	0.879166	0.761714	0.326279	0.855304	0.739719	
0.500	0.246970	0.924172	0.783714	0.255327	0.906606	0.758064	0.263343	0.887834	0.734988	
0.600	0.204551	0.938425	0.781483	0.211604	0.924372	0.755437	0.218423	0.909215	0.731854	
0.800	0.149164	0.955411	0.777628	0.154369	0.945635	0.751405	0.159426	0.935031	0.727573	
1.000	0.115202	0.965146	0.774335	0.119224	0.957783	0.748213	0.123126	0.949806	0.724504	
1.200	0.092827	0.971467	0.771568	0.095851	0.965821	0.745623	0.098968	0.959307	0.722133	
1.400	0.076732	0.975912	0.769276	0.079389	0.971100	0.743528	0.081951	0.965917	0.720279	
1.600	0.065041	0.979211	0.767372	0.067281	0.975145	0.741828	0.069434	0.970777	0.718817	
1.800	0.056144	0.981756	0.765796	0.058066	0.978251	0.740455	0.059909	0.974495	0.717675	
2.000	0.049185	0.983777	0.764475	0.050857	0.980709	0.739333	0.052458	0.977428	0.716773	

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.582139	0.659416	0.751719	0.598943	0.589397	0.730628	0.615073	0.515100	0.711469
0.300	0.429573	0.770934	0.730758	0.446896	0.712216	0.702431	0.464530	0.646235	0.675766
0.400	0.335145	0.830855	0.720151	0.351255	0.781828	0.687121	0.368574	0.723094	0.654835
0.500	0.271014	0.868214	0.714186	0.285319	0.827619	0.678378	0.301309	0.776680	0.642377
0.600	0.225009	0.893195	0.710429	0.237494	0.859403	0.673083	0.251825	0.815644	0.634778
0.800	0.164345	0.923730	0.705794	0.173808	0.899464	0.667368	0.184986	0.866952	0.627040
1.000	0.126922	0.941300	0.702835	0.134245	0.922962	0.664493	0.142983	0.898085	0.623886
1.200	0.101995	0.952586	0.700702	0.107826	0.938112	0.662812	0.114789	0.918429	0.622604
1.400	0.084433	0.960414	0.699110	0.089198	0.948592	0.661758	0.094875	0.932544	0.622164
1.600	0.071515	0.968149	0.697905	0.075498	0.956237	0.661087	0.080224	0.942819	0.622139
1.800	0.061685	0.970524	0.697007	0.065076	0.962040	0.660690	0.069084	0.950591	0.622357
2.000	0.053998	0.973966	0.696336	0.056929	0.966585	0.660484	0.060361	0.956654	0.622720

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		
C_D/r_D^2	=	0.002		0.002		
$C_D \exp(2s)$	=	1.00E+30		1.00E+40		
0.200	0.627516	0.452412	0.697361			
0.300	0.478656	0.589086	0.655823	0.499605	0.497191	0.628324
0.400	0.383159	0.669291	0.629908	0.406870	0.578466	0.594647
0.500	0.315333	0.727746	0.613808	0.338285	0.640348	0.572162
0.600	0.264780	0.772090	0.603720	0.286873	0.690477	0.557227
0.800	0.195476	0.833142	0.593393	0.214429	0.765325	0.540944
1.000	0.151324	0.871670	0.589495	0.166909	0.816518	0.534454
1.200	0.121477	0.897357	0.588328	0.134187	0.852401	0.532603
1.400	0.100328	0.915334	0.588351	0.110761	0.878251	0.532931
1.600	0.084753	0.928450	0.588897	0.093424	0.897390	0.534235
1.800	0.072911	0.938361	0.589689	0.080223	0.911937	0.535946
2.000	0.063666	0.946071	0.590590	0.069917	0.923261	0.537784

TABLE D.2v

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.464528	0.937132	0.943668	0.475375	0.922896	0.922136	0.486015	0.905693	0.901948
0.300	0.334739	0.957807	0.942147	0.342358	0.950457	0.921179	0.349958	0.941392	0.901176
0.400	0.257957	0.967959	0.940777	0.263771	0.963154	0.920042	0.269598	0.957315	0.900155
0.500	0.207192	0.973924	0.939506	0.211867	0.970442	0.918774	0.216559	0.966222	0.898666
0.600	0.171323	0.977925	0.938333	0.175219	0.975214	0.917469	0.179128	0.971936	0.897447
0.800	0.124546	0.983040	0.936313	0.127447	0.981172	0.914998	0.130352	0.978923	0.894608
1.000	0.095912	0.986233	0.934696	0.098208	0.984812	0.912850	0.100499	0.983104	0.892037
1.200	0.078924	0.988440	0.933381	0.078813	0.987294	0.911010	0.080692	0.985920	0.889791
1.400	0.063588	0.990063	0.932308	0.065186	0.989104	0.909449	0.066771	0.987956	0.887860
1.600	0.053805	0.991306	0.931416	0.055186	0.990483	0.908112	0.056551	0.989499	0.886193
1.800	0.046378	0.992289	0.930650	0.047590	0.991569	0.906944	0.048785	0.990709	0.884733
2.000	0.040580	0.993063	0.929980	0.041859	0.992444	0.905911	0.042718	0.991681	0.883441

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.496304	0.885299	0.883248	0.506160	0.862258	0.866051	0.515529	0.837213	0.850312
0.300	0.367474	0.930447	0.882327	0.364858	0.917769	0.864373	0.372071	0.903579	0.847617
0.400	0.275405	0.950236	0.881176	0.281158	0.941975	0.863143	0.286835	0.932637	0.846062
0.500	0.221244	0.961105	0.879832	0.225900	0.955125	0.861701	0.230508	0.948344	0.844476
0.600	0.183031	0.967967	0.878310	0.186910	0.963330	0.860082	0.190752	0.958072	0.842760
0.800	0.133245	0.976207	0.875184	0.136114	0.973044	0.856738	0.138950	0.969465	0.839252
1.000	0.102773	0.981049	0.872301	0.105020	0.978664	0.853637	0.107234	0.975973	0.836010
1.200	0.082550	0.984272	0.869765	0.084379	0.982363	0.850909	0.086176	0.980218	0.833168
1.400	0.068332	0.986582	0.867579	0.069863	0.984997	0.848563	0.071363	0.983220	0.830737
1.600	0.057890	0.988324	0.865692	0.059199	0.986972	0.846546	0.060477	0.985460	0.828659
1.800	0.049953	0.989684	0.864044	0.051091	0.988508	0.844784	0.052199	0.987196	0.826864
2.000	0.043751	0.990774	0.862592	0.044754	0.989735	0.843258	0.045727	0.988579	0.825303

TABLE D.2w

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09			
CYCLE LENGTH (Δt_c) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.524385	0.810777	0.835950	0.532721	0.783488	0.822870	0.540542	0.755807	0.810964
0.300	0.379083	0.888112	0.831937	0.385876	0.871599	0.817292	0.392436	0.854259	0.803630
0.400	0.292414	0.922336	0.829918	0.297684	0.911195	0.814680	0.303233	0.899320	0.800308
0.500	0.235056	0.940835	0.828136	0.239535	0.932669	0.812650	0.243940	0.923914	0.797975
0.600	0.194548	0.952244	0.826317	0.198292	0.945896	0.810715	0.201981	0.939076	0.795907
0.800	0.141748	0.985505	0.822688	0.144505	0.981198	0.806987	0.147221	0.956569	0.792097
1.000	0.109413	0.973004	0.819382	0.111555	0.969782	0.803629	0.113661	0.966329	0.788740
1.200	0.087939	0.977858	0.816468	0.089667	0.975303	0.800730	0.091362	0.972572	0.785873
1.400	0.072829	0.981271	0.814009	0.074284	0.979165	0.798285	0.075667	0.976920	0.783476
1.600	0.061724	0.983808	0.811921	0.062941	0.982023	0.796227	0.064129	0.980126	0.781477
1.800	0.053277	0.985763	0.810133	0.054327	0.984224	0.794478	0.055350	0.982587	0.779792
2.000	0.046673	0.987320	0.808587	0.047591	0.985968	0.792979	0.048485	0.984535	0.778361

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.002		0.002		0.002			
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
0.200	0.547862	0.728110	0.800128	0.581083	0.873803	0.781275	0.572578	0.822232	0.785590
0.300	0.398756	0.836291	0.790892	0.410667	0.799175	0.787954	0.421616	0.761452	0.748011
0.400	0.308456	0.886824	0.786758	0.318502	0.860368	0.781941	0.328003	0.832556	0.739871
0.500	0.248287	0.914635	0.784068	0.256676	0.894755	0.758381	0.264749	0.873483	0.735255
0.600	0.205614	0.931829	0.781845	0.212707	0.916216	0.755774	0.219569	0.899380	0.732153
0.800	0.149897	0.951649	0.777959	0.155130	0.941030	0.751716	0.160216	0.929506	0.727855
1.000	0.115732	0.962665	0.774829	0.119774	0.954771	0.748486	0.123697	0.946215	0.724749
1.200	0.093026	0.969679	0.771820	0.096265	0.963465	0.745852	0.099399	0.956749	0.722335
1.400	0.077042	0.974546	0.769496	0.079712	0.969461	0.743725	0.082287	0.963981	0.720449
1.600	0.065290	0.978124	0.767577	0.067540	0.973845	0.742009	0.069704	0.969247	0.718971
1.800	0.056349	0.980864	0.765976	0.058278	0.977188	0.740611	0.060130	0.973247	0.717804
2.000	0.049356	0.983027	0.764829	0.051036	0.979818	0.739463	0.052644	0.976385	0.716878

TABLE D.2x

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.002$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{40}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.002			0.002			0.002		
$C_D \exp(2s)$	1.00E+16			1.00E+20			1.00E+25		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR		TIME LAG FACTOR	AMPLITUDE FACTOR		TIME LAG FACTOR	AMPLITUDE FACTOR		TIME LAG FACTOR
(DESIGN)	(ANALYSIS)	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	(ANALYSIS)	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	(ANALYSIS)	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$
		t_{LO}/t_L			t_{LO}/t_L			t_{LO}/t_L	
0.200	0.582563	0.574285	0.752468	0.598798	0.490417	0.732069	0.613777	0.407119	0.714201
0.300	0.431642	0.724021	0.730836	0.449160	0.652368	0.702140	0.466980	0.571876	0.675346
0.400	0.336955	0.804001	0.720215	0.353254	0.746557	0.666985	0.370829	0.677395	0.654426
0.500	0.272481	0.851218	0.714390	0.286923	0.805048	0.678433	0.303107	0.746887	0.642210
0.600	0.226203	0.881528	0.710683	0.238788	0.843855	0.673226	0.253260	0.794943	0.634756
0.800	0.165165	0.917215	0.706044	0.174691	0.890803	0.667543	0.185954	0.855374	0.627110
1.000	0.127514	0.937086	0.703050	0.134883	0.917396	0.664642	0.143679	0.890666	0.623953
1.200	0.102442	0.949598	0.700874	0.108307	0.934190	0.662923	0.115314	0.913228	0.622640
1.400	0.084782	0.958160	0.699260	0.089574	0.945652	0.661839	0.095285	0.928664	0.622175
1.600	0.071795	0.964374	0.698030	0.075799	0.953932	0.661154	0.080553	0.939793	0.622138
1.800	0.061815	0.969080	0.697109	0.065324	0.960173	0.660735	0.069354	0.948150	0.622337
2.000	0.054191	0.972760	0.696414	0.057136	0.965032	0.660509	0.060607	0.954631	0.622682

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00		
C_D/r_D^2	0.002			0.002		
$C_D \exp(2s)$	1.00E+30			1.00E+40		
0.200	0.624644	0.343822	0.701776	0.501794	0.395028	0.628492
0.300	0.481177	0.502691	0.655421	0.408828	0.505895	0.593600
0.400	0.385673	0.613721	0.629236	0.340755	0.589730	0.571256
0.500	0.317345	0.690745	0.613396	0.288826	0.654002	0.556592
0.600	0.268373	0.746096	0.603508	0.215695	0.744233	0.540641
0.800	0.198535	0.818473	0.593349	0.167798	0.802873	0.534268
1.000	0.152062	0.862261	0.589479	0.134849	0.842845	0.532440
1.200	0.122046	0.890777	0.588294	0.111275	0.871183	0.532767
1.400	0.100771	0.910442	0.588297	0.093836	0.891902	0.534069
1.600	0.085109	0.924647	0.588834	0.080580	0.907542	0.535770
1.800	0.073204	0.935302	0.589610	0.070200	0.919648	0.537596
2.000	0.063911	0.943546	0.590495			

TABLE D.2₁

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 31.62			100.00			316.23		
C_D/r_D^2	= 0.004			0.004			0.004		
$C_D \exp(2s)$	= 1.00E+01			1.00E+02			1.00E+03		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.491187	0.859430	0.908972	0.511147	0.819984	0.873477	0.529792	0.772971	0.842737
0.300	0.351160	0.915652	0.903994	0.365681	0.895944	0.868098	0.379748	0.871735	0.835939
0.400	0.268945	0.939778	0.900147	0.280163	0.927111	0.864105	0.291174	0.911464	0.831426
0.500	0.215074	0.951069	0.898065	0.224128	0.941900	0.861785	0.233053	0.930563	0.828782
0.600	0.177299	0.959048	0.898021	0.184840	0.951915	0.859462	0.192278	0.943106	0.826216
0.800	0.128440	0.969057	0.892861	0.134020	0.964136	0.855682	0.139505	0.958089	0.822040
1.000	0.098726	0.974709	0.890856	0.103117	0.971195	0.852924	0.107397	0.966646	0.818931
1.200	0.079137	0.979131	0.889093	0.082709	0.976141	0.850697	0.086180	0.972497	0.816429
1.400	0.065398	0.982113	0.887907	0.068395	0.979624	0.848999	0.071292	0.976602	0.814503
1.600	0.055332	0.984386	0.887004	0.057901	0.982260	0.847647	0.060371	0.979687	0.812968
1.800	0.047696	0.986189	0.886281	0.049936	0.984339	0.846534	0.052078	0.982106	0.811711
2.000	0.041731	0.987401	0.885857	0.043710	0.985767	0.845759	0.045594	0.983800	0.810813

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.004			0.004			0.004		
$C_D \exp(2s)$	= 1.00E+04			1.00E+05			1.00E+06		
0.200	0.546786	0.720554	0.816545	0.562066	0.665587	0.794347	0.575699	0.610354	0.775536
0.300	0.393142	0.843550	0.807460	0.405754	0.812473	0.782362	0.417578	0.779740	0.760210
0.400	0.301840	0.893007	0.802047	0.312084	0.872293	0.775721	0.321669	0.849865	0.752139
0.500	0.241754	0.917129	0.798953	0.250182	0.901936	0.772038	0.258315	0.865325	0.747730
0.600	0.199542	0.932658	0.796139	0.206601	0.920810	0.768937	0.213445	0.907799	0.744281
0.800	0.144850	0.950942	0.791709	0.150042	0.942848	0.764313	0.155084	0.933950	0.739460
1.000	0.111548	0.961288	0.788458	0.115566	0.955238	0.761045	0.119459	0.948598	0.736242
1.200	0.089529	0.968225	0.785893	0.092756	0.963419	0.758548	0.095873	0.958162	0.733889
1.400	0.074071	0.973072	0.783937	0.076739	0.969115	0.756685	0.079306	0.964798	0.732191
1.600	0.062730	0.976693	0.782403	0.064984	0.973347	0.755259	0.067147	0.969706	0.730936
1.800	0.054114	0.979515	0.781168	0.056054	0.976827	0.754139	0.057908	0.973494	0.729987
2.000	0.047377	0.981625	0.780397	0.049069	0.978996	0.753386	0.050683	0.978258	0.729396

TABLE D.2x

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.004			0.004			0.004		
$C_D \exp(2s)$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.587815	0.558480	0.759550	0.598588	0.505038	0.745908	0.808100	0.458882	0.734214
0.300	0.428570	0.745888	0.740712	0.438774	0.711661	0.723485	0.448230	0.877842	0.708222
0.400	0.331181	0.826207	0.730990	0.340021	0.801732	0.711985	0.348399	0.778782	0.894885
0.500	0.286145	0.887601	0.725734	0.273689	0.849030	0.705779	0.280893	0.829841	0.687830
0.600	0.220074	0.893833	0.721864	0.228489	0.879098	0.701418	0.232895	0.863747	0.682711
0.800	0.159987	0.924389	0.718802	0.184758	0.914206	0.698044	0.189406	0.903548	0.876944
1.000	0.123240	0.941454	0.713658	0.128920	0.933873	0.692982	0.130511	0.925909	0.873898
1.200	0.098892	0.952518	0.711488	0.101825	0.948538	0.690991	0.104883	0.940263	0.872122
1.400	0.081785	0.960176	0.709993	0.084189	0.955289	0.689724	0.086527	0.950187	0.871088
1.600	0.069230	0.965818	0.708945	0.071244	0.961711	0.688902	0.073199	0.957417	0.870501
1.800	0.059890	0.970153	0.708187	0.051408	0.968833	0.688371	0.053075	0.962957	0.870194
2.000	0.052230	0.973344	0.707794	0.053719	0.970281	0.688168	0.055180	0.967086	0.870197

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.004			0.004			0.004		
$C_D \exp(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.200	0.816580	0.411780	0.724139	0.830770	0.332598	0.707825	0.842080	0.287103	0.895358
0.300	0.456983	0.844202	0.894857	0.472588	0.580124	0.871748	0.485901	0.520821	0.853315
0.400	0.356329	0.751655	0.879400	0.370911	0.701880	0.852889	0.383928	0.853147	0.830563
0.500	0.287819	0.810232	0.871082	0.300811	0.770404	0.842097	0.312714	0.730604	0.817857
0.600	0.238695	0.847928	0.865548	0.250098	0.815348	0.835204	0.280733	0.782170	0.808296
0.800	0.173939	0.892471	0.859303	0.182679	0.889322	0.827781	0.191008	0.845221	0.800392
1.000	0.134021	0.917610	0.858250	0.140825	0.900160	0.824542	0.147373	0.881798	0.888791
1.200	0.107477	0.933725	0.854653	0.112897	0.919982	0.823221	0.118132	0.905427	0.885805
1.400	0.088808	0.944837	0.853850	0.093229	0.933625	0.822843	0.097498	0.921777	0.885571
1.600	0.075103	0.952954	0.853499	0.078786	0.943579	0.822951	0.082336	0.933685	0.886095
1.800	0.064894	0.959141	0.853419	0.067818	0.951140	0.823316	0.070822	0.942709	0.886881
2.000	0.056558	0.963774	0.853828	0.059250	0.958843	0.823933	0.061831	0.949553	0.887889

TABLE D.2aa

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_{Dexp}(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$	1000.00			1000.00				1000.00		
$C_D/r_D^2 =$	0.004			0.004				0.004		
$C_{Dexp}(2s) =$	1.00E+16			1.00E+20				1.00E+25		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)			
0.200	0.651170	0.213771	0.685850							
0.300	0.497325	0.486842	0.638308	0.515591	0.374774	0.615895	0.532117	0.286037	0.596573	
0.400	0.395537	0.608860	0.612054	0.415154	0.522556	0.583133	0.434272	0.433457	0.557461	
0.500	0.323624	0.691688	0.596835	0.342705	0.617753	0.583604	0.362259	0.535129	0.533183	
0.600	0.270638	0.749006	0.586996	0.288443	0.684497	0.550781	0.307348	0.609472	0.516884	
0.800	0.198940	0.820552	0.576447	0.213681	0.770689	0.536682	0.230136	0.709659	0.498309	
1.000	0.163689	0.862758	0.572268	0.165686	0.823430	0.530894	0.179488	0.773553	0.490065	
1.200	0.123210	0.890263	0.571059	0.132953	0.858548	0.529209	0.144422	0.817404	0.487183	
1.400	0.101646	0.909389	0.571287	0.109651	0.883307	0.529565	0.119195	0.848977	0.487160	
1.600	0.085783	0.923337	0.572144	0.082445	0.901493	0.530912	0.100443	0.872502	0.486635	
1.800	0.073733	0.933901	0.573313	0.079356	0.915302	0.532691	0.086123	0.890520	0.490834	
2.000	0.064327	0.941949	0.574686	0.069138	0.925907	0.534699	0.074926	0.904503	0.493393	

TABLE D.2ab

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.478976	0.881176	0.911059	0.498227	0.844001	0.875857	0.515905	0.800723	0.845844
0.300	0.348217	0.912700	0.905519	0.362565	0.889973	0.869683	0.376390	0.862272	0.837739
0.400	0.269597	0.931838	0.901949	0.280794	0.916418	0.865982	0.291772	0.897377	0.833398
0.500	0.217170	0.943990	0.899241	0.226255	0.932601	0.863134	0.235218	0.918495	0.830243
0.600	0.179922	0.952412	0.897038	0.187513	0.943486	0.860723	0.195014	0.932437	0.827615
0.800	0.131094	0.963398	0.893708	0.136735	0.957255	0.856841	0.142295	0.949682	0.823361
1.000	0.101068	0.970320	0.891359	0.105503	0.965682	0.853888	0.109854	0.959988	0.820071
1.200	0.081101	0.975122	0.889663	0.084734	0.971417	0.851617	0.088259	0.966887	0.817507
1.400	0.067054	0.978652	0.888399	0.070097	0.975581	0.849833	0.073050	0.971840	0.815481
1.600	0.056739	0.981357	0.887437	0.059349	0.978744	0.848410	0.061868	0.975571	0.813860
1.800	0.048902	0.983491	0.886686	0.051178	0.981223	0.847253	0.053364	0.978478	0.812543
2.000	0.042782	0.985214	0.886082	0.044794	0.983216	0.846293	0.046717	0.980804	0.811453

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.531666	0.754101	0.820769	0.545486	0.707220	0.799976	0.557476	0.862266	0.782769
0.300	0.389451	0.830462	0.809644	0.401630	0.796021	0.785093	0.412884	0.760282	0.763694
0.400	0.302382	0.875009	0.804156	0.312537	0.850082	0.778028	0.322191	0.823355	0.754715
0.500	0.243960	0.901784	0.800491	0.252426	0.882926	0.773644	0.260587	0.862388	0.749416
0.600	0.202353	0.919315	0.797600	0.209494	0.904433	0.770412	0.216422	0.888105	0.745749
0.800	0.147728	0.940702	0.793077	0.153020	0.930506	0.765653	0.158169	0.919276	0.740725
1.000	0.114087	0.953283	0.789643	0.118196	0.945648	0.762192	0.122187	0.937274	0.737296
1.200	0.091681	0.961559	0.786994	0.094989	0.955546	0.759587	0.098192	0.948953	0.734813
1.400	0.075894	0.967456	0.784922	0.078832	0.962526	0.757592	0.081273	0.957136	0.732971
1.600	0.064283	0.971865	0.783286	0.066598	0.967712	0.756052	0.068825	0.963183	0.731592
1.800	0.055450	0.975282	0.781976	0.057441	0.971672	0.754865	0.059353	0.967825	0.730552
2.000	0.048544	0.978004	0.780909	0.050284	0.974883	0.753894	0.051947	0.971496	0.729759

TABLE D.2ac

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_{Dexp}(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_{Dexp}(2s)$	=	1.00E+07		1.00E+08		1.00E+09			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)				
0.200	0.567814	0.620649	0.768518	0.576693	0.582993	0.756685	0.584305	0.549548	0.746828
0.300	0.423219	0.724341	0.745044	0.432688	0.689006	0.728773	0.441280	0.654861	0.714551
0.400	0.331323	0.795504	0.733914	0.339928	0.767097	0.715335	0.348012	0.738604	0.698718
0.500	0.268427	0.840597	0.727527	0.275940	0.817930	0.707719	0.283123	0.794716	0.689764
0.600	0.223133	0.870618	0.723321	0.229624	0.852229	0.702873	0.235896	0.833164	0.684187
0.800	0.183184	0.907173	0.717963	0.188071	0.894330	0.697088	0.172837	0.880867	0.677865
1.000	0.126071	0.928248	0.714584	0.129858	0.918859	0.693744	0.133558	0.908578	0.674522
1.200	0.101300	0.941862	0.712265	0.104326	0.934337	0.691605	0.107280	0.926429	0.672561
1.400	0.083830	0.951353	0.710817	0.088312	0.945227	0.690176	0.088731	0.938798	0.671380
1.600	0.070974	0.958334	0.709438	0.073056	0.953209	0.689219	0.075081	0.947839	0.670634
1.800	0.061192	0.963675	0.708594	0.062970	0.959296	0.688588	0.064695	0.954715	0.670226
2.000	0.053544	0.967884	0.707990	0.055085	0.964080	0.688186	0.056577	0.960106	0.670034

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D^{exp}(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
0.200	0.590823	0.520256	0.738588	0.601175	0.473114	0.725871	0.608738	0.438960	0.716852
0.300	0.449112	0.622299	0.702089	0.462682	0.562776	0.681498	0.473856	0.511176	0.665428
0.400	0.355589	0.710397	0.683829	0.369300	0.655925	0.658442	0.381241	0.605202	0.637818
0.500	0.289978	0.771236	0.673458	0.302720	0.721300	0.645110	0.314223	0.678634	0.621490
0.600	0.241948	0.813626	0.667072	0.253399	0.773822	0.636926	0.263994	0.733988	0.611365
0.800	0.177487	0.866888	0.660104	0.186455	0.837782	0.628354	0.194992	0.807628	0.600846
1.000	0.137181	0.898067	0.656710	0.144216	0.875970	0.621673	0.150990	0.852753	0.598615
1.200	0.110171	0.918179	0.654912	0.115794	0.900792	0.623113	0.121237	0.882413	0.595137
1.400	0.091095	0.932099	0.653937	0.095687	0.917984	0.622559	0.100132	0.903042	0.594922
1.600	0.077056	0.942251	0.653447	0.080883	0.930495	0.622530	0.084580	0.918060	0.595316
1.800	0.068375	0.949954	0.653285	0.069622	0.939956	0.622797	0.072751	0.929399	0.596009
2.000	0.058028	0.955981	0.653284	0.060825	0.947334	0.623233	0.063514	0.938221	0.596855

TABLE D.2nd

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D		1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.614214	0.415057	0.710461						
0.300	0.483065	0.467222	0.652742	0.496996	0.399104	0.634446	0.508618	0.341937	0.619948
0.400	0.391618	0.558940	0.620920	0.408444	0.480241	0.595338	0.423866	0.405225	0.573678
0.500	0.324571	0.635481	0.601680	0.342175	0.557300	0.570726	0.359372	0.476547	0.543414
0.600	0.273759	0.694983	0.589557	0.290959	0.621627	0.554706	0.308599	0.541343	0.522998
0.800	0.203104	0.777052	0.576848	0.218070	0.716353	0.537259	0.234501	0.644459	0.499615
1.000	0.157545	0.828755	0.571824	0.169951	0.779581	0.530082	0.184171	0.718336	0.489154
1.200	0.126528	0.863241	0.570251	0.136701	0.823240	0.527812	0.148681	0.771785	0.485284
1.400	0.104461	0.887401	0.570265	0.112842	0.854457	0.527910	0.122868	0.811219	0.484834
1.600	0.088179	0.905034	0.571016	0.095160	0.877490	0.529131	0.103577	0.840919	0.486132
1.800	0.075791	0.918350	0.572103	0.081682	0.894965	0.530847	0.088804	0.863739	0.488272
2.000	0.066119	0.928696	0.573333	0.071156	0.908555	0.532749	0.077244	0.881609	0.490765

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.82	100.00	316.23			
C_D/r_D^2 =	0.004	0.004	0.004			
$C_D \exp(2s)$ =	1.00E+01	1.00E+02	1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.200	0.480873	0.892394	0.910022	0.500283	0.861734	0.874716
0.300	0.348842	0.925537	0.905081	0.361157	0.907194	0.869189
0.400	0.267893	0.941621	0.901610	0.278846	0.928855	0.865550
0.500	0.215316	0.951536	0.898928	0.224361	0.941880	0.862691
0.600	0.178256	0.958407	0.896781	0.185812	0.950699	0.860298
0.800	0.129823	0.967498	0.893475	0.135435	0.962080	0.858452
1.000	0.100100	0.973354	0.891181	0.104512	0.969184	0.853541
1.200	0.080348	0.977484	0.889489	0.083952	0.974118	0.851303
1.400	0.066454	0.980561	0.888251	0.069481	0.977751	0.849555
1.600	0.058250	0.982942	0.887300	0.058846	0.980537	0.848153
1.800	0.048496	0.984836	0.886565	0.050760	0.982740	0.847022
2.000	0.042440	0.986375	0.885978	0.044441	0.984523	0.846085

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, $r_D =$	1000.00	1000.00	1000.00
$C_D/r_D^2 =$	0.004	0.004	0.004
$C_D \exp(2s) =$	1.00E+04	1.00E+05	1.00E+06
0.200	0.534312	0.786575	0.819007
0.300	0.387961	0.859235	0.809137
0.400	0.300305	0.894662	0.803698
0.500	0.241951	0.915816	0.799973
0.600	0.200551	0.929872	0.797070
0.800	0.146351	0.947434	0.792573
1.000	0.113033	0.958038	0.789194
1.200	0.090858	0.965179	0.786595
1.400	0.075236	0.970328	0.784574
1.600	0.063745	0.974220	0.782973
1.800	0.055002	0.977260	0.781699
2.000	0.048165	0.979899	0.780668
0.200	0.548604	0.746334	0.797671
0.300	0.400105	0.831466	0.784577
0.400	0.310380	0.874127	0.777610
0.500	0.250343	0.899908	0.773154
0.600	0.207630	0.917080	0.769897
0.800	0.151595	0.938445	0.765154
1.000	0.117105	0.951218	0.761751
1.200	0.094136	0.959738	0.759203
1.400	0.077049	0.965034	0.757264
1.600	0.068040	0.970412	0.755763
1.800	0.058977	0.973972	0.754598
2.000	0.049889	0.976815	0.753679
0.200	0.561200	0.706687	0.778767
0.300	0.411341	0.802604	0.763147
0.400	0.319948	0.852141	0.754357
0.500	0.258423	0.882614	0.748982
0.600	0.214489	0.903069	0.745275
0.800	0.156694	0.928558	0.740258
1.000	0.121057	0.943728	0.736886
1.200	0.097307	0.953778	0.734463
1.400	0.080584	0.960925	0.732679
1.600	0.068245	0.966264	0.731342
1.800	0.058870	0.970398	0.730342
2.000	0.051537	0.973689	0.729585

**CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/\tau_D^2 = 0.004$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}**

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =				1000.00				1000.00					
C_D/r_D^2 =				0.004				0.004					
$C_D \exp(2a)$ =				1.00E+07				1.00E+08					
CYCLE LENGTH		AMPLITUDE FACTOR		TIME LAG FACTOR		AMPLITUDE FACTOR		TIME LAG FACTOR		AMPLITUDE FACTOR		TIME LAG FACTOR	
$(\Delta t_c)_D/r_D^2$		$t_L/\Delta t_c$ $\Delta p/\Delta p_0$		t_{L0}/t_L		$t_L/\Delta t_c$ $\Delta p/\Delta p_0$		t_{L0}/t_L		$t_L/\Delta t_c$ $\Delta p/\Delta p_0$		t_{L0}/t_L	
(DESIGN)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.200	0.572282	0.668605	0.764667	0.582044	0.632578	0.761842	0.590671	0.598779	0.740861				
0.300	0.421679	0.773474	0.744436	0.431161	0.744688	0.728066	0.439840	0.716671	0.713699				
0.400	0.328990	0.829255	0.733623	0.337508	0.805929	0.715113	0.345505	0.782535	0.698557				
0.500	0.266175	0.864295	0.727168	0.273595	0.845271	0.707448	0.280681	0.825816	0.689587				
0.600	0.221125	0.888087	0.722910	0.227536	0.872357	0.702539	0.233724	0.856073	0.683941				
0.800	0.161855	0.917916	0.717541	0.166485	0.906637	0.696723	0.171192	0.894825	0.677567				
1.000	0.124899	0.935664	0.714217	0.128643	0.927104	0.693429	0.132300	0.918113	0.674283				
1.200	0.100383	0.947374	0.711960	0.103375	0.940584	0.691351	0.106295	0.933454	0.672362				
1.400	0.083094	0.955662	0.710373	0.085550	0.950092	0.689983	0.087941	0.944251	0.671221				
1.600	0.070372	0.961827	0.709236	0.072432	0.957140	0.689069	0.074434	0.952233	0.670539				
1.800	0.060690	0.966583	0.708453	0.062449	0.962560	0.688479	0.064155	0.958355	0.670171				
2.000	0.053118	0.970357	0.707865	0.054643	0.966850	0.688113	0.056119	0.963169	0.670014				

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.004			0.004			0.004		
$C_D \exp(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.200	0.598330	0.567191	0.731377	0.611297	0.510125	0.715863	0.621852	0.460054	0.703712
0.300	0.447779	0.689699	0.701045	0.481692	0.639444	0.679919	0.473391	0.594335	0.683117
0.400	0.353004	0.759364	0.683718	0.366590	0.714514	0.658379	0.378468	0.672489	0.637716
0.500	0.287437	0.806164	0.673380	0.299980	0.767012	0.645222	0.311296	0.728973	0.621768
0.600	0.239686	0.839411	0.666921	0.250955	0.805539	0.636980	0.261358	0.771727	0.611627
0.800	0.175781	0.882576	0.659878	0.164618	0.857095	0.628289	0.193015	0.830793	0.600956
1.000	0.135877	0.908746	0.656512	0.142819	0.889075	0.624604	0.149502	0.868439	0.596682
1.200	0.109151	0.926020	0.654768	0.114701	0.910366	0.623084	0.120070	0.893834	0.595222
1.400	0.090277	0.936167	0.653653	0.094811	0.925358	0.622583	0.099198	0.911808	0.595050
1.600	0.076385	0.947129	0.653406	0.080165	0.936397	0.622585	0.083816	0.925053	0.595479
1.800	0.065816	0.953987	0.653264	0.069024	0.944819	0.622899	0.072114	0.935144	0.596209
2.000	0.057553	0.959391	0.653317	0.060318	0.951432	0.623371	0.062973	0.943049	0.597084

TABLE D.2ag

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.630624	0.415683	0.693924						
0.300	0.483302	0.554085	0.649518	0.499110	0.485849	0.628947	0.513740	0.417864	0.611036
0.400	0.388854	0.633754	0.620683	0.405966	0.566187	0.594521	0.422223	0.497829	0.571629
0.500	0.321477	0.692757	0.602077	0.338852	0.627073	0.571206	0.356021	0.557945	0.543659
0.600	0.270931	0.738683	0.590016	0.287774	0.676623	0.555483	0.305075	0.608459	0.523980
0.800	0.200980	0.804170	0.577142	0.215632	0.751501	0.537925	0.231657	0.689383	0.500713
1.000	0.155944	0.847141	0.572034	0.188124	0.803618	0.530591	0.182032	0.749847	0.490051
1.200	0.125284	0.876607	0.570451	0.135293	0.840725	0.528247	0.147046	0.794711	0.486026
1.400	0.103488	0.897633	0.570494	0.111725	0.867809	0.528333	0.121582	0.828743	0.485500
1.600	0.087367	0.913176	0.571274	0.094249	0.888076	0.529560	0.102536	0.854791	0.486762
1.800	0.075115	0.925032	0.572393	0.080925	0.903609	0.531296	0.087943	0.875036	0.488897
2.000	0.065546	0.934291	0.573650	0.070516	0.915779	0.533218	0.076518	0.891022	0.491395

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.481509	0.871508	0.910389	0.500928	0.832772	0.875098	0.518846	0.787389	0.844875
0.300	0.348395	0.912889	0.905217	0.362755	0.890582	0.889384	0.376598	0.863653	0.837426
0.400	0.269128	0.933268	0.901735	0.280313	0.918487	0.885747	0.291278	0.900247	0.833156
0.500	0.218515	0.945850	0.899052	0.225586	0.934759	0.882900	0.234531	0.921278	0.829987
0.600	0.179243	0.954001	0.896873	0.186820	0.945481	0.880497	0.194303	0.934894	0.827357
0.800	0.130503	0.964711	0.893570	0.136131	0.958817	0.858630	0.141875	0.951554	0.823109
1.000	0.100588	0.971399	0.891248	0.105012	0.966936	0.853702	0.109349	0.961461	0.819845
1.200	0.080713	0.976017	0.889559	0.084327	0.972446	0.851440	0.087850	0.968081	0.817295
1.400	0.066737	0.979410	0.888311	0.069772	0.976445	0.849676	0.072715	0.972834	0.815292
1.600	0.056476	0.982007	0.887365	0.059079	0.979481	0.848273	0.061589	0.976416	0.813694
1.800	0.048681	0.984058	0.886620	0.050951	0.981864	0.847127	0.053129	0.979209	0.812392
2.000	0.042594	0.985714	0.886019	0.044600	0.983779	0.846173	0.046516	0.981444	0.811312

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.534934	0.737962	0.819465	0.549171	0.687482	0.798221	0.561669	0.638118	0.780460
0.300	0.389689	0.832684	0.809285	0.401914	0.799071	0.784678	0.413237	0.704079	0.763170
0.400	0.301873	0.878825	0.803916	0.312011	0.854951	0.777792	0.321851	0.829346	0.754483
0.500	0.243252	0.905318	0.800233	0.251692	0.887318	0.773397	0.259825	0.867724	0.749190
0.600	0.201620	0.922355	0.797332	0.208736	0.908143	0.770151	0.215636	0.892562	0.745506
0.800	0.147089	0.942948	0.792810	0.152359	0.933183	0.765387	0.157486	0.922438	0.740472
1.000	0.113566	0.954999	0.789403	0.117657	0.947887	0.761955	0.121628	0.939652	0.737073
1.200	0.091258	0.962951	0.786772	0.094551	0.957187	0.758372	0.097737	0.950828	0.734615
1.400	0.075547	0.968607	0.784727	0.078272	0.963857	0.757408	0.080900	0.958667	0.732805
1.600	0.063994	0.972838	0.783117	0.066299	0.968831	0.755896	0.068514	0.964465	0.731456
1.800	0.055208	0.976120	0.781824	0.057190	0.972871	0.754711	0.059090	0.968922	0.730437
2.000	0.048336	0.978737	0.780770	0.050067	0.975720	0.753771	0.051721	0.972449	0.729659

TABLE D.2*ai*

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)				
0.200	0.572598	0.591223	0.765566	0.582140	0.547535	0.753015	0.590479	0.507371	0.742380
0.300	0.423666	0.728692	0.744392	0.433237	0.693685	0.727948	0.442003	0.659586	0.713510
0.400	0.330772	0.802644	0.733678	0.339372	0.775376	0.715085	0.347461	0.747975	0.698438
0.500	0.267635	0.846942	0.727327	0.275117	0.825330	0.707548	0.282270	0.803197	0.689617
0.600	0.222316	0.875888	0.723106	0.228775	0.858359	0.702892	0.235012	0.840199	0.684042
0.800	0.162475	0.910863	0.717733	0.167336	0.898589	0.696886	0.172074	0.885730	0.677696
1.000	0.125492	0.930999	0.714382	0.129258	0.921809	0.693567	0.132937	0.912153	0.674373
1.200	0.100829	0.944015	0.712089	0.103838	0.936788	0.691455	0.106774	0.929197	0.672438
1.400	0.083442	0.953101	0.710476	0.085911	0.947209	0.690061	0.088315	0.941028	0.671273
1.600	0.070651	0.959793	0.709328	0.072721	0.954857	0.689136	0.074734	0.949688	0.670581
1.800	0.060919	0.964919	0.708505	0.062687	0.960696	0.688527	0.064402	0.956282	0.670195
2.000	0.053310	0.968962	0.707917	0.054842	0.965291	0.688142	0.056325	0.961457	0.670019

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
0.200	0.597778	0.470779	0.733316	0.609810	0.407763	0.718846	0.619172	0.356759	0.707978
0.300	0.450021	0.626757	0.700798	0.464054	0.565706	0.679605	0.475802	0.511283	0.662825
0.400	0.355053	0.720779	0.683503	0.368835	0.667982	0.657964	0.380909	0.618339	0.637108
0.500	0.289096	0.780803	0.673333	0.301792	0.736077	0.645007	0.313273	0.692462	0.621368
0.600	0.241029	0.821596	0.666967	0.252408	0.783711	0.636898	0.262934	0.745793	0.611401
0.800	0.176695	0.872386	0.659971	0.185601	0.844607	0.628303	0.194071	0.815895	0.600882
1.000	0.136537	0.902090	0.656592	0.143525	0.880948	0.624623	0.150257	0.858754	0.596638
1.200	0.109648	0.921281	0.654818	0.115233	0.904606	0.623079	0.120637	0.886990	0.595165
1.400	0.090665	0.934589	0.653879	0.095226	0.921028	0.622557	0.099640	0.906681	0.594976
1.600	0.078696	0.944309	0.653422	0.080498	0.932999	0.622561	0.084170	0.921042	0.595399
1.800	0.068071	0.951695	0.653263	0.069297	0.942066	0.622650	0.072405	0.931903	0.596116
2.000	0.057767	0.957480	0.653298	0.060547	0.949144	0.623306	0.063217	0.940383	0.596977

TABLE D.2aj

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.004$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.626546	0.315710	0.899645						
0.300	0.485673	0.463371	0.649353	0.501095	0.384886	0.629368	0.514691	0.312602	0.612743
0.400	0.391481	0.572471	0.619903	0.408888	0.492490	0.593512	0.425293	0.412564	0.570618
0.500	0.323628	0.650777	0.601488	0.341356	0.574778	0.570250	0.358926	0.494393	0.542335
0.600	0.272641	0.708625	0.589634	0.289774	0.638472	0.554771	0.307460	0.560838	0.522859
0.800	0.202112	0.786791	0.576975	0.216936	0.729060	0.537549	0.233206	0.660634	0.500046
1.000	0.158750	0.835833	0.571925	0.169038	0.788931	0.530347	0.183099	0.730617	0.489620
1.200	0.125888	0.868627	0.570342	0.135973	0.830353	0.528038	0.147830	0.781206	0.485690
1.400	0.103938	0.891667	0.570374	0.112252	0.860069	0.528130	0.122184	0.818651	0.485200
1.600	0.087744	0.908521	0.571151	0.094671	0.882055	0.529361	0.103015	0.846946	0.486482
1.800	0.075423	0.921269	0.572258	0.081270	0.898771	0.531091	0.088334	0.868746	0.488617
2.000	0.065804	0.931188	0.573503	0.070804	0.911791	0.533003	0.076844	0.885850	0.491112

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.82			100.00			318.23		
C_D/r_D^2 =	0.007			0.007			0.007		
$C_D \exp(2s)$ =	1.00E+01			1.00E+02			1.00E+03		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$			TIME LAG FACTOR t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.510483	0.758622	0.874648	0.540181	0.680584	0.828529	0.565577	0.595014	0.789416
0.300	0.367507	0.851191	0.863784	0.390443	0.808055	0.813043	0.411456	0.757560	0.771521
0.400	0.282574	0.891818	0.856732	0.300783	0.862740	0.804866	0.317948	0.828009	0.761412
0.500	0.228533	0.912432	0.852835	0.241414	0.891081	0.800077	0.255630	0.865139	0.755585
0.600	0.187052	0.926653	0.849299	0.199513	0.909884	0.796256	0.211482	0.889382	0.751192
0.800	0.135750	0.944458	0.844776	0.144976	0.932815	0.791021	0.153841	0.918629	0.745437
1.000	0.104426	0.954934	0.842234	0.111641	0.948342	0.787802	0.118529	0.935670	0.742024
1.200	0.083720	0.962596	0.840425	0.089558	0.955568	0.785640	0.095103	0.947070	0.739829
1.400	0.069177	0.967960	0.839404	0.074043	0.962144	0.784238	0.078634	0.955141	0.738449
1.600	0.058513	0.972048	0.838788	0.062857	0.967111	0.783306	0.066542	0.961189	0.737574
1.800	0.050419	0.975278	0.838418	0.054010	0.971006	0.782673	0.057358	0.965899	0.737020
2.000	0.044095	0.977643	0.838387	0.047250	0.973892	0.782390	0.050173	0.969424	0.736818

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.007			0.007			0.007		
$C_D \exp(2s)$ =	1.00E+04			1.00E+05			1.00E+06		
0.250	0.497969	0.629580	0.747364	0.515222	0.563823	0.722338	0.529936	0.501869	0.702281
0.300	0.430220	0.703044	0.737871	0.448787	0.647754	0.710510	0.461336	0.593843	0.688103
0.400	0.333826	0.789257	0.725199	0.348368	0.748409	0.694926	0.361822	0.706966	0.669457
0.500	0.269014	0.835708	0.717992	0.281527	0.804042	0.686079	0.293179	0.771162	0.658812
0.600	0.222854	0.865947	0.712857	0.233614	0.840432	0.680024	0.243771	0.813565	0.651690
0.800	0.182311	0.902321	0.706539	0.170407	0.884368	0.672970	0.178158	0.865239	0.643692
1.000	0.125095	0.923408	0.703076	0.131379	0.909894	0.669446	0.137421	0.895386	0.640010
1.200	0.100385	0.937339	0.701041	0.105389	0.926029	0.667623	0.110218	0.915127	0.638371
1.400	0.082967	0.947151	0.699880	0.087089	0.938377	0.666756	0.091042	0.928966	0.637804
1.600	0.070190	0.954455	0.699245	0.073646	0.947080	0.666434	0.076950	0.939185	0.637816
1.800	0.060481	0.960110	0.698933	0.063431	0.953786	0.666431	0.066242	0.947030	0.638144
2.000	0.052890	0.964374	0.698958	0.055446	0.958873	0.666744	0.057874	0.953007	0.638763

TABLE D.2a1

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_{Dexp}(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.007		0.007		0.007			
$C_{Dexp}(2s)$	=	1.00E+07		1.00E+08		1.00E+09			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.542477	0.444971	0.686046	0.553181	0.393583	0.672771	0.562343	0.347685	0.661809
0.300	0.474085	0.542613	0.669598	0.485256	0.494768	0.654184	0.495052	0.450610	0.641238
0.400	0.373662	0.665945	0.647885	0.384586	0.626075	0.629481	0.394495	0.587815	0.613670
0.500	0.304001	0.737857	0.635359	0.314053	0.704815	0.615024	0.323355	0.672282	0.597331
0.600	0.253344	0.785934	0.627066	0.262355	0.758003	0.605529	0.270828	0.730132	0.586585
0.800	0.185586	0.845210	0.617929	0.192706	0.824579	0.595097	0.199530	0.803580	0.574744
1.000	0.143252	0.880094	0.613960	0.148892	0.864188	0.590704	0.154353	0.847816	0.569803
1.200	0.114887	0.902974	0.612430	0.119418	0.890282	0.589189	0.123630	0.877145	0.568198
1.400	0.094861	0.919022	0.612131	0.098569	0.908622	0.589101	0.102185	0.897830	0.568253
1.600	0.080135	0.930851	0.612466	0.083225	0.922137	0.589727	0.086237	0.913088	0.569126
1.800	0.068946	0.939908	0.613133	0.071563	0.932489	0.590696	0.074112	0.924740	0.570381
2.000	0.060204	0.946835	0.614049	0.062454	0.940397	0.591921	0.064642	0.933720	0.571888

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.007		0.007		0.007			
$C_{Dexp}(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
0.250	0.570318	0.306994	0.052070	0.683914	0.239535	0.639454	0.592561	0.187550	0.628060
0.300	0.503659	0.410188	0.630281	0.517927	0.340037	0.612918	0.529111	0.282627	0.599962
0.400	0.403484	0.551438	0.599999	0.419058	0.484813	0.577701	0.431943	0.426403	0.560467
0.500	0.331971	0.640640	0.581828	0.347342	0.580767	0.556080	0.360544	0.526048	0.535719
0.600	0.278790	0.702596	0.569832	0.293314	0.649426	0.541615	0.306116	0.599329	0.518964
0.800	0.208083	0.782370	0.550522	0.218319	0.740173	0.525280	0.229535	0.698874	0.499613
1.000	0.159645	0.831109	0.550915	0.169741	0.797136	0.518149	0.179208	0.763025	0.490776
1.200	0.128132	0.863647	0.549123	0.136430	0.835867	0.515724	0.144340	0.807480	0.487461
1.400	0.105722	0.886702	0.549243	0.112587	0.863632	0.515753	0.119200	0.839778	0.487139
1.600	0.089186	0.903744	0.550311	0.094925	0.884297	0.517041	0.100487	0.864041	0.488423
1.800	0.076805	0.918773	0.551817	0.081461	0.900148	0.518928	0.086179	0.882760	0.490515
2.000	0.068779	0.928826	0.553584	0.070938	0.912452	0.521132	0.074981	0.897389	0.493030

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.007		0.007		0.007	
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		
0.250	0.600056	0.147627	0.620216				
0.300	0.537992	0.235684	0.590058	0.550975	0.166822	0.576154	0.561586
0.400	0.442862	0.375692	0.546896	0.459185	0.294090	0.527216	0.473488
0.500	0.371910	0.476650	0.519346	0.390239	0.392872	0.494954	0.407043
0.600	0.317419	0.552860	0.500485	0.336270	0.471090	0.472427	0.354354
0.800	0.239788	0.659102	0.478250	0.257725	0.585497	0.444965	0.276083
1.000	0.188072	0.729340	0.467646	0.204098	0.664726	0.430925	0.221262
1.200	0.151873	0.778929	0.463282	0.165837	0.722667	0.424273	0.181324
1.400	0.125574	0.815463	0.462413	0.137613	0.766536	0.421960	0.151337
1.600	0.105890	0.843201	0.463498	0.116239	0.800592	0.422233	0.128298
1.800	0.090786	0.864763	0.465627	0.099694	0.827533	0.424018	0.110254
2.000	0.078938	0.881739	0.468317	0.086639	0.849092	0.426689	0.095886

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.007		0.007		0.007			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.496335	0.800591	0.879194	0.524203	0.732228	0.832455	0.547157	0.661606	0.797532
0.300	0.363757	0.847675	0.866833	0.366130	0.799927	0.816608	0.406293	0.745277	0.776082
0.400	0.282916	0.879231	0.859485	0.300993	0.844811	0.807867	0.317933	0.803845	0.764823
0.500	0.228559	0.900089	0.854433	0.243474	0.873864	0.802090	0.257708	0.842114	0.757789
0.600	0.189722	0.914816	0.850899	0.202282	0.893925	0.797881	0.214364	0.866448	0.752911
0.800	0.138540	0.934297	0.845876	0.147898	0.919743	0.792168	0.156924	0.901952	0.746804
1.000	0.106913	0.946694	0.842630	0.114242	0.935696	0.788570	0.121282	0.922291	0.742799
1.200	0.085820	0.955327	0.840747	0.091771	0.948573	0.786220	0.097453	0.935949	0.740366
1.400	0.070954	0.961687	0.839572	0.075920	0.954489	0.784651	0.080629	0.945744	0.738820
1.600	0.060025	0.966564	0.838648	0.064256	0.960456	0.783594	0.068246	0.953103	0.737805
1.800	0.051717	0.970413	0.838415	0.055388	0.965143	0.782880	0.058821	0.958621	0.737156
2.000	0.045226	0.973522	0.838170	0.048452	0.968905	0.782399	0.051453	0.963364	0.736754

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=			0.007		0.007			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.250	0.485068	0.842726	0.755235	0.501115	0.584846	0.732407	0.513555	0.533779	0.714665
0.300	0.423926	0.688463	0.743802	0.439101	0.633344	0.718096	0.452052	0.582201	0.697523
0.400	0.333451	0.758968	0.729230	0.347479	0.712820	0.699791	0.360052	0.667346	0.675353
0.500	0.271065	0.806408	0.720447	0.283479	0.768506	0.686897	0.294940	0.729844	0.662128
0.600	0.225845	0.839404	0.714635	0.236688	0.808006	0.681895	0.246886	0.775287	0.653729
0.800	0.165572	0.881460	0.707607	0.173854	0.858959	0.673698	0.181789	0.834983	0.644462
1.000	0.128018	0.906854	0.703714	0.134464	0.889816	0.669878	0.140716	0.871524	0.640211
1.200	0.102865	0.923746	0.701429	0.108050	0.910284	0.667773	0.113047	0.895805	0.638253
1.400	0.085093	0.935757	0.700067	0.089353	0.924764	0.666692	0.093450	0.912950	0.637464
1.600	0.072005	0.944714	0.699279	0.075579	0.935505	0.666212	0.079006	0.925624	0.637315
1.800	0.062044	0.951632	0.698863	0.065096	0.943760	0.666101	0.068013	0.935332	0.637535
2.000	0.054256	0.957124	0.698691	0.056901	0.950286	0.666221	0.059420	0.942979	0.637970

TABLE D.200

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_{Dexp}(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.007		0.007		0.007			
$C_{Dexp}(2s)$	=	1.00E+07		1.00E+08		1.00E+09			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.523750	0.489987	0.700753	0.532112	0.453108	0.689742	0.538987	0.422409	0.680944
0.300	0.483081	0.536101	0.680940	0.472408	0.495328	0.667466	0.480352	0.459713	0.656429
0.400	0.371263	0.623827	0.654960	0.381226	0.583024	0.637843	0.390065	0.545319	0.623389
0.500	0.305489	0.691505	0.639305	0.315107	0.654258	0.619752	0.323903	0.618607	0.602921
0.600	0.256442	0.742085	0.629368	0.265369	0.709054	0.608197	0.273686	0.676686	0.589714
0.800	0.189391	0.810018	0.618614	0.198667	0.784469	0.595727	0.203621	0.758673	0.575382
1.000	0.146740	0.852280	0.613929	0.152573	0.832267	0.590458	0.158224	0.811758	0.569370
1.200	0.117889	0.880493	0.612035	0.122600	0.864498	0.588522	0.127192	0.847954	0.567272
1.400	0.097416	0.900446	0.611506	0.101278	0.887355	0.588191	0.105051	0.873763	0.567064
1.600	0.082317	0.915177	0.611680	0.085537	0.904237	0.588658	0.088682	0.892864	0.567780
1.800	0.070824	0.926433	0.612231	0.073552	0.917122	0.589526	0.076213	0.907445	0.568939
2.000	0.061842	0.935276	0.612985	0.064187	0.927228	0.590591	0.066471	0.918669	0.570300

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.004		0.004		0.004			
$C_{Dexp}(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
0.250	0.544657	0.397043	0.673855	0.553247	0.359094	0.663393	0.559190	0.333750	0.656342
0.300	0.487115	0.428848	0.647315	0.497837	0.379330	0.633374	0.505760	0.342746	0.623451
0.400	0.397901	0.510823	0.611113	0.411024	0.451220	0.591601	0.421400	0.402855	0.577035
0.500	0.331921	0.584895	0.588356	0.345864	0.523824	0.564639	0.357411	0.471275	0.546396
0.600	0.281418	0.645341	0.573511	0.295246	0.586598	0.546651	0.307115	0.533862	0.525526
0.800	0.210258	0.732929	0.557220	0.222598	0.662473	0.528330	0.233738	0.634440	0.501246
1.000	0.163697	0.790928	0.550333	0.174117	0.748947	0.517399	0.183837	0.707448	0.490044
1.200	0.131676	0.830980	0.547957	0.140331	0.796186	0.514158	0.148578	0.760914	0.485621
1.400	0.108748	0.859748	0.547787	0.115939	0.830717	0.513809	0.122880	0.800806	0.484788
1.600	0.091767	0.881109	0.548695	0.097787	0.856632	0.514915	0.103639	0.831154	0.485840
1.800	0.078821	0.897437	0.550112	0.083915	0.876546	0.516719	0.088882	0.854678	0.487842
2.000	0.068706	0.910228	0.551747	0.073067	0.892181	0.516820	0.077321	0.873239	0.490274

TABLE D.2ap

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_{Dexp}(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.007		0.007		0.007		0.007	
$C_{Dexp}(2s)$	=	1.00E+16		1.00E+20		1.00E+25		1.00E+25	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.563342	0.317214	0.651504						
0.300	0.511701	0.315683	0.616213	0.519683	0.280462	0.606748	0.525321	0.257049	0.600237
0.400	0.429666	0.363861	0.565933	0.441709	0.306978	0.550504	0.451396	0.261906	0.538690
0.500	0.366995	0.426623	0.532127	0.381678	0.357089	0.511657	0.394238	0.297394	0.495356
0.600	0.317288	0.487269	0.506676	0.333515	0.411002	0.483926	0.348107	0.341339	0.463641
0.800	0.243751	0.589598	0.480854	0.260760	0.510608	0.449302	0.277334	0.431258	0.422450
1.000	0.192862	0.667232	0.467110	0.208909	0.592611	0.431230	0.225548	0.512243	0.399419
1.200	0.156409	0.725827	0.461306	0.170807	0.658159	0.422421	0.186467	0.581241	0.386945
1.400	0.129572	0.770498	0.459749	0.142180	0.710323	0.418982	0.156409	0.638946	0.380866
1.600	0.109336	0.805010	0.460523	0.120259	0.751970	0.418697	0.132940	0.686893	0.378758
1.800	0.093746	0.832053	0.462532	0.103180	0.785428	0.420241	0.114371	0.726685	0.379122
2.000	0.081498	0.853545	0.465148	0.089660	0.812517	0.422804	0.099494	0.759759	0.381013

TABLE D.2a_q

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_{Dexp}(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62			100.00			316.23		
C_D/r_D^2 =	0.007			0.007			0.007		
$C_{Dexp}(2s)$ =	1.00E+01			1.00E+02			1.00E+03		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.498965	0.816558	0.877028	0.527419	0.757930	0.829710	0.551293	0.695316	0.793780
0.300	0.362448	0.869671	0.866093	0.384787	0.830918	0.815811	0.404942	0.786484	0.775208
0.400	0.280945	0.898549	0.859083	0.298923	0.868083	0.807416	0.315741	0.834270	0.764408
0.500	0.226607	0.913580	0.854139	0.241428	0.891412	0.801711	0.255538	0.864838	0.757436
0.600	0.187956	0.925586	0.850482	0.200430	0.907609	0.797552	0.212405	0.885734	0.752586
0.800	0.137182	0.941690	0.845545	0.146474	0.928855	0.791908	0.155419	0.913191	0.746328
1.000	0.105874	0.952167	0.842555	0.113151	0.942315	0.788371	0.120128	0.930328	0.742586
1.200	0.085010	0.959587	0.840708	0.090919	0.951664	0.786068	0.096549	0.942081	0.740226
1.400	0.070308	0.965128	0.839583	0.075239	0.958545	0.784540	0.079907	0.950599	0.738709
1.600	0.059499	0.969419	0.838853	0.063702	0.963818	0.783508	0.067655	0.957083	0.737724
1.800	0.051280	0.972834	0.838437	0.054923	0.967980	0.782820	0.058329	0.962165	0.737106
2.000	0.044858	0.975611	0.838208	0.048060	0.971343	0.782362	0.051037	0.966246	0.736731

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.007			0.007			0.007		
$C_{Dexp}(2s)$ =	1.00E+04			1.00E+05			1.00E+06		
0.250	0.486569	0.697247	0.753003	0.502311	0.647124	0.729405	0.515553	0.600927	0.710871
0.300	0.422827	0.739995	0.742767	0.437946	0.694363	0.716785	0.451155	0.651241	0.695800
0.400	0.331128	0.797275	0.728886	0.345033	0.759226	0.699514	0.357508	0.721654	0.675107
0.500	0.268754	0.834598	0.720189	0.281015	0.802777	0.688767	0.292318	0.770371	0.662135
0.600	0.223782	0.860855	0.714389	0.234488	0.834023	0.681771	0.244517	0.806125	0.653752
0.800	0.163976	0.895193	0.707384	0.172157	0.875449	0.673766	0.179984	0.854458	0.644466
1.000	0.126793	0.916541	0.703546	0.133184	0.901350	0.669787	0.139336	0.885061	0.640214
1.200	0.101906	0.931046	0.701316	0.107031	0.918911	0.667732	0.111967	0.905873	0.638296
1.400	0.084325	0.941516	0.700005	0.088537	0.931529	0.666703	0.092585	0.920806	0.637555
1.600	0.071377	0.949410	0.699252	0.074912	0.940995	0.666258	0.078299	0.931974	0.637440
1.800	0.061521	0.955559	0.698869	0.064540	0.948334	0.666179	0.067423	0.940803	0.637691
2.000	0.053813	0.960474	0.698724	0.056430	0.954175	0.666327	0.058921	0.947448	0.638153

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.007			0.007			0.007		
$C_D \exp(2s)$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LU}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.528750	0.558971	0.895663	0.536299	0.521028	0.683179	0.544520	0.486659	0.672864
0.300	0.482547	0.611356	0.678662	0.472408	0.574862	0.664497	0.480990	0.541608	0.652641
0.400	0.368654	0.685535	0.654692	0.378603	0.651417	0.837489	0.387484	0.619545	0.622877
0.500	0.302692	0.738261	0.639441	0.312187	0.707056	0.619994	0.320861	0.677150	0.603234
0.600	0.253918	0.777873	0.629548	0.262686	0.749812	0.808533	0.270847	0.722348	0.590198
0.800	0.187471	0.832842	0.618729	0.194625	0.810358	0.595985	0.201453	0.787906	0.575786
1.000	0.145277	0.867930	0.614035	0.151022	0.850172	0.590678	0.158581	0.831983	0.569705
1.400	0.096501	0.909465	0.611679	0.100311	0.897599	0.588447	0.104032	0.885286	0.567401
1.600	0.081569	0.922441	0.611864	0.084747	0.912465	0.588940	0.087850	0.902098	0.568136
1.800	0.070200	0.932446	0.612465	0.072893	0.923915	0.539835	0.075520	0.915052	0.569319
2.000	0.061314	0.940361	0.613243	0.063630	0.932959	0.590923	0.065885	0.925275	0.570700

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.007			0.007			0.007		
$C_D \exp(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.250	0.551670	0.455388	0.664144	0.583508	0.400471	0.650191	0.572931	0.353606	0.639497
0.300	0.486508	0.511299	0.642607	0.501037	0.458177	0.628527	0.511071	0.418033	0.614227
0.400	0.395426	0.589973	0.610367	0.408948	0.537367	0.590185	0.419967	0.492414	0.574700
0.500	0.328779	0.648768	0.588705	0.342614	0.596914	0.564933	0.354195	0.551475	0.546461
0.600	0.278429	0.695763	0.574126	0.291992	0.645902	0.547458	0.303661	0.600911	0.526421
0.800	0.207958	0.765536	0.557775	0.220026	0.721803	0.527182	0.230894	0.680279	0.502369
1.000	0.161958	0.813533	0.550790	0.172174	0.776444	0.518109	0.181076	0.739894	0.491010
1.200	0.130328	0.847632	0.548373	0.138634	0.818465	0.514774	0.148820	0.784950	0.486445
1.400	0.107675	0.872596	0.548205	0.114753	0.846344	0.514389	0.121573	0.819338	0.485533
1.600	0.090891	0.891386	0.549124	0.096823	0.869097	0.515483	0.102582	0.845921	0.486544
1.800	0.078093	0.905888	0.550559	0.083116	0.886767	0.517292	0.088009	0.866765	0.488532
2.000	0.068091	0.917333	0.552212	0.072392	0.900750	0.519403	0.076585	0.883351	0.490963

TABLE D.2as

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_{Dexp}(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.007			0.007			0.007		
$C_{Dexp}(2s)$	1.00E+16			1.00E+20			1.00E+25		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.580616	0.313066	0.631033						
0.300	0.518310	0.373947	0.604482	0.532081	0.309243	0.589962	0.543519	0.246623	0.577557
0.400	0.428093	0.453703	0.562477	0.443346	0.390218	0.544395	0.458304	0.328662	0.528934
0.500	0.363962	0.511811	0.531797	0.379430	0.446509	0.510118	0.393591	0.383772	0.491764
0.600	0.313719	0.560768	0.509544	0.330003	0.493398	0.484400	0.345180	0.428091	0.463101
0.800	0.240647	0.641560	0.482007	0.257221	0.573211	0.450949	0.273491	0.503664	0.424123
1.000	0.190476	0.704586	0.468327	0.206089	0.639291	0.432890	0.222199	0.569051	0.401465
1.200	0.154579	0.753685	0.462342	0.168606	0.693639	0.423877	0.183787	0.625733	0.388864
1.400	0.128136	0.792029	0.460665	0.140459	0.738000	0.420249	0.154295	0.674288	0.382566
1.600	0.108181	0.822172	0.461363	0.118685	0.774115	0.419823	0.131257	0.715435	0.380252
1.800	0.092794	0.846088	0.463337	0.102059	0.803554	0.421276	0.113007	0.750164	0.380463
2.000	0.080699	0.865271	0.465937	0.088726	0.827649	0.423784	0.098368	0.779400	0.382244

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_{Dexp}(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	31.02			100.00			316.23		
C_D/r_D^2	0.007			0.007			0.007		
$C_{Dexp}(2s)$	1.00E+01			1.00E+02			1.00E+03		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$			TIME LAG FACTOR t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.499419	0.782429	0.877740	0.527801	0.709292	0.830540	0.551508	0.831899	0.794842
0.300	0.364089	0.847222	0.866246	0.386508	0.800485	0.816955	0.406786	0.746771	0.775280
0.400	0.282467	0.881685	0.859148	0.300529	0.848632	0.807509	0.317456	0.809281	0.764452
0.500	0.227887	0.903028	0.854188	0.242771	0.877952	0.801816	0.266966	0.847613	0.757524
0.600	0.189012	0.917661	0.850517	0.201539	0.897889	0.797655	0.213579	0.873355	0.752687
0.800	0.137913	0.936666	0.845563	0.147241	0.922723	0.791994	0.156230	0.905693	0.746423
1.000	0.106400	0.948842	0.842565	0.113704	0.938079	0.788443	0.120713	0.925218	0.742663
1.200	0.085404	0.956945	0.840703	0.091334	0.948522	0.786118	0.096989	0.938307	0.740279
1.400	0.070813	0.963055	0.839552	0.075561	0.956099	0.784576	0.080249	0.947698	0.738745
1.600	0.059743	0.967738	0.838847	0.063959	0.961845	0.783544	0.067929	0.954756	0.737758
1.800	0.051480	0.971436	0.838424	0.055134	0.966346	0.782845	0.058554	0.960244	0.737126
2.000	0.045025	0.974423	0.838183	0.048237	0.969960	0.782372	0.051225	0.964627	0.736735

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.007			0.007			0.007		
$C_{Dexp}(2s)$	1.00E+04			1.00E+05			1.00E+06		
0.250	0.468145	0.634049	0.753309	0.503867	0.572843	0.729804	0.517002	0.517164	0.711262
0.300	0.424603	0.690469	0.742750	0.440045	0.635172	0.716684	0.453351	0.583000	0.695650
0.400	0.332973	0.766108	0.728828	0.347021	0.721575	0.699323	0.359649	0.677469	0.674768
0.500	0.270281	0.813507	0.720207	0.282653	0.777297	0.688683	0.294079	0.740323	0.661925
0.600	0.225012	0.845640	0.714445	0.235802	0.815699	0.681752	0.245944	0.784511	0.653639
0.800	0.164836	0.886107	0.707452	0.173072	0.864601	0.673788	0.180957	0.841716	0.644429
1.000	0.127415	0.910417	0.703600	0.133844	0.894097	0.669803	0.140036	0.876588	0.640185
1.200	0.102373	0.926585	0.701348	0.107528	0.913663	0.667726	0.112494	0.899774	0.638250
1.400	0.084689	0.938089	0.700018	0.088923	0.927520	0.666681	0.092995	0.916167	0.637495
1.600	0.071669	0.946674	0.699260	0.075222	0.937809	0.666232	0.078627	0.928302	0.637377
1.800	0.061760	0.953312	0.698863	0.064794	0.945725	0.666140	0.067692	0.937607	0.637616
2.000	0.054013	0.958585	0.698703	0.056642	0.951989	0.666274	0.059146	0.944944	0.638065

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.007			0.007			0.007		
$C_D \exp(2s)$ =	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.527989	0.467628	0.696461	0.537213	0.424108	0.684503	0.544998	0.386137	0.674728
0.300	0.464798	0.534975	0.678517	0.474656	0.491429	0.664425	0.483168	0.452298	0.652719
0.400	0.370955	0.634954	0.654204	0.381058	0.594710	0.638859	0.390082	0.557079	0.622125
0.500	0.304586	0.703581	0.639091	0.314220	0.667770	0.619496	0.323039	0.633346	0.602583
0.600	0.255445	0.752860	0.629326	0.264322	0.721351	0.608190	0.272598	0.690432	0.589726
0.800	0.188505	0.817906	0.618625	0.195724	0.793558	0.595807	0.202620	0.768991	0.575529
1.000	0.146018	0.858163	0.613957	0.151807	0.839054	0.590547	0.157411	0.819466	0.569522
1.200	0.117303	0.885093	0.612081	0.121979	0.869767	0.588617	0.126536	0.853922	0.567420
1.400	0.096935	0.904158	0.611580	0.100769	0.891590	0.588310	0.104514	0.878546	0.567229
1.600	0.081916	0.918253	0.611784	0.085113	0.907735	0.588804	0.088236	0.896804	0.567966
1.800	0.070485	0.929038	0.612355	0.073194	0.920076	0.589691	0.075836	0.910764	0.568143
2.000	0.061552	0.937520	0.613122	0.063881	0.929766	0.590769	0.066149	0.921715	0.570515

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D =	1000.00			1000.00			1000.00		
C_D/r_D^2 =	0.007			0.007			0.007		
$C_D \exp(2s)$ =	1.00E+10			1.00E+12			1.00E+14		
0.250	0.551599	0.353122	0.666650	0.562079	0.299554	0.654221	0.569896	0.259083	0.645248
0.300	0.490545	0.417318	0.642904	0.502571	0.358363	0.627520	0.511832	0.311805	0.616166
0.400	0.398150	0.522179	0.609519	0.411849	0.480379	0.589245	0.422919	0.408312	0.573822
0.500	0.331104	0.600587	0.587905	0.345224	0.540540	0.563859	0.357059	0.487820	0.545171
0.600	0.280301	0.660423	0.573521	0.294117	0.603905	0.546579	0.306044	0.552644	0.525278
0.800	0.209198	0.744479	0.557433	0.221423	0.696432	0.526658	0.232483	0.650631	0.501643
1.000	0.162835	0.799584	0.550551	0.173151	0.759558	0.517750	0.182783	0.720028	0.490521
1.200	0.130982	0.837676	0.548160	0.139558	0.804405	0.514476	0.147717	0.770720	0.486059
1.400	0.108182	0.865099	0.547997	0.115312	0.837371	0.514114	0.122186	0.808627	0.485192
1.600	0.091297	0.885508	0.546922	0.097269	0.861999	0.515222	0.103069	0.837546	0.486229
1.800	0.078425	0.901134	0.550353	0.083480	0.881041	0.517031	0.086406	0.860018	0.488223
2.000	0.068368	0.913392	0.551999	0.072695	0.896016	0.519138	0.076916	0.877783	0.490654

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.007$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.007		0.007		0.007			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.575853	0.228321	0.838572						
0.300	0.519087	0.274413	0.607553	0.529533	0.220720	0.595589	0.537893	0.178600	0.586312
0.400	0.431952	0.384587	0.581822	0.445800	0.296711	0.544813	0.457200	0.238032	0.530796
0.500	0.367025	0.441909	0.530368	0.382868	0.367392	0.508887	0.398592	0.299010	0.490827
0.600	0.316351	0.506724	0.508164	0.333053	0.429551	0.482681	0.348508	0.355587	0.461275
0.800	0.242403	0.607733	0.481074	0.259389	0.531501	0.449805	0.278114	0.453304	0.422338
1.000	0.191682	0.681734	0.467697	0.207543	0.610570	0.431954	0.224048	0.533376	0.400133
1.200	0.155456	0.737252	0.461861	0.169664	0.672776	0.423185	0.185108	0.599428	0.387877
1.400	0.128806	0.779636	0.460256	0.141254	0.722177	0.419894	0.155274	0.654136	0.381800
1.600	0.108710	0.812477	0.460995	0.119507	0.761898	0.418347	0.132012	0.699544	0.379626
1.800	0.093225	0.838281	0.462983	0.102561	0.793542	0.420840	0.113609	0.737302	0.379916
2.000	0.081057	0.858835	0.465588	0.089140	0.819394	0.423366	0.098860	0.768772	0.381741

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.010		0.010		0.010			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	
(DESIGN)	(ANALYSIS)		(ANALYSIS)			(ANALYSIS)			
0.200	0.524187	0.671152	0.851748	0.560544	0.562560	0.796503	0.589152	0.454153	0.757827
0.250	0.441938	0.745893	0.842118	0.474733	0.663658	0.783943	0.502048	0.576017	0.741292
0.300	0.380160	0.791268	0.835033	0.409846	0.725845	0.774930	0.435145	0.653374	0.729519
0.400	0.293555	0.845519	0.824682	0.317565	0.799793	0.762331	0.339277	0.747008	0.713547
0.500	0.235971	0.874844	0.818533	0.255875	0.840253	0.754862	0.274295	0.799490	0.704189
0.600	0.195188	0.894828	0.813898	0.211986	0.867252	0.749404	0.227724	0.834399	0.697613
0.800	0.141920	0.920031	0.808054	0.154428	0.900685	0.742802	0.166244	0.877470	0.689822
1.000	0.109247	0.935195	0.805064	0.119011	0.920556	0.739018	0.128216	0.902977	0.685959
1.200	0.087590	0.946046	0.803289	0.095480	0.934322	0.736911	0.102877	0.920289	0.683926
1.400	0.072357	0.953774	0.802509	0.078909	0.944090	0.735870	0.085011	0.932539	0.683054
1.600	0.061178	0.959672	0.802246	0.066738	0.951472	0.735413	0.071879	0.941726	0.682812
1.800	0.052690	0.964331	0.802279	0.057490	0.957254	0.735300	0.061898	0.948873	0.682932
2.000	0.046058	0.967853	0.802846	0.050260	0.961661	0.735539	0.054095	0.954351	0.683390

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.010		0.010		0.010			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.611044	0.357805	0.730876	0.627772	0.277808	0.711205	0.640675	0.213675	0.696882
0.250	0.524152	0.492000	0.710030	0.541908	0.416401	0.686766	0.556190	0.350757	0.669131
0.300	0.456816	0.580737	0.695215	0.474530	0.512304	0.668970	0.489451	0.450118	0.648577
0.400	0.358488	0.691345	0.675309	0.375325	0.635973	0.645015	0.390029	0.582865	0.620697
0.500	0.291056	0.755287	0.663617	0.306193	0.709898	0.630812	0.319829	0.665098	0.603916
0.600	0.242291	0.798154	0.655671	0.255706	0.760221	0.621275	0.268022	0.721859	0.592726
0.800	0.177360	0.851447	0.646589	0.187823	0.823600	0.610567	0.197874	0.794703	0.580139
1.000	0.136910	0.883155	0.642402	0.145167	0.861719	0.605861	0.153041	0.839158	0.574689
1.200	0.109849	0.904465	0.640514	0.116487	0.887296	0.604018	0.122851	0.869110	0.572726
1.400	0.090739	0.919538	0.639937	0.096184	0.905425	0.603710	0.101412	0.890434	0.572587
1.600	0.076682	0.930786	0.640050	0.081233	0.918922	0.604187	0.085599	0.906314	0.573374
1.800	0.065995	0.939489	0.640535	0.069864	0.929332	0.605063	0.073566	0.918545	0.574613
2.000	0.057642	0.946191	0.641338	0.060979	0.937377	0.606239	0.064164	0.928029	0.576150

**CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D \wedge D^2 = 0.010$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}**

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

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TABLE D.2ay

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_{Dexp}(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.010		0.010		0.010			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.555924	0.129703	0.571026						
0.400	0.466717	0.243902	0.518708	0.479608	0.179378	0.504767	0.490117	0.126920	0.493943
0.500	0.399809	0.336809	0.483347	0.415124	0.262483	0.465283	0.428354	0.197413	0.450913
0.600	0.346676	0.412946	0.458247	0.363777	0.334140	0.436706	0.379032	0.261314	0.419129
0.800	0.268648	0.528467	0.426874	0.286668	0.448867	0.400012	0.303953	0.369538	0.377291
1.000	0.214495	0.611486	0.410037	0.231873	0.535744	0.379307	0.249368	0.456172	0.352696
1.200	0.176316	0.673941	0.401332	0.191355	0.603561	0.367693	0.208159	0.526580	0.338012
1.400	0.146073	0.722372	0.397523	0.160566	0.657823	0.361641	0.176247	0.584775	0.329464
1.600	0.123708	0.760757	0.396740	0.136654	0.701983	0.359156	0.151046	0.633480	0.324935
1.800	0.106256	0.791673	0.397832	0.117751	0.738387	0.358998	0.130629	0.674650	0.323110
2.000	0.092399	0.816829	0.400091	0.102582	0.768646	0.360375	0.114397	0.709678	0.323156

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.010		0.010		0.010			
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.508130	0.734690	0.858786	0.541365	0.645926	0.806065	0.566077	0.565342	0.770876
0.250	0.432916	0.762751	0.847786	0.463806	0.682953	0.791323	0.488558	0.603230	0.751232
0.300	0.375507	0.789250	0.839710	0.403836	0.719626	0.780804	0.427673	0.646023	0.737284
0.400	0.293510	0.829917	0.828464	0.317162	0.776775	0.766682	0.338268	0.716897	0.718845
0.500	0.237875	0.857966	0.820970	0.257757	0.816136	0.757644	0.276062	0.767448	0.707405
0.600	0.197873	0.878231	0.815660	0.214791	0.844251	0.751412	0.230632	0.804006	0.699801
0.800	0.144829	0.905540	0.808954	0.157540	0.881412	0.743682	0.169589	0.852434	0.690646
1.000	0.111871	0.923172	0.806282	0.121833	0.904816	0.739441	0.131270	0.882726	0.686279
1.200	0.089820	0.935541	0.803298	0.097890	0.920913	0.737079	0.105497	0.903342	0.683933
1.400	0.074251	0.944693	0.802293	0.080961	0.932642	0.735798	0.087244	0.918216	0.682803
1.600	0.062793	0.951727	0.801877	0.068490	0.941552	0.735174	0.073789	0.929414	0.682381
1.800	0.054078	0.957289	0.801821	0.058997	0.948532	0.734956	0.063543	0.938122	0.682386
2.000	0.047268	0.961766	0.801984	0.051577	0.954134	0.734992	0.055332	0.945068	0.682646

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=			0.010		0.010			
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.583718	0.501755	0.747578	0.596151	0.455622	0.731987	0.604696	0.424343	0.721405
0.250	0.507667	0.532807	0.722955	0.522249	0.474919	0.702768	0.533372	0.429165	0.668112
0.300	0.447046	0.578646	0.705333	0.462577	0.515694	0.681653	0.474082	0.464235	0.663650
0.400	0.356574	0.655971	0.681942	0.372223	0.598014	0.653271	0.385506	0.545122	0.630761
0.500	0.292553	0.715741	0.667529	0.307229	0.664188	0.635643	0.320188	0.614841	0.609917
0.600	0.245236	0.760150	0.658129	0.258579	0.715083	0.624168	0.270692	0.670554	0.596236
0.800	0.180943	0.820039	0.647498	0.191624	0.785602	0.611406	0.201652	0.750230	0.581002
1.000	0.140215	0.857808	0.642497	0.148732	0.830912	0.605707	0.158861	0.802726	0.574318
1.200	0.112698	0.883488	0.640227	0.119577	0.861927	0.603399	0.126190	0.839102	0.571779
1.400	0.093170	0.901934	0.639376	0.098824	0.884226	0.602797	0.104269	0.865398	0.571317
1.600	0.078761	0.915749	0.639303	0.083491	0.900896	0.603085	0.088042	0.885085	0.571910
1.800	0.067786	0.926434	0.639668	0.071808	0.913751	0.603843	0.075668	0.900256	0.573035
2.000	0.059208	0.934915	0.640284	0.062675	0.923920	0.604846	0.065995	0.912235	0.574417

TABLE D.26a

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.010			0.010			0.010		
$C_D \exp(2s)$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.541897	0.393769	0.677287	0.548472	0.366713	0.669168	0.553569	0.346184	0.663006
0.300	0.484910	0.421745	0.650259	0.492893	0.387066	0.639726	0.499354	0.358909	0.631449
0.400	0.396749	0.498072	0.612888	0.406268	0.456895	0.598528	0.414343	0.421192	0.586863
0.500	0.331582	0.568891	0.588959	0.341575	0.526866	0.571728	0.350334	0.488897	0.557434
0.600	0.281637	0.627731	0.573067	0.291490	0.587315	0.553696	0.300345	0.549706	0.537371
0.800	0.211038	0.714791	0.555161	0.219798	0.679951	0.533035	0.227951	0.646182	0.513969
1.000	0.164622	0.773821	0.547241	0.172024	0.744676	0.523694	0.179069	0.715685	0.503090
1.200	0.132569	0.815383	0.544264	0.138731	0.791092	0.520091	0.144680	0.766513	0.498705
1.400	0.109546	0.845694	0.543784	0.114678	0.825326	0.519459	0.119676	0.804488	0.497766
1.600	0.092457	0.868485	0.544599	0.096763	0.851237	0.520363	0.100976	0.833470	0.498650
1.800	0.079410	0.886074	0.546035	0.083061	0.871303	0.522032	0.086640	0.856029	0.500466
2.000	0.069206	0.899960	0.547762	0.072337	0.887165	0.524053	0.075407	0.873910	0.502719

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.010			0.010			0.010		
$C_D \exp(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.250	0.557531	0.330706	0.656295	0.563035	0.310803	0.651860			
0.300	0.504619	0.336076	0.624861	0.512509	0.302449	0.615241	0.517947	0.280027	0.608782
0.400	0.421215	0.390394	0.577286	0.432128	0.341068	0.562709	0.440243	0.304416	0.552337
0.500	0.358015	0.454867	0.545475	0.370696	0.397536	0.526814	0.380568	0.352298	0.513148
0.600	0.308293	0.515038	0.523516	0.321831	0.454369	0.501495	0.332766	0.404258	0.485016
0.800	0.235522	0.613808	0.497448	0.249036	0.553975	0.470454	0.260600	0.501111	0.449578
1.000	0.185761	0.687162	0.484967	0.198106	0.632422	0.454748	0.209124	0.581696	0.430768
1.200	0.150417	0.741894	0.479683	0.161250	0.693348	0.447457	0.171226	0.646732	0.421368
1.400	0.124544	0.783359	0.478312	0.133686	0.740865	0.444936	0.142669	0.698944	0.417487
1.600	0.105105	0.815308	0.479065	0.113115	0.778264	0.445138	0.120790	0.740984	0.416854
1.800	0.090159	0.840335	0.480835	0.097033	0.808012	0.446863	0.103697	0.774969	0.418148
2.000	0.078428	0.860251	0.483352	0.084354	0.831940	0.448397	0.090142	0.802682	0.420542

TABLE D.26b

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10^{18}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.010		0.010		0.010
$C_D \exp(2s)$	=	1.00E+18		1.00E+20		1.00E+25
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)		(ANALYSIS)
0.300	0.521747	0.284877	0.804348			
0.400	0.448394	0.278898	0.544727	0.454876	0.239700	0.534569
0.500	0.388344	0.318571	0.502874	0.399581	0.285397	0.488757
0.600	0.341851	0.363108	0.472402	0.354942	0.301441	0.454713
0.800	0.270480	0.455024	0.433155	0.286191	0.380767	0.409378
1.000	0.218913	0.535508	0.411524	0.235288	0.456754	0.382916
1.200	0.180358	0.602834	0.400051	0.196244	0.524554	0.367667
1.400	0.150936	0.658403	0.394678	0.165758	0.583405	0.359384
1.600	0.128109	0.704124	0.393039	0.141613	0.633869	0.355559
1.800	0.110158	0.741789	0.393699	0.122270	0.670090	0.354630
2.000	0.095790	0.772924	0.395745	0.106611	0.713512	0.355579

TABLE D.26c

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23					
C_D/r_D^2	=	0.010		0.010		0.010					
$C_D \exp(2s)$	=	1.00E+01		1.00E+02		1.00E+03					
CYCLE LENGTH (Δt_c) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)				(ANALYSIS)			
0.200	0.511630	0.751128	0.855316	0.546126	0.670918	0.801289	0.572796	0.592157	0.763981		
0.250	0.433115	0.791757	0.845937	0.464374	0.725172	0.788994	0.489804	0.656707	0.748030		
0.300	0.374316	0.818731	0.838632	0.402680	0.761648	0.779560	0.426675	0.700661	0.735720		
0.400	0.291489	0.854083	0.828007	0.315000	0.810082	0.766207	0.335955	0.760529	0.718414		
0.500	0.235832	0.877098	0.820729	0.255560	0.841788	0.757373	0.273677	0.800795	0.707235		
0.600	0.196009	0.893632	0.815542	0.212787	0.864458	0.751236	0.228455	0.829997	0.699715		
0.800	0.143386	0.916199	0.808964	0.155989	0.894971	0.743603	0.167907	0.869532	0.690822		
1.000	0.110764	0.931086	0.805364	0.120640	0.914683	0.739432	0.129978	0.894976	0.686310		
1.200	0.088955	0.941710	0.803422	0.096956	0.928498	0.737120	0.104484	0.912653	0.684012		
1.400	0.073560	0.949678	0.802449	0.080214	0.938711	0.735880	0.086434	0.925600	0.682926		
1.600	0.062229	0.955865	0.802046	0.067880	0.946552	0.735278	0.073126	0.935458	0.682530		
1.800	0.053609	0.960797	0.802005	0.058490	0.952746	0.735082	0.062991	0.943188	0.682559		
2.000	0.046873	0.964812	0.802179	0.051148	0.957751	0.735137	0.055065	0.949396	0.682841		

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00					
C_D/r_D^2	=	0.010		0.010		0.010					
$C_D \exp(2s)$	=	1.00E+04		1.00E+05		1.00E+06					
0.200	0.593081	0.521386	0.737851	0.608750	0.459699	0.718859	0.621147	0.406053	0.704511		
0.250	0.509970	0.593018	0.716450	0.525991	0.536444	0.696568	0.538888	0.486851	0.679896		
0.300	0.446401	0.641900	0.703209	0.462521	0.588378	0.678702	0.475758	0.540800	0.659817		
0.400	0.354142	0.709976	0.681520	0.369743	0.661540	0.652764	0.383077	0.616755	0.630043		
0.500	0.289965	0.757342	0.667507	0.304446	0.714037	0.635759	0.317239	0.672518	0.610120		
0.600	0.242862	0.792550	0.658206	0.255997	0.764161	0.624434	0.267901	0.718289	0.596666		
0.800	0.179113	0.841161	0.647601	0.189633	0.811075	0.611676	0.199487	0.780250	0.581461		
1.000	0.136613	0.872768	0.642630	0.147210	0.848680	0.605972	0.155211	0.823872	0.574733		
1.200	0.111600	0.894775	0.640397	0.118368	0.875384	0.603661	0.124905	0.854654	0.572183		
1.400	0.092291	0.910822	0.639586	0.097873	0.894766	0.603109	0.103243	0.877711	0.571735		
1.600	0.078042	0.922980	0.639538	0.082713	0.909432	0.603417	0.087204	0.895019	0.572341		
1.800	0.067187	0.932467	0.639928	0.071161	0.920844	0.604197	0.074972	0.908484	0.573484		
2.000	0.058699	0.940049	0.640564	0.062127	0.929935	0.605219	0.065408	0.919193	0.574880		

TABLE D.2bd

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_{Dexp}(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$	1000.00			1000.00			1000.00		
$C_D/r_D^2 =$	0.010			0.010			0.010		
$C_{Dexp}(2s) =$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L			AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$ t_{LO}/t_L		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.549456	0.443281	0.866820	0.558267	0.404698	0.656295	0.565732	0.370241	0.647636
0.300	0.486745	0.498778	0.844923	0.495983	0.461561	0.632912	0.603864	0.428368	0.623024
0.400	0.394488	0.576127	0.811818	0.404297	0.539579	0.596975	0.412782	0.506769	0.584703
0.500	0.328512	0.633661	0.589184	0.338444	0.597822	0.571894	0.347208	0.565039	0.557458
0.600	0.278647	0.679880	0.573677	0.288326	0.645482	0.554420	0.297035	0.613355	0.538162
0.800	0.208691	0.749445	0.555815	0.217264	0.719220	0.533683	0.225230	0.689974	0.515002
1.000	0.162837	0.798277	0.547818	0.170095	0.772525	0.524441	0.176991	0.746963	0.504010
1.200	0.131183	0.833610	0.544798	0.137239	0.811856	0.520760	0.143076	0.789881	0.499515
1.400	0.108443	0.859878	0.544321	0.113494	0.841462	0.520096	0.118407	0.822844	0.498515
1.600	0.091558	0.879897	0.545126	0.095801	0.864195	0.520984	0.099948	0.848032	0.499366
1.800	0.078663	0.895500	0.546573	0.082263	0.881983	0.522655	0.085789	0.868013	0.501170
2.000	0.068575	0.907911	0.548310	0.071364	0.896156	0.524681	0.074690	0.883982	0.503422

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, $r_D =$	1000.00			1000.00			1000.00		
$C_D/r_D^2 =$	0.010			0.010			0.010		
$C_{Dexp}(2s) =$	1.00E+10			1.00E+12			1.00E+14		
0.250	0.572139	0.339254	0.640383	0.582559	0.285653	0.628929			
0.300	0.510647	0.398526	0.614736	0.521800	0.346839	0.601598	0.530589	0.303476	0.691632
0.400	0.420177	0.477256	0.574413	0.432422	0.426376	0.558146	0.442160	0.383927	0.545854
0.500	0.354967	0.535164	0.545273	0.368020	0.483159	0.525933	0.378528	0.439667	0.511334
0.600	0.304677	0.583568	0.524320	0.318335	0.530728	0.502154	0.329379	0.485872	0.485317
0.800	0.232617	0.661966	0.498647	0.245792	0.610195	0.471918	0.257081	0.564264	0.451195
1.000	0.183527	0.721866	0.486058	0.195554	0.673834	0.456165	0.206260	0.629432	0.432488
1.200	0.148695	0.767910	0.480637	0.159278	0.724710	0.448701	0.168990	0.683379	0.422915
1.400	0.123186	0.803587	0.479176	0.132338	0.765349	0.446039	0.140934	0.727752	0.418834
1.600	0.104008	0.831524	0.479874	0.111872	0.797909	0.446141	0.119387	0.764150	0.418058
1.800	0.089253	0.853666	0.481720	0.098012	0.824151	0.447807	0.102551	0.794034	0.419255
2.000	0.077867	0.871442	0.484126	0.083500	0.845466	0.450307	0.089188	0.818656	0.421587

TABLE D.20e

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10^{18}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.010		0.010		0.010		0.010	
$C_D \exp(2s)$	=	1.00E+18		1.00E+20		1.00E+25		1.00E+25	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
		t_{L0}/t_L			t_{L0}/t_L			t_{L0}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.537687	0.266605	0.583822						
0.400	0.450115	0.347748	0.536208	0.462392	0.288851	0.521970	0.473339	0.232820	0.509899
0.500	0.387157	0.402822	0.499937	0.400531	0.343284	0.483243	0.412593	0.286573	0.469116
0.600	0.338556	0.447611	0.472162	0.352888	0.385952	0.452986	0.365864	0.327737	0.436920
0.800	0.286774	0.523922	0.434802	0.282391	0.457351	0.410756	0.296867	0.394077	0.390726
1.000	0.215759	0.589022	0.413448	0.231654	0.519815	0.385079	0.246971	0.451797	0.361196
1.200	0.177853	0.644576	0.401839	0.193226	0.575535	0.369870	0.208675	0.504772	0.342487
1.400	0.148961	0.691515	0.396264	0.163325	0.624771	0.361413	0.178345	0.553427	0.330976
1.600	0.126533	0.730907	0.394448	0.139659	0.667799	0.357375	0.153879	0.597659	0.324349
1.800	0.108855	0.763863	0.394976	0.120685	0.705098	0.356257	0.133902	0.637453	0.321093
2.000	0.094729	0.791433	0.396929	0.105306	0.737266	0.357058	0.117436	0.672956	0.320177

TABLE D.20f

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_{Dexp}(2s) = 10 \text{ TO } 10^6$

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.010		0.010		0.010			
$C_{Dexp}(2s)$	=	1.00E+01		1.00E+02		1.00E+03			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.200	0.511823	0.707579	0.858489	0.546044	0.609561	0.802792	0.572161	0.516041	0.766148
0.250	0.434468	0.754030	0.846377	0.465787	0.672439	0.789468	0.491207	0.589037	0.748613
0.300	0.375988	0.787849	0.838787	0.404495	0.719036	0.779672	0.428640	0.645435	0.735754
0.400	0.293097	0.833124	0.827985	0.316748	0.781921	0.766160	0.337880	0.724068	0.716242
0.500	0.237192	0.862047	0.820676	0.257031	0.822014	0.757333	0.275288	0.775418	0.707107
0.600	0.197135	0.882259	0.815474	0.214001	0.849782	0.751204	0.229778	0.811348	0.699625
0.800	0.144166	0.908948	0.808883	0.158829	0.885853	0.743571	0.188819	0.858146	0.690763
1.000	0.111326	0.925987	0.805281	0.121247	0.908379	0.739395	0.130636	0.887208	0.686253
1.200	0.089377	0.937885	0.803330	0.097412	0.923826	0.737068	0.104978	0.906954	0.683942
1.400	0.073687	0.946877	0.802354	0.080568	0.935077	0.735820	0.086818	0.921203	0.682846
1.600	0.062491	0.953431	0.801961	0.068163	0.943625	0.735222	0.073434	0.931937	0.682454
1.800	0.053823	0.958773	0.801915	0.058722	0.950324	0.735020	0.063243	0.940290	0.682474
2.000	0.047051	0.963094	0.802082	0.051341	0.955704	0.735064	0.055275	0.946956	0.682746

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=			0.010		0.010			
$C_{Dexp}(2s)$	=	1.00E+04		1.00E+05		1.00E+06			
0.200	0.591537	0.436343	0.741052	0.605943	0.372158	0.723434	0.616785	0.321738	0.710718
0.250	0.511221	0.512853	0.719305	0.526895	0.446754	0.697907	0.539234	0.391518	0.681936
0.300	0.448480	0.574870	0.703205	0.464633	0.510732	0.678759	0.477788	0.454812	0.660069
0.400	0.358286	0.664842	0.681176	0.372072	0.607925	0.652240	0.385596	0.555222	0.629363
0.500	0.291740	0.725668	0.667230	0.306403	0.676307	0.635301	0.319390	0.626609	0.609468
0.600	0.244311	0.769485	0.658006	0.257588	0.726446	0.624090	0.269648	0.683849	0.596178
0.800	0.180105	0.827206	0.647477	0.190712	0.794348	0.611464	0.200662	0.760624	0.581145
1.000	0.139626	0.863352	0.642523	0.147984	0.837828	0.605804	0.156046	0.810693	0.574494
1.200	0.112136	0.887906	0.640284	0.118968	0.867236	0.603516	0.125531	0.845372	0.571964
1.400	0.092708	0.905556	0.639468	0.098324	0.888550	0.602942	0.103730	0.870479	0.571520
1.600	0.078378	0.918787	0.639421	0.083074	0.904503	0.603258	0.087593	0.889305	0.572135
1.800	0.067461	0.929030	0.639805	0.071456	0.916819	0.604031	0.075290	0.903832	0.573275
2.000	0.058927	0.937167	0.640432	0.062374	0.928572	0.605045	0.065671	0.915315	0.574667

TABLE D.26g

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.60$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.010			0.010			0.010		
$C_D \exp(2s)$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.549037	0.345820	0.669761	0.556913	0.308196	0.660290	0.563311	0.277237	0.652790
0.300	0.488557	0.406701	0.645519	0.497437	0.365620	0.633996	0.504819	0.330635	0.624726
0.400	0.397166	0.507465	0.611029	0.407085	0.464717	0.586140	0.415621	0.426702	0.583897
0.500	0.330881	0.583814	0.588339	0.340984	0.542382	0.570872	0.349925	0.504456	0.556284
0.600	0.280561	0.642752	0.572989	0.290414	0.603783	0.553549	0.299301	0.567263	0.537112
0.800	0.209970	0.726850	0.555384	0.218654	0.693834	0.533325	0.226738	0.661407	0.514310
1.000	0.163742	0.783098	0.547503	0.171072	0.755297	0.524044	0.178043	0.727658	0.503524
1.200	0.131857	0.822689	0.544522	0.137962	0.799437	0.520426	0.143852	0.775951	0.499120
1.400	0.108965	0.851578	0.544060	0.114053	0.832053	0.519789	0.119005	0.812091	0.498162
1.600	0.091975	0.873355	0.544878	0.096246	0.856789	0.520696	0.100423	0.839735	0.499039
1.800	0.079004	0.890186	0.546325	0.082627	0.875981	0.522370	0.086177	0.861296	0.500852
2.000	0.068859	0.903494	0.548059	0.071967	0.891175	0.524395	0.075012	0.876416	0.503104

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.010			0.010			0.010		
$C_D \exp(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.250	0.568566	0.251716	0.646757	0.576572	0.213108	0.637776			
0.300	0.511006	0.300839	0.617161	0.520690	0.253690	0.605683	0.527814	0.219012	0.597508
0.400	0.423000	0.393000	0.573712	0.435003	0.336694	0.557882	0.444235	0.292366	0.546287
0.500	0.357839	0.469911	0.543983	0.371107	0.410133	0.524534	0.381678	0.361033	0.510006
0.600	0.307318	0.533304	0.523101	0.321100	0.472910	0.500649	0.332406	0.421689	0.483621
0.800	0.234250	0.630454	0.497817	0.247692	0.572976	0.470802	0.259255	0.521700	0.449803
1.000	0.184661	0.700473	0.485479	0.196885	0.648282	0.455383	0.207766	0.599806	0.431491
1.200	0.149526	0.752445	0.460178	0.160228	0.706139	0.448105	0.170073	0.661699	0.422167
1.400	0.123823	0.791865	0.478777	0.133059	0.751237	0.445543	0.141748	0.711214	0.418231
1.600	0.104513	0.822311	0.479511	0.112440	0.786808	0.445703	0.120024	0.751113	0.417543
1.800	0.089664	0.846214	0.481369	0.096473	0.815174	0.447396	0.103064	0.783482	0.418785
2.000	0.078009	0.865272	0.483780	0.083881	0.838042	0.449909	0.089611	0.809928	0.421141

TABLE D.26h

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.010$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$ 1000.00				1000.00				1000.00			
$C_D/r_D^2 =$ 0.010				0.010				0.010			
$C_D \exp(2s) =$ 1.00E+16				1.00E+20				1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR		TIME LAG FACTOR t_{LO}/t_L	TIME LAG FACTOR	
	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$		$t_L/\Delta t_c$	$\Delta p/\Delta p_0$		$t_L/\Delta t_c$	$\Delta p/\Delta p_0$		$t_L/\Delta t_c$	$\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)			(ANALYSIS)	
0.300	0.533192	0.193162	0.591482								
0.400	0.451473	0.257219	0.537529	0.461924	0.206420	0.525368	0.470363	0.166148	0.515942		
0.500	0.390210	0.320604	0.498855	0.402953	0.259265	0.483079	0.413659	0.207464	0.470576		
0.600	0.341758	0.378334	0.470387	0.356138	0.310244	0.451393	0.368645	0.250089	0.436079		
0.800	0.269217	0.476401	0.433159	0.285299	0.401489	0.408742	0.300126	0.330939	0.388550		
1.000	0.217473	0.555458	0.412230	0.233801	0.478954	0.383442	0.249616	0.403218	0.359148		
1.200	0.179082	0.619821	0.400928	0.194781	0.544836	0.368615	0.210667	0.467240	0.340818		
1.400	0.149878	0.672545	0.395545	0.164478	0.600990	0.360436	0.179837	0.523873	0.329652		
1.600	0.127244	0.715908	0.393849	0.140541	0.648866	0.356586	0.155016	0.573885	0.323288		
1.800	0.109424	0.751702	0.394444	0.121382	0.689673	0.355586	0.134790	0.617946	0.320214		
2.000	0.095196	0.781366	0.396435	0.105872	0.724454	0.356460	0.118147	0.656670	0.319423		

TABLE D.2i

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_{Dexp}(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23	
C_D/r_D^2	=	0.020		0.020		0.020	
$C_{Dexp}(2s)$	=	1.00E+02		1.00E+03		1.00E+04	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$
							TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)
0.250	0.598005	0.311471	0.748608	0.627840	0.194665	0.711128	
0.300	0.514995	0.431864	0.722655	0.546007	0.316388	0.681610	0.567497
0.400	0.358486	0.623171	0.679100	0.385996	0.530844	0.627183	0.229451
0.500	0.291254	0.689833	0.663168	0.318168	0.611258	0.607069	0.448596
0.600	0.243643	0.736635	0.652034	0.267813	0.668745	0.593187	0.591727
0.800	0.207579	0.771215	0.644293	0.229208	0.712016	0.583494	0.537322
1.000	0.179500	0.797970	0.638879	0.198835	0.745737	0.576753	0.567559
1.200	0.123516	0.662489	0.712061	0.154584	0.795175	0.568952	0.340317
1.400	0.111690	0.663835	0.629956	0.124373	0.829734	0.565718	0.537322
1.600	0.092254	0.663405	0.629427	0.102760	0.854977	0.565077	0.567559
1.800	0.077924	0.698673	0.629845	0.086758	0.874497	0.565712	0.288429
2.000	0.067007	0.910710	0.630866	0.074542	0.889851	0.567090	0.802674
							0.550789
							0.248110
							0.652719
							0.539040
							0.216067
							0.692392
							0.530757
							0.168813
							0.751438
							0.520996
							0.136149
							0.793303
							0.516787
							0.112588
							0.824275
							0.515747
							0.095044
							0.848233
							0.516390
							0.081608
							0.867126
							0.517992

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00			
C_D/r_D^2	=	0.020	0.020			
$C_{Dexp}(2s)$	=	1.00E+05	1.00E+06			
0.300	0.520886	0.249784	0.609435	0.533180	0.197049	0.595383
0.400	0.427166	0.378518	0.566735	0.441334	0.320178	0.548541
0.500	0.358426	0.470932	0.538885	0.373265	0.412868	0.517460
0.600	0.305856	0.541111	0.519405	0.320598	0.485403	0.495525
0.800	0.231330	0.640331	0.495737	0.244816	0.590984	0.468427
1.000	0.181792	0.707390	0.483800	0.193608	0.664345	0.454274
1.200	0.147102	0.755822	0.478309	0.157287	0.718362	0.447336
1.400	0.121855	0.792315	0.476527	0.130590	0.759658	0.444853
1.600	0.102913	0.820629	0.476906	0.110410	0.792065	0.444525
1.800	0.088340	0.843095	0.478515	0.094799	0.818001	0.445915
2.000	0.076881	0.861128	0.480849	0.082477	0.838994	0.448222

TABLE D.20j

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00				
C_D/r_D^2	=	0.020		0.020		0.020				
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09				
CYCLE LENGTH (Δt_c) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)			
0.300	0.542531	0.156708	0.585121	0.549806	0.125740	0.577380	0.555566	0.101792	0.571394	
0.400	0.452574	0.272089	0.534918	0.461595	0.232555	0.524464	0.468922	0.200006	0.516269	
0.500	0.385492	0.362771	0.501049	0.395632	0.319821	0.488206	0.404104	0.283074	0.477971	
0.600	0.333097	0.435784	0.476928	0.343742	0.391966	0.462159	0.352848	0.353437	0.450232	
0.800	0.256740	0.545132	0.446672	0.267284	0.502963	0.429052	0.276627	0.464470	0.414561	
1.000	0.204349	0.623115	0.430395	0.214107	0.584150	0.410780	0.222971	0.547653	0.394450	
1.200	0.166744	0.681675	0.421965	0.175511	0.646262	0.400887	0.183630	0.612428	0.383163	
1.400	0.138831	0.727111	0.418259	0.146593	0.695150	0.396112	0.153891	0.664111	0.377325	
1.600	0.117568	0.763202	0.417461	0.124395	0.734459	0.394551	0.130895	0.706160	0.374958	
1.800	0.101020	0.792373	0.418455	0.107011	0.766558	0.393025	0.112774	0.740847	0.374840	
2.000	0.087901	0.816201	0.420566	0.093163	0.793026	0.396810	0.098266	0.769717	0.376205	

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00				
C_D/r_D^2	=	0.020		0.020		0.020				
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14				
0.400	0.474946	0.173107	0.509721	0.484172	0.132092	0.500008	0.490840	0.103125	0.493215	
0.600	0.411333	0.261619	0.489886	0.422439	0.201430	0.457326	0.430720	0.164020	0.448435	
0.800	0.360676	0.319613	0.440460	0.373316	0.263814	0.425547	0.382940	0.220530	0.414852	
0.800	0.284924	0.429478	0.402489	0.298903	0.368989	0.383666	0.310101	0.319329	0.369811	
1.000	0.231045	0.513754	0.380667	0.245061	0.453103	0.358894	0.256727	0.401307	0.342566	
1.200	0.191144	0.580336	0.368100	0.204533	0.521576	0.344003	0.218020	0.469871	0.325710	
1.400	0.160746	0.634216	0.361236	0.173207	0.576328	0.335247	0.184161	0.527887	0.315306	
1.600	0.137073	0.678544	0.358058	0.148495	0.625978	0.330516	0.158747	0.577495	0.309171	
1.800	0.118307	0.715471	0.357311	0.126684	0.666399	0.328497	0.138166	0.620256	0.305953	
2.000	0.103205	0.746485	0.358199	0.112584	0.700919	0.328359	0.121289	0.657318	0.304794	

TABLE D.26k

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D r_D^2 = 0.020$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
$C_D r_D^2$	=	0.020		0.020		0.020		0.020	
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+20		1.00E+25	
CYCLE LENGTH $(\Delta t_c)_D / r_D^2$		AMPLITUDE FACTOR $t_L / \Delta t_c$	TIME LAG FACTOR $\Delta p / \Delta p_0$		AMPLITUDE FACTOR $t_L / \Delta t_c$	TIME LAG FACTOR $\Delta p / \Delta p_0$		AMPLITUDE FACTOR $t_L / \Delta t_c$	TIME LAG FACTOR $\Delta p / \Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.500	0.437006	0.135689	0.441985	0.445782	0.096810	0.433284	0.452678	0.067665	0.426683
0.600	0.390412	0.186620	0.406912	0.401064	0.138188	0.398104	0.409544	0.100118	0.387903
0.800	0.319172	0.278454	0.359301	0.332749	0.216476	0.344641	0.344143	0.164102	0.333230
1.000	0.266499	0.357160	0.330024	0.281738	0.287229	0.312174	0.295178	0.224824	0.297960
1.200	0.225901	0.424593	0.311464	0.241838	0.350396	0.290939	0.256499	0.281277	0.274309
1.400	0.193794	0.482744	0.299833	0.209779	0.406687	0.276802	0.225021	0.333287	0.258052
1.600	0.167934	0.533270	0.292258	0.183548	0.456945	0.267398	0.198909	0.381036	0.246747
1.800	0.146802	0.577443	0.287954	0.161794	0.501952	0.261271	0.178951	0.424842	0.236892
2.000	0.129331	0.616228	0.285841	0.143555	0.542335	0.257517	0.158288	0.464996	0.233548

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D \tau_D^2 = 0.020$ AND $C_D \exp(2s) = 10^2$ TO 10^6

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23	
C_D/r_D^2	=	0.020		0.020		0.020	
$C_D \exp(2s)$	=	1.00E+02		1.00E+03		1.00E+04	

CYCLE LENGTH		AMPLITUDE FACTOR		TIME LAG FACTOR		AMPLITUDE FACTOR		TIME LAG FACTOR	
$(\Delta t_c)_D / r_D^2$	$t_L / \Delta t_c$	$\Delta p / \Delta p_0$	t_{L0} / t_L	$t_L / \Delta t_0$	$\Delta p / \Delta p_0$	t_{L0} / t_L	$t_L / \Delta t_c$	$\Delta p / \Delta p_0$	t_{L0} / t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.589683	0.491000	0.785996	0.592203	0.427186	0.736867			
0.300	0.498965	0.503680	0.738522	0.522539	0.419507	0.702378	0.538848	0.385339	0.681120
0.400	0.353093	0.599766	0.688665	0.380086	0.508682	0.639757	0.400225	0.434519	0.607565
0.500	0.291750	0.654266	0.669368	0.317375	0.569471	0.615322	0.337712	0.494920	0.578268
0.600	0.245994	0.697830	0.656100	0.269672	0.620750	0.598492	0.289330	0.549247	0.557829
0.800	0.210760	0.732841	0.646828	0.232345	0.663308	0.586738	0.250886	0.598241	0.543378
1.000	0.182976	0.761413	0.640302	0.202527	0.698785	0.576490	0.219780	0.636529	0.533127
1.200			0.158384	0.753832	0.568796	0.172953	0.700929	0.520881	
1.400	0.114690	0.836365	0.629111	0.127808	0.794095	0.564538	0.140009	0.749254	0.515341
1.600	0.094864	0.859930	0.627959	0.105766	0.824467	0.563229	0.118005	0.786282	0.513518
1.800	0.080166	0.878160	0.628097	0.089349	0.847965	0.563542	0.098005	0.815215	0.513769
2.000	0.068940	0.892609	0.628958	0.078780	0.866595	0.564741	0.084188	0.838220	0.515166

Distance, r_D	1000.00	1000.00	1000.00
C_D/r_D^2	0.020	0.020	
$C_D \exp(2s)$	1.00E+05	1.00E+05	
0.300	0.498908	0.332788	0.634560
0.400	0.415145	0.376917	0.585729
0.500	0.353653	0.432740	0.552202
0.600	0.305420	0.486466	0.528442
0.800	0.234754	0.577912	0.499075
1.000	0.186140	0.648804	0.483979
1.200	0.151337	0.703710	0.478767
1.400	0.125683	0.748692	0.474050
1.600	0.106245	0.780771	0.473924
1.800	0.091233	0.808133	0.475273
2.000	0.079400	0.830374	0.477435

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/\rho D^2 = 0.020$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO; $F' = 0.50$

Distance, r_D =		1000.00		1000.00		1000.00			
C_D/r_D^2 =		0.020		0.020		0.020			
$C_{Dexp}(2s)$ =		1.00E+07		1.00E+08		1.00E+09			
DAL CYCLE		AMPLITUDE		TIME LAG		AMPLITUDE		TIME LAG	
WAVELENGTH		FACTOR		FACTOR		FACTOR		FACTOR	
$(\Delta t_c)_D/r_D^2$		$t_L/\Delta t_c$		$\Delta p/\Delta p_0$		t_{LO}/t_L		$t_L/\Delta t_c$	
$\Delta p/\Delta p_0$		t_{LO}/t_L		$t_L/\Delta t_c$		$\Delta p/\Delta p_0$		t_{LO}/t_L	
(DESIGN)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.300	0.511827	0.280185	0.816061	0.518293	0.265218	0.810733	0.519583	0.254901	0.808865
0.400	0.434774	0.299804	0.559285	0.441313	0.274008	0.550998	0.446444	0.254162	0.544686
0.500	0.378063	0.341728	0.519298	0.383989	0.309195	0.508603	0.380357	0.282988	0.500280
0.600	0.329273	0.388391	0.490160	0.338090	0.351237	0.477378	0.345386	0.320365	0.487294
0.800	0.258861	0.477278	0.452599	0.268451	0.435697	0.438430	0.276712	0.399469	0.423400
1.000	0.208801	0.553250	0.431888	0.218050	0.511245	0.413153	0.228454	0.473289	0.397821
1.200	0.171448	0.616121	0.420841	0.180274	0.575782	0.400238	0.188328	0.538233	0.383121
1.400	0.143325	0.667788	0.415833	0.151329	0.630074	0.393650	0.158786	0.594182	0.375183
1.600	0.121627	0.710279	0.413987	0.128789	0.675802	0.391026	0.135534	0.641965	0.371508
1.800	0.104603	0.745354	0.414525	0.110924	0.713766	0.390905	0.116989	0.682642	0.370636
2.000	0.091043	0.774461	0.416382	0.096618	0.745832	0.392354	0.102024	0.717259	0.371564

Distance, r_D = 1000.00				1000.00				1000.00			
C_D/r_D^2 = 0.020				0.020				0.020			
$C_D \exp(2s)$ = 1.00E+10				1.00E+12				1.00E+14			
0.400	0.450532	0.238568	0.539723	0.458533	0.216078	0.532828	0.480611	0.200982	0.527914		
0.500	0.395578	0.261663	0.483677	0.403500	0.229732	0.483985	0.409137	0.207404	0.477316		
0.600	0.351471	0.294840	0.459203	0.360929	0.254935	0.447170	0.367833	0.226342	0.438777		
0.800	0.283846	0.367999	0.412759	0.295407	0.316927	0.396806	0.304238	0.278139	0.385094		
1.000	0.233921	0.439208	0.385122	0.248476	0.381557	0.365504	0.258488	0.335669	0.351284		
1.200	0.195661	0.503843	0.368763	0.208383	0.443040	0.348249	0.218889	0.392805	0.329631		
1.400	0.165711	0.560369	0.359486	0.178053	0.499354	0.334567	0.188580	0.446971	0.315891		
1.600	0.141918	0.608691	0.354795	0.153560	0.549061	0.327896	0.163774	0.497087	0.307446		
1.800	0.122791	0.652314	0.353126	0.133575	0.594945	0.324617	0.143289	0.542776	0.302652		
2.000	0.107250	0.689052	0.353459	0.117122	0.634878	0.323666	0.126185	0.584044	0.300420		

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D \tau_D^2 = 0.020$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

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TABLE D.2b

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$	31.82	100.00	316.23
$C_D/r_D^2 =$	0.020	0.020	0.020
$C_D \exp(2s) =$	1.00E+02	1.00E+03	1.00E+04

CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR			TIME LAG FACTOR			AMPLITUDE FACTOR			TIME LAG FACTOR		
	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{L0}/t_L	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{L0}/t_L	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{L0}/t_L	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.580879	0.474464	0.753350	0.609810	0.374587	0.717845						
0.300	0.500717	0.544028	0.731727	0.529401	0.452937	0.692080	0.549639	0.379705	0.666597			
0.400	0.351032	0.655378	0.687559	0.378236	0.578800	0.636107	0.398969	0.509891	0.604947			
0.500	0.289228	0.701315	0.669210	0.314643	0.629094	0.615154	0.334942	0.564615	0.577873			
0.600	0.243553	0.738843	0.656339	0.266904	0.670824	0.598916	0.286297	0.609370	0.558347			
0.800	0.208547	0.765416	0.647240	0.229796	0.705289	0.587390	0.248008	0.647357	0.544280			
1.000	0.181012	0.788955	0.640807	0.200254	0.734286	0.579233	0.217159	0.680083	0.534142			
1.200			0.156615	0.780078	0.589583	0.170916	0.733297	0.521924				
1.400	0.113491	0.852275	0.629729	0.126422	0.814334	0.565317	0.138415	0.774191	0.516333			
1.600	0.093904	0.872723	0.628594	0.104659	0.840821	0.564001	0.114737	0.808122	0.514464			
1.800	0.079363	0.888723	0.628735	0.088447	0.861234	0.564303	0.096974	0.831423	0.514679			
2.000	0.068290	0.901517	0.629598	0.078031	0.877703	0.565496	0.083315	0.851754	0.516053			

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00			1000.00	
C_D/r_D^2	=	0.020			0.020	
$C_D \exp(2s)$	=	1.00E+05			1.00E+06	
0.300	0.503808	0.377756	0.623084	0.515533	0.330075	0.608910
0.400	0.414874	0.454189	0.581755	0.427347	0.407669	0.564776
0.500	0.351079	0.509288	0.551312	0.364034	0.462351	0.531692
0.600	0.302241	0.554818	0.528893	0.315375	0.507493	0.506868
0.800	0.231836	0.629102	0.500327	0.244513	0.582675	0.474388
1.000	0.183817	0.687349	0.485282	0.195384	0.643766	0.456563
1.200	0.149517	0.733539	0.477996	0.159750	0.693739	0.447378
1.400	0.124218	0.770434	0.475194	0.133134	0.734648	0.443372
1.600	0.105076	0.800140	0.474997	0.112797	0.768210	0.442480
1.800	0.090269	0.824272	0.476300	0.096955	0.795861	0.443453
2.000	0.078591	0.844063	0.478430	0.084399	0.818772	0.445507

TABLE D.26p

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_D \exp(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.020		0.020		0.020		0.020	
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+08		1.00E+09	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.300	0.524819	0.289789	0.598137	0.532338	0.255408	0.589888	0.538528	0.225891	0.582910
0.400	0.437371	0.368289	0.661832	0.445611	0.334376	0.641627	0.452614	0.304831	0.633364
0.500	0.374596	0.422453	0.516701	0.383352	0.388174	0.504899	0.390731	0.358359	0.495363
0.600	0.328278	0.468705	0.489930	0.335427	0.431456	0.476587	0.343195	0.400768	0.465779
0.800	0.255450	0.541144	0.454075	0.264909	0.504300	0.437863	0.273122	0.471685	0.424695
1.000	0.205709	0.603354	0.433647	0.214905	0.566403	0.415091	0.223093	0.532890	0.399856
1.200	0.180136	0.665704	0.422549	0.177712	0.619960	0.402168	0.185626	0.586750	0.385222
1.400	0.141486	0.699603	0.417199	0.149277	0.665891	0.395425	0.156517	0.633882	0.377134
1.600	0.120146	0.736334	0.415415	0.127116	0.705068	0.392640	0.133699	0.674820	0.373305
1.800	0.103391	0.767072	0.415848	0.109574	0.738384	0.392385	0.115492	0.710187	0.372277
2.000	0.090034	0.792855	0.417626	0.095498	0.766701	0.393730	0.100785	0.740652	0.373076

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.020		0.020		0.020		0.020	
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+12		1.00E+14	
0.400	0.458385	0.278814	0.528533	0.467827	0.235151	0.515906	0.475053	0.200181	0.508059
0.500	0.397043	0.332119	0.487489	0.407295	0.287884	0.475218	0.415285	0.251842	0.466075
0.600	0.349871	0.373803	0.456892	0.360765	0.328474	0.443096	0.369304	0.291622	0.432850
0.800	0.280296	0.442763	0.413826	0.292179	0.393968	0.396996	0.301601	0.354429	0.384593
1.000	0.230392	0.502610	0.387188	0.242762	0.450582	0.367459	0.252777	0.407890	0.352901
1.200	0.192633	0.556120	0.371007	0.204982	0.502218	0.348657	0.216240	0.456985	0.332041
1.400	0.163225	0.603778	0.361634	0.175159	0.549490	0.336996	0.185338	0.502737	0.318487
1.600	0.139896	0.645869	0.356769	0.151160	0.592436	0.330184	0.161014	0.545204	0.309977
1.800	0.121138	0.682780	0.354927	0.131594	0.631117	0.326724	0.140955	0.584301	0.305027
2.000	0.105884	0.714995	0.355111	0.115481	0.665709	0.325598	0.124252	0.620011	0.302616

**CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/\tau_D^2 = 0.020$ AND $C_D \exp(2s) = 10^{16}$ TO 10^{25}**

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

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TABLE D.20r

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.020		0.020		0.020			
$C_D \exp(2s)$	=	1.00E+02		1.00E+03		1.00E+04			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.250	0.578179	0.409801	0.758173	0.604285	0.314659	0.725419			
0.300	0.501233	0.470746	0.733639	0.528865	0.371047	0.605308	0.547461	0.299321	0.671690
0.400	0.353145	0.604870	0.687197	0.380612	0.513357	0.637605	0.401474	0.436185	0.604473
0.500	0.291101	0.663582	0.668696	0.316835	0.580914	0.614384	0.337440	0.506907	0.576867
0.600	0.245121	0.707834	0.655831	0.268750	0.633618	0.598170	0.288446	0.564176	0.557326
0.800	0.209851	0.742439	0.646764	0.231327	0.675827	0.586721	0.249795	0.611335	0.543344
1.000	0.182103	0.770278	0.640371	0.201529	0.710372	0.578644	0.218645	0.650787	0.533347
1.200		0.157528	0.763405	0.569101	0.171971	0.712841	0.521304		
1.400	0.114081	0.842478	0.629372	0.127103	0.801974	0.564888	0.139198	0.759059	0.515808
1.600	0.094362	0.865079	0.628257	0.105186	0.831042	0.563605	0.116339	0.794431	0.513994
1.800	0.079747	0.882558	0.628422	0.088866	0.853555	0.563936	0.097453	0.822086	0.514250
2.000	0.068587	0.896416	0.629294	0.076373	0.871384	0.565143	0.083704	0.844098	0.515645

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		
C_D/r_D^2	=	0.020		0.020		
$C_D \exp(2s)$	=	1.00E+05		1.00E+06		
0.300	0.503473	0.291413	0.626396	0.613819	0.218755	0.613783
0.400	0.417300	0.373494	0.581549	0.429459	0.323267	0.565083
0.500	0.353817	0.443538	0.550166	0.366902	0.390395	0.530545
0.600	0.304688	0.502290	0.527616	0.318085	0.448560	0.505394
0.800	0.233556	0.594455	0.499297	0.246480	0.542898	0.473116
1.000	0.185031	0.663020	0.464507	0.196774	0.615581	0.455593
1.200	0.150410	0.715516	0.477357	0.160765	0.672780	0.446608
1.400	0.124902	0.756517	0.474641	0.133906	0.718438	0.442726
1.600	0.105616	0.789040	0.474502	0.113404	0.755278	0.441916
1.800	0.090707	0.815188	0.475836	0.097445	0.785284	0.442934
2.000	0.078955	0.836472	0.477984	0.084804	0.809942	0.445015

TABLE D.26s

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_{Dexp}(2s) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.020			0.020			0.020		
$C_{Dexp}(2s)$	1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR		TIME LAG FACTOR	AMPLITUDE FACTOR		TIME LAG FACTOR	AMPLITUDE FACTOR		TIME LAG FACTOR
$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{LO}/t_L	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{LO}/t_L	$t_L/\Delta t_c$	$\Delta p/\Delta p_0$	t_{LO}/t_L	$t_L/\Delta t_c$
(DESIGN)	(ANALYSIS)		(ANALYSIS)	(ANALYSIS)		(ANALYSIS)	(ANALYSIS)		(ANALYSIS)
0.300	0.521568	0.216729	0.604664	0.527504	0.192437	0.597860	0.532141	0.173787	0.592650
0.400	0.438953	0.283079	0.552861	0.446489	0.250790	0.543530	0.452564	0.224672	0.536234
0.500	0.377458	0.346130	0.515708	0.386068	0.309259	0.504208	0.393171	0.278442	0.495097
0.600	0.329188	0.402447	0.488348	0.338456	0.363013	0.474975	0.346254	0.329270	0.464278
0.800	0.257668	0.496571	0.452573	0.267365	0.455346	0.436159	0.275795	0.418822	0.422828
1.000	0.207289	0.571401	0.432483	0.216685	0.530824	0.413731	0.225075	0.493866	0.398307
1.200	0.170287	0.631811	0.421636	0.179009	0.593172	0.401093	0.186977	0.557132	0.383999
1.400	0.142354	0.681073	0.416451	0.150251	0.645036	0.394564	0.157605	0.610721	0.376153
1.600	0.120824	0.721530	0.414776	0.127871	0.688371	0.391917	0.134539	0.656225	0.372493
1.800	0.103936	0.754958	0.415271	0.110177	0.724704	0.391747	0.116160	0.694926	0.371572
2.000	0.090482	0.782743	0.417089	0.095993	0.755276	0.393145	0.101329	0.727892	0.372441

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.020			0.020			0.020		
$C_{Dexp}(2s)$	1.00E+10			1.00E+12			1.00E+14		
0.400	0.457531	0.203384	0.530412	0.465089	0.171391	0.521793	0.470490	0.149088	0.515803
0.500	0.399094	0.252560	0.487750	0.408322	0.212138	0.476726	0.415102	0.182652	0.468940
0.600	0.352868	0.300317	0.455576	0.363391	0.253814	0.442384	0.371299	0.218732	0.432961
0.800	0.283152	0.386499	0.411842	0.295279	0.332475	0.394927	0.304766	0.289736	0.382633
1.000	0.232574	0.460358	0.385464	0.245313	0.402623	0.365448	0.255622	0.355334	0.350710
1.200	0.194248	0.523759	0.369626	0.206929	0.464712	0.346974	0.217507	0.414680	0.330101
1.400	0.164436	0.578342	0.360527	0.176634	0.519648	0.335630	0.187091	0.468758	0.316870
1.600	0.140828	0.625383	0.355860	0.152294	0.568221	0.329068	0.162371	0.517381	0.308646
1.800	0.121674	0.665931	0.354150	0.132464	0.611101	0.325787	0.142020	0.561167	0.303913
2.000	0.106480	0.700888	0.354422	0.116197	0.646893	0.324765	0.125103	0.600484	0.301664

TABLE D.26t

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.020$ AND $C_D \exp(2s) = 10^{18}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.020		0.020		0.020			
$C_D \exp(2s)$	=	1.00E+18		1.00E+20		1.00E+25			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.400	0.474483	0.132979	0.511482						
0.500	0.420236	0.160641	0.463211	0.427391	0.130748	0.455457	0.432983	0.108287	0.449595
0.600	0.377397	0.191799	0.425986	0.386067	0.154074	0.416400	0.392987	0.124855	0.409068
0.800	0.312320	0.255549	0.373379	0.323447	0.205253	0.360534	0.332679	0.164046	0.350530
1.000	0.264060	0.316383	0.339502	0.276895	0.256985	0.323765	0.287940	0.206107	0.311346
1.200	0.226381	0.372848	0.317160	0.240271	0.306882	0.298828	0.252630	0.248358	0.284207
1.400	0.196066	0.424880	0.302365	0.210489	0.354229	0.281647	0.223723	0.289679	0.264987
1.600	0.171203	0.472607	0.292722	0.185755	0.398841	0.269791	0.199497	0.329591	0.251206
1.800	0.150542	0.516311	0.286709	0.164916	0.440899	0.261719	0.178870	0.367878	0.241302
2.000	0.133206	0.556191	0.283313	0.147179	0.479837	0.256416	0.161105	0.404442	0.234251

TABLE D.26u

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.040$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62	100.00	316.23			
C_D/r_D^2 =	0.040	0.040	0.040			
$C_D \exp(2s)$ =	1.00E+02	1.00E+03	1.00E+04			
FACT						
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.300	0.545623	0.215103	0.682091			
0.400	0.395274	0.403244	0.612462	0.427965	0.297269	0.565677
0.500	0.330418	0.482874	0.584563	0.362759	0.379836	0.532447
0.600	0.281414	0.543640	0.564519	0.312476	0.445733	0.508401
0.800	0.243174	0.591688	0.549982	0.272525	0.499546	0.490750
1.000	0.212624	0.630881	0.539350	0.240091	0.544447	0.477648
1.200	0.187214	0.691422	0.525978	0.190943	0.615582	0.460615
1.400	0.135491	0.736317	0.519296	0.155843	0.669596	0.451479
1.600	0.112395	0.770889	0.516634	0.129876	0.712168	0.447095
1.800	0.095061	0.798515	0.516298	0.110120	0.746538	0.445696
2.000	0.081702	0.820946	0.517396	0.094745	0.774730	0.446169
						0.449683
						0.221421
						0.538357
						0.385638
						0.299979
						0.500859
						0.335552
						0.365537
						0.473439
						0.295187
						0.420872
						0.453073
						0.261982
						0.468230
						0.437735
						0.210787
						0.545292
						0.417250
						0.173488
						0.605548
						0.405560
						0.145424
						0.654054
						0.399296
						0.123778
						0.693878
						0.396515
						0.106747
						0.727050
						0.396005

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00
C_D/r_D^2 =	0.040	0.040
$C_D \exp(2s)$ =	1.00E+05	1.00E+06
0.400	0.464494	0.107998
0.500	0.402039	0.239653
0.600	0.352807	0.301876
0.800	0.279413	0.403492
1.000	0.227315	0.462807
1.200	0.186687	0.548554
1.400	0.159183	0.599000
1.600	0.136130	0.642836
1.800	0.117790	0.679921
2.000	0.102977	0.711543
		0.474984
		0.130091
		0.509680
		0.414075
		0.194203
		0.466461
		0.365913
		0.251789
		0.434150
		0.293392
		0.349408
		0.390872
		0.241111
		0.428417
		0.364774
		0.201773
		0.493570
		0.348709
		0.171330
		0.548265
		0.338921
		0.147262
		0.594759
		0.333283
		0.127917
		0.634679
		0.330485
		0.112153
		0.669183
		0.329622

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.040$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.040		0.040		0.040
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+06
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$
						TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.400	0.482700	0.102739	0.501533	0.488574	0.082608	0.495504
0.600	0.423128	0.159689	0.456482	0.430089	0.133158	0.448083
0.800	0.376043	0.212303	0.422460	0.384010	0.180951	0.413696
0.800	0.304708	0.304449	0.376356	0.313962	0.267048	0.365263
1.000	0.252680	0.381514	0.348072	0.262439	0.341183	0.335129
1.200	0.213061	0.446808	0.330234	0.222820	0.405191	0.315770
1.400	0.182044	0.502235	0.318972	0.191504	0.460820	0.303217
1.600	0.157273	0.550276	0.312069	0.166266	0.509545	0.295189
1.800	0.137175	0.592089	0.308162	0.145620	0.552481	0.290292
2.000	0.120660	0.628680	0.306382	0.128523	0.590479	0.287637

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00					
C_D/r_D^2	=	0.040	0.040	0.040					
$C_D \exp(2s)$	=	1.00E+10	1.00E+12	1.00E+14					
0.500	0.439993	0.098130	0.438984	0.446592	0.072417	0.432497	0.451275	0.056467	0.428010
0.600	0.395547	0.135477	0.401630	0.403348	0.106078	0.393861	0.408893	0.083845	0.388520
0.800	0.327981	0.208603	0.349651	0.337906	0.168655	0.339381	0.345177	0.138721	0.332232
1.000	0.277800	0.276838	0.316598	0.289148	0.228365	0.304173	0.297738	0.191692	0.295397
1.200	0.238674	0.336718	0.294795	0.250820	0.283568	0.280520	0.260286	0.241911	0.270318
1.400	0.207287	0.390533	0.280130	0.219756	0.334273	0.264234	0.229728	0.289035	0.252785
1.600	0.181617	0.438841	0.270239	0.194076	0.380761	0.252891	0.204267	0.333027	0.240274
1.800	0.160324	0.482342	0.263668	0.172542	0.423380	0.244997	0.182738	0.374002	0.231526
2.000	0.142458	0.521588	0.259501	0.154282	0.462471	0.239613	0.164327	0.412080	0.224986

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00					
C_D/r_D^2	=	0.040	0.040	0.040					
$C_D \exp(2s)$	=	1.00E+18	1.00E+20	1.00E+25					
0.400	0.510132	0.022924	0.474563	0.515149	0.014750	0.469941			
0.500	0.454748	0.045275	0.424741	0.459490	0.031043	0.420358	0.463712	0.021297	0.416530
0.600	0.413001	0.068730	0.384656	0.418638	0.048838	0.378477	0.423026	0.034540	0.375541
0.800	0.360665	0.116295	0.327033	0.358280	0.085665	0.320081	0.384201	0.062560	0.314878
1.000	0.304386	0.163344	0.288945	0.313856	0.123255	0.280227	0.321404	0.091820	0.273846
1.200	0.267788	0.208871	0.262745	0.278758	0.160740	0.252405	0.267755	0.121706	0.244513
1.400	0.237801	0.252364	0.244183	0.249900	0.197554	0.232361	0.260104	0.151753	0.223246
1.600	0.212677	0.293602	0.230773	0.225568	0.233339	0.217584	0.236731	0.181615	0.207324
1.800	0.191300	0.332536	0.220974	0.204698	0.267884	0.206510	0.216589	0.211042	0.195173
2.000	0.172892	0.369143	0.213822	0.186576	0.301064	0.198139	0.198990	0.239648	0.185778

**CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D \wedge D^2 = 0.040$ AND $C_D \exp(2s) = 10^2$ TO 10^6**

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

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TABLE D.26z

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.040$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	1000.00	1000.00	1000.00
C_D/r_D^2 =	0.040	0.040	0.040
$C_D \exp(2s)$ =	1.00E+07	1.00E+08	1.00E+09
CYCLE LENGTH (Δt_c)/ r_D^2	AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)
0.400	0.453765	0.201250	0.505878
0.500	0.402306	0.207221	0.485422
0.600	0.361271	0.224530	0.446747
0.800	0.298575	0.271687	0.392397
1.000	0.251870	0.324116	0.357877
1.200	0.215319	0.376496	0.335096
1.400	0.185914	0.426592	0.320421
1.600	0.161858	0.473421	0.311087
1.800	0.141950	0.516592	0.305464
2.000	0.125330	0.556035	0.302470
0.400	0.467568	0.190078	0.531424
0.500	0.407245	0.191075	0.479534
0.600	0.367111	0.204116	0.439640
0.800	0.305813	0.243935	0.383110
1.000	0.260023	0.290640	0.346461
1.200	0.223967	0.336885	0.322156
1.400	0.194714	0.386260	0.305940
1.600	0.170552	0.431552	0.295229
1.800	0.150359	0.474135	0.288360
2.000	0.133339	0.513729	0.284301
0.400	0.411052	0.178703	0.475093
0.500	0.371858	0.188299	0.434228
0.600	0.331822	0.221690	0.376968
0.800	0.266723	0.263347	0.337758
1.000	0.231237	0.307448	0.312028
1.200	0.202271	0.351766	0.294509
1.400	0.178168	0.394985	0.282610
1.600	0.157859	0.436341	0.274679
1.800	0.140600	0.475409	0.268619

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D =	1000.00	1000.00	1000.00
C_D/r_D^2 =	0.040	0.040	0.040
$C_D \exp(2s)$ =	1.00E+10	1.00E+12	1.00E+14
0.500	0.414050	0.168935	0.471653
0.600	0.375346	0.175750	0.429995
0.800	0.316357	0.204114	0.370341
1.000	0.272287	0.240903	0.330857
1.200	0.237384	0.281082	0.303948
1.400	0.208781	0.322258	0.286326
1.600	0.184842	0.363133	0.272405
1.800	0.164539	0.402863	0.263528
2.000	0.147164	0.440934	0.257594
0.500	0.418446	0.164496	0.466598
0.600	0.380794	0.157147	0.423842
0.800	0.323554	0.177482	0.362103
1.000	0.280915	0.206630	0.320695
1.200	0.247121	0.239892	0.291972
1.400	0.219309	0.275168	0.271629
1.600	0.195862	0.311187	0.257078
1.800	0.175792	0.347125	0.246659
2.000	0.158433	0.382405	0.239272
0.500	0.421416	0.144170	0.463409
0.600	0.384618	0.143956	0.419629
0.800	0.328723	0.158636	0.358410
1.000	0.287228	0.182045	0.313646
1.200	0.254395	0.209768	0.283624
1.400	0.227345	0.239935	0.262027
1.600	0.204463	0.271429	0.248263
1.800	0.184769	0.303498	0.234675
2.000	0.167617	0.335590	0.226161

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D =	1000.00	1000.00	1000.00
C_D/r_D^2 =	0.040	0.040	0.040
$C_D \exp(2s)$ =	1.00E+16	1.00E+20	1.00E+25
0.600	0.387416	0.133993	0.416597
0.800	0.332593	0.144627	0.352283
1.000	0.292011	0.163719	0.308509
1.200	0.259980	0.187077	0.277531
1.400	0.233609	0.213009	0.255002
1.600	0.211279	0.240560	0.238319
1.800	0.192002	0.269054	0.225834
2.000	0.175142	0.298005	0.216444
0.600	0.391272	0.119701	0.412493
0.800	0.337976	0.125057	0.346652
1.000	0.296729	0.138347	0.301571
1.200	0.267918	0.155545	0.269308
1.400	0.242638	0.175215	0.245513
1.600	0.221253	0.196608	0.227576
1.800	0.202769	0.219229	0.213842
2.000	0.186539	0.242697	0.203220
0.600	0.342231	0.109058	0.342341
0.800	0.304099	0.118170	0.296246
1.000	0.274313	0.130679	0.263030
1.200	0.249993	0.145345	0.238290
1.400	0.229491	0.161571	0.219407
1.600	0.211801	0.178994	0.204723
1.800	0.196269	0.197351	0.193145

TABLE D.26y

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.040$ AND $C_D \exp(2s) = 10^2$ TO 10^8

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 31.62		100.00		316.23	
C_D/r_D^2	= 0.040		0.040		0.040	
$C_D \exp(2s)$	= 1.00E+02		1.00E+03		1.00E+04	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
	t_{L0}/t_L		t_{L0}/t_L		t_{L0}/t_L	
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.300	0.529494	0.351846	0.691960			
0.400	0.385135	0.472596	0.626676	0.414857	0.384362	0.581778
0.500	0.324344	0.522112	0.596756	0.353600	0.435563	0.547381
0.600	0.278335	0.562313	0.574319	0.306795	0.477070	0.521043
0.800	0.242134	0.596749	0.557459	0.269511	0.513168	0.500832
1.000	0.212907	0.626971	0.544810	0.238999	0.545545	0.485332
1.200	0.186822	0.677843	0.528398	0.192055	0.601895	0.464477
1.400	0.137508	0.718921	0.519741	0.157869	0.649252	0.452707
1.600	0.114447	0.752530	0.515767	0.132167	0.689251	0.446614
1.800	0.096982	0.780298	0.514638	0.112384	0.723122	0.444108
2.000	0.083445	0.803440	0.515248	0.096861	0.751880	0.443884
						0.434877 0.318144 0.554996
						0.373974 0.369446 0.517559
						0.327297 0.410309 0.488404
						0.289901 0.445774 0.465807
						0.259051 0.477896 0.447764
						0.210915 0.535175 0.422942
						0.175138 0.585082 0.408069
						0.147716 0.628663 0.399805
						0.126249 0.666633 0.395336
						0.109167 0.699650 0.393847

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	= 1000.00		1000.00	
C_D/r_D^2	= 0.040		0.040	
$C_D \exp(2s)$	= 1.00E+05		1.00E+06	
0.400	0.449067	0.266966	0.537459	0.459599 0.226407 0.525142
0.500	0.388720	0.317987	0.497927	0.399856 0.276787 0.484059
0.600	0.342434	0.357928	0.466814	0.354005 0.315908 0.451557
0.800	0.274522	0.423113	0.422530	0.286671 0.378627 0.404624
1.000	0.226118	0.478918	0.394507	0.238437 0.432066 0.374125
1.200	0.189614	0.528793	0.376915	0.201720 0.480539 0.354296
1.400	0.161192	0.573566	0.366195	0.172795 0.524969 0.341606
1.600	0.138804	0.613665	0.360095	0.149520 0.565612 0.333805
1.800	0.120383	0.649355	0.357153	0.130516 0.602583 0.329422
2.000	0.105507	0.681019	0.356380	0.114828 0.636035 0.327451

TABLE D.3a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.040$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $P = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.040		0.040		0.040
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09
CYCLE LENGTH (Δt_c) _D / r_D^2		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.400	0.467684	0.193737	0.518064	0.474047	0.187135	0.509138
0.500	0.408563	0.243021	0.473744	0.415548	0.214886	0.465781
0.600	0.383138	0.281389	0.440202	0.370534	0.252402	0.431414
0.800	0.298418	0.341964	0.391318	0.304408	0.311204	0.381050
1.000	0.248531	0.393000	0.358928	0.258918	0.360048	0.347212
1.200	0.211878	0.439459	0.337309	0.220464	0.404410	0.324172
1.400	0.182767	0.482843	0.322969	0.191354	0.445946	0.308475
1.600	0.159115	0.522823	0.313877	0.167534	0.485083	0.297914
1.800	0.139608	0.560029	0.307970	0.147729	0.521788	0.291039
2.000	0.123344	0.594280	0.304843	0.131079	0.558112	0.286854
						0.421261 0.191176 0.458463
						0.376650 0.227741 0.424408
						0.311076 0.284861 0.372881
						0.283985 0.331916 0.337917
						0.227787 0.374302 0.313750
						0.188784 0.414080 0.298845
						0.174930 0.451836 0.285318
						0.164973 0.487670 0.277436
						0.138079 0.521539 0.272311

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.040			0.040			0.040		
$C_D \exp(2s)$	= 1.00E+10			1.00E+12			1.00E+14		
0.500	0.426008	0.171028	0.454346	0.433382	0.138952	0.446613	0.438794	0.114961	0.441105
0.600	0.381787	0.206514	0.418898	0.389911	0.171995	0.409874	0.396005	0.145388	0.403685
0.800	0.316734	0.282253	0.366218	0.325831	0.224812	0.355993	0.332827	0.195190	0.348511
1.000	0.270021	0.307592	0.330363	0.279798	0.267499	0.318820	0.287394	0.235657	0.310393
1.200	0.234095	0.348204	0.305296	0.244395	0.305188	0.292429	0.252458	0.271071	0.283091
1.400	0.205252	0.386275	0.287587	0.215927	0.340249	0.273369	0.224358	0.303712	0.263086
1.600	0.181448	0.422565	0.275071	0.192341	0.373703	0.258491	0.201045	0.334722	0.248256
1.800	0.161438	0.457267	0.266328	0.172397	0.405939	0.248398	0.181273	0.364630	0.237184
2.000	0.144404	0.490371	0.260384	0.155291	0.437058	0.242129	0.164241	0.393653	0.228935

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.040			0.040			0.040		
$C_D \exp(2s)$	= 1.00E+16			1.00E+20			1.00E+25		
0.600	0.400706	0.124509	0.388929	0.407399	0.094448	0.392375			
0.800	0.338363	0.171229	0.342808	0.348516	0.135185	0.334742	0.353309	0.104568	0.328307
1.000	0.293477	0.209668	0.303980	0.302808	0.189780	0.294788	0.310440	0.134771	0.287350
1.200	0.268954	0.243214	0.275989	0.268803	0.200222	0.265876	0.277401	0.161875	0.257636
1.400	0.231190	0.273914	0.255322	0.241814	0.227933	0.244308	0.250809	0.186895	0.235349
1.600	0.208146	0.302906	0.239787	0.219047	0.253888	0.227853	0.228734	0.209870	0.218204
1.800	0.188577	0.330787	0.227997	0.199872	0.278628	0.215113	0.208974	0.231669	0.204763
2.000	0.171680	0.357887	0.219015	0.183285	0.302579	0.205147	0.183742	0.253021	0.194075

TABLE D.2ca

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.040$ AND $C_D \exp(2s) = 10^2$ TO 10^8

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	0.040	0.040	0.040		
$C_D \exp(2s)$	=	1.00E+02	1.00E+03	1.00E+04		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)
0.300	0.526448	0.298388	0.698500			
0.400	0.387087	0.404863	0.826938	0.416267	0.310434	0.582992
0.500	0.328628	0.464398	0.595963	0.358030	0.387943	0.546746
0.600	0.280458	0.514296	0.573199	0.309302	0.418729	0.519746
0.800	0.243986	0.558677	0.556279	0.271797	0.463479	0.499359
1.000	0.214492	0.593178	0.543674	0.240996	0.503146	0.483882
1.200	0.189982	0.652947	0.527404	0.193533	0.570315	0.463224
1.400	0.138377	0.699791	0.518868	0.158973	0.624903	0.451645
1.600	0.115117	0.737326	0.514987	0.133013	0.669899	0.445698
1.800	0.097513	0.767884	0.513933	0.113049	0.707344	0.443303
2.000	0.083875	0.793084	0.514593	0.097397	0.738746	0.443154
						0.435134 0.246248 0.557713
						0.378145 0.297446 0.517509
						0.329974 0.345055 0.487185
						0.292532 0.388504 0.463964
						0.261441 0.428074 0.446042
						0.212743 0.497261 0.421396
						0.178512 0.555557 0.406766
						0.148765 0.605078 0.398506
						0.127069 0.647359 0.394393
						0.109823 0.683591 0.393012

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00
C_D/r_D^2	=	0.040	0.040
$C_D \exp(2s)$	=	1.00E+05	1.00E+06
0.400	0.447790	0.202519	0.541951
0.500	0.390235	0.246414	0.498823
0.600	0.344996	0.289309	0.465971
0.800	0.277214	0.367492	0.420663
1.000	0.228293	0.435353	0.392693
1.200	0.191283	0.494352	0.375356
1.400	0.162472	0.545845	0.364884
1.600	0.139802	0.590865	0.358985
1.800	0.121176	0.630320	0.356189
2.000	0.108151	0.664870	0.355522
			0.456654 0.172114 0.531430
			0.400433 0.209091 0.486119
			0.356181 0.246993 0.451339
			0.289639 0.318983 0.402770
			0.240918 0.383763 0.372114
			0.203686 0.441605 0.352499
			0.174325 0.493260 0.340076
			0.150716 0.538398 0.332512
			0.131466 0.580585 0.328311
			0.115595 0.617319 0.326477

TABLE D.2c

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/\tau_D^2 = 0.040$ AND $C_{Dexp}(2\pi) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $P' = 0.50$

Distance, $r_D =$	1000.00	1000.00	1000.00
$C_D/\tau_D^2 =$	0.040	0.040	0.040
$C_{Dexp}(2\pi) =$	1.00E+07	1.00E+08	1.00E+09
CYCLE LENGTH (Δt_c) $_D/\tau_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)
0.400	0.463102	0.150406	0.524032
0.500	0.408047	0.161323	0.477048
0.600	0.364715	0.214500	0.440777
0.800	0.288280	0.280004	0.388835
1.000	0.251249	0.340911	0.356813
1.200	0.214124	0.396567	0.335315
1.400	0.184551	0.447240	0.321231
1.600	0.160524	0.493309	0.312186
1.800	0.140730	0.535128	0.308599
2.000	0.124249	0.573014	0.303738
0.400	0.467842	0.134477	0.518612
0.500	0.415889	0.160083	0.470316
0.600	0.371377	0.189196	0.432871
0.800	0.307144	0.248436	0.379871
1.000	0.258786	0.305208	0.345086
1.200	0.222953	0.358168	0.322038
1.400	0.193388	0.407194	0.306555
1.600	0.169164	0.452435	0.298252
1.800	0.149036	0.494086	0.288806
2.000	0.132135	0.532340	0.285610
0.400	0.418476	0.143979	0.485159
0.500	0.376882	0.169206	0.426775
0.600	0.313557	0.222633	0.371906
0.800	0.266911	0.275292	0.335876
1.000	0.230468	0.325349	0.311536
1.200	0.201044	0.372373	0.294879
1.400	0.176777	0.416326	0.283492
1.600	0.156471	0.457279	0.276846
1.800	0.139286	0.495332	0.270926

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, $r_D =$	1000.00	1000.00	1000.00
$C_D/\tau_D^2 =$	0.040	0.040	0.040
$C_{Dexp}(2\pi) =$	1.00E+10	1.00E+12	1.00E+14
0.500	0.422151	0.131148	0.461111
0.600	0.380982	0.153179	0.421957
0.800	0.318861	0.201339	0.365719
1.000	0.272917	0.250066	0.328485
1.200	0.236910	0.297180	0.303065
1.400	0.207709	0.342038	0.285417
1.600	0.183501	0.384441	0.273105
1.800	0.163128	0.424360	0.264592
2.000	0.145789	0.461822	0.256860
0.500	0.427622	0.112470	0.455210
0.600	0.387477	0.139421	0.414884
0.800	0.327063	0.188690	0.356549
1.000	0.282409	0.210287	0.317444
1.200	0.247301	0.251803	0.290331
1.400	0.218665	0.292263	0.271115
1.600	0.194749	0.331251	0.257331
1.800	0.174447	0.368589	0.247419
2.000	0.157012	0.404198	0.240357
0.500	0.431462	0.099693	0.451159
0.600	0.392104	0.112919	0.409989
0.800	0.333050	0.145237	0.350139
1.000	0.289501	0.180832	0.309687
1.200	0.255242	0.217327	0.281298
1.400	0.227215	0.253630	0.260914
1.600	0.203700	0.289194	0.246024
1.800	0.183625	0.323764	0.235063
2.000	0.166274	0.357099	0.226965

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, $r_D =$	1000.00	1000.00	1000.00
$C_D/\tau_D^2 =$	0.040	0.040	0.040
$C_{Dexp}(2\pi) =$	1.00E+16	1.00E+20	1.00E+25
0.600	0.395638	0.100923	0.408430
0.800	0.337575	0.127834	0.345445
1.000	0.294954	0.158468	0.303943
1.200	0.261453	0.190605	0.274618
1.400	0.234014	0.223149	0.253334
1.600	0.210930	0.255495	0.237591
1.800	0.191149	0.287295	0.225801
2.000	0.173974	0.318344	0.216923
0.600	0.400255	0.084787	0.401640
0.800	0.343900	0.104109	0.338092
1.000	0.302703	0.127332	0.298161
1.200	0.270437	0.152570	0.265493
1.400	0.244028	0.178870	0.242938
1.600	0.221768	0.205645	0.225979
1.800	0.202820	0.232511	0.213018
2.000	0.185908	0.259212	0.203001
0.600	0.348895	0.085903	0.334237
0.800	0.308822	0.103104	0.290200
1.000	0.277771	0.122356	0.258483
1.200	0.252356	0.142917	0.234921
1.400	0.230858	0.164310	0.216989
1.600	0.212531	0.186199	0.203084
1.800	0.196407	0.208333	0.192147

TABLE D.2c

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62	100.00	316.23
C_D/r_D^2 =	0.070	0.070	0.070
$C_D \exp(2s)$ =	1.00E+02	1.00E+03	1.00E+04

CYCLE LENGTH				AMPLITUDE				TIME LAG			
$(\Delta t_c)_D/r_D^2$				FACTOR				FACTOR			
$t_L/\Delta t_c$				$\Delta p/\Delta p_0$				t_{LO}/t_L			
(DESIGN)				(ANALYSIS)				(ANALYSIS)			
0.300	0.559480	0.103038	0.665196								
0.400	0.418756	0.246157	0.578118	0.450661	0.157808	0.537188		0.469386	0.105823	0.515759	
0.500	0.357310	0.316587	0.540567	0.390251	0.220570	0.494938		0.410627	0.158596	0.470379	
0.600	0.309877	0.374798	0.512666	0.342973	0.275437	0.463195		0.364497	0.206909	0.435843	
0.800	0.272024	0.423873	0.491653	0.304642	0.323709	0.439012		0.326789	0.251023	0.409259	
1.000	0.241112	0.466013	0.475624	0.272841	0.366542	0.420313		0.295195	0.291363	0.388485	
1.200	0.193795	0.535177	0.453835	0.223105	0.439426	0.394214		0.245024	0.362415	0.358949	
1.400	0.159530	0.590005	0.441045	0.186124	0.499398	0.378028		0.206948	0.422979	0.339989	
1.600	0.133838	0.634839	0.433860	0.157746	0.549791	0.368104		0.177184	0.475320	0.327721	
1.800	0.114053	0.672211	0.430327	0.135458	0.592776	0.362327		0.153408	0.520985	0.319934	
2.000	0.098490	0.703812	0.429204	0.117829	0.629847	0.359370		0.134094	0.561149	0.315242	

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00
C_D/r_D^2 =	0.070	0.070
$C_D \exp(2s)$ =	1.00E+05	1.00E+06

0.400	0.481250	0.074268	0.503044			
0.500	0.423882	0.118098	0.455670	0.432986	0.090819	0.446086
0.600	0.379003	0.159653	0.419162	0.389189	0.126423	0.408191
0.800	0.311242	0.235399	0.368455	0.323080	0.193501	0.354977
1.000	0.261563	0.301945	0.336252	0.274247	0.254586	0.320700
1.200	0.223313	0.360540	0.315073	0.236289	0.309899	0.297772
1.400	0.192966	0.412414	0.300919	0.205847	0.359975	0.282089
1.600	0.166392	0.458836	0.291462	0.180921	0.405397	0.271279
1.800	0.148176	0.500015	0.285284	0.160202	0.446718	0.263868
2.000	0.131338	0.537194	0.281471	0.142772	0.484362	0.256930

TABLE D.2cd

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00				1000.00		
C_D/r_D^2	=	0.070		0.070				0.070		
$C_D \exp(2s)$	=	1.00E+07		1.00E+08				1.00E+09		
CYCLE LENGTH (Δt_e) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)				(ANALYSIS)		
0.500	0.439550	0.071819	0.439426	0.444482	0.058157	0.434551		0.448312	0.048049	0.430838
0.600	0.396618	0.102462	0.400545	0.402220	0.084742	0.394967		0.406566	0.071322	0.390744
0.800	0.331985	0.161702	0.345433	0.338885	0.137176	0.338400		0.344331	0.117946	0.333048
1.000	0.284143	0.217260	0.309530	0.291996	0.187539	0.301206		0.298328	0.163603	0.294815
1.200	0.246701	0.268781	0.285203	0.255159	0.235198	0.275749		0.262112	0.207555	0.268435
1.400	0.216434	0.316344	0.268290	0.225214	0.279952	0.257831		0.232560	0.249442	0.249687
1.600	0.191443	0.360198	0.258369	0.200328	0.321815	0.244998		0.207881	0.289128	0.236097
1.800	0.170491	0.400647	0.247944	0.178323	0.360912	0.235733		0.186939	0.326607	0.226129
2.000	0.152717	0.437950	0.242069	0.161378	0.397357	0.229077		0.168943	0.361876	0.218819

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00	1000.00						
C_D/r_D^2 =	0.070	0.070	0.070						
$C_D \exp(2s)$ =	1.00E+10	1.00E+12	1.00E+14						
1.000	0.303502	0.144103	0.289787	0.311384	0.114860	0.282452	0.317035	0.093883	0.277418
1.200	0.267891	0.184606	0.262645	0.276861	0.149182	0.254135	0.283423	0.123498	0.248251
1.400	0.238758	0.223705	0.243205	0.248557	0.183164	0.233617	0.255868	0.153160	0.226942
1.600	0.214343	0.261169	0.228978	0.224734	0.216362	0.218392	0.232632	0.182544	0.210977
1.800	0.193538	0.296804	0.218419	0.204316	0.248565	0.206898	0.212655	0.211436	0.198783
2.000	0.175591	0.330878	0.210534	0.186587	0.279651	0.198127	0.195237	0.239674	0.189350

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00			1000.00				1000.00
C_D/r_D^2	=	0.070			0.070				0.070
$C_D \exp(2s)$	=	1.00E+16			1.00E+20				1.00E+25
0.600	0.421448	0.029842	0.376947		0.425006	0.020986	0.373791		0.428170
0.800	0.363285	0.053594	0.315689		0.367891	0.039109	0.311719		0.371455
1.000	0.321240	0.078640	0.273786		0.327008	0.058262	0.268957		0.331451
1.200	0.288377	0.104355	0.243986		0.295268	0.078218	0.238292		0.300645
1.400	0.261470	0.130394	0.222079		0.269384	0.098741	0.215555		0.275656
1.600	0.238774	0.156484	0.205550		0.247588	0.119633	0.198234		0.254685
1.800	0.219231	0.182414	0.192821		0.228810	0.140723	0.184748		0.236657
2.000	0.202149	0.208017	0.182875		0.212369	0.161863	0.174074		0.220878

TABLE D.2c

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_{Dexp}(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62	100.00	316.23					
C_D/r_D^2	=	0.070	0.070	0.070					
$C_{Dexp}(2s)$	=	1.00E+02	1.00E+03	1.00E+04					
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L			
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)			
0.400	0.402332	0.299401	0.604382	0.428260	0.236907	0.567792	0.442503	0.203430	0.549516
0.500	0.347513	0.326331	0.561959	0.375054	0.252349	0.520693	0.391143	0.209458	0.499275
0.600	0.304695	0.357815	0.529700	0.333118	0.275776	0.484502	0.350522	0.225297	0.460447
0.800	0.270047	0.389929	0.504821	0.298818	0.302219	0.456216	0.317181	0.245450	0.429804
1.000	0.241333	0.421236	0.485470	0.270037	0.329867	0.433866	0.289061	0.267710	0.405312
1.200	0.198455	0.479447	0.458569	0.224158	0.384153	0.401895	0.243772	0.314637	0.369558
1.400	0.163144	0.531081	0.442264	0.189136	0.435667	0.381484	0.208595	0.361653	0.345897
1.600	0.137669	0.576389	0.432709	0.161628	0.483118	0.368570	0.180427	0.408955	0.330165
1.800	0.117761	0.618014	0.427576	0.139800	0.526266	0.360687	0.157432	0.449711	0.319832
2.000	0.101933	0.650652	0.425363	0.121711	0.565219	0.356259	0.138408	0.489561	0.313282

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D =	1000.00	1000.00				
C_D/r_D^2 =	0.070	0.070				
$C_{Dexp}(2s)$ =	1.00E+05	1.00E+06				
0.400	0.450960	0.183932	0.539211			
0.500	0.401194	0.183017	0.486767	0.407883	0.165448	0.478785
0.600	0.361756	0.193068	0.446147	0.369433	0.171306	0.436877
0.800	0.302033	0.225631	0.387904	0.311229	0.196192	0.370444
1.000	0.257809	0.264773	0.349438	0.268105	0.228594	0.336018
1.200	0.233146	0.306969	0.323342	0.234168	0.264115	0.308123
1.400	0.195049	0.347193	0.305414	0.206471	0.300795	0.288518
1.600	0.171794	0.387370	0.283094	0.183339	0.337500	0.274638
1.800	0.152278	0.425882	0.264745	0.163725	0.373525	0.264837
2.000	0.135737	0.462385	0.279279	0.146920	0.408411	0.258022

TABLE D.2cJ

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.070			0.070			0.070		
$C_D \exp(2s)$	= 1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $i_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR i_{L0}/i_L	AMPLITUDE FACTOR $i_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR i_{L0}/i_L	AMPLITUDE FACTOR $i_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR i_{L0}/i_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.500	0.412603	0.153006	0.473307	0.418025	0.143625	0.469414			
0.600	0.374937	0.155763	0.430463	0.379040	0.144091	0.425804	0.382191	0.134943	0.422294
0.800	0.317996	0.174825	0.368433	0.323143	0.158745	0.362564	0.327172	0.146239	0.358099
1.000	0.275864	0.201734	0.326567	0.281864	0.181270	0.319615	0.286614	0.165278	0.314318
1.200	0.242673	0.232276	0.297324	0.249364	0.207622	0.289347	0.254726	0.188163	0.283255
1.400	0.215492	0.264623	0.276441	0.222711	0.236110	0.267480	0.228578	0.213326	0.260617
1.600	0.192664	0.297700	0.261345	0.200262	0.265762	0.251430	0.206517	0.239893	0.243814
1.800	0.173173	0.330803	0.250389	0.181005	0.295912	0.239554	0.187543	0.267258	0.231203
2.000	0.156339	0.363444	0.242477	0.164280	0.326089	0.230755	0.171002	0.294987	0.221685

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.070			0.070			0.070		
$C_D \exp(2s)$	= 1.00E+10			1.00E+12			1.00E+14		
0.600	0.384722	0.127577	0.419515	0.388392	0.116133	0.415551			
0.800	0.330402	0.136223	0.354598	0.336244	0.121089	0.349477	0.338685	0.110045	0.345926
1.000	0.290454	0.152481	0.310163	0.296258	0.133301	0.304086	0.300426	0.119557	0.299867
1.200	0.269100	0.172509	0.278473	0.265769	0.149021	0.271486	0.270591	0.132285	0.266648
1.400	0.251406	0.194847	0.255223	0.240845	0.166949	0.247340	0.246269	0.147040	0.241893
1.600	0.211725	0.218703	0.237818	0.219830	0.186419	0.228049	0.225802	0.165247	0.233003
1.800	0.193046	0.243537	0.224612	0.201717	0.207009	0.214957	0.208173	0.180556	0.208290
2.000	0.178720	0.268951	0.214511	0.185848	0.228394	0.203978	0.192727	0.198717	0.196695

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.070			0.070			0.070		
$C_D \exp(2s)$	= 1.00E+18			1.00E+20			1.00E+25		
0.800	0.341247	0.101485	0.343329	0.344899	0.088858	0.339894	0.347775	0.077699	0.336884
1.000	0.303561	0.109136	0.296771	0.307960	0.094117	0.292532	0.311485	0.081342	0.289221
1.200	0.274231	0.119728	0.263109	0.279359	0.101969	0.258279	0.283498	0.087285	0.254508
1.400	0.250383	0.132160	0.237919	0.256194	0.111334	0.232522	0.260892	0.094442	0.228334
1.600	0.230356	0.145919	0.218582	0.236818	0.121723	0.212618	0.242051	0.102448	0.208021
1.800	0.213134	0.160708	0.203443	0.220210	0.133085	0.196906	0.225959	0.111115	0.191896
2.000	0.198054	0.176324	0.191405	0.205704	0.145092	0.184287	0.211949	0.120334	0.178857

TABLE D.2g

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62			100.00			316.23					
C_D/r_D^2 =	0.070			0.070			0.070					
$C_D \exp(2s)$ =	1.00E+02			1.00E+03			1.00E+04					
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$ (DESIGN)	AMPLITUDE FACTOR $t_L/\Delta t_c$ (ANALYSIS)			TIME LAG FACTOR t_{LO}/t_L (ANALYSIS)			AMPLITUDE FACTOR $t_L/\Delta t_c$ (ANALYSIS)			TIME LAG FACTOR t_{LO}/t_L (ANALYSIS)		
0.400	0.408090	0.333229	0.594339	0.436556	0.248281	0.552861	0.455325	0.190071	0.530072			
0.500	0.347599	0.380502	0.556832	0.377885	0.295869	0.512204	0.397190	0.236259	0.487308			
0.600	0.303060	0.418224	0.527463	0.333024	0.333263	0.480006	0.352626	0.272613	0.453322			
0.800	0.267640	0.450722	0.504334	0.297150	0.365085	0.454248	0.318928	0.303197	0.425901			
1.000	0.238635	0.479889	0.486072	0.267555	0.393579	0.433533	0.287407	0.330288	0.403587			
1.200	0.193808	0.531423	0.460274	0.221176	0.444521	0.403322	0.240876	0.378466	0.370336			
1.400	0.160827	0.576162	0.444381	0.186291	0.490039	0.383639	0.205468	0.421908	0.347832			
1.600	0.135713	0.615405	0.434947	0.159109	0.531317	0.370989	0.177470	0.462106	0.332607			
1.800	0.116125	0.649924	0.429801	0.137438	0.568819	0.363149	0.154785	0.499528	0.322450			
2.000	0.100562	0.680316	0.427548	0.119874	0.602829	0.358670	0.136098	0.534328	0.315913			

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00				
C_D/r_D^2 =	0.070	0.070				
$C_D \exp(2s)$ =	1.00E+05	1.00E+06				
0.400	0.467733	0.148903	0.516010			
0.500	0.410358	0.192524	0.471672	0.419827	0.159510	0.461033
0.600	0.366266	0.227463	0.436440	0.376261	0.192886	0.424847
0.800	0.301628	0.282628	0.384559	0.312282	0.245455	0.371439
1.000	0.255400	0.328011	0.349276	0.268471	0.288462	0.334764
1.200	0.220041	0.368748	0.324796	0.231361	0.326707	0.308904
1.400	0.191655	0.406712	0.307669	0.203262	0.362298	0.290403
1.600	0.168782	0.442554	0.295710	0.180123	0.398090	0.277093
1.800	0.149554	0.476473	0.287488	0.160692	0.428393	0.267561
2.000	0.133325	0.508508	0.282021	0.144152	0.459295	0.260839

TABLE D.2a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_{Dexp}(2a) = 10^7$ TO 10^{14}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F = 0.50$

Distance, r_D	=	1000.00	1000.00	1000.00		
C_D/r_D^2	=	0.070	0.070	0.070		
$C_{Dexp}(2a)$	=	1.00E+07	1.00E+08	1.00E+09		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.500	0.428903	0.134064	0.453381	0.480049	0.114180	0.447890
0.600	0.383868	0.165263	0.416430	0.386817	0.143273	0.410072
0.800	0.320558	0.215608	0.361849	0.327170	0.191128	0.354537
1.000	0.275180	0.256587	0.324170	0.282213	0.230287	0.318091
1.200	0.240373	0.292723	0.297323	0.247713	0.264645	0.288513
1.400	0.212488	0.326175	0.277822	0.220030	0.296264	0.268272
1.600	0.189410	0.357637	0.263508	0.197120	0.326199	0.253199
1.800	0.169980	0.388437	0.252971	0.177741	0.354968	0.241897
2.000	0.153306	0.417637	0.245284	0.161086	0.382786	0.233419

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.070		0.070		0.070
$C_{Dexp}(2a)$	=	1.00E+10		1.00E+12		1.00E+14
0.600	0.898463	0.110716	0.401186	0.404332	0.088290	0.395352
0.800	0.337039	0.153533	0.344155	0.344004	0.126334	0.337188
1.000	0.292880	0.189355	0.304578	0.300576	0.159026	0.298781
1.200	0.258958	0.220787	0.275985	0.267179	0.187984	0.267493
1.400	0.231719	0.249494	0.254739	0.240348	0.214417	0.245595
1.600	0.209149	0.276470	0.238637	0.218102	0.239145	0.228841
1.800	0.190011	0.302294	0.226277	0.198225	0.262701	0.215811
2.000	0.173500	0.327289	0.216717	0.182918	0.285428	0.205559

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00					
C_D/r_D^2	=	0.070	0.070	0.070					
$C_{Dexp}(2a)$	=	1.00E+16	1.00E+20	1.00E+25					
0.800	0.363043	0.090605	0.328554	0.358539	0.068705	0.323517	0.362871	0.051861	0.318656
1.000	0.310852	0.117597	0.286970	0.317302	0.091252	0.281136	0.322534	0.069902	0.276575
1.200	0.276372	0.142271	0.256737	0.285573	0.112327	0.250263	0.291537	0.087365	0.245143
1.400	0.252248	0.165067	0.234008	0.260044	0.132136	0.226982	0.266616	0.104104	0.221397
1.600	0.230672	0.186436	0.216484	0.238850	0.150888	0.208982	0.245927	0.120179	0.202949
1.800	0.212186	0.206728	0.202648	0.220842	0.168775	0.194687	0.226342	0.135659	0.186292
2.000	0.196250	0.226206	0.191594	0.205283	0.185957	0.183182	0.213123	0.150618	0.178428

TABLE D.2*i*

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.070		0.070		0.070			
$C_D \exp(2s)$	=	1.00E+02		1.00E+03		1.00E+04			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)				
0.400	0.406373	0.273199	0.597186	0.434680	0.197907	0.558296	0.450970	0.154885	0.538129
0.500	0.349374	0.318704	0.557162	0.378696	0.234856	0.514021	0.396445	0.183109	0.491009
0.600	0.305280	0.360618	0.526594	0.335010	0.271478	0.479861	0.353795	0.213192	0.454382
0.800	0.269872	0.398776	0.502921	0.299556	0.306444	0.453085	0.319037	0.243247	0.425419
1.000	0.240713	0.433553	0.484452	0.270011	0.339447	0.431885	0.289903	0.272554	0.402251
1.200	0.195468	0.494802	0.458638	0.223323	0.399705	0.401432	0.243377	0.328006	0.368355
1.400	0.162116	0.546472	0.442886	0.188025	0.453113	0.381859	0.207622	0.378992	0.345816
1.600	0.136720	0.591012	0.433612	0.160486	0.500615	0.369401	0.179239	0.425724	0.330752
1.800	0.116924	0.629525	0.428611	0.138534	0.542971	0.361751	0.156218	0.468519	0.320802
2.000	0.101207	0.662988	0.426470	0.120756	0.580790	0.357428	0.137259	0.507680	0.314453

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00
C_D/r_D^2	=	0.070		0.070
$C_D \exp(2s)$	=	1.00E+05		1.00E+06
0.400	0.461080	0.128910	0.526330	
0.500	0.407871	0.150080	0.477254	0.415673 0.138006 0.468206
0.600	0.366262	0.174322	0.438916	0.374962 0.147511 0.428732
0.800	0.303813	0.224920	0.383834	0.313891 0.190346 0.371510
1.000	0.258037	0.274445	0.347428	0.269018 0.234042 0.333245
1.200	0.222512	0.321448	0.322876	0.234002 0.276691 0.306831
1.400	0.193984	0.365616	0.305811	0.205674 0.317629 0.288241
1.600	0.170558	0.406946	0.293830	0.182211 0.356626 0.275039
1.800	0.151019	0.445525	0.285803	0.162458 0.393615 0.265678
2.000	0.134533	0.481459	0.280518	0.145632 0.428593 0.259139

TABLE D.2c

**CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.070$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}**

**RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL**

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $P' = 0.50$

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.070			0.070			0.070		
$C_D \exp(2s)$	= 1.00E+07			1.00E+08			1.00E+09		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.500	0.421283	0.112560	0.462082	0.425429	0.101286	0.457557			
0.600	0.381298	0.128342	0.421608	0.386078	0.114162	0.416390	0.389787	0.103343	0.412428
0.800	0.321435	0.164858	0.362791	0.327245	0.145121	0.356350	0.331828	0.129930	0.351428
1.000	0.277449	0.203074	0.323119	0.284067	0.178924	0.315591	0.289367	0.159773	0.309811
1.200	0.243031	0.241508	0.295433	0.250250	0.213487	0.286910	0.256117	0.190873	0.280338
1.400	0.215058	0.278098	0.275685	0.222990	0.247840	0.268216	0.228980	0.233384	0.268908
1.600	0.181751	0.315458	0.261355	0.198638	0.281580	0.251030	0.206225	0.253415	0.243012
1.800	0.171999	0.350410	0.250941	0.180008	0.314331	0.239777	0.188781	0.284018	0.231081
2.000	0.155052	0.383871	0.243395	0.163074	0.346032	0.231422	0.169941	0.313890	0.222071

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.070			0.070			0.070		
$C_D \exp(2s)$	= 1.00E+10			1.00E+12			1.00E+14		
0.600	0.392740	0.094855	0.409325	0.397127	0.082427	0.404803			
0.800	0.335521	0.117871	0.347580	0.341072	0.100090	0.341903	0.345024	0.087701	0.337988
1.000	0.293686	0.144343	0.305255	0.300280	0.121287	0.298572	0.304994	0.105029	0.293937
1.200	0.260954	0.172388	0.275141	0.268411	0.144301	0.267497	0.273848	0.124247	0.262186
1.400	0.234228	0.201088	0.253102	0.242428	0.168366	0.244544	0.248482	0.144650	0.238583
1.600	0.211781	0.228838	0.236636	0.220678	0.192953	0.227200	0.237114	0.165794	0.220612
1.800	0.192558	0.258365	0.224151	0.201814	0.217719	0.213869	0.208843	0.187365	0.206670
2.000	0.175858	0.286434	0.214602	0.185454	0.242429	0.203495	0.182841	0.209135	0.195701

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.070			0.070			0.070		
$C_D \exp(2s)$	= 1.00E+18			1.00E+20			1.00E+25		
0.800	0.347889	0.078583	0.335127	0.352058	0.066045	0.331235	0.355307	0.056010	0.328206
1.000	0.308547	0.093077	0.290553	0.313601	0.076731	0.285981	0.317437	0.063928	0.282415
1.200	0.277982	0.108375	0.258306	0.263736	0.088982	0.253049	0.286341	0.073138	0.249007
1.400	0.253106	0.126882	0.234225	0.258647	0.102357	0.228323	0.264886	0.083283	0.223799
1.600	0.232242	0.145221	0.216786	0.239493	0.118553	0.208255	0.245356	0.094104	0.204254
1.800	0.214318	0.164122	0.201391	0.222213	0.131383	0.194235	0.228655	0.105528	0.188783
2.000	0.198652	0.183375	0.189975	0.207123	0.146695	0.182206	0.214104	0.117432	0.176265

TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.100$ AND $C_D \exp(2s) = 10^2$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $P' = 0.50$

Distance, r_D	= 31.62		100.00		316.23	
C_D/r_D^2	= 0.100		0.100		0.100	
$C_D \exp(2s)$	= 1.00E+02		1.00E+03		1.00E+04	
CYCLE LENGTH (Δt_c) _D / r_D^2	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.400	0.428429	0.170880	0.565064	0.459834	0.100252	0.528701
0.500	0.369605	0.228261	0.522302	0.402150	0.147548	0.480293
0.600	0.324288	0.279757	0.489887	0.357272	0.190884	0.444857
0.800	0.287825	0.324055	0.464886	0.320733	0.230652	0.416987
1.000	0.267367	0.363389	0.445585	0.290183	0.267283	0.395181
1.200	0.210297	0.430607	0.418223	0.241763	0.332472	0.363790
1.400	0.175464	0.488367	0.400994	0.204694	0.388918	0.343230
1.600	0.148805	0.533650	0.390223	0.178174	0.438352	0.329602
1.800	0.127694	0.574358	0.383756	0.153077	0.482073	0.320622
2.000	0.111174	0.609787	0.380234	0.134248	0.521010	0.314863
						0.152848 0.445484 0.278567

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	= 1000.00		1000.00	
C_D/r_D^2	= 0.100		0.100	
$C_D \exp(2s)$	= 1.00E+05		1.00E+06	
0.500	0.432285	0.072268	0.446812	0.440067 0.064273 0.436910
0.600	0.389687	0.101395	0.407690	0.398233 0.078395 0.398921
0.800	0.325784	0.157289	0.352009	0.335880 0.125910 0.341448
1.000	0.278787	0.209558	0.315500	0.289931 0.171721 0.303351
1.200	0.242125	0.258095	0.290594	0.253959 0.215371 0.277053
1.400	0.212684	0.303045	0.273149	0.224752 0.258683 0.258381
1.600	0.188230	0.344858	0.260744	0.200474 0.295638 0.244819
1.800	0.167828	0.383208	0.251878	0.178980 0.332304 0.234886
2.000	0.150522	0.418918	0.245599	0.162400 0.366734 0.227638

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	0.100	0.100	0.100
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09
0.500	0.445827	0.042232	0.433434	
0.600	0.404355	0.062520	0.392881	0.408920 0.051151 0.388495
0.800	0.343219	0.103237	0.334127	0.348772 0.086399 0.328807
1.000	0.298303	0.143416	0.294836	0.304743 0.121800 0.288607
1.200	0.263055	0.182493	0.267473	0.270189 0.156798 0.260410
1.400	0.234318	0.220149	0.247816	0.241956 0.191025 0.239992
1.600	0.210295	0.256216	0.233386	0.218272 0.224246 0.224857
1.800	0.189871	0.290634	0.222637	0.198046 0.256323 0.213446
2.000	0.172385	0.323331	0.214800	0.180543 0.287175 0.204780
				0.412445 0.042744 0.385174
				0.353079 0.073576 0.324796
				0.306811 0.104965 0.283886
				0.275890 0.138402 0.255029
				0.248149 0.167521 0.234001
				0.224832 0.198084 0.218296
				0.204857 0.227857 0.206350
				0.187506 0.258778 0.197154

TABLE D.2c1

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.100$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.100		0.100		0.100			
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.400	0.511058	0.011084	0.473704						
0.500	0.455837	0.023198	0.423912	0.459845	0.017083	0.420033	0.462955	0.013180	0.417211
0.600	0.415245	0.036355	0.382577	0.419401	0.027437	0.378787	0.422247	0.021613	0.376234
0.800	0.356500	0.063593	0.321879	0.361558	0.049267	0.317180	0.365093	0.039656	0.314109
1.000	0.313877	0.091613	0.280208	0.319948	0.072044	0.274891	0.324221	0.058622	0.271269
1.200	0.280521	0.119969	0.250819	0.287528	0.095445	0.244708	0.292521	0.078301	0.240530
1.400	0.253243	0.148320	0.229294	0.261055	0.119195	0.222433	0.266704	0.098480	0.217722
1.600	0.230288	0.176409	0.213124	0.238771	0.143070	0.205553	0.244993	0.118977	0.200332
1.800	0.210585	0.204047	0.200737	0.219608	0.166891	0.192490	0.226319	0.139638	0.186781
2.000	0.193427	0.231093	0.191121	0.202870	0.190509	0.182225	0.209990	0.160328	0.176047

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.100		0.100		0.100			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25			
0.500	0.465369	0.010562	0.415047						
0.600	0.424158	0.017617	0.374273	0.427754	0.012602	0.371380	0.430472	0.009091	0.369044
0.800	0.367890	0.032869	0.311890	0.371234	0.024084	0.308912	0.373985	0.017745	0.306640
1.000	0.327364	0.048988	0.268664	0.331639	0.036307	0.265201	0.334919	0.028995	0.262603
1.200	0.296226	0.065823	0.237521	0.301299	0.049168	0.233522	0.305206	0.038766	0.230532
1.400	0.270937	0.083210	0.214320	0.276789	0.062566	0.209788	0.281337	0.046995	0.206397
1.600	0.249705	0.101003	0.196552	0.256289	0.076407	0.191503	0.261459	0.057625	0.187716
1.800	0.231456	0.118076	0.182636	0.238712	0.090606	0.177085	0.244473	0.068604	0.172911
2.000	0.215496	0.137312	0.171548	0.223359	0.105081	0.165509	0.229675	0.079879	0.160958

TABLE D.2m

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.100$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62		100.00		316.23			
C_D/r_D^2	=	0.100		0.100		0.100			
$C_D \exp(2s)$	=	1.00E+02		1.00E+03		1.00E+04			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.400	0.408477	0.249021	0.595290	0.433692	0.199864	0.560680			
0.500	0.356279	0.263923	0.548132	0.383052	0.204047	0.509821	0.397896	0.171720	0.491048
0.600	0.315497	0.285469	0.511564	0.343237	0.217323	0.470219	0.359062	0.178856	0.449495
0.800	0.282389	0.309461	0.482759	0.310728	0.234549	0.438730	0.327480	0.190544	0.416287
1.000	0.254788	0.334229	0.459833	0.283428	0.253757	0.413368	0.300919	0.204718	0.389340
1.200	0.211130	0.383305	0.428695	0.239660	0.294689	0.375899	0.258145	0.236987	0.348982
1.400	0.178067	0.429859	0.405199	0.205785	0.336274	0.350621	0.224721	0.271715	0.321078
1.600	0.152229	0.473031	0.391324	0.178678	0.376927	0.333396	0.197628	0.307178	0.301431
1.800	0.131602	0.512624	0.382607	0.156517	0.415868	0.321701	0.175140	0.342422	0.287495
2.000	0.114873	0.548708	0.377464	0.138129	0.452705	0.313914	0.156178	0.376851	0.277635

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D =	1000.00			1000.00		
C_D/r_D^2 =	0.100			0.100		
$C_D \exp(2s)$ =	1.00E+05			1.00E+06		
0.500	0.408517	0.152200	0.480393	0.412220	0.139090	0.473747
0.600	0.368875	0.155169	0.437538	0.375416	0.139227	0.429914
0.800	0.312248	0.173395	0.375215	0.320036	0.152121	0.366084
1.000	0.270591	0.198668	0.332931	0.279358	0.172135	0.322482
1.200	0.237943	0.227168	0.303235	0.247486	0.195609	0.291541
1.400	0.211323	0.257277	0.281894	0.221448	0.221057	0.269005
1.600	0.189046	0.288061	0.266347	0.199574	0.247656	0.252296
1.800	0.170073	0.318918	0.254953	0.180839	0.274843	0.239775
2.000	0.153715	0.349423	0.246616	0.164573	0.302220	0.230345

TABLE D.2cn

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.100$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	0.100	0.100	0.100
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ (DESIGN)	TIME LAG FACTOR t_{L0}/t_L (ANALYSIS)	AMPLITUDE FACTOR $t_L/\Delta t_c$ (ANALYSIS)	TIME LAG FACTOR t_{L0}/t_L (ANALYSIS)
0.600	0.380089	0.127716	0.383490	0.118863
0.800	0.325666	0.136812	0.329906	0.125238
1.000	0.285798	0.152931	0.290699	0.138454
1.200	0.254608	0.172491	0.260086	0.154987
1.400	0.229131	0.194131	0.235108	0.173574
1.600	0.207699	0.217123	0.214095	0.193566
1.800	0.189290	0.240976	0.196028	0.214546
2.000	0.173242	0.265339	0.180242	0.236199

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	0.100	0.100	0.100
$C_D \exp(2s)$	=	1.00E+10	1.00E+12	1.00E+14
0.800	0.335832	0.108698	0.339804	0.097223
1.000	0.297632	0.118045	0.302286	0.104190
1.200	0.267907	0.130372	0.273197	0.113860
1.400	0.243729	0.144562	0.249605	0.125170
1.600	0.223426	0.160078	0.229845	0.137655
1.800	0.205977	0.176599	0.212892	0.151054
2.000	0.190716	0.193097	0.198078	0.166103

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	0.100	0.100	0.100
$C_D \exp(2s)$	=	1.00E+16	1.00E+20	1.00E+25
0.800	0.344730	0.081679	0.311723	0.074330
1.000	0.308128	0.086068	0.283944	0.079435
1.200	0.279883	0.092760	0.261614	0.085620
1.400	0.257067	0.100725	0.243046	0.092503
1.600	0.238041	0.109585	0.227227	0.099921
1.800	0.221780	0.119146	0.213488	0.107781
2.000	0.207617	0.129286	0.201383	0.117567

TABLE D.2c

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.100$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.82			100.00			318.23		
C_D/r_D^2 =	0.100			0.100			0.100		
$C_D \exp(2s)$ =	1.00E+02			1.00E+03			1.00E+04		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$		TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.400	0.415582	0.255200	0.580763	0.448458	0.177174	0.540600			
0.500	0.358777	0.299687	0.539483	0.389545	0.220118	0.496873	0.408049	0.167515	0.474340
0.600	0.315488	0.334893	0.506686	0.345990	0.254314	0.462016	0.364875	0.199699	0.438104
0.800	0.280999	0.364889	0.480358	0.311161	0.283188	0.433795	0.330270	0.227029	0.408695
1.000	0.252655	0.391681	0.459099	0.282412	0.308724	0.410725	0.301657	0.251097	0.384522
1.200	0.208485	0.439319	0.427872	0.237222	0.353871	0.376040	0.256546	0.293227	0.347715
1.400	0.175482	0.481663	0.407268	0.202931	0.394327	0.352180	0.222108	0.330709	0.321773
1.600	0.149896	0.520022	0.393793	0.175850	0.431720	0.335672	0.194669	0.365472	0.303222
1.800	0.129564	0.554957	0.385221	0.153898	0.466654	0.324310	0.172178	0.398319	0.289878
2.000	0.113116	0.586795	0.380097	0.135781	0.499364	0.316650	0.153379	0.429574	0.280318

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00
C_D/r_D^2 =	0.100	0.100
$C_D \exp(2s)$ =	1.00E+05	1.00E+06
0.500	0.420113	0.131237 0.460719
0.600	0.377499	0.160870 0.423454
0.800	0.314946	0.209066 0.368297
1.000	0.270210	0.248539 0.330132
1.200	0.235978	0.283356 0.302861
1.400	0.208601	0.315482 0.282970
1.600	0.186038	0.345896 0.268281
1.800	0.167046	0.375011 0.257385
2.000	0.150812	0.403030 0.249321
		0.428472 0.105394 0.451732
		0.366440 0.132316 0.413656
		0.324634 0.177169 0.357306
		0.280350 0.214253 0.318191
		0.246420 0.246843 0.290027
		0.219241 0.276752 0.269237
		0.196785 0.304957 0.253630
		0.177813 0.331976 0.241800
		0.161518 0.358074 0.232795

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D \tau_D^2 = 0.100$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

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TABLE D.2g

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.100$ AND $C_D \exp(2s) = 10^2$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $P' = 0.50$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	0.100	0.100	0.100		
$C_{Dexp}(2s)$	=	1.00E+02	1.00E+03	1.00E+04		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.400	0.413987	0.212069	0.588202	0.441817	0.151696	0.549277
0.500	0.359443	0.246012	0.541555	0.388285	0.176060	0.501327
0.600	0.317178	0.279394	0.508842	0.346620	0.202313	0.463788
0.800	0.283084	0.311203	0.479449	0.312802	0.228771	0.433898
1.000	0.254824	0.341238	0.457825	0.284547	0.254780	0.409823
1.200	0.210448	0.398227	0.426996	0.239681	0.304529	0.374223
1.400	0.177110	0.445214	0.405392	0.205056	0.350870	0.350145
1.600	0.151218	0.489050	0.392045	0.177861	0.393848	0.333690
1.800	0.130633	0.528404	0.383631	0.165407	0.433651	0.322477
2.000	0.113988	0.563807	0.378650	0.157030	0.470484	0.314980
						0.404598 0.136909 0.481114
						0.363930 0.156722 0.441729
						0.330885 0.177750 0.410186
						0.303209 0.199183 0.384599
						0.268887 0.241818 0.346286
						0.224521 0.283107 0.319788
						0.196880 0.322562 0.301115
						0.174107 0.360039 0.287841
						0.155025 0.395515 0.278418

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00
C_D/r_D^2	=	0.100	0.100
$C_D \exp(2s)$	=	1.00E+05	1.00E+06
0.500	0.414673	0.113348	0.469425
0.600	0.374902	0.128290	0.428801
0.800	0.315575	0.162393	0.369528
1.000	0.272204	0.198349	0.328345
1.200	0.238412	0.234347	0.301152
1.400	0.211039	0.269628	0.280913
1.600	0.188290	0.303843	0.266169
1.800	0.169044	0.336822	0.255328
2.000	0.152550	0.368485	0.247387
			0.421382 0.098056 0.461952
			0.382337 0.109461 0.420462
			0.324210 0.137057 0.359886
			0.281760 0.167367 0.318175
			0.248838 0.198572 0.288770
			0.221711 0.229623 0.267391
			0.199230 0.260867 0.251556
			0.180075 0.290848 0.239687
			0.163554 0.320214 0.230743

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	0.100	0.100	0.100
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09
0.600	0.387651	0.096284	0.414698	0.394675
0.800	0.330512	0.118905	0.352828	0.338998
1.000	0.288889	0.144619	0.310345	0.298617
1.200	0.268899	0.171711	0.280040	0.267214
1.400	0.229948	0.199343	0.257813	0.241666
1.600	0.207801	0.227030	0.241169	0.220231
1.800	0.188876	0.254472	0.228518	0.201853
2.000	0.178470	0.281477	0.218815	0.183841
				0.079213 0.407318
				0.095073 0.343995
				0.114127 0.300214
				0.134900 0.268698
				0.158882 0.245312
				0.179031 0.227556
				0.201847 0.213828
				0.224319 0.203072

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D \wedge D^2 = 0.100$ AND $C_D \exp(2s) = 10^{-10}$ TO 10^{-25}

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

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TABLE D.2a

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.200$ AND $C_{Dexp}(2s) = 10^3$ TO 10^5

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62	100.00	316.23						
C_D/r_D^2 =	0.200	0.200	0.200						
$C_{Dexp}(2s)$ =	1.00E+03	1.00E+04	1.00E+05						
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR t_{L0}/t_L			
(DESIGN)	(ANALYSIS)		(ANALYSIS)			(ANALYSIS)			
0.400	0.468863	0.040337	0.516334	0.484968	0.023088	0.499188	0.495302	0.014712	0.488772
0.500	0.415044	0.064281	0.465373	0.431222	0.040359	0.447913	0.441010	0.027632	0.437972
0.600	0.373909	0.087399	0.424871	0.390717	0.057569	0.406595	0.400911	0.040948	0.396256
0.800	0.340712	0.109774	0.392535	0.358234	0.074832	0.373336	0.368956	0.054323	0.362486
1.000	0.313004	0.131459	0.366381	0.331176	0.091531	0.348277	0.342449	0.067755	0.334878
1.200	0.288773	0.172900	0.327232	0.287937	0.124765	0.305452	0.300195	0.094672	0.292980
1.400	0.234577	0.211923	0.299944	0.254329	0.157125	0.276649	0.267349	0.121493	0.263177
1.600	0.207113	0.248682	0.280365	0.227116	0.188495	0.255672	0.240679	0.148039	0.241264
1.800	0.184484	0.283321	0.266039	0.204474	0.218796	0.240031	0.218387	0.174166	0.224739
2.000	0.165483	0.315942	0.255447	0.185268	0.247992	0.228168	0.199370	0.199770	0.212029

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D =	1000.00				1000.00								
C_D/r_D^2 =	0.200				0.200				0.200				
$C_{Dexp}(2s)$ =	2.00E+05				5.00E+05				1.00E+06				
0.400	0.497698	0.013053	0.486420	0.500509	0.011250	0.483687	0.502407	0.010119	0.481860				
0.500	0.443068	0.024944	0.435938	0.445729	0.022037	0.433335	0.447514	0.020180	0.431607				
0.600	0.403209	0.037395	0.393998	0.405864	0.033405	0.391420	0.407630	0.030822	0.389724				
0.800	0.371378	0.049902	0.360123	0.347970	0.056503	0.329565	0.349941	0.052571	0.327709				
1.000	0.345009	0.062497	0.332394	0.306305	0.079986	0.287136	0.308501	0.074778	0.285091				
1.200	0.303019	0.087848	0.290249	0.273961	0.103658	0.256825	0.276356	0.097257	0.254597				
1.400	0.270395	0.113244	0.260211	0.247893	0.127345	0.234433	0.250257	0.119839	0.232030				
1.600	0.243900	0.136507	0.238078	0.225707	0.150697	0.217450	0.228406	0.142378	0.214881				
1.800	0.221738	0.163487	0.221342	0.206911	0.174196	0.204302	0.209712	0.164755	0.201573				
2.000	0.202811	0.186072	0.208431	0.190586	0.197142	0.193970	0.193463	0.186865	0.191086				

**CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D \sim D^8 = 0.200$ AND $C_{Texp}(8s) = 10^7$ TO 10^{25}**

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

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TABLE D.8c

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.200$ AND $C_{Dexp}(B_0) = 10^3$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $P' = 0.50$.

Distance, r_D	31.62			100.00			316.23		
C_D/r_D^2	0.200			0.200			0.200		
$C_{Dexp}(B_0)$	1.00E+03			1.00E+04			1.00E+05		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $\Delta p/\Delta p_0$			TIME LAG FACTOR t_{LO}/t_L			AMPLITUDE FACTOR $\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.500	0.391421	0.142105	0.498921						
0.800	0.364518	0.144263	0.455257	0.368347	0.120484	0.438165	0.376579	0.105739	0.428586
0.800	0.324829	0.150176	0.419943	0.339083	0.123459	0.402042	0.347840	0.108856	0.391820
1.000	0.299894	0.158094	0.390932	0.314884	0.128522	0.372311	0.323907	0.110319	0.361709
1.200	0.259942	0.177258	0.346570	0.275781	0.142009	0.326665	0.285742	0.120242	0.315277
1.400	0.229182	0.198582	0.314854	0.245644	0.158081	0.283729	0.256215	0.132614	0.281809
1.600	0.204298	0.221828	0.291587	0.221244	0.175896	0.268253	0.232328	0.148480	0.256408
1.800	0.183629	0.245478	0.274204	0.200876	0.194322	0.250681	0.212382	0.161380	0.237082
2.000	0.168095	0.269450	0.261058	0.183485	0.213631	0.236304	0.196335	0.177042	0.221981

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.200			0.200			0.200		
$C_{Dexp}(B_0)$	2.00E+06			5.00E+06			1.00E+08		
0.800	0.378403	0.102288	0.426521						
0.800	0.349873	0.103175	0.389843	0.328420	0.101187	0.358738	0.330032	0.097824	0.354998
1.000	0.325999	0.106107	0.359388	0.290693	0.109394	0.309908	0.292476	0.105481	0.308019
1.200	0.288030	0.115236	0.312773	0.261828	0.119936	0.276889	0.263450	0.115355	0.273875
1.400	0.258668	0.126759	0.278941	0.237959	0.131868	0.250340	0.240008	0.128618	0.248205
1.600	0.234921	0.139741	0.253578	0.218291	0.144828	0.230684	0.220450	0.138844	0.228405
1.800	0.216098	0.153740	0.234088	0.201485	0.158514	0.215205	0.203741	0.151802	0.212822
2.000	0.198156	0.168499	0.218820	0.186862	0.172787	0.202868	0.189205	0.165340	0.200357

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.200			0.200			0.200		
$C_{Dexp}(B_0)$	1.00E+07			1.00E+08			1.00E+09		
0.800	0.334439	0.088617	0.350317	0.337694	0.081389	0.348941	0.340208	0.075508	0.344377
1.000	0.297304	0.094887	0.303018	0.300927	0.086344	0.299369	0.303740	0.079682	0.296596
1.200	0.268884	0.102852	0.268540	0.272638	0.093313	0.264848	0.276727	0.085737	0.261681
1.400	0.245801	0.112276	0.242351	0.249848	0.101399	0.238428	0.253178	0.092823	0.235291
1.600	0.226372	0.122588	0.222429	0.230889	0.110261	0.218078	0.234443	0.100804	0.214772
1.800	0.209961	0.133625	0.206517	0.214728	0.119719	0.201932	0.218491	0.108916	0.198455
2.000	0.195691	0.145024	0.193716	0.200889	0.129866	0.188892	0.204847	0.117884	0.185239

TABLE D.2c

**CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.200$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}**

**RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL**

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.200			0.200			0.200		
$C_D \exp(2s)$	= 1.00E+10			1.00E+13			1.00E+14		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.800	0.342204	0.070586	0.342369						
1.000	0.308053	0.074176	0.294354	0.308476	0.065485	0.291099	0.311937	0.058856	0.288802
1.200	0.278208	0.079529	0.259347	0.281943	0.069857	0.255911	0.284692	0.062605	0.253441
1.400	0.255861	0.085850	0.232825	0.259916	0.075093	0.229192	0.262840	0.067079	0.226643
1.600	0.237311	0.092794	0.212177	0.241857	0.080842	0.208361	0.244798	0.072024	0.205687
1.800	0.221533	0.100211	0.195729	0.228153	0.086971	0.191731	0.229498	0.077281	0.188937
2.000	0.207855	0.108016	0.182380	0.212735	0.093408	0.178196	0.218274	0.082788	0.175280

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.200			0.200			0.200		
$C_D \exp(2s)$	= 1.00E+16			1.00E+20			1.00E+25		
1.000	0.313795	0.053575	0.287082						
1.200	0.286750	0.056864	0.251622	0.289680	0.048269	0.249076	0.292083	0.040766	0.247028
1.400	0.265049	0.060804	0.224753	0.268262	0.051521	0.222062	0.270870	0.043463	0.219924
1.600	0.247179	0.065173	0.203708	0.250556	0.055079	0.200961	0.253383	0.046430	0.198719
1.800	0.232036	0.069806	0.186870	0.235844	0.058877	0.184009	0.238588	0.049550	0.181738
2.000	0.218982	0.074645	0.173128	0.222766	0.062823	0.170156	0.225912	0.052810	0.167802

TABLE D.8-w

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.200$ AND $C_{Dexp}(2s) = 10^3$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $P = 0.50$

Distance, r_D	31.82			100.00			318.23		
C_D/r_D^2	0.200			0.200			0.200		
$C_{Dexp}(2s)$	1.00E+03			1.00E+04			1.00E+05		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.500	0.404301	0.111928	0.478738						
0.600	0.363281	0.136354	0.440027	0.380484	0.098131	0.420131	0.391217	0.074210	0.408605
0.800	0.330476	0.157825	0.408441	0.348016	0.116863	0.387856	0.359185	0.090065	0.375818
1.000	0.303398	0.177112	0.382315	0.321170	0.133620	0.361160	0.332845	0.104832	0.348701
1.200	0.280812	0.211180	0.342028	0.278844	0.164009	0.319910	0.290787	0.131782	0.306771
1.400	0.228391	0.241346	0.312921	0.246513	0.191098	0.289917	0.258757	0.156136	0.276198
1.600	0.202590	0.289069	0.291367	0.220690	0.215985	0.267469	0.233127	0.178631	0.253201
1.800	0.181412	0.295134	0.275122	0.199408	0.238343	0.250294	0.211960	0.199767	0.235472
2.000	0.163639	0.319974	0.262743	0.181456	0.261590	0.236944	0.194066	0.219885	0.221548

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.200			0.200			0.200		
$C_{Dexp}(2s)$	2.00E+05			5.00E+05			1.00E+06		
0.500	0.393656	0.068770	0.406074						
0.600	0.361733	0.083905	0.373148	0.338432	0.090143	0.342739	0.340527	0.084814	0.340631
1.000	0.333313	0.098066	0.345926	0.296926	0.114898	0.300429	0.299189	0.106883	0.298176
1.200	0.293607	0.124047	0.303824	0.265145	0.137515	0.269545	0.267495	0.130582	0.267176
1.400	0.261883	0.147636	0.273110	0.239693	0.158529	0.248265	0.242127	0.151011	0.243789
1.600	0.236127	0.169477	0.249983	0.218655	0.178327	0.228262	0.221150	0.170275	0.225667
1.800	0.215013	0.190018	0.231199	0.200868	0.197180	0.214080	0.203383	0.186641	0.211389
2.000	0.197156	0.206575	0.218076	0.185514	0.215316	0.202683	0.188088	0.206295	0.197909

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/r_D^2	0.200			0.200			0.200		
$C_{Dexp}(2s)$	1.00E+07			1.00E+08			1.00E+09		
0.500	0.346218	0.070347	0.336031	0.350488	0.059550	0.330949	0.353793	0.051273	0.327858
1.000	0.305330	0.091536	0.292159	0.310023	0.078451	0.287757	0.313701	0.088228	0.284363
1.200	0.274014	0.111281	0.260620	0.279031	0.096288	0.256125	0.283012	0.094399	0.252527
1.400	0.248916	0.129680	0.237140	0.254201	0.113237	0.232209	0.258420	0.099904	0.228418
1.600	0.228149	0.147498	0.218784	0.233644	0.129438	0.213618	0.238063	0.114825	0.209653
1.800	0.210666	0.164371	0.204198	0.218220	0.145005	0.198849	0.220804	0.129234	0.194720
2.000	0.195378	0.180617	0.192450	0.201179	0.160036	0.186901	0.205900	0.143194	0.182615

TABLE D.2x

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.200$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.200			0.200			0.200		
$C_D \exp(2s)$	= 1.00E+10			1.00E+12			1.00E+14		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.800	0.358404	0.044778	0.325456						
1.000	0.318650	0.060078	0.281715	0.321059	0.048025	0.277846	0.324171	0.039649	0.275179
1.200	0.288226	0.074801	0.249892	0.291082	0.060392	0.245528	0.294555	0.050214	0.242632
1.400	0.261856	0.089029	0.225421	0.267092	0.072492	0.221002	0.270872	0.060643	0.217918
1.600	0.241685	0.102808	0.206511	0.247249	0.084338	0.201864	0.251300	0.070941	0.198610
1.800	0.224583	0.116180	0.191444	0.230429	0.095940	0.186587	0.234720	0.081104	0.183176
2.000	0.209811	0.129184	0.179211	0.215901	0.107307	0.174157	0.220403	0.091127	0.170599

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/r_D^2	= 0.200			0.200			0.200		
$C_D \exp(2s)$	= 1.00E+16			1.00E+20			1.00E+25		
1.000	0.328482	0.033556	0.273248						
1.200	0.297145	0.042723	0.240517	0.300725	0.032567	0.237654	0.303489	0.024833	0.235489
1.400	0.273714	0.051827	0.215655	0.277675	0.039741	0.212579	0.280780	0.030430	0.210320
1.600	0.254366	0.060876	0.196216	0.258671	0.046933	0.192950	0.262093	0.036084	0.190431
1.800	0.237988	0.069860	0.180661	0.242607	0.054135	0.177221	0.245305	0.041775	0.174560
2.000	0.223853	0.078770	0.167970	0.228760	0.061338	0.164367	0.232717	0.047602	0.161572

TABLE D.8-v

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/\tau_D^2 = 0.200$ AND $C_{Dexp}(B_0) = 10^3$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $P' = 0.50$

Distance, r_D	31.62			100.00			316.23		
C_D/τ_D^2	0.200			0.200			0.200		
$C_{Dexp}(B_0)$	1.00E+03			1.00E+04			1.00E+05		
CYCLE LENGTH (Δt_c) $_D/\tau_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$			TIME LAG FACTOR $\Delta p/\Delta p_0$			AMPLITUDE FACTOR $t_L/\Delta t_c$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.500	0.398730	0.106778	0.488196						
0.600	0.360075	0.118093	0.444458	0.375163	0.091966	0.428502	0.384307	0.078713	0.418307
0.800	0.328938	0.130721	0.412613	0.344590	0.100857	0.393872	0.354195	0.083209	0.383191
1.000	0.303047	0.144043	0.384805	0.319184	0.110808	0.365349	0.329209	0.090582	0.354223
1.200	0.281888	0.171856	0.342318	0.278803	0.131592	0.321549	0.289560	0.106913	0.309604
1.400	0.250131	0.199865	0.311993	0.247593	0.153674	0.289989	0.258952	0.124561	0.277268
1.600	0.183419	0.254914	0.273227	0.201384	0.199052	0.248853	0.213591	0.161895	0.234630
2.000	0.165551	0.281895	0.280715	0.183524	0.221787	0.235183	0.188993	0.181074	0.220221

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00					
C_D/τ_D^2	0.200			0.200					
$C_{Dexp}(B_0)$	2.00E+06			5.00E+05			1.00E+06		
0.600	0.386384	0.073304	0.416080						
0.800	0.356370	0.078280	0.380852	0.334145	0.080902	0.348992	0.335913	0.077459	0.347154
1.000	0.331494	0.086085	0.351782	0.294930	0.094849	0.303987	0.296686	0.090545	0.301885
1.200	0.292041	0.101318	0.308974	0.264899	0.110118	0.271249	0.268782	0.104944	0.269131
1.400	0.261800	0.117869	0.274461	0.240286	0.126243	0.248719	0.242502	0.120207	0.244486
1.600	0.237009	0.135251	0.250132	0.218827	0.143944	0.227888	0.222258	0.138070	0.225481
1.800	0.216500	0.153185	0.231478	0.202554	0.160028	0.213087	0.204975	0.162347	0.210571
2.000	0.198996	0.171403	0.216898	0.187456	0.177348	0.201322	0.189955	0.188896	0.198673

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	1000.00			1000.00			1000.00		
C_D/τ_D^2	0.200			0.200			0.200		
$C_{Dexp}(B_0)$	1.00E+07			1.00E+08			1.00E+09		
0.600	0.340879	0.068220	0.342298	0.344233	0.061342	0.336764	0.346983	0.056982	0.336078
1.000	0.302111	0.079002	0.298742	0.308044	0.070442	0.292928	0.309100	0.063832	0.290033
1.200	0.272458	0.091024	0.263523	0.276742	0.080689	0.259444	0.280083	0.072727	0.256350
1.400	0.248585	0.103891	0.238504	0.253170	0.091729	0.234185	0.256777	0.082350	0.230876
1.600	0.228864	0.117382	0.219184	0.230504	0.103370	0.214567	0.237418	0.092536	0.211083
1.800	0.211682	0.131342	0.203899	0.216847	0.115488	0.199042	0.220930	0.103176	0.195363
2.000	0.196820	0.145650	0.191647	0.202322	0.127976	0.186529	0.206616	0.114191	0.182653

TABLE D.2x

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.200$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLS STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.200		0.200		0.200		0.200	
$C_D \exp(2s)$	=	1.00E+10		1.00E+13		1.00E+14		1.00E+14	
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.800	0.349175	0.051686	0.333970						
1.000	0.311540	0.058559	0.287761	0.315195	0.050622	0.284424	0.317805	0.044870	0.282088
1.200	0.282758	0.066402	0.253925	0.286771	0.056956	0.250371	0.289641	0.050191	0.247891
1.400	0.259673	0.074910	0.228301	0.264030	0.063844	0.224534	0.267149	0.055980	0.221912
1.600	0.240523	0.083934	0.208358	0.245207	0.071163	0.204379	0.248567	0.062127	0.201616
1.800	0.224231	0.093384	0.192486	0.229226	0.078841	0.188293	0.232819	0.068575	0.185387
2.000	0.210099	0.103193	0.179625	0.215390	0.086830	0.175213	0.219206	0.075285	0.172162

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00	
C_D/r_D^2	=	0.200		0.200		0.200		0.200	
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25		1.00E+25	
1.000	0.319786	0.040461	0.280358						
1.200	0.291797	0.045000	0.246069	0.294880	0.037711	0.243528	0.297280	0.031567	0.241521
1.400	0.269494	0.050066	0.219981	0.272791	0.041678	0.217322	0.275453	0.034757	0.215222
1.600	0.251095	0.055372	0.199586	0.254660	0.045868	0.198800	0.257517	0.038112	0.194808
1.800	0.235525	0.060929	0.183257	0.238332	0.050241	0.180342	0.242401	0.041597	0.178059
2.000	0.222085	0.066707	0.169931	0.226138	0.054772	0.168885	0.229405	0.045193	0.164508

TABLE D.2da

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/\tau_D^2 = 0.400$ AND $C_D \exp(2s) = 10^3$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F = 0.50$

Distance, r_D	= 31.62			100.00			316.23		
C_D/τ_D^2	= 0.400			0.400			0.400		
$C_D \exp(2s)$	= 1.00E+03			1.00E+04			1.00E+05		
CYCLE LENGTH (Δt_c) $_D/\tau_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.400	0.470494	0.017215	0.514544						
0.500	0.418282	0.028789	0.481770	0.434621	0.018981	0.444410	0.444627	0.011312	0.434410
0.600	0.379272	0.040083	0.418864	0.395617	0.025010	0.401559	0.405159	0.017325	0.392102
0.800	0.348281	0.051221	0.384005	0.364772	0.033008	0.368644	0.374408	0.023410	0.357210
1.000	0.322689	0.062232	0.355385	0.339429	0.041024	0.337858	0.348257	0.029504	0.328350
1.200	0.282228	0.083981	0.311832	0.299504	0.057147	0.293655	0.309819	0.042042	0.283878
1.400	0.251124	0.105424	0.280181	0.268861	0.073394	0.261897	0.279654	0.054788	0.251597
1.600	0.226115	0.126570	0.256804	0.244200	0.089735	0.237785	0.255417	0.067781	0.227342
1.800	0.205382	0.147392	0.238970	0.223705	0.106122	0.219396	0.235281	0.080921	0.208601
2.000	0.187809	0.167862	0.225081	0.206289	0.122506	0.204938	0.218141	0.094224	0.193784

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00					
C_D/τ_D^2	= 0.400			0.400					
$C_D \exp(2s)$	= 4.00E+06			7.00E+05			1.00E+06		
0.600	0.409133	0.014390	0.388293	0.410461	0.013428	0.387037	0.411172	0.012881	0.388387
0.800	0.378437	0.019874	0.353405	0.394774	0.023517	0.323244	0.355804	0.022838	0.322490
1.000	0.353571	0.025020	0.324527	0.315654	0.033883	0.278631	0.318533	0.032683	0.277857
1.200	0.314170	0.035930	0.279948	0.285828	0.044537	0.248182	0.286782	0.043015	0.245360
1.400	0.284252	0.047122	0.247527	0.261908	0.055450	0.221708	0.262896	0.053610	0.220675
1.600	0.260246	0.068589	0.223124	0.242058	0.068591	0.202781	0.243094	0.064435	0.201897
1.800	0.240317	0.070236	0.204230	0.225170	0.077923	0.187734	0.226250	0.075458	0.186839
2.000	0.223359	0.082085	0.189257	0.210529	0.089407	0.175595	0.211846	0.086635	0.174668

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	= 1000.00			1000.00			1000.00		
C_D/τ_D^2	= 0.400			0.400			0.400		
$C_D \exp(2s)$	= 1.00E+07			1.00E+08			1.00E+09		
0.600	0.416617	0.010065	0.382235						
0.800	0.380014	0.018120	0.318540	0.363249	0.014964	0.318703	0.365721	0.012703	0.313568
1.000	0.321211	0.028448	0.273811	0.324639	0.022058	0.270920	0.327252	0.018828	0.268757
1.200	0.291748	0.035058	0.241189	0.295412	0.029389	0.238178	0.298212	0.025188	0.235940
1.400	0.268180	0.043924	0.216523	0.272087	0.036966	0.213414	0.275079	0.031771	0.211062
1.600	0.248680	0.053027	0.197578	0.252797	0.044767	0.194148	0.256078	0.038886	0.191735
1.800	0.232074	0.062339	0.182150	0.236428	0.052773	0.178785	0.239790	0.045552	0.176289
2.000	0.217706	0.071830	0.169807	0.222262	0.060960	0.168326	0.225794	0.052713	0.163724

TABLE D.2db

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.400$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.400		0.400		0.400
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.800	0.367678	0.010984	0.311902			
1.000	0.329305	0.016366	0.267080	0.332321	0.012896	0.264656
1.200	0.300414	0.021965	0.234210	0.303646	0.017390	0.231717
1.400	0.277438	0.027770	0.209298	0.280905	0.022055	0.206714
1.600	0.258493	0.033767	0.189870	0.262198	0.026881	0.187187
1.800	0.242455	0.039943	0.174351	0.246393	0.031860	0.171564
2.000	0.228603	0.046283	0.161713	0.232767	0.036980	0.158820
						0.334425 0.010587 0.262992
						0.305896 0.014324 0.230013
						0.283321 0.018204 0.204951
						0.264784 0.022220 0.185359
						0.249149 0.026366 0.169666
						0.235890 0.030634 0.156850

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.400		0.400		0.400
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25
1.200	0.307549	0.012141	0.228777			
1.400	0.285095	0.015452	0.203676	0.287518	0.011810	0.201960
1.600	0.266685	0.018880	0.184037	0.269280	0.014446	0.182263
1.800	0.251177	0.022419	0.168296	0.253950	0.017168	0.166459
2.000	0.237845	0.026063	0.155429	0.240794	0.019969	0.153526
						0.289398 0.009083 0.200648
						0.271294 0.011119 0.180911
						0.256101 0.013218 0.165061
						0.243084 0.015376 0.152079

TABLE D.2dc

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.400$ AND $C_D \exp(2s) = 10^3$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	0.400	0.400	0.400		
$C_D \exp(2s)$	=	1.00E+03	1.00E+04	1.00E+05		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	

1 RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS						
0.600	0.358110	0.097939	0.450690			
0.800	0.329780	0.098649	0.413383	0.344096	0.081486	0.396186
1.000	0.306361	0.102895	0.382424	0.320898	0.083371	0.365101
1.200	0.289318	0.111828	0.334504	0.284193	0.089360	0.316996
1.400	0.240940	0.122031	0.299483	0.256101	0.096921	0.281734
1.600	0.218189	0.133405	0.273024	0.233586	0.105357	0.255027
1.800	0.199353	0.145431	0.252577	0.214945	0.114385	0.234255
2.000	0.183382	0.157927	0.236449	0.199130	0.123854	0.217750
						0.329443 0.071212 0.355630
						0.293093 0.075625 0.307370
						0.265324 0.081524 0.271841
						0.243076 0.088186 0.245070
						0.224672 0.095355 0.224113
						0.209069 0.102902 0.207399

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D =	1000.00			1000.00					
C_D/r_D^2	0.400			0.400			0.400		
$C_D \exp(2s)$ =	4.00E+05			7.00E+05			1.00E+06		
1.000	0.333028	0.065776	0.351802	0.298239	0.067450	0.302066	0.299015	0.066171	0.301283
1.200	0.296933	0.069581	0.303395	0.270641	0.072392	0.266598	0.271451	0.070974	0.265803
1.400	0.269279	0.074759	0.267947	0.246595	0.078063	0.239629	0.249439	0.076497	0.238819
1.600	0.247178	0.080681	0.241004	0.230369	0.084179	0.218570	0.231243	0.082455	0.217745
1.800	0.228903	0.087084	0.219971	0.214930	0.090620	0.201743	0.215831	0.088730	0.200901
2.000	0.213418	0.093787	0.203172	0.201597	0.097321	0.188041	0.202524	0.095257	0.187180

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00	
C_D/r_D^2	=	0.400	0.400	0.400	
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09	
1.000	0.303175	0.059117	0.297149	0.306270 0.053596 0.294145	0.308665 0.049123 0.291864
1.200	0.275799	0.063185	0.261613	0.279116 0.057170 0.258503	0.281662 0.052306 0.256167
1.400	0.253987	0.067930	0.234542	0.257397 0.061315 0.231435	0.260048 0.056011 0.229076
1.600	0.235965	0.073052	0.213387	0.239521 0.065830 0.210219	0.242294 0.060068 0.207813
1.800	0.220713	0.078443	0.196457	0.224400 0.070578 0.193229	0.227284 0.064327 0.190777
2.000	0.207554	0.084045	0.182644	0.211365 0.075504 0.179351	0.214351 0.068740 0.176852

**CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/\tau_D^2 = 0.400$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}**

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE										
Distance, r_D =		1000.00			1000.00			1000.00		
C_D/r_D^2 =		0.400			0.400			0.400		
$C_D \exp(2s)$ =		1.00E+16			1.00E+20			1.00E+25		
1.200	0.290631	0.033427	0.248261	0.292975	0.027863	0.246275				
1.400	0.269555	0.035890	0.220997	0.272056	0.029742	0.218965	0.274093	0.024864	0.217338	
1.600	0.252206	0.038160	0.199646	0.254832	0.031799	0.197588	0.256978	0.026376	0.195938	
1.800	0.237589	0.040755	0.182503	0.240328	0.033960	0.180482	0.242670	0.028177	0.178755	
2.000	0.225003	0.043419	0.168480	0.227884	0.036190	0.166350	0.230215	0.030036	0.164666	

TABLE D.2ds

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.400$ AND $C_{Dexp}(2s) = 10^3$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62			100.00			316.23		
C_D/r_D^2 =	0.400			0.400			0.400		
$C_{Dexp}(2s)$ =	1.00E+03			1.00E+04			1.00E+05		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$		TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)		
0.800	0.370545	0.067470	0.431401						
0.800	0.339619	0.080371	0.397445	0.356517	0.055329	0.378608			
1.000	0.314151	0.092414	0.369230	0.331182	0.064925	0.350242	0.341408	0.048690	0.339751
1.200	0.274184	0.114575	0.325348	0.291382	0.082972	0.306145	0.301959	0.063560	0.295421
1.400	0.243798	0.134859	0.293146	0.261077	0.099855	0.273745	0.271915	0.077723	0.262834
1.600	0.219611	0.153791	0.268783	0.236907	0.115847	0.249181	0.247942	0.091328	0.238071
1.800	0.199729	0.171706	0.249891	0.216991	0.131128	0.230013	0.228174	0.104468	0.218740
2.000	0.182991	0.188826	0.234957	0.200180	0.145827	0.214782	0.211469	0.117208	0.203316

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00							
C_D/r_D^2 =	0.400	0.400							
$C_{Dexp}(2s)$ =	4.00E+05	7.00E+05	1.00E+06						
1.000	0.345723	0.041825	0.335511	0.308070	0.052435	0.289561	0.308999	0.050754	0.288690
1.200	0.306505	0.055272	0.291040	0.278266	0.064782	0.256835	0.279238	0.062785	0.255940
1.400	0.278600	0.069009	0.258351	0.254489	0.078722	0.231847	0.255497	0.074476	0.231032
1.600	0.252799	0.080491	0.233497	0.234880	0.088368	0.212494	0.235918	0.085875	0.211559
1.800	0.233144	0.092540	0.214077	0.218308	0.099735	0.196949	0.219368	0.097014	0.195995
2.000	0.218530	0.104279	0.198563	0.204028	0.110850	0.184291	0.205112	0.107916	0.183317

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00	1000.00						
C_D/r_D^2 =	0.400	0.400	0.400						
$C_{Dexp}(2s)$ =	1.00E+07	1.00E+08	1.00E+09						
1.000	0.313973	0.041827	0.284116	0.317657	0.035330	0.280822	0.320470	0.030429	0.278357
1.200	0.284478	0.052189	0.251227	0.288392	0.044370	0.247817	0.291415	0.038412	0.245246
1.400	0.260955	0.062346	0.226199	0.265064	0.053290	0.222693	0.268257	0.046327	0.220042
1.600	0.241563	0.072328	0.206616	0.245841	0.062113	0.203020	0.249185	0.054193	0.200296
1.800	0.225173	0.082149	0.190942	0.229600	0.070843	0.187260	0.233078	0.062014	0.184466
2.000	0.211053	0.091817	0.178157	0.215611	0.079480	0.174390	0.219208	0.069785	0.171529

TABLE D.24

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.400$ AND $C_{Dexp}(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$				1000.00				1000.00			
$C_D/r_D^2 =$				0.400				0.400			
$C_{Dexp}(2s) =$				1.00E+10				1.00E+12			
CYCLE				AMPLITUDE				AMPLITUDE			
LENGTH				FACTOR				FACTOR			
$(\Delta t_c)_D/r_D^2$				$t_L/\Delta t_c$				$t_L/\Delta t_c$			
$\Delta p/\Delta p_0$				$\Delta p/\Delta p_0$				$\Delta p/\Delta p_0$			
t_{LO}/t_L				t_{LO}/t_L				t_{LO}/t_L			
(DESIGN)				(ANALYSIS)				(ANALYSIS)			
1.000	0.322765	0.026646	0.278378								
1.200	0.293809	0.033749	0.243248	0.297352	0.026979	0.240349		0.299821	0.022343	0.238370	
1.400	0.270804	0.040838	0.217972	0.274595	0.032802	0.214963		0.277265	0.027255	0.212893	
1.600	0.251863	0.047910	0.198166	0.255871	0.038641	0.195062		0.258715	0.032196	0.192917	
1.800	0.235875	0.054966	0.182279	0.240080	0.044501	0.179086		0.243078	0.037170	0.176877	
2.000	0.222113	0.062004	0.169286	0.226499	0.050376	0.166007		0.229641	0.042177	0.163738	

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, $r_D =$				1000.00				1000.00			
$C_D/r_D^2 =$				0.400				0.400			
$C_{Dexp}(2s) =$				1.00E+16				1.00E+20			
1.200	0.301746	0.019016	0.236849	0.304292	0.014556	0.234866					
1.400	0.279240	0.023228	0.211366	0.282012	0.017831	0.209310		0.284159	0.013736	0.207728	
1.600	0.260827	0.027491	0.191355	0.263740	0.021142	0.189242		0.266004	0.016304	0.187631	
1.800	0.245316	0.031794	0.175264	0.248413	0.024502	0.173079		0.250844	0.018922	0.171402	
2.000	0.231993	0.036135	0.162076	0.235264	0.027902	0.159823		0.237644	0.021574	0.158089	

TABLE D.2dg

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.400$ AND $C_D \exp(2s) = 10^3$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	0.400	0.400	0.400		
$C_D \exp(2s)$	=	1.00E+03	1.00E+04	1.00E+05		
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.600	0.364537	0.073944	0.440993			
0.800	0.335133	0.079488	0.404987	0.350358	0.061624	0.387388
1.000	0.310885	0.085628	0.375127	0.326263	0.065907	0.357423
1.200	0.272841	0.098936	0.328817	0.288353	0.075493	0.310901
1.400	0.243417	0.113074	0.294963	0.259400	0.085923	0.278789
1.600	0.220013	0.127715	0.269454	0.236222	0.098910	0.250966
1.800	0.200853	0.142677	0.249760	0.217039	0.108307	0.230903
2.000	0.184252	0.157838	0.234253	0.200768	0.120014	0.214983
						0.335374 0.054410 0.347713
						0.297803 0.061751 0.301035
						0.269158 0.069881 0.266755
						0.246259 0.078484 0.240737
						0.227326 0.087496 0.220455
						0.211276 0.096822 0.204291

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00		
C_D/r_D^2	=	0.400	0.400	0.400	
$C_D \exp(2s)$	=	4.00E+05	7.00E+05	1.00E+06	
1.000	0.339215	0.049519	0.343776	0.303206 0.053924 0.295671	0.304026 0.052733 0.294873
1.200	0.301625	0.055927	0.297024	0.274788 0.060714 0.261290	0.275645 0.059325 0.260477
1.400	0.273345	0.063052	0.262669	0.252098 0.067964 0.235161	0.252990 0.066368 0.234332
1.600	0.250598	0.070653	0.236568	0.233358 0.075587 0.214756	0.234283 0.073756 0.213908
1.800	0.231806	0.078617	0.216194	0.217487 0.083457 0.198457	0.218442 0.081426 0.197589
2.000	0.215885	0.086878	0.199929	0.203779 0.091592 0.185196	0.204762 0.089338 0.184307

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00	
C_D/r_D^2	=	0.400	0.400	0.400	
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09	
1.000	0.308417	0.046319	0.290675	0.311679 0.041486 0.287633	0.314198 0.037686 0.285327
1.200	0.280250	0.051867	0.258197	0.283683 0.046282 0.253096	0.286342 0.041919 0.250746
1.400	0.257794	0.057809	0.229965	0.261369 0.051424 0.226802	0.264179 0.046459 0.224407
1.600	0.239275	0.064049	0.209445	0.243023 0.056824 0.206216	0.245939 0.051224 0.203770
1.800	0.223610	0.070535	0.193022	0.227503 0.062437 0.189719	0.230539 0.056173 0.187221
2.000	0.210096	0.077234	0.179628	0.214127 0.068235 0.176246	0.217277 0.061281 0.173691

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/\tau_D^2 = 0.400$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

[illegible]

TABLE D.8d

**CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.700$ AND $C_D \exp(2s) = 10^3$ TO 10^6**

**RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL**

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	= 31.82		100.00		316.23	
C_D/r_D^2	= 0.700		0.700		0.700	
$C_D \exp(2s)$	= 1.00E+03		1.00E+04		1.00E+05	
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.500	0.418820	0.016009	0.463389			
0.600	0.378773	0.022422	0.419415	0.398244	0.013484	0.400923
0.800	0.348832	0.028723	0.383398	0.388038	0.017884	0.365378
1.000	0.324299	0.034961	0.353621	0.341418	0.022285	0.335891
1.200	0.285863	0.047349	0.307869	0.303008	0.031142	0.290280
1.400	0.258598	0.059702	0.274204	0.273850	0.040108	0.258929
1.600	0.233224	0.072059	0.248975	0.250589	0.049198	0.231723
1.800	0.213929	0.084426	0.229421	0.231388	0.058408	0.212112
2.000	0.197610	0.098795	0.213917	0.215136	0.067726	0.196491
						0.375752 0.012492 0.355930
						0.361107 0.015818 0.326620
						0.312833 0.022561 0.281144
						0.283878 0.029445 0.247853
						0.260828 0.036476 0.222827
						0.241825 0.043649 0.202956
						0.225755 0.050955 0.187249

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	= 1000.00		1000.00	
C_D/r_D^2	= 0.700		0.700	
$C_D \exp(2s)$	= 7.00E+05		1.00E+06	
0.800	0.358451	0.012517	0.321724	0.357250 0.012042 0.321004
1.000	0.318272	0.018078	0.278339	0.319088 0.017424 0.275634
1.200	0.289475	0.023776	0.243061	0.290315 0.022946 0.242358
1.400	0.266590	0.029619	0.217814	0.267457 0.028610 0.217106
1.600	0.247748	0.035602	0.198104	0.248642 0.034411 0.197392
1.800	0.231829	0.041716	0.182342	0.232749 0.040343 0.181622
2.000	0.218109	0.047950	0.169493	0.219053 0.046394 0.168783

TABLE D.24

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.700$ AND $C_D \exp(2s) = 10^7$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00	1000.00	1000.00					
C_D/r_D^2	=	0.700	0.700	0.700					
$C_D \exp(Es)$	=	1.00E+07	1.00E+08	1.00E+09					
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$			
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)			
1.000	0.323391	0.014089	0.271965	0.326524	0.011733	0.269356	0.328902	0.010027	0.267408
1.200	0.294763	0.018648	0.238700	0.298007	0.015827	0.236102	0.300472	0.013405	0.234165
1.400	0.272062	0.023355	0.213434	0.275431	0.019637	0.210823	0.277995	0.016887	0.208878
1.600	0.253403	0.028189	0.193684	0.256898	0.023761	0.191049	0.259584	0.020471	0.189088
1.800	0.237659	0.033143	0.177869	0.241277	0.027993	0.175202	0.244045	0.024152	0.173215
2.000	0.224106	0.038209	0.164958	0.227843	0.032327	0.162252	0.230708	0.027925	0.160237

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	0.700	0.700	0.700
$C_D \exp(2s)$	=	1.00E+10	1.00E+12	1.00E+14
1.200	0.302406	0.011710	0.232667	
1.400	0.280009	0.014781	0.207376	0.282963 0.011784 0.205211
1.600	0.261601	0.017942	0.187671	0.264741 0.014333 0.185386 0.288887 0.011896 0.183898
1.800	0.246225	0.021192	0.171682	0.249431 0.016954 0.169475 0.251668 0.014084 0.167968
2.000	0.232970	0.024525	0.156682	0.236301 0.019643 0.156444 0.238629 0.016330 0.154916

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00					
C_D/r_D^2	=	0.700	0.700	0.700					
$C_D \exp(2s)$	=	1.00E+16	1.00E+20	1.00E+25					
1.200	0.308664	0.006555	0.227950	0.310653	0.005037	0.226490	0.312208	0.003896	0.225363
1.400	0.286532	0.008325	0.202655	0.286603	0.006409	0.201201	0.290219	0.004965	0.200080
1.600	0.268465	0.010149	0.182817	0.270627	0.007822	0.181357	0.272312	0.006064	0.180234
1.800	0.253314	0.012023	0.166876	0.255569	0.009274	0.165404	0.257328	0.007193	0.164274
2.000	0.240344	0.013946	0.153813	0.242694	0.010763	0.152324	0.244526	0.008351	0.151182

**CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/\tau_D^2 = 0.700$ AND $C_D \exp(2s) = 10^3$ TO 10^9**

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

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CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D \tau_D^2 = 0.700$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =				1000.00				1000.00				1000.00			
C_D/r_D^2 =				0.700				0.700				0.700			
$C_{Dexp(2s)}$ =				1.00E+10				1.00E+12				1.00E+14			
CYCLE LENGTH		AMPLITUDE FACTOR		TIME LAG FACTOR		AMPLITUDE FACTOR		TIME LAG FACTOR		AMPLITUDE FACTOR		TIME LAG FACTOR			
$(\Delta t_c)_D/r_D^2$		$t_L/\Delta t_c$ $\Delta p/\Delta p_0$		t_{LO}/t_L		$t_L/\Delta t_c$ $\Delta p/\Delta p_0$		t_{LO}/t_L		$t_L/\Delta t_c$ $\Delta p/\Delta p_0$		t_{LO}/t_L			
(DESIGN)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)		(ANALYSIS)			
1.200	0.286284	0.031198	0.252031	0.289062	0.026785	0.249609	0.291034	0.023497	0.247918	0.289062	0.026785	0.249609	0.291034		
1.400	0.265216	0.033378	0.224612	0.268110	0.028647	0.222188	0.270177	0.025126	0.220488	0.268110	0.028647	0.222188	0.270177		
1.600	0.247901	0.035737	0.203113	0.250886	0.030666	0.200696	0.253024	0.026898	0.199000	0.250886	0.030666	0.200696	0.253024		
1.800	0.233329	0.038202	0.185834	0.236395	0.032780	0.183424	0.236595	0.028755	0.181733	0.236395	0.032780	0.183424	0.236595		
2.000	0.220797	0.040724	0.171689	0.223971	0.034954	0.169256	0.226229	0.030665	0.167567	0.223971	0.034954	0.169256	0.226229		

Distance, r_D	=	1000.00			1000.00			1000.00			
C_D/r_D^2	=	0.700			0.700			0.700			
$C_D \exp(2s)$	=	1.00E+16			1.00E+20			1.00E+25			
1.400	0.271729	0.022394	0.218228		0.273908	0.018417	0.217485		0.275858	0.015087	0.216104
1.600	0.254634	0.023976	0.197742		0.256902	0.019723	0.195997		0.258732	0.016163	0.194610
1.800	0.240254	0.025835	0.180478		0.242596	0.021087	0.178736		0.244491	0.017297	0.177350
2.000	0.227933	0.027344	0.166314		0.230341	0.022512	0.164576		0.232293	0.018466	0.163193

TABLE D.24m

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.700$ AND $C_D \exp(2s) = 10^3$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.82	100.00	316.23			
C_D/r_D^2 =	0.700	0.700	0.700			
$C_D \exp(2s)$ =	1.00E+03	1.00E+04	1.00E+05			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.800	0.341367	0.046023	0.395410			
1.000	0.316929	0.053415	0.365993	0.334315	0.035884	0.346959
1.200	0.278724	0.067362	0.320048	0.296028	0.046569	0.301340
1.400	0.249799	0.080513	0.286103	0.267007	0.056832	0.267665
1.600	0.226842	0.093084	0.260216	0.243955	0.066796	0.241982
1.800	0.208002	0.105203	0.239952	0.225019	0.076525	0.221806
2.000	0.192155	0.116949	0.223752	0.209069	0.086054	0.205650
						0.306122 0.034758 0.291403
						0.277233 0.043001 0.257792
						0.254283 0.051092 0.232134
						0.235431 0.059069 0.211997
						0.219548 0.066949 0.195834

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00
C_D/r_D^2 =	0.700	0.700
$C_D \exp(2s)$ =	7.00E+05	1.00E+06
1.200	0.283028 0.035306 0.252514	0.283902 0.034157 0.251736
1.400	0.260198 0.042219 0.226857	0.261095 0.040886 0.226078
1.600	0.241449 0.049077 0.206713	0.242366 0.047567 0.205931
1.800	0.225857 0.055890 0.190533	0.226591 0.054210 0.189747
2.000	0.212092 0.062662 0.177284	0.213041 0.060618 0.178494

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D =	1000.00	1000.00	1000.00
C_D/r_D^2 =	0.700	0.700	0.700
$C_D \exp(2s)$ =	1.00E+07	1.00E+08	1.00E+09
1.000	0.317178 0.022373 0.281246	0.320486 0.016823 0.278343	
1.200	0.288558 0.028110 0.247674	0.291971 0.023759 0.244779	0.294567 0.020502 0.242821
1.400	0.265893 0.033826 0.221998	0.269438 0.028704 0.219078	0.272151 0.024843 0.216894
1.600	0.247284 0.039529 0.201835	0.250940 0.033652 0.198895	0.253754 0.029198 0.196689
1.800	0.231618 0.045226 0.185629	0.235372 0.038613 0.182669	0.238273 0.033574 0.180444
2.000	0.218166 0.050919 0.172348	0.222010 0.043586 0.169364	0.224992 0.037972 0.167119

TABLE D.2a.

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 0.700$ AND $C_{Dexp}(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00			
C_D/r_D^2	=	0.700		0.700		0.700			
$C_{Dexp}(3s)$	=	1.00E+10		1.00E+12		1.00E+14			
CYCLE LENGTH (Δt_c) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L			
(DESIGN)	(ANALYSIS)			(ANALYSIS)		(ANALYSIS)			
1.200	0.298705	0.018000	0.240873	0.299752	0.014393	0.238425	0.301881	0.011948	0.236743
1.400	0.274303	0.021846	0.215192	0.277445	0.017517	0.212755	0.279736	0.014578	0.211012
1.600	0.255983	0.025723	0.194976	0.259277	0.020883	0.192500	0.261587	0.017229	0.190799
1.800	0.240580	0.029627	0.178714	0.244002	0.023877	0.178208	0.246410	0.019920	0.174486
2.000	0.227367	0.033558	0.165373	0.230906	0.027102	0.162839	0.233405	0.022639	0.161095

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.700		0.700		0.700
$C_{Dexp}(2s)$	=	1.00E+16		1.00E+20		1.00E+25
1.400	0.281383	0.012451	0.209777			
1.600	0.263286	0.014729	0.189568	0.265716	0.011383	0.187835
1.800	0.248191	0.017047	0.173233	0.250638	0.013179	0.171543
2.000	0.235258	0.018391	0.159828	0.237813	0.015006	0.158110
						0.267575 0.008832 0.186529
						0.252630 0.010236 0.170190
						0.239815 0.011655 0.156780

TABLE D.2do

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.700$ AND $C_{Dexp}(2s) = 10^3$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.82	100.00	318.23			
C_D/r_D^2 =	0.700	0.700	0.700			
$C_{Dexp}(2s)$ =	1.00E+03	1.00E+04	1.00E+05			
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)
0.800	0.335728	0.054708	0.404268			
1.000	0.312287	0.058170	0.373419	0.328381	0.044414	0.355117
1.200	0.275595	0.065764	0.325292	0.291808	0.049876	0.307430
1.400	0.247764	0.073882	0.289789	0.263734	0.055817	0.272241
1.600	0.225626	0.082333	0.262751	0.241575	0.062058	0.245404
1.800	0.207416	0.091026	0.241816	0.223354	0.068521	0.224375
2.000	0.192057	0.099906	0.224734	0.207986	0.075183	0.207522
						0.300876 0.040677 0.297960
						0.273103 0.045338 0.262901
						0.251045 0.050256 0.236147
						0.232921 0.055362 0.215159
						0.217647 0.060619 0.198310

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D =	1000.00	1000.00
C_D/r_D^2 =	0.700	0.700
$C_D^{exp}(2s)$ =	7.00E+05	1.00E+06
1.200	0.278393 0.039371 0.257906	0.279192 0.038463 0.257168
1.400	0.256431 0.043547 0.231188	0.257246 0.042528 0.230454
1.600	0.238398 0.047885 0.210215	0.239230 0.046749 0.209485
1.800	0.223211 0.052350 0.193387	0.224058 0.051096 0.192838
2.000	0.210185 0.056925 0.179588	0.211027 0.055548 0.178835

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D =	1000.00	1000.00	1000.00
C_D/r_D^2 =	0.700	0.700	0.700
$C_{Dexp}(2s)$ =	1.00E+07	1.00E+08	1.00E+09
1.000	0.310995	0.030285 0.288285	0.314045 0.026999 0.285485
1.200	0.283455	0.033565 0.253300	0.286804 0.029872 0.250517
1.400	0.261610	0.037040 0.226611	0.264845 0.032916 0.223843
1.600	0.243688	0.040649 0.205852	0.247004 0.036077 0.202892
1.800	0.228608	0.044361 0.188802	0.232000 0.039328 0.186042
2.000	0.215663	0.048161 0.174991	0.219129 0.042648 0.172223
			0.289026 0.028969 0.248418
			0.267339 0.029687 0.221754
			0.249568 0.032506 0.200809
			0.234826 0.035402 0.183960
			0.221817 0.038360 0.170136

TABLE D.2dp

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 0.700$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.700		0.700		0.700
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)		(ANALYSIS)
1.200	0.290943	0.024617	0.246781	0.293795	0.021019	0.244386
1.400	0.269321	0.027077	0.220122	0.272276	0.023097	0.217733
1.600	0.251605	0.029628	0.199181	0.254651	0.025250	0.196799
1.800	0.236720	0.032246	0.182332	0.239851	0.027458	0.179952
2.000	0.223963	0.034917	0.168506	0.227176	0.029707	0.166122

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	0.700		0.700		0.700
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25
1.400	0.275937	0.017949	0.214644	0.278124	0.014726	0.213155
1.600	0.258442	0.019610	0.193912	0.260708	0.016087	0.192226
1.800	0.243757	0.021309	0.177088	0.246103	0.017480	0.175381
2.000	0.231192	0.023038	0.163237	0.233608	0.018896	0.161549

TABLE D-14

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^3$ TO 10^9

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	1.00	1.00	1.00		
$C_{Dexp}(2s)$	=	1.00E+03	1.00E+04	1.00E+05		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$ $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.500	0.414489 0.011399 0.466018		0.434351 0.006280 0.444687		0.445654 0.004045 0.433408	
0.600	0.376897 0.015933 0.421503		0.395687 0.009353 0.401487		0.405939 0.006291 0.391348	
0.800	0.347442 0.020369 0.384932		0.365740 0.012408 0.365674		0.375816 0.008579 0.355870	
1.000	0.323393 0.024750 0.354811		0.341405 0.015453 0.335903		0.351354 0.010865 0.326391	
1.200	0.285886 0.033434 0.307644		0.303614 0.021561 0.289680		0.313521 0.015482 0.280527	
1.400	0.257482 0.042094 0.273281		0.275080 0.027730 0.255780		0.285044 0.020179 0.246839	
1.600	0.234900 0.050774 0.247199		0.252423 0.033982 0.230039		0.262475 0.024967 0.221229	
1.800	0.216328 0.059492 0.226878		0.233800 0.040321 0.209923		0.243946 0.029847 0.201192	
2.000	0.200666 0.068248 0.210859		0.218094 0.046747 0.193826		0.228334 0.034819 0.185133	

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00
C_D/r_D^2	=	1.00	1.00
$C_D \exp(2s)$	=	1.00E+06	1.00E+06
0.600	0.412576	0.004623	0.385053
0.800	0.357577	0.008236	0.320711
1.000	0.319739	0.011910	0.275071
1.200	0.291348	0.015663	0.241499
1.400	0.268884	0.019503	0.215956
1.600	0.250464	0.023428	0.195956
1.800	0.234960	0.027438	0.179912
2.000	0.221645	0.031528	0.166789
0.600	0.412576	0.004623	0.385053
0.800	0.357577	0.008236	0.320711
1.000	0.319739	0.011910	0.275071
1.200	0.291348	0.015663	0.241499
1.400	0.268884	0.019503	0.215956
1.600	0.250464	0.023428	0.195956
1.800	0.234960	0.027438	0.179912
2.000	0.221645	0.031528	0.166789

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	1.000	1.000	1.000
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09
1.000	0.323986	0.009601	0.271465	0.329389
1.200	0.295688	0.012709	0.237970	0.301177
1.400	0.273296	0.015895	0.212470	0.278942
1.600	0.254972	0.019168	0.192401	0.260763
1.800	0.239563	0.022497	0.176455	0.245499
2.000	0.226341	0.025907	0.163329	0.232420
1.000	0.323986	0.008004	0.268913	0.300684
1.200	0.295688	0.010847	0.235473	0.278942
1.400	0.273296	0.013360	0.210003	0.260763
1.600	0.254972	0.016141	0.190039	0.245499
1.800	0.239563	0.018989	0.174008	0.232420
2.000	0.226341	0.021902	0.160879	0.219057

TABLE D.24r

CORRECTION FACTORS FOR THE FIRST PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00			
C_D/r_D^2	=	1.00		1.00		1.00		1.00			
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14		1.00E+16			
CYCLE LENGTH (Δt_c) r_D/r_D^2		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$		
(DESIGN)	(ANALYSIS)			(ANALYSIS)				(ANALYSIS)			
1.000	0.331211	0.005962	0.265544	0.333876	0.004725	0.263424		0.335730	0.003903	0.261969	
1.200	0.303036	0.007985	0.232184	0.305755	0.008358	0.230119		0.307846	0.005269	0.228704	
1.400	0.280851	0.010064	0.206755	0.283645	0.008037	0.204718		0.285589	0.006674	0.203324	
1.600	0.262725	0.012199	0.186811	0.265601	0.009761	0.184788		0.267604	0.008117	0.183405	
1.800	0.247516	0.014387	0.170786	0.250476	0.011529	0.168768		0.252539	0.009596	0.167389	
2.000	0.234490	0.016626	0.157653	0.237533	0.013339	0.155633		0.239657	0.011110	0.154254	

CORRECTION FACTORS FOR 1st PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00		1000.00			
C_D/r_D^2	=	1.000		1.000		1.000		1.000			
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25		1.00E+30			
0.800	0.375083	0.002183	0.305743	0.377018	0.001665	0.304173		0.378548	0.001281	0.302944	
1.000	0.337095	0.003319	0.260909	0.338967	0.002548	0.259467		0.340433	0.001971	0.258350	
1.200	0.309036	0.004492	0.227676	0.310942	0.003461	0.226280		0.312431	0.002684	0.225201	
1.400	0.287018	0.005698	0.202312	0.288970	0.004399	0.200941		0.290507	0.003410	0.199802	
1.600	0.269077	0.006937	0.182401	0.271095	0.005363	0.181044		0.272672	0.004170	0.179997	
1.800	0.254067	0.008206	0.168339	0.256138	0.006350	0.165037		0.257763	0.004941	0.163996	
2.000	0.241221	0.009506	0.153254	0.243365	0.007360	0.151903		0.245041	0.005730	0.150864	

TABLE D.24s

CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^3$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	1.00	1.00	1.00		
$C_D \exp(2s)$	=	1.00E+03	1.00E+04	1.00E+05		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$
(DESIGN)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)	(ANALYSIS)
0.800	0.329225	0.055970	0.414080			
1.000	0.306918	0.057314	0.381731	0.323218	0.044866	0.362482
1.200	0.271857	0.061190	0.331380	0.288046	0.047585	0.312756
1.400	0.245350	0.065909	0.294080	0.261258	0.051043	0.276174
1.600	0.224295	0.071021	0.265591	0.240066	0.054912	0.248143
1.800	0.207015	0.076372	0.243228	0.222659	0.058984	0.226139
2.000	0.192478	0.081884	0.225275	0.208008	0.063189	0.208456
						0.297117 0.039351 0.303207
						0.270427 0.042120 0.266810
						0.249162 0.045208 0.239084
						0.231791 0.048520 0.217230
						0.217166 0.051945 0.199665

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00
C_D/r_D^2	=	1.00	1.00
$C_D \exp(2s)$	=	1.00E+06	1.00E+06
1.200	0.276265	0.036041	0.261171
1.400	0.255119	0.038662	0.233502
1.600	0.237716	0.041439	0.211815
1.800	0.223151	0.044349	0.194311
2.000	0.210654	0.047328	0.179957
			0.276265 0.036041 0.261171
			0.255119 0.038662 0.233502
			0.237716 0.041439 0.211815
			0.223151 0.044349 0.194311
			0.210654 0.047328 0.179957

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	1.000	1.000	1.000
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09
1.000	0.306787	0.029617	0.293650	
1.200	0.280317	0.031594	0.257396	0.283293 0.028175 0.254692
1.400	0.259241	0.033868	0.229789	0.262284 0.030189 0.227123
1.600	0.241944	0.036303	0.208114	0.245040 0.032353 0.205485
1.800	0.227357	0.038819	0.190715	0.230543 0.034606 0.188080
2.000	0.214915	0.041420	0.176368	0.218082 0.036903 0.173826
				0.285571 0.025453 0.252660
				0.264625 0.027264 0.225114
				0.247427 0.029215 0.203502
				0.232971 0.031249 0.186120
				0.220529 0.033320 0.171898

**CORRECTION FACTORS FOR THE FIRST INVERSE (ODD) PULSE
FOR $C_D/\tau_D^2 = 1.00$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}**

DATA FOR 1st INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

CORRECTION FACTORS FOR 1st INVERSE (ODD) PULSE

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TABLE D.8a

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^3$ TO 10^5

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.60$

Distance, r_D	=	31.62	100.00	316.23		
C_D/r_D^2	=	1.00	1.00	1.00		
$C_D \exp(2s)$	=	1.00E+03	1.00E+04	1.00E+05		
CYCLE LENGTH (Δt_c) $_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)		(ANALYSIS)		(ANALYSIS)	
0.800	0.340493	0.032602	0.396425			
1.000	0.316609	0.037916	0.366362	0.334872	0.024875	0.346383
1.200	0.279323	0.048010	0.319361	0.297203	0.032371	0.300149
1.400	0.251177	0.057833	0.284533	0.268805	0.039648	0.265875
1.600	0.228895	0.068934	0.257882	0.248306	0.046773	0.239652
1.800	0.210647	0.075992	0.236940	0.227869	0.053791	0.219032
2.000	0.195322	0.084851	0.220124	0.212372	0.060726	0.202451
						0.307303 0.023857 0.290283
						0.278953 0.029596 0.258202
						0.256479 0.035261 0.230147
						0.238063 0.040884 0.209653
						0.222584 0.046480 0.193163

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00
C_D/r_D^2	=	1.00	1.00
$C_D \exp(2s)$	=	1.00E+06	1.00E+06
1.200	0.285446	0.023339	0.250375
1.400	0.263058	0.027991	0.224393
1.600	0.244712	0.032631	0.203956
1.800	0.229299	0.037272	0.187506
2.000	0.216089	0.041915	0.174005
			0.285446 0.023339 0.250375
			0.263058 0.027991 0.224393
			0.244712 0.032631 0.203956
			0.229299 0.037272 0.187506
			0.216089 0.041915 0.174005

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00	1000.00	1000.00
C_D/r_D^2	=	1.000	1.000	1.000
$C_D \exp(2s)$	=	1.00E+07	1.00E+08	1.00E+09
1.000	0.318193	0.015217	0.280349	
1.200	0.289900	0.019131	0.246528	0.293244 0.016151 0.243716
1.400	0.267618	0.023053	0.220568	0.270972 0.018516 0.217837
1.600	0.249364	0.026978	0.200152	0.252785 0.022900 0.197443
1.800	0.234023	0.030915	0.183722	0.237515 0.026303 0.181021
2.000	0.220879	0.034867	0.170231	0.224433 0.029727 0.167536
				0.295739 0.015930 0.241660
				0.273505 0.016869 0.215820
				0.255396 0.019837 0.195425
				0.240193 0.022826 0.179002
				0.227167 0.025836 0.165519

TABLE D.2d

CORRECTION FACTORS FOR THE SECOND PEAK (EVEN) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd PEAK (EVEN) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	1.00		1.00		1.00
$C_D \exp(2s)$	=	1.00E+10		1.00E+12		1.00E+14
CYCLE LENGTH (Δt_c) $_D/r_D^2$		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L		AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR t_{LO}/t_L
(DESIGN)	(ANALYSIS)			(ANALYSIS)		(ANALYSIS)
1.200	0.297699	0.012222	0.240069			
1.400	0.275574	0.014836	0.214200	0.278539	0.011905	0.211919
1.600	0.257463	0.017464	0.193855	0.260486	0.014040	0.191606
1.800	0.242308	0.020121	0.177439	0.245427	0.016207	0.175184
2.000	0.228335	0.022801	0.163955	0.232540	0.018397	0.161695
						0.262878 0.011714 0.190007
						0.247625 0.013530 0.173630
						0.234784 0.015371 0.160150

CORRECTION FACTORS FOR 2nd PEAK (EVEN) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	1.000		1.000		1.000
$C_D \exp(2s)$	=	1.00E+16		1.00E+20		1.00E+25
1.400	0.282139	0.008479	0.209215	0.284235	0.008559	0.207672
1.600	0.264266	0.010028	0.188672	0.266427	0.007767	0.187333
1.800	0.249222	0.011590	0.172517	0.251521	0.008989	0.170840
2.000	0.236455	0.013178	0.159018	0.238739	0.010221	0.157496
						0.266129 0.006045 0.186144
						0.253279 0.007000 0.169753
						0.240605 0.007967 0.156275

TABLE D.2dw

CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^3$ TO 10^6

RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, r_D =	31.62	100.00	316.23
C_D/r_D^2 =	1.00	1.00	1.00
$C_D \exp(2s)$ =	1.00E+03	1.00E+04	1.00E+05

CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	AMPLITUDE FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L
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(DESIGN) (ANALYSIS)

(ANALYSIS)

(ANALYSIS)

0.800	0.334640	0.043102	0.405583						
1.000	0.311598	0.045813	0.374244	0.328671	0.034410	0.354804			
1.200	0.275634	0.051122	0.325247	0.292394	0.038390	0.308603	0.301841	0.031090	0.297007
1.400	0.248459	0.056991	0.288978	0.264983	0.042898	0.270958	0.274430	0.034491	0.261830
1.600	0.226923	0.063077	0.261250	0.243264	0.047197	0.243701	0.252720	0.038059	0.234582
1.800	0.209286	0.069318	0.239480	0.225481	0.051830	0.222278	0.234933	0.041738	0.213316
2.000	0.194419	0.075679	0.222003	0.210492	0.056568	0.205051	0.219984	0.045503	0.198204

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00			1000.00		
C_D/r_D^2	=	1.00			1.00		1.00
$C_D \exp(2s)$	=	1.00E+08			1.00E+08		
1.200	0.280476	0.029122	0.255990		0.280476	0.029122	0.255990
1.400	0.258819	0.032089	0.229054		0.258819	0.032089	0.229054
1.600	0.241084	0.035151	0.207874		0.241084	0.035151	0.207874
1.800	0.226186	0.038283	0.190824		0.226186	0.038283	0.190824
2.000	0.213421	0.041474	0.176829		0.213421	0.041474	0.176829

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, r_D	=	1000.00		1000.00		1000.00
C_D/r_D^2	=	1.000		1.000		1.000
$C_D \exp(2s)$	=	1.00E+07		1.00E+08		1.00E+09
1.000	0.311942	0.022883	0.287390			
1.200	0.284667	0.025303	0.252222	0.287735	0.022426	0.249532
1.400	0.263069	0.027851	0.225354	0.266198	0.024667	0.222705
1.600	0.245389	0.030483	0.204227	0.248568	0.026982	0.201615
1.800	0.230543	0.033174	0.187217	0.233771	0.029349	0.184632
2.000	0.217829	0.035914	0.173250	0.221103	0.031756	0.170685

TABLE D.2dz

**CORRECTION FACTORS FOR THE SECOND INVERSE (ODD) PULSE
FOR $C_D/r_D^2 = 1.00$ AND $C_D \exp(2s) = 10^{10}$ TO 10^{25}**

**RESPONSE AMPLITUDE AND TIME LAG CORRECTION FACTORS
FOR WELLBORE STORAGE AND SKIN EFFECTS AT THE PULSING OR RESPONDING WELL**

DATA FOR 2nd INVERSE (ODD) PULSE AND PULSE RATIO, $F' = 0.50$

Distance, $r_D =$	1000.00			1000.00				1000.00			
$C_D/r_D^2 =$	1.00			1.00				1.00			
$C_D \exp(2s) =$	1.00E+10			1.00E+1E				1.00E+14			
CYCLE LENGTH $(\Delta t_c)_D/r_D^2$	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L	AMPLITUDE FACTOR $t_L/\Delta t_c$	TIME LAG FACTOR $\Delta p/\Delta p_0$	TIME LAG FACTOR t_{L0}/t_L		
(DESIGN)	(ANALYSIS)			(ANALYSIS)			(ANALYSIS)				
1.200	0.291934	0.018346	0.245943	0.294671	0.015568	0.243659					
1.400	0.270493	0.020164	0.219168	0.273306	0.017104	0.216913	0.275291	0.014876	0.215349		
1.600	0.252951	0.022042	0.198121	0.255832	0.018893	0.195890	0.257867	0.016256	0.194344		
1.800	0.238232	0.023961	0.181175	0.241172	0.020316	0.178966	0.243253	0.017667	0.177432		
2.000	0.225639	0.025911	0.167254	0.228635	0.021964	0.165062	0.230764	0.019100	0.163539		

CORRECTION FACTORS FOR 2nd INVERSE (ODD) PULSE

Distance, $r_D =$	1000.00			1000.00				1000.00			
$C_D/r_D^2 =$	1.000			1.000				1.000			
$C_D \exp(2s) =$	1.00E+16			1.00E+20				1.00E+25			
1.400	0.276768	0.013174	0.214199	0.278868	0.010740	0.212566					
1.600	0.259366	0.014397	0.193206	0.261500	0.011735	0.191644	0.263183	0.009546	0.190419		
1.800	0.244816	0.015648	0.176302	0.246984	0.012758	0.174755	0.248715	0.010382	0.173539		
2.000	0.232356	0.016917	0.162419	0.234581	0.013797	0.160876	0.236354	0.011231	0.159671		