SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

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APPENDIX VOL. 1

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APPENDIX 1.1

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APPENDIX 1.1

Earthquake-Resistant Design of Drilling Towers in the Santa Barbara Channel

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EARTHQUAKE-RESISTANT DESIGN OF DRILLING TOWERS IN THE SANTA BARBARA CHANNEL

Introduction

Most of the characteristics of strong earthquake motions are known only in a statistical sense and as a result rational techniques of earthquake-resistant design of structures must cope with the essentially statistical nature of the problem. Not only are the locations in space and time of future strong earthquakes unknown except in a rough statistical manner, but also the ground motion can only be specified statistically even assuming that an earthquake will occur. Given that an earthquake of specified Richter Magnitude has occurred at a known distance from the site, the ground motion at the structure and the structural response are subject to statistical fluctuations that may exceed one hundred percent for lightly damped structures. In earthquake-resistant design, therefore, there are two fundamental decisions of a statistical nature that must be made: a) an assessment of the probability of occurrence of earthquakes of potentially damaging intensity; and b) an evaluation of structural response statistics for levels of earthquake excitation crucial to the design.

The general approach to earthquake-resistant design must take these probabilistic considerations into account. For small or moderate earthquakes which can occur with a relatively high probability in California, the structure should be designed to respond elastically, without damage. However, for the extremely severe earthquake, which has a relatively low

probability of occurrence, it is usually not economically feasible to design important structures to resist the motions elastically. Rather, the design should be such that the structure, although moderately damaged, is safe from collapse. Furthermore, the damage should be controlled so that repair is both possible and practical.

The earthquakes that produce destructive ground motion in California usually originate at some point approximately ten miles beneath the surface of the ground. Slipping begins at this hypocenter, which can be located by means of seismograms from nearby stations, and progresses until the total area of slip is covered. For a small earthquake, the area of slip is small and there is usually no breakage of the ground surface. Earthquakes of Magnitude 6.5 and above have large slip areas, usually breaking the surface of the ground, with large relative displacements along the fault during shocks of Magnitude 7 and above. For example, the El Centro, California earthquake of 1940 is estimated to have had a slip area of approximately 15 x 40 miles and showed a maximum relative displacement (horizontal) at the ground surface of about 15 ft. During the great earthquakes of 1906 (central California) and 1857 (southern California), surface rupture extended over 250 miles, with a maximum relative displacement along the fault trace of approximately 20 ft. The average relative displacement is usually much less than the maximum, about six feet in the 1906 shock.

It is the radiation of energy in the form of elastic waves from the zone of slipping that produces the shaking experienced during earthquakes. Because of the relation between the strength of the shaking and nearness to the fault, shaking strong enough to be of significance to structures is, in general, confined to an oval-shaped zone, with the major axis aligned with the

causative fault.

Earthquake Environment of the Santa Barbara Channel

The Santa Barbara Channel lies within the most active seismic region of the United States. This region, consisting primarily of California and western Nevada, is a portion of the Circum-Pacific Belt which experiences 80 percent of the world's large shallow-focus earthquakes (Richter, 1958).

Figure 1 shows the epicenters of the major earthquakes that have occurred in the southern California area since about 1800 (Epply, Wood and Heck, 1966). This figure makes it clear that the Santa Barbara Channel lies in a seismically active region. Figure 1 classifies the earthquakes according to the Modified Mercalli Scale which is only roughly coordinated with the true intensity of motion in an engineering sense. Therefore, the intensities should not be taken as precise.

For the shallow earthquakes occurring in California, the Richter Magnitude is usually a better indicator of the damaging potential of earthquake motion and the area over which the motion will be significant. Earthquake motions of engineering importance are usually associated with earthquakes of Magnitudes 5.0 or greater. Of course, the best indication of the intensity of motion is given by a record of the strong motion at the site in question, but these records are too scarce to define by themselves the complete characteristics of strong-motion earthquakes.

Figure 2 shows the epicentral locations of earthquakes of Magnitude ≥ 6.0 that have occurred in the southern California area since 1912 (Allen, et al., 1965). It is clear from this figure that it has been generally true in the past that the larger earthquakes have been associated with known fault

systems. The east-west trending fault to the south of Santa Barbara is the Santa Ynez fault (Richter, 1958), and it is probable that the 1927 offshore earthquake (Byerly, 1930), which had a Magnitude of 7.5, was associated with this fault. The major earthquake of 1812 also occurred in this general area and was possibly associated with the Santa Ynez fault or one of the more southerly parallel faults.

The major earthquakes in the Santa Barbara area were the earthquake of 1812, the great earthquake of 1857 along the lower portion of the San Andreas fault, and the earthquakes of 1925, 1927 and 1941. The brief summaries of these earthquakes given by Epply, Wood and Heck are included in the Appendix of this report. As would be expected, the information from the earlier earthquakes is limited but there is a considerable literature on the earthquake of 1925. Much of this information can be found in the Bulletin of the Seismological Society of America.

The strong motion in one of the earthquakes occurring near Santa Barbara has been recorded by the network of instruments maintained by the Coast and Geodetic Survey. Figure 3 shows one component of the horizontal ground acceleration recorded in the city of Santa Barbara during the earthquake of June 30, 1941 (Alford, Housner and Martel, 1951). The Magnitude of the shock was 6.0 and the recording was made approximately 15 miles from the epicenter of the earthquake. The record is fairly typical of earthquakes of this Magnitude recorded at this distance.

It is difficult to draw conclusions directly from accelerograms such as shown in Fig. 3; the maximum recorded acceleration is a convenient rule-of-thumb guide to the strength of the accelerogram, but it is imprecise and has little meaning for structures with natural periods greater than about

0.1 seconds. The concept of a response spectrum (Alford, Housner and Martel, 1951; Atomic Energy Commission, 1963) has been introduced to characterize features of earthquake motions that are significant for most engineering purposes. The velocity response spectrum is perhaps the most common spectrum; it is a plot of the maximum velocity, with respect to the base, of a one-degree of freedom structure whose base is excited by a component of the earthquake motion. The natural period of vibration of the structure and the fraction of critical damping are varied to form a spectrum. As an example, the velocity spectrum for the earthquake acceleration shown in Fig. 3 is presented in Fig. 4. More detailed information about the response spectrum concept can be found in the references cited above.

If the spectra from several strong earthquake motions are averaged after appropriate normalization, a smoothed set of design spectrum curves can be constructed whose characteristics are representative of real earthquakes. The scale of the design spectra can then be adjusted to correspond to different intensities of ground motion. Figure 5 shows these design spectra with the scale adjusted to 33%g acceleration at very short periods and 2.7 ft per second for zero damping at 3 seconds period. This design spectrum is representative of the ground motion recorded at El Centro, California May 18, 1940 which was the strongest destructive motion yet recorded, with a maximum ground acceleration of 1/3g.

The presentation of the design spectra on a tripartite logarithmic plot such as Fig. 5 is especially convenient because design values of relative velocity and displacement and total acceleration of a one-degree of freedom structure can all be read from the same plot. For example, according to the design spectrum of Fig. 5 a structure with a period of one-half second

and 2 percent of critical damping has a maximum relative displacement of 0.14 ft, a maximum relative velocity of 1.8 ft/sec, and a maximum total acceleration of 68%.

In Fig. 5 it is seen that the design spectrum curves converge to a constant value of acceleration as the period T becomes very small. This constant corresponds to the maximum acceleration of the ground and its value represents a convenient way to scale the design spectra. Thus, design spectra of earthquakes 3/4 as intense as those characterized by Fig. 5 would have ordinates 3/4 as large, and the spectra curves would converge to a constant acceleration value of about 25%g.

Probabilities of Earthquake Occurrence

In assessing the seismicity of a given area, heavy reliance is placed on historical records of earthquake occurrence. In their simplest form, the summary of these records can be given as maps of earthquake epicenters such as Figs. 1 and 2. These maps give a generally consistent picture of relative seismicity of different regions but have the major drawback that the areal extent of significant ground motion is not indicated. A study of earthquake ground motion in California has been made (Housner, 1952) in which the areal extent of significant shaking and the consequences of the length of fault rupture in large earthquakes are taken into account. The probability estimates in the 1952 report have been revised (Housner, in press) and it is the revised results that have been used to prepare the estimates given below.

For each Magnitude of earthquake, spatial intensity distributions are established and these are summarized in Table I.

The historical record of earthquakes in California is too meager to define the seismicity of small areas and hence the probability calculations have been made for the entire State of California (150, 000 square miles). The expected frequency of occurrence of earthquakes in California is shown in Table II. These figures have been adjusted to take into account the fact that large shocks are accompanied by smaller aftershocks which provide a multiple shaking of the affected area.

The probability estimates are directed toward determining the likelihood of experiencing strong motion at a location in California equalling or exceeding a specified level in a given period of years. The intensity of motion is measured in terms of the maximum ground acceleration in the sense that this number is a convenient way to scale the design spectra.

The computed probabilities of experiencing ground motion equalling or exceeding a given level are summarized in Table III, and the probabilities for 50 and 100 year periods are graphed in Fig. 6. This figure shows that there is a 20 percent probability of ground motion equalling or exceeding 26 percent g in a 50-year period. The 20 percent probability level increases to about 30 percent g for a 100-year period. Figure 6 shows also that the level of ground motion expected with a probability of one-half in a one-hundred year period is 22. 5 percent g. It should be realized that such probabilities of ground shaking equalling or exceeding specified levels are more meaningful for design purposes than are assessments of 50-year or 100-year earthquakes.

Figure 6 and Table I are based on the assumption that all portions of California are equally likely to experience strong shaking. However it can be seen from Fig. 2 that some areas of the state are clearly more

TABLE I

Area in 1000 Square Miles Covered by Ground Acceleration (%g)

Acceleration	5.0	5.5	6.0	6.5	7.0	7.5	8.0
≥ 5%g	0.4	1.6	3.6	6.8	13	28	56
≥ 10		0.6	1.6	3.6	7.6	14	32
≥ 15			0.6	2.0	4.4	9.6	21
≥ 20				0.9	2.5	6.0	14
≥ 25					1.3	4.0	10
≥ 30					0.25	2.0	6.4
≥ 35						0.6	4.0
≥ 40							1.2

TABLE II

Expectation of Earthquakes in California

(150,000 sq. miles)

Magnitude	No. per 100 Years
4.75 - 5.25	250
5.25 - 5.75	140
5.75 - 6.25	78
6.25 - 6.75	40
6.75 - 7.25	19
7.25 - 7.75	7.6
7.75 - 8.25	2.1
8.25 - 8.75	0.6

TABLE III

Probability of Strong Ground Motion

in California

Maximum Ground Acceleration Equalling or Exceeding	Computed Probability of Occurrence in a Given Period			
	10 Years	25 Years	50 Years	100 Years
10%g	37	70	88	98
15	19	41	64	87
20	10	23	40	63
25	5	12	22	37
30	2.5	5.5	10	19
35	1.0	2.5	4.4	8.7

seismic than others and such facts, when available, should be considered in setting design requirements.

When estimating the probability of earthquake occurrence, it should be emphasized that the results must be rough approximations. It is not improbable that a period of a few years could go by with no perceptible shaking at a given location, nor is it impossible for several significant earthquakes to occur in a few days. Even over a period of 29 years in a seismically active region it has been found that there is a wide variability of earthquake occurrence over areas as large as 5000 square miles. Nor should the quiescence of an area within a generally active region over a period of years be taken as an indication of low seismicity; the quietest area over a 29-year period in southern California is the zone along the San Andreas fault where the great 1857 earthquake took place (Allen, et al., 1965). Probabilities of earthquake motions therefore should be interpreted as reasonable estimates based on available data.

In assessing the expected performance of structures during very large earthquakes, it is important to realize that there is an upper bound to the intensity of strong shaking. If the historical records and available data for great earthquakes are examined, it soon becomes clear that the primary difference between great earthquakes and lesser ones is the length of fault rupture and as a result the areal extent of strong shaking. Thus, a Magnitude 8 earthquake with about 200 miles of slipped fault is very much like several Magnitude 7 earthquakes, with fault ruptures of about 50 miles, laid end to end. Because the strongest shaking is determined by the zone of rupture closest to the site, a location close to the fault in a Magnitude 8

earthquake would receive longer, but not much stronger, shaking than would occur during a Magnitude 7 shock. On the basis of measured motions and observed earthquake effects, it has been estimated (Housner, 1965) that for California earthquakes the maximum ground acceleration near the causative fault is approximately 50 percent g, which corresponds to shaking approximately half again as strong as the motion experienced in El Centro in 1940.

Design Philosophy

Earthquake design criteria specify the strength that a structure should have to resist earthquake ground motions. This requires the specification of the following three items:

a) The design spectrum. The shapes of the spectrum curves are intended to achieve a uniform factor of safety for structures of different periods of vibration. The scale of the spectrum curves may be varied to correspond to different intensities of ground shaking.

b) Allowable design stresses and strains. Varying the allowable design stresses and strains is equivalent to varying the scale of the design spectrum. The use of a large design spectrum and large allowable stresses and strains may result in a less strong design than the use of a smaller design spectrum and smaller allowable stresses and strains.

c) Damping factors. The stresses and deformations that a structure experiences during an earthquake are strongly dependent on the amount of damping the structure has. When designing a structure the appropriate damping must be estimated in order to read values from the design spectra.

Increasing the assumed values of damping is equivalent to reducing the scale of the design spectrum or of increasing the allowable design stresses and strains.

The scale of the design spectrum, the allowable design stresses and strains, and the damping factors should be given equal consideration when establishing earthquake design criteria.

When establishing the allowable stresses and strains it is customary to consider two situations; first, to design for no damage in the event of ground shaking for which there is a significant probability of occurrence during the life of the structure, and second, to design for the strongest potential ground motion permitting some overstress, plastic straining, and possibly moderate damage, but providing safety against collapse. Both of these approaches require that the structure have adequate ductility so that it can undergo plastic straining without undesirable effects.

Table III and Fig. 6 show that there is a significant probability of experiencing moderate earthquake shaking at a typical point in California. Also, it is seen from Figs. 1 and 2 that the Santa Barbara Channel lies in a relatively seismic region of the state, as evidenced by the earthquakes of 1925, 1927 and 1941. Because there is a significant probability of moderate shaking, the design philosophy should be to establish a design spectrum corresponding to such shaking and to use allowable design stresses not exceeding the yieldpoint. Thus the intent would be that the structures would respond, on the average to earthquakes of the design level, with maximum stresses approximately equal to yieldpoint stresses (primary stresses). The ductile capacity of the structure (see below) would provide a margin of safety against an unusually close or strong earthquake of this intensity, or a disadvantageous

combination of frequency components in the ground motion.

The probabilities given in Table III and Fig. 6 show that there is a rather small probability of very strong ground motion, such as is expected during a great earthquake. This is also apparent from Fig. 2. However, very strong ground shaking has occurred in the past in California, and the possibility of reoccurrence cannot be ignored.

We recommend that the design philosophy for very strong shaking be that the structure resist the strongest potential motions without collapse, although plastic deformations and some damage may be expected. Indeed, this is the most important criterion for the earthquake-resistant design of major structures in seismic regions since a structure designed to this standard can also survive lesser shocks, without collapse and usually without significant damage. The ability to withstand strong shaking without collapse must be insured by designing to retain structural integrity even for large displacements, well into the yielding range. Thus, local buckling, brittle connections and other impediments to ductile behavior of the structure must be avoided.

The above paragraphs state that the essential feature of the design should be to resist the strongest potential shaking without collapse, thereby insuring the survival of the structure. The limit of the elastic response level is set by making an estimate of the level of earthquake intensity for which yielding and damage cannot be permitted, on the average, because of the probability of reoccurrence of equally intense shaking, the difficulties of repair, or economic factors.

Recommended Design Spectra

To specify the level of structural response needed to resist the strongest potential ground shaking, we recommend the spectra of the shape shown in Fig. 5, but with ordinates increased by a factor of 1.5. Spectra of this level are shown in Fig. 7 wherein it is seen that the spectrum values converge on the left to a maximum acceleration value of 50 percent g. Although, on the average, motions during great earthquakes should be less in the Santa Barbara area, this level is considered appropriate in view of the statistical nature of the problem. The structure should have sufficient ductility so that it can withstand the maximum deformations corresponding to this spectrum without danger of collapse.

The design spectra recommended for determining the level of elastic response are also similar to those shown in Fig. 5, but with ordinates multiplied by a factor of 0.75. Such spectra are shown in Fig. 8 which shows the spectrum curves converging on the left to a maximum acceleration of 25 percent g. The allowable design stresses should be taken to be equal to the yieldpoint stresses, and the structure should have a ductility that will accommodate deformations 2.0 times the yieldpoint deformations.

Recommended Accelerograms for Design Calculations

The spectra of strong ground motion recorded on firm ground within 20 to 30 miles of the causative fault during large west coast earthquakes exhibit similar characteristics. Over the period range of about 0.4 to 5.0 seconds the characteristics are approximately those of a "white noise" signal, whereas for periods less than 0.4 seconds the energy content drops

off to zero at zero period. Although a smoothed set of design spectrum curves can be constructed whose characteristics are representative of real earthquakes in an average sense, statistical fluctuations of individual response spectra or other variables about values chosen for design are intrinsic to the nature of the earthquake motions and must be kept in mind when interpreting the results of an integration of the equations of motion of a structure in response to a particular accelerogram. In this connection it should be kept in mind also that the maximum dynamic stress has a very short duration and that the average stress amplitude is lower. For the accelerograms typical of the strongest potential shaking, artificial or simulated accelerograms must be used because such motions have not yet been recorded. We therefore recommend the use of earthquake A-1 and A-2 of the report "Simulated Earthquake Motions," a copy of which is attached to this report. Earthquakes A-1 and A-2 are illustrated in Figs. 9 and 10 of that report, and the corresponding spectra are shown in Figs. 17 and 18. The spectra are shown also in tripartite logarithmic form in Figs. 25 and 26. The accelerograms, which are available in punched card form, are defined by numbers spaced at equal intervals of 1/40 of a second. The scale of the accelerograms is such that the average intensity of earthquakes A-1 and A-2 is 1.5 times the average intensity of the El Centro, 1940 accelerogram and therefore representative of the level of intensity shown in Fig. 7. The two accelerograms can represent the two horizontal components of the same earthquake, or two samples of the same level of intensity. According to the recommendations set forth above, a properly designed structure subjected to this excitation would experience deflections into the yielding range, but not so large as to indicate structural failure or danger of collapse.

For the less intense motion, which is to be resisted elastically on the average, we recommend earthquakes B-1 and B-2 of "Simulated Earthquake Motions" multiplied by a factor of 0.75. These accelerograms are examples of earthquakes which, if enough were taken, would produce the average spectra shown in Fig. 8. Accelerograms B-1 and B-2 are shown in Figs. 11 and 12 of "Simulated Earthquake Motions." Corresponding spectra are given in Figs. 19 and 20 and again, in tripartite form, in Figs. 27 and 28. According to our recommendations, structures should respond to this level of shaking elastically in the sense that, on the average, this intensity of shaking brings the structures just to the point of yielding. Digital forms of accelerograms B-1 and B-2 can be furnished if desired.

Structural Dynamics

Introduction

There are three general levels at which the dynamic problems of earthquake-resistant design can be approached. The first level replaces the earthquake forces by horizontal static loads which are equivalent to the earthquake excitation in some sense. This approach, which is exemplified by most building codes, is not suitable for special structures for which earthquake experience is lacking, and it is not recommended for offshore drilling platforms.

The spectrum approach is a method which takes into account the dynamic nature of the problem, using average earthquake characteristics and the natural periods and damping values of the structure to determine a rational approximation for the average earthquake response of structures. We feel that the spectrum approach is appropriate for use in the design of offshore

drilling structures. The spectrum technique is explained in detail in TID-7024 (Atomic Energy Commission, 1963). It should be noted that the design spectrum, together with the allowable design stresses, specifies the desired strength of the structure.

The third level of approach consists of forming a mathematical model of the structure and integrating the equations of motion for excitation by accelerations recorded in a past earthquake, or by other suitable motions. During the computations the maximum moments, shears and other quantities of interest can be monitored to determine their maximum values. This method is more accurate than the spectrum approach in the sense that the approximations needed in the spectrum approach for combining the response of different modes are avoided; the true combinations are evaluated automatically. However, it must be borne in mind that what is calculated is the response to a particular excitation, and several different excitations would have to be used to give information on the statistics of earthquake response. This third level of approach is certainly appropriate for use in the design of offshore drilling structures, if computing facilities are available. It should be noted however, that the strength of a structure is specified by the design criteria: the design spectrum, the amount of damping and the allowable design stresses and strains. For complex structures, it may be informative to calculate how modal contributions combine; this can be done by adjusting the scale of the ground motion so that its spectrum has approximately the same value as the design spectrum at the significant periods of vibration.

Calculation of Yielding Response

For calculating the response of structures excited into the yielding range, the direct integration of the equations of motion is the only method

giving accurate results in the mathematical sense; modal analysis and other techniques based on linearity no longer apply, strictly speaking.

However, the evaluation of the response of a complex, yielding structure to earthquake excitation is a very large computing job and usually has not been attempted outside of university research programs. It has been found from such research studies that the overall effect of yielding is to dissipate energy and reduce the amplitude of response in a way similar to the effects of viscous damping. Thus for the analysis of offshore drilling platforms in the yielding range, we recommend that the structure be modeled by a linear structure with the damping increased to approximate the dissipative effects of yielding.

Virtual Mass of Water

If no tests or analyses are available to fix more precisely the added mass of the structure because of its immersion, the mass of the added water should be equal to the mass of water contained within the structure, plus a virtual mass distributed uniformly over the height of the structure with a volume equal to not less than 60 percent of the volume of the submerged portion of the structure. (Clough, 1960)

Damping Values

Specifying the amount of damping appropriate for various levels of response is necessarily imprecise because of the limited available data that bears on this problem. Based on the earthquake response data that is available and the results of vibration tests of structures, if such a structure were built on land, we would recommend that the amount of damping in the structure be taken as 2 percent of critical in all modes of vibration for

response which does not, on the average, exceed the yield level of the structure.

Placing the structure in the water increases the mass of the structure but does not increase the mechanism within the structure for dissipating energy within the elastic range of response. Defining M as the total mass of the structure and M_f as the total mass of the water contained in the structure plus the virtual mass, the change in period due to the added mass of water changes the critical damping by a multiplicative factor of approximately $\left\{1 + \frac{M_f}{M}\right\}^{-\frac{1}{2}}$.

For response to the strongest possible shaking, where yielding is expected, we recommend that the dissipative effect of yielding be modeled by an additional 3 percent damping in all modes of response.

To these values must be added the dissipative effect of the water. In this area you may have knowledge that can fix the damping effects of the water more precisely, but in the absence of such data, we recommend from the results of R. W. Clough (1960) that the viscous effect of the water contributes an additional damping factor of 1.5 percent to each mode. Thus, in response to earthquakes of 3/4 the intensity of the El Centro 1940 (Fig. 8) the damping for all modes of the structure should be taken as

$$n_1 = 0.015 + \frac{0.02}{\sqrt{1 + \frac{M_f}{M}}}$$

For excitation 1.5 times as strong as that experienced in El Centro (Fig. 7) the damping should be found for all modes from

$$n_2 = 0.045 + \frac{0.02}{\sqrt{1 + \frac{M_f}{M}}}$$

Soil-Structure Interaction

It is our understanding that the structures are to be founded on firm material, probably rock. Under these conditions it would be appropriate to assume that the structures are fixed at the foundation level in the structural analyses; that is, there is no significant soil-structure interaction.

Eccentricity

Dynamic symmetry is preferred in earthquake-resistant design because the maximum stresses are distributed more uniformly throughout the structure than is the case for eccentric structures, which concentrate the maximum stresses at points furthest removed from the center of the eccentric motion. Because of its adverse effects, eccentricity should be avoided wherever possible. In any case, when eccentricity occurs, its effects on the dynamic response of the structure must be considered. One of the most important effects of eccentricity is the coupling of translational and torsional oscillations of the structure. Thus, modes which are primarily torsional in nature can become significant in the response of the structure to earthquake motions.

Interaction of the Horizontal Components of Motion

The two horizontal components of recorded earthquake motion have been found to be about equally strong, whereas the vertical component is usually less intense than the horizontal shaking by a factor of 1/3 to 1/2. Shaking in both horizontal directions implies that the dynamic stresses at a point are contributed by several modes of response in each of the two

horizontal directions, and in the case of eccentric structures, torsional modes as well. The two-dimensional character of the shaking must be considered whether the analysis is done by spectrum techniques or by integration of the equations of motion.

Combination of Modal Responses

When the spectrum approach is used, it must be decided how the response of the various modes of vibration are to be combined for design purposes. For example, if the absolute value of all the modal responses are added the result is an upper bound on the response. Although this bound is often quite close to the actual response for structures with only a very few degrees of freedom, it will be overly conservative for a structure like the drilling platforms which will have many degrees of freedom excited by the earthquake. However, it is informative to compute this result because it represents the largest possible transient stress.

Another estimate of the response which is used commonly is the square root of the sum of the squares of the individual modal responses. This method gives a good estimate of the total response on the average, but can be unconservative in many cases.

For purposes of design we recommend that the modal responses excited by each component of the excitation be combined by taking the largest modal response and adding to that the square root of the sum of the squares of the other modal contributions excited by that component of motion. This method is based on the idea that one mode often dominates the response (e.g. base overturning moment), so the proper approach is to take the value for the most important mode and add to that an estimate of the response of the other modes.

Defining R_1 as the largest modal response, N as the number of modes, and R_d as the design response, the recommended approach is

$$R_d = R_1 + \sqrt{\sum_{1=2}^{N} R_i^2}$$

For example, if the modal responses for a variable of interest are $R_1 = 6$, $R_2 = 4$, $R_3 = 4$, and $R_4 = 3$, the various methods produce

$$R_{max} = 17 \text{ (largest possible value)}$$

$$R_{rs} = 8.76 \text{ (root square value)}$$

$$R_d = 10.4 \text{ (recommended design value)}$$

For use of the spectrum approach it is recommended that the first four modes of response of each type be considered so that in general twelve modes of response, four in each principal direction and four torsional modes would be included. Of course, all twelve modes will not be equally significant and many important response variables will be determined primarily by just a few modes of response.

Integration of the equation of motion is usually carried out only for a single component of excitation so for this approach, as well as the spectrum approach, the effect of the two components must be combined to produce design values of stresses and strains. To effect this combination it is recommended that the effects of the two components be considered to happen simultaneously and be combined vectorally. Thus, the maximum displacement would be the vector sum of the x and y components of the displacements caused by the two components of the shaking, whereas the maximum axial

force in a member, for example, would be the sum of the forces produced by the ground shaking in each direction.

Vertical Motions

For building structures, which usually have a relatively high factor of safety for vertical loads, the vertical component of the earthquake excitation is not considered in the design. If this is also the case for the drilling platforms, it would be acceptable to base the design on the horizontal components of excitation only.

If the vertical components of the shaking is considered in the design, we recommend a design spectrum 1/3 the scale of Fig. 7 for the strongest potential shaking and 1/2 the scale of Fig. 8 for use in conjunction with design calculations based on Fig. 8.

Response of Equipment and Other Non-Structural Elements

Earthquake accelerations recorded in the tops of multistoried buildings have shown that the intensity of the shaking on top of the structure is greater than that occurring at the base. For this reason, equipment which could be hazardous to personnel or which has a function vital to the drilling platform must be secured against shaking stronger than that exciting the structure itself.

It is the motion of the platform to which the equipment is attached that acts on the equipment. From the spectrum curve the maximum platform displacement, A_i, can be computed for each mode of interest. If the platform motion is taken to be

$$y_i = A_i \sin \omega_i t$$

the response of the equipment can be determined using the frequency ω_i closest to the frequency of the equipment. This will give somewhat conservative results, particularly if the natural frequency of the equipment is very close to one of the values of ω_i. It is recommended that the equipment be designed and supported so that its natural frequency does not coincide with the natural frequency of a strongly excited mode of the tower.

Strong-Motion Instruments

Because of the many unknowns involved in predicting the effects of earthquakes on structures it is recommended that at least one strong-motion accelerometer be installed on each drilling platform. The intent of such an installation is to correlate the observed system response with measured motions, should an earthquake occur.

If, during small earthquake motions, some portion of the system proves particularly sensitive to ground shaking, the recorded motions will be very valuable for determining a way to prevent problems in the event of stronger shaking and for improving the design of future platforms. On the other hand, measured motions obviously would be of value should significant structural damage occur during a strong earthquake. Without a record of the acceleration it would be extremely difficult to assess the significance of vibratory damage, or the lack of it, as a result of a strong earthquake. Commercially available strong-motion accelerographs are made and distributed in the United States by Teledyne, Inc., and range in price from about $1650 to $4600 each. The instruments need about three feet of clearance above for removing the cover and sufficient clearance on the sides for service and calibration. Arrangements probably can be made with the U. S. Coast and Geodetic Survey for the

routine maintenance of the accelerographs, and for the handling of records in the event of an earthquake.

Dynamic Testing

It is recommended that dynamic testing of selected towers be undertaken to improve design techniques and to assess the accuracy of assumptions made in the analysis. Such tests could be forced vibration tests using eccentric mass shakers as has been done for buildings and other structures, or measurements of strains and vibrations induced by wind or wave action. Vibration tests could be done by your own staff or by commercial firms such as Teledyne's Structural Sciences Division, but whatever form the tests might take, we strongly recommend that a testing program be carried out.

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P. C. Jennings

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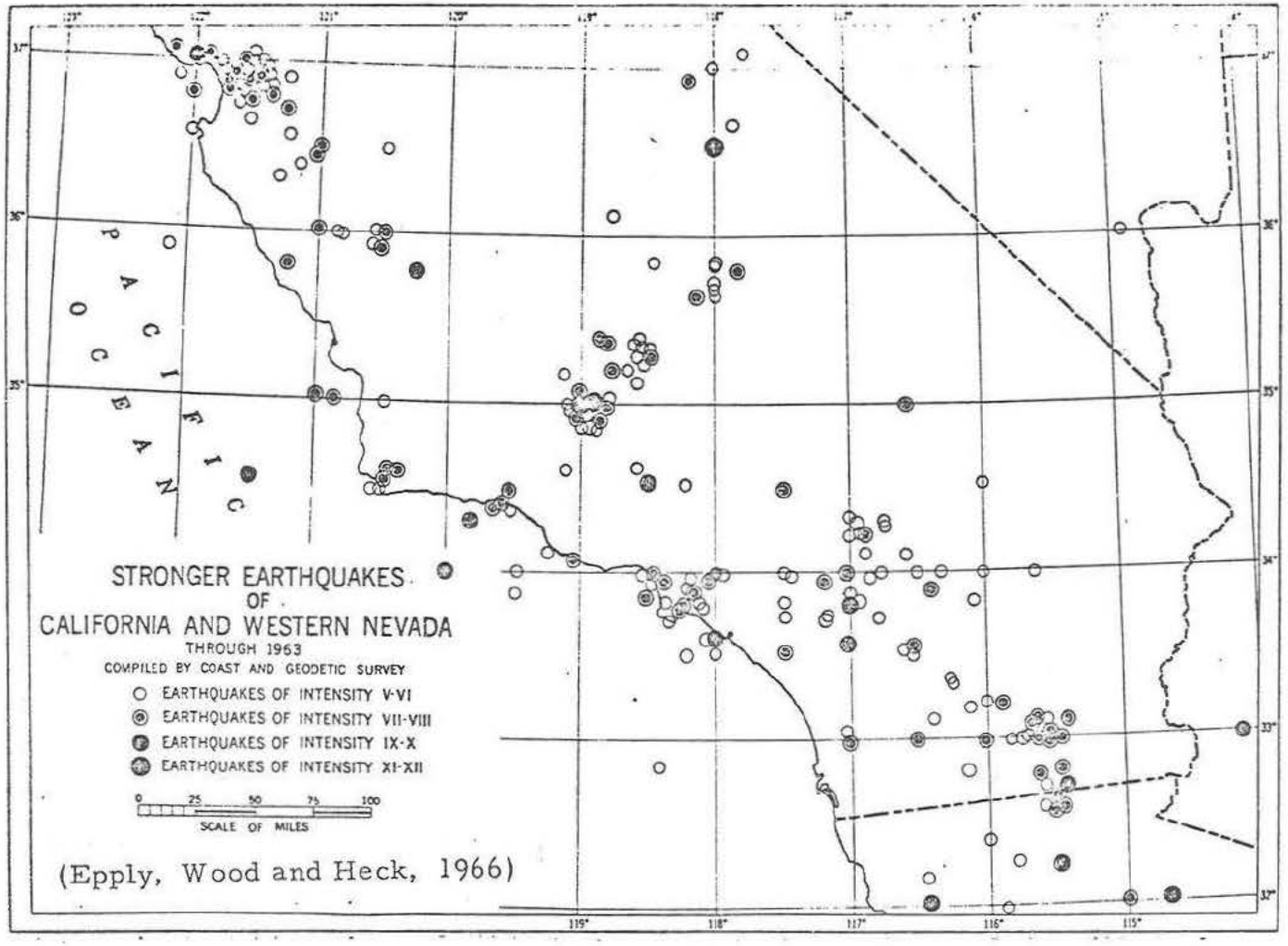
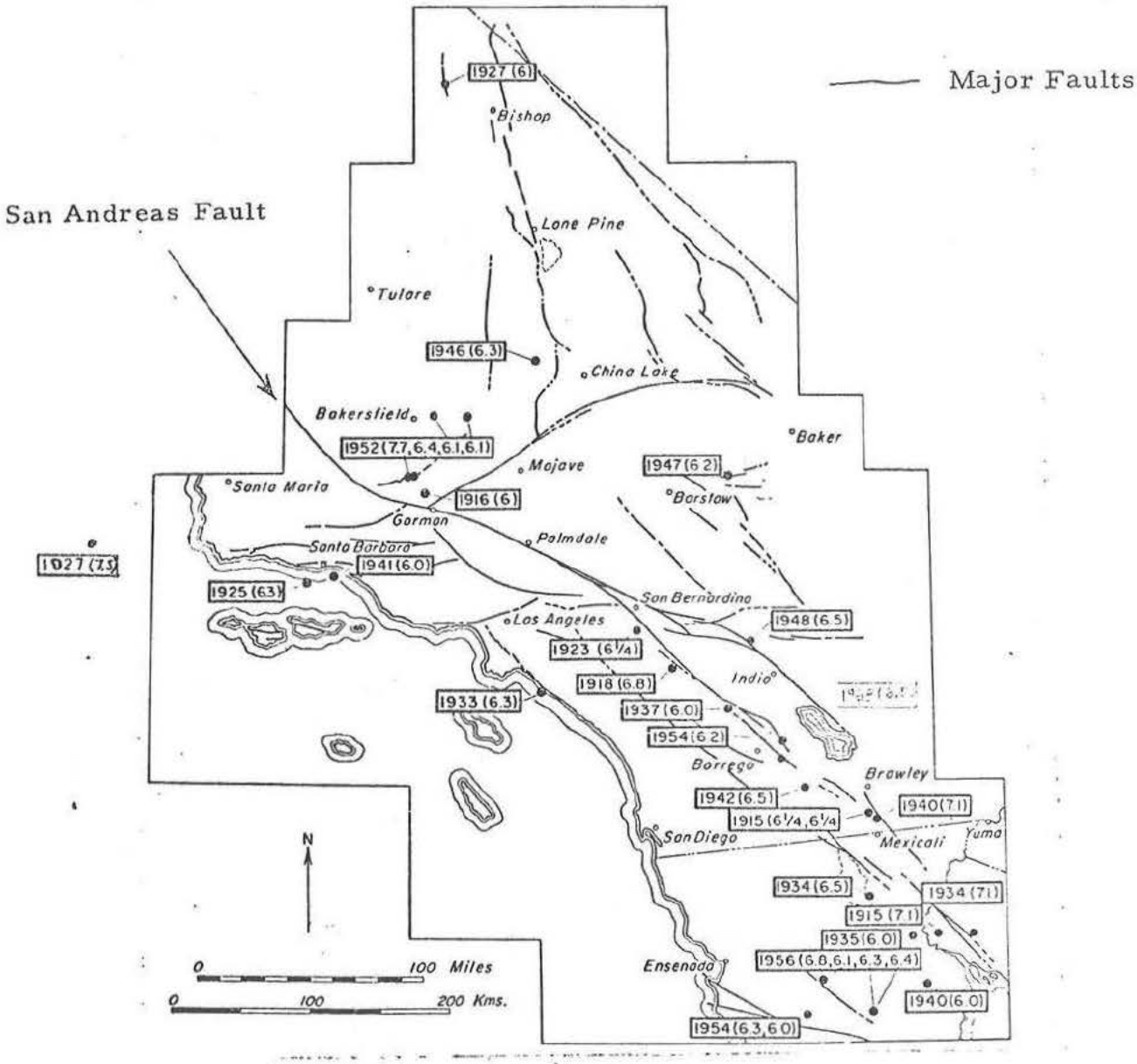
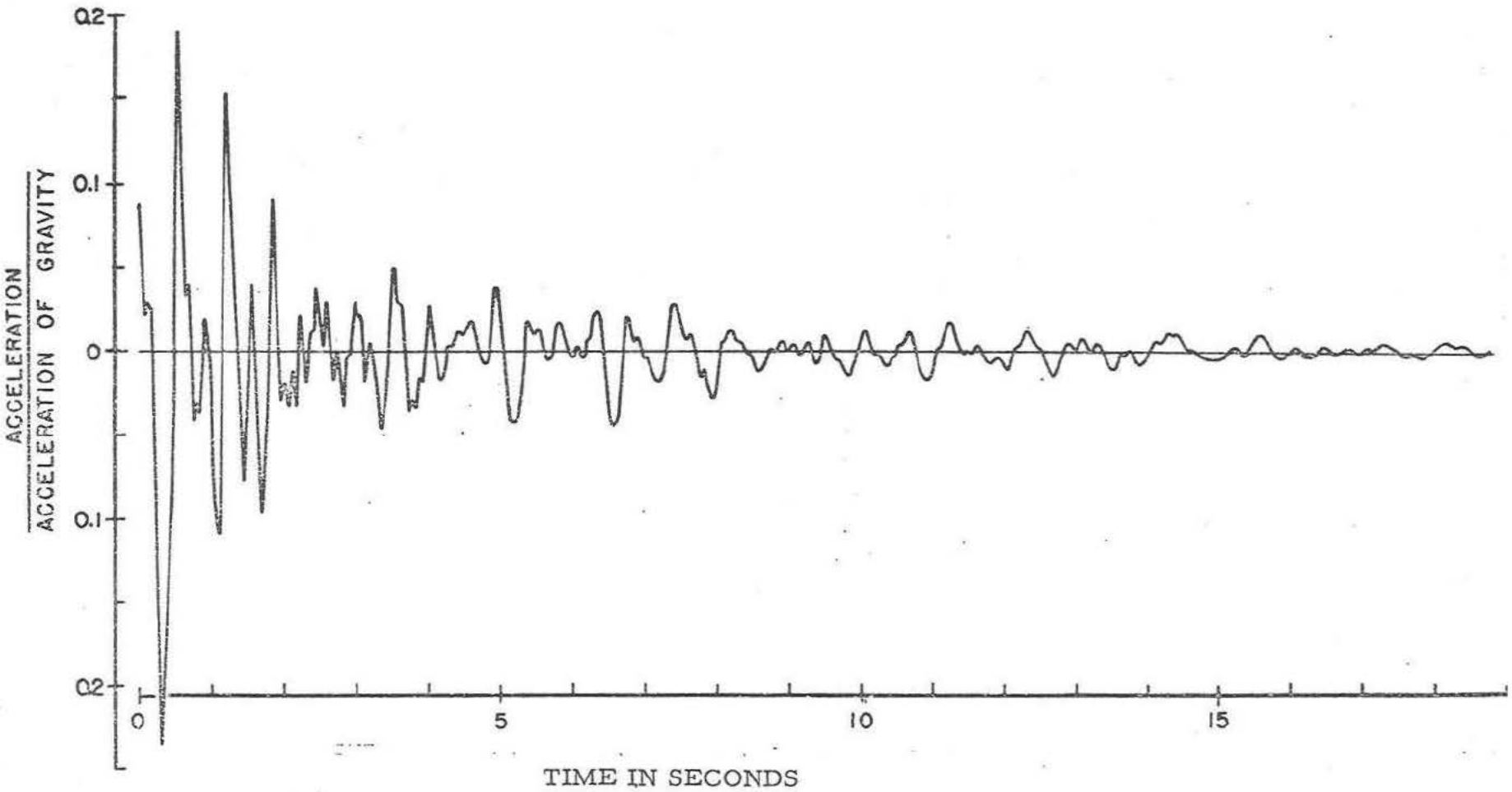

STRONGER EARTHQUAKES
OF
CALIFORNIA AND WESTERN NEVADA
THROUGH 1963
COMPILED BY COAST AND GEODETIC SURVEY
EARTHQUAKES OF INTENSITY V-VI
EARTHQUAKES OF INTENSITY VII-VIII
EARTHQUAKES OF INTENSITY IX-X
EARTHQUAKES OF INTENSITY XI-XII
0 25 50 75 100
SCALE OF MILES
(Epply, Wood and Heck, 1966)
PACIFIC OCEAN
37°
36°
35°
34°
33°
32°
119°
118°
117°
116°
115°

FIGURE 1



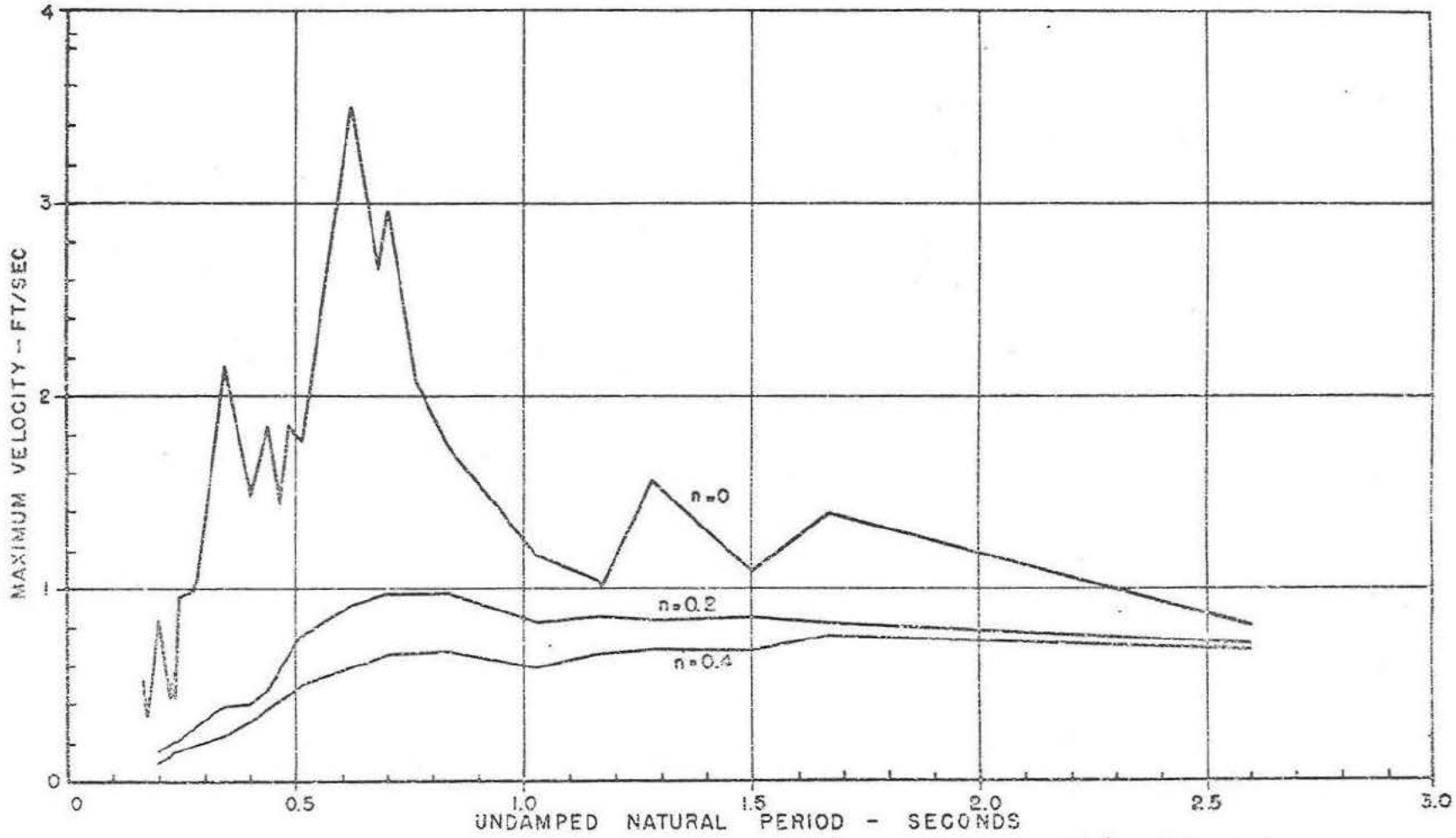
Earthquakes of Magnitude 6.0 and greater in southern California region, 1912-1963. (Allen, St. Amand, Richter and Nordquist, 1965).

FIGURE 2



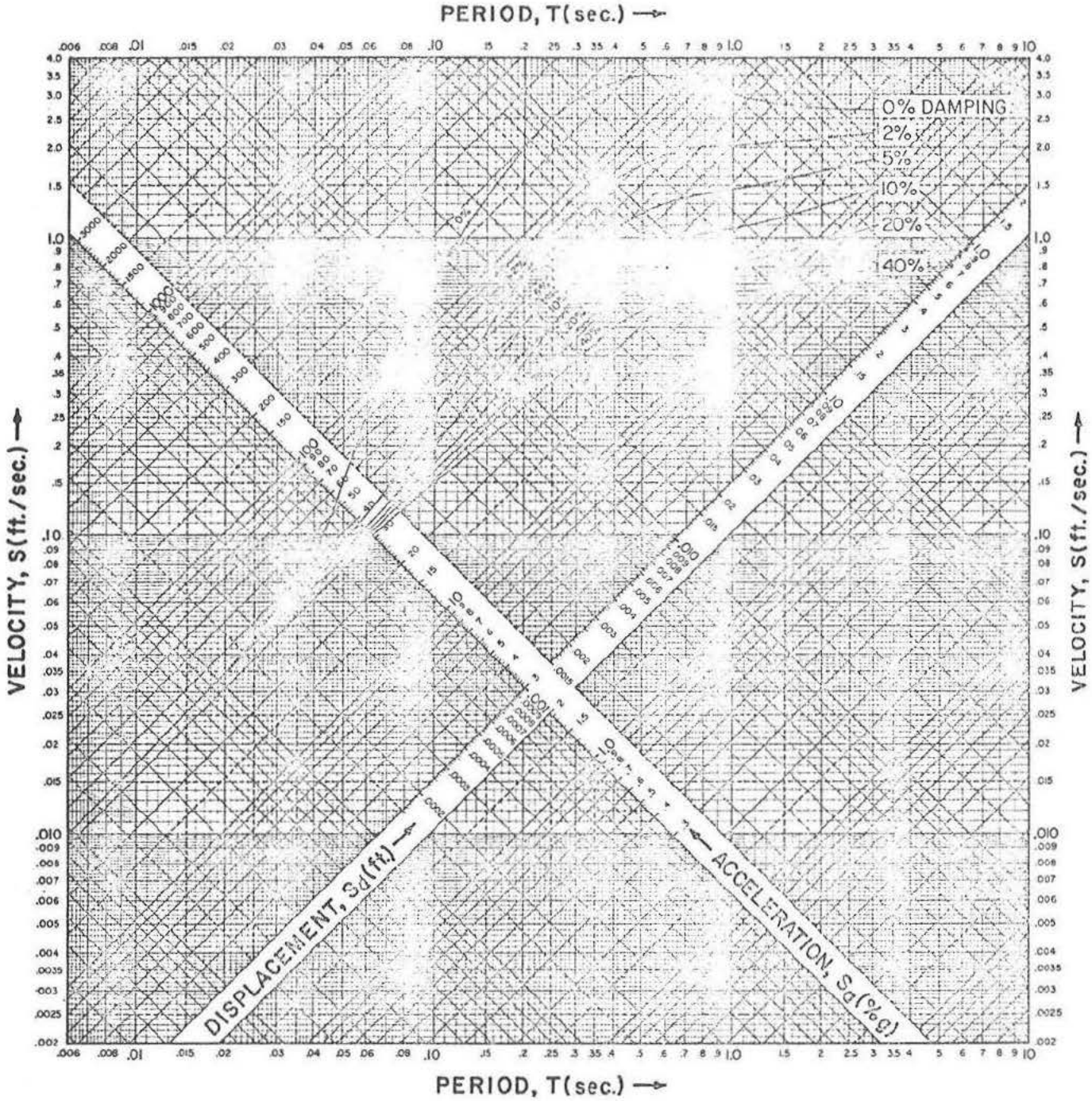
Accelerogram for the Santa Barbara, California earthquake of June 30, 1941. Component S45°E. (Alford, Housner and Martel, 1951).

FIGURE 3



Velocity Spectrum for the Santa Barbara, California earthquake of June 30, 1941. Component S45° E. (Alford, Housner and Martel, 1951).

FIGURE 4

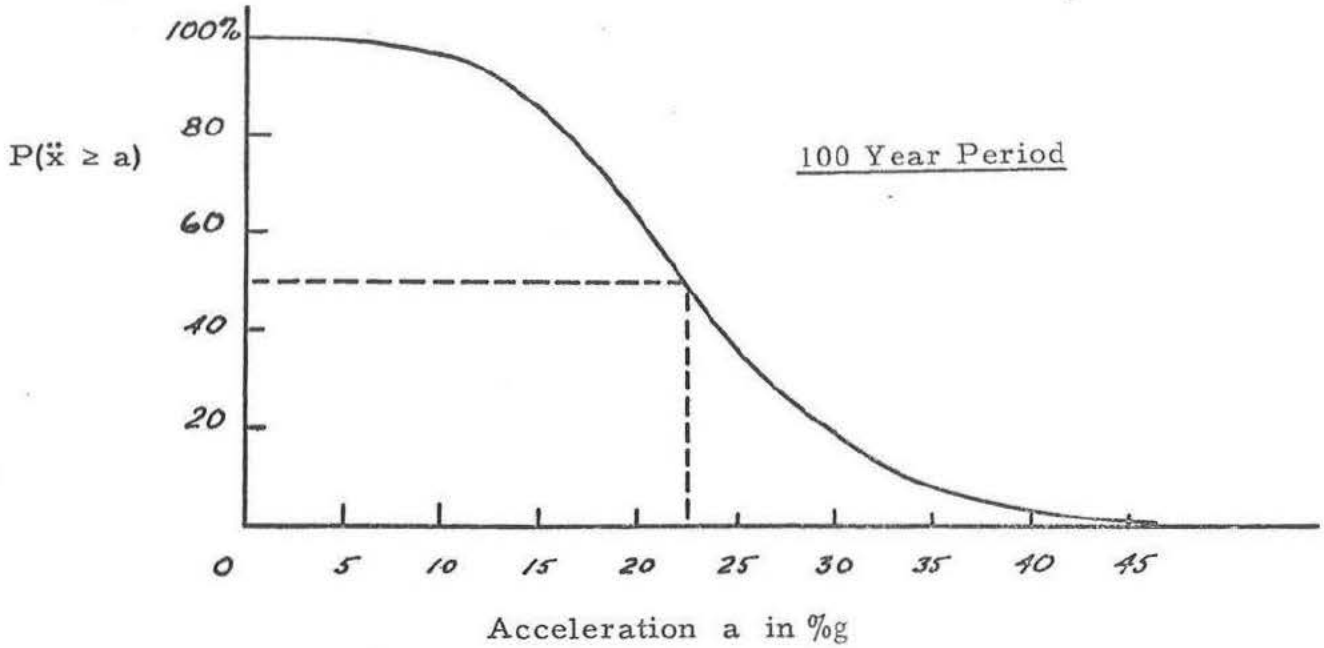


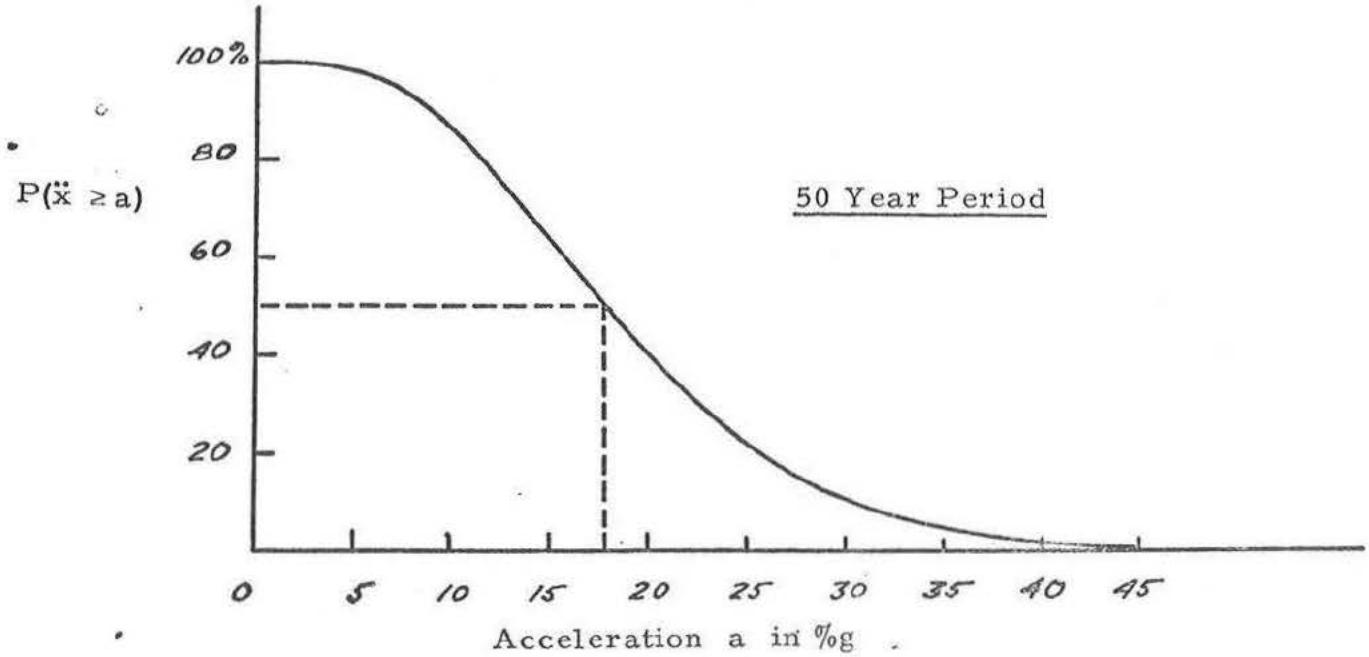
AVERAGE RESPONSE SPECTRA FOR EARTHQUAKE GROUND MOTION

(Maximum Ground Acceleration 33%g)

Converted to logarithmic plot from spectra given in
T.I.D. 7024, "Nuclear Reactors and Earthquakes"
U.S. Atomic Energy Commission, August 1963

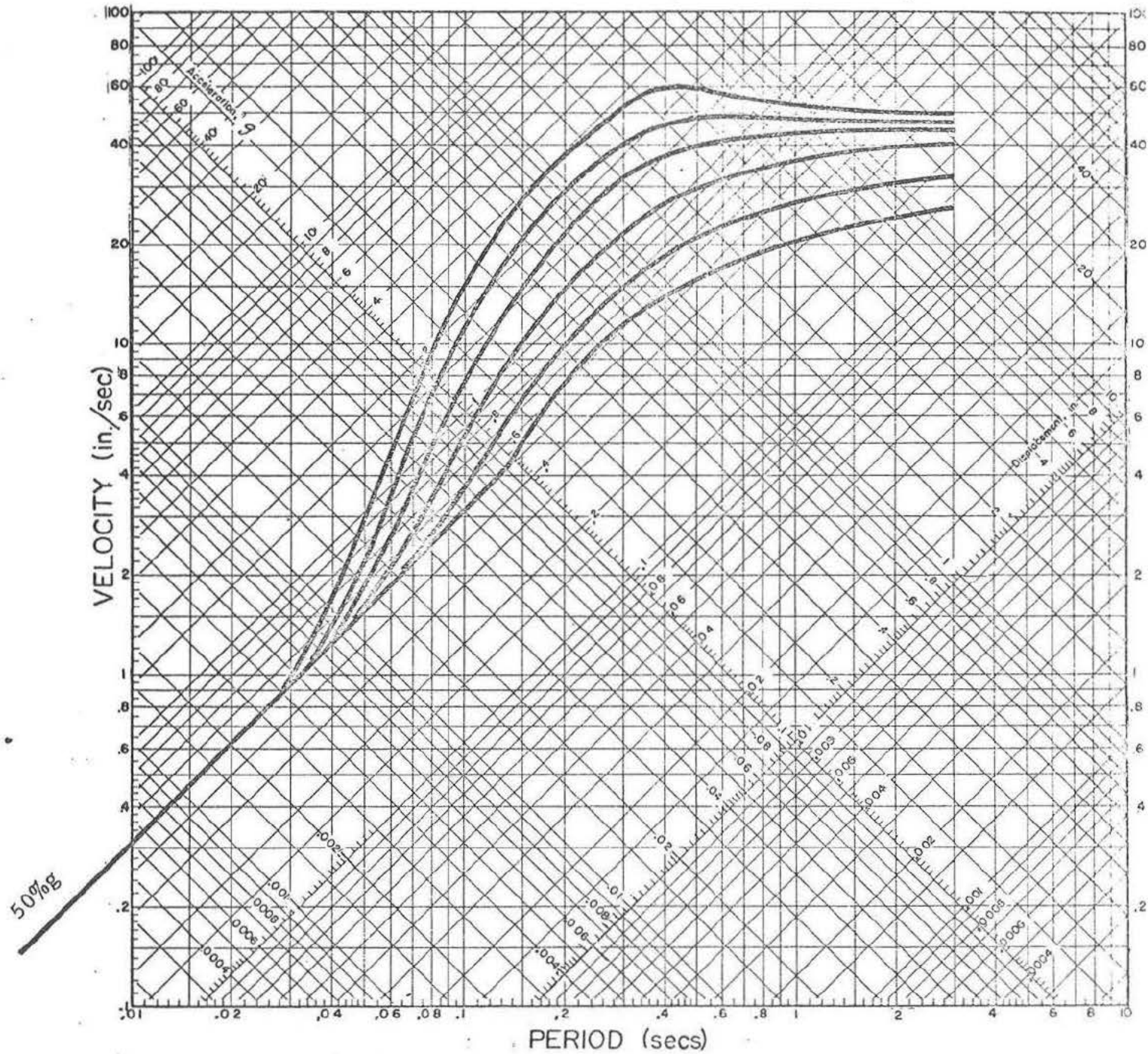
FIGURE 5





Probability of Ground Shaking in California
Equalling or Exceeding a Specified Intensity

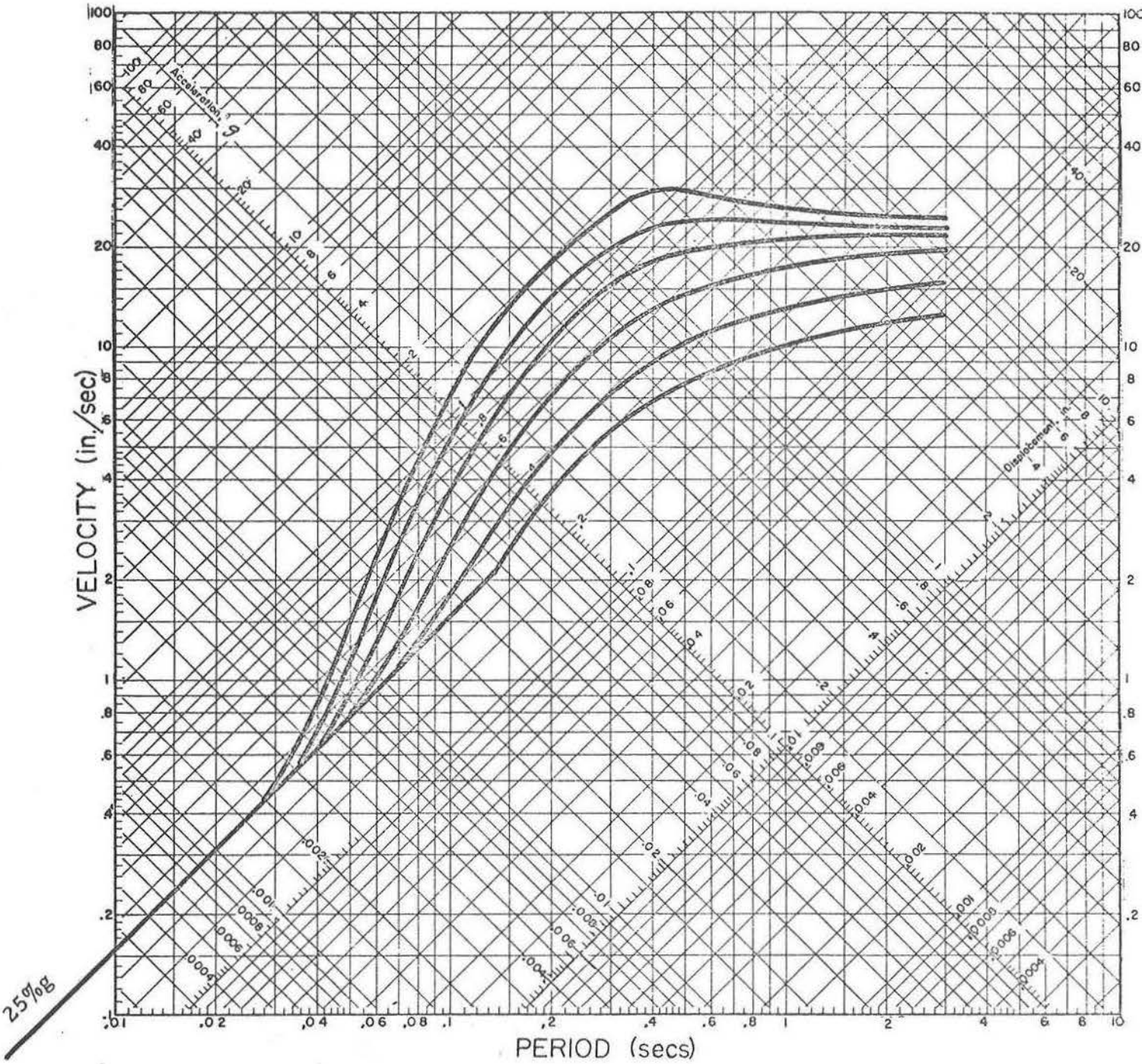
FIGURE 6



DESIGN SPECTRUM

Recommended Design Spectrum
for Strongest Potential Shaking

FIGURE 7



DESIGN SPECTRUM

Recommended Design Spectrum
for Yield Point Stresses

FIGURE 8

APPENDIX

Major Earthquakes in the Santa Barbara Channel Area

(Epply, Wood and Heck, 1966)

CALIFORNIA EARTHQUAKE OF DECEMBER 21, 1812

Time of earthquake.—About 11:00.
Epicenter.—34° N., 120° W., probably offshore in the province of the Transverse Ranges.
Area affected.—Total area unknown.
Intensity.—X.
Description.—This shock was damaging in Santa Barbara, Ventura, and northern Los Angeles counties. A strong and damaging foreshock at about 10:30 alarmed the inhabitants and sent them fleeing from the buildings. This undoubtedly saved many lives when the main shock came. Some people were injured, but there were no deaths reported. The church of Purisima Mission and many of the mission buildings were destroyed. At Santa Ynez Mission, a corner of the church fell, all roofs were ruined, walls cracked, and many new homes were demolished. At Santa Barbara, all mission buildings were severely damaged and the church was later rebuilt. At the presidio, some buildings were ruined and the remaining structures were damaged. The tower was wrecked and much of the facade of the church had to be rebuilt at San Buenaventura Mission. At San Fernando Mission, 30 beams had to be used to keep the walls from falling. Strong aftershocks occurred until February and shocks of less intensity continued until April 1813.

This earthquake was associated with the largest seismic sea wave ever reported originating in California. Descriptive accounts indicate that it may have reached land elevations of 50 feet at Gaviota, 30-35 feet at Santa Barbara, and 15 or more feet at Ventura. It may even have shown visible effects in the San Francisco Harbor. Information on this tsunami does not appear in the Church records. In the 1951 issue of Part II, wave heights were apparently supplied by G. D. Louderback who took into consideration isolated reports combined with the topography of the area. The *Marine Advisers Report* gives well documented data about the effects on structures and the reported tsunami wave heights. This report will soon be published in the *Bulletin of the Seismological Society of America.*

SOUTHERN CALIFORNIA EARTHQUAKE OF JANUARY 9, 1857

Time of earthquake.—About 08:00.
Epicenter.—35° N., 119° W., near Fort Tejon.
Area affected.—Considerable. Total felt area unknown.
Intensity.—X-XI.
Description.—Violent shock. A ground crack 40 miles long was observed in the vicinity of Fort Tejon. This was an army post about 4 miles from the San Andreas Fault, between Los Angeles and San Francisco. Near Tejon, a corral was converted by horizontal dislocation of the ground into an open S-shaped figure; at the Fort, buildings and large trees were thrown down. The roof of the mission church at Ventura collapsed. Artesian wells in the Santa Clara Valley (near Ventura) ceased to flow, and in other places increased their flow. Several new springs were formed near Santa Barbara. There were large fissures in a number of places. Wood and Allen considered this as potentially the most destructive shock in the Coast Ranges since the advent of white men.

1925. June 29. Santa Barbara and vicinity. The shock was felt sharply at Ventura where some damage resulted. It was noticed throughout the San Gabriel Mountains to the east and in the Mojave Desert. At Naples, west of Santa Barbara, a stone church was damaged. The soil cracked at few places in the Santa Ynez Mountains north of Santa Barbara and there was increased flow of springs, but in general, such effects were very moderate.

The damage at Santa Barbara was related to geological conditions and to the types of construction. In general, the structures in that city were equal to those of other cities, good, bad, and indifferent, with some concealment of poor work which was exposed relentlessly by the earthquake. State Street, the principal business thoroughfare which was built on made land, had few buildings that escaped damage.

A 4-story brick hotel with long unsupported side walls lost a large part of its exterior. A large office building failed at a corner through giving away of columns, and the whole building fell. Some large public buildings failed, with evidence of poor design and workmanship. A large frame church on a good foundation would have withstood the shock had not its roof, entirely too heavy for the building, collapsed. Thirteen persons lost their lives as a result of the earthquake.

A three-story concrete building of good design and construction stood up well, although built on marshy ground; its foundation had been carried down 19 feet to clay. In general, reinforced concrete endured the earthquake except where there was poor workmanship. Frame buildings covered with stucco, sheathing or lath withstood the shock, though other methods did not hold up so well. Brick, stone, cement block, hollow tile, and veneer walls generally were cracked or shattered, yet where the structures were properly braced and bonded and well laid in good mortar, they stood the shock well, though chimneys fell and plaster cracked. The sewage system was undamaged except on made land where the loss was heavy. Pipes were cracked for considerable distances. There were cracks in pavement, and movement estimated from 8 to 14 inches was observed on a boulevard situated on a sand beach.

The earth dam of the Sheffield Reservoir north of the city failed, but little damage was done by the released water.

Eight million dollars damage was caused in Santa Barbara.

Strongly felt, with moderate damage, at a number of points in the Santa Ynez and Santa Maria Valleys, north of the Santa Ynez Mountains. Magnitude 6.3. There were a number of strong aftershocks on July 3.

1927. November 4. West of Point Arguello. The shock was widely recorded by seismographs. From Lompoc to the coast at Honda and Surf there were heavy earth- and rock slides on steep slopes, spurting of water, and formation of sand craters. Chimneys were wrecked at Lompoc and some were damaged at Arroyo Grande and Santa Maria. House shifted on foundation at Roberd's Ranch. Felt from Morgan Hill to Redondo Beach to Sanger. Tide gages recorded a sea wave which was about 6 feet high at Surf. Heavy shocks were felt by two vessels 27 and 14 miles, respectively, from Point Arguello. Larger than the Santa Barbara shock of June 29, 1925, but less destructive because of location. Magnitude 7.5.

1941. June 30. Santa Barbara and Carpinteria. Total damage about $100,000 of which 25 percent was damage to drug and liquor stocks and 10 percent damage to plate glass. A small slide covered the railroad and reached the highway about 20 miles east of Santa Barbara on Route 101. Telephone service between Santa Barbara, Carpinteria, Ventura, and San Luis Obispo was interrupted. In Santa Barbara 30 glass-topped street lamps were snapped off and practically every store in the 600 to 1000 blocks of State Street suffered considerable inside damage. There were 17 breaks in the larger water mains and 18 service breaks. Sidewalks buckled in a few places. In Carpinteria about 25 chimneys and a number of walls fell, 1 cornice was shaken down, and many dishes and windows were broken. In both places many of the structures affected had been damaged in the 1925 earthquake and imperfectly repaired. Magnitude 5.9.

APPENDIX 1.2

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.2

Interpretation of Side-Scan Sonar Records From Santa Ynez Unit, Santa Barbara Channel, California

Esso Production Research Company

February, 1971

ESSO PRODUCTION RESEARCH COMPANY

INTERPRETATION OF SIDE-SCAN SONAR RECORDS FROM SANTA YNEZ UNIT, SANTA BARBARA CHANNEL, CALIFORNIA

H. R. Hopkins

Offshore Geology Division

February, 1971

EPR.14ES.71

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Plate (in pocket)

1 Side-scan sonar Interpretation, Santa Ynez Unit, Santa Barbara Channel

Table

1 Extraneous noise and superimposed images

INTERPRETATION OF SIDE-SCAN SONAR RECORDS FROM SANTA YNEZ UNIT, SANTA BARBARA CHANNEL, CALIFORNIA[1]

by

H. R. Hopkins

SUMMARY

Examination of side-scan sonar records (shadowgrams) from the surveyed portion of the Santa Ynez Unit indicates that the sea floor is a low-relief area with few surface features. The Santa Ynez Unit can be divided morphologically into an eastern area, comprising all of tracts 311 through 335, and a western area, comprising portions of tracts 325, 326, and 327, and all of tracts 336 through 340. In the eastern area, the sea floor is very smooth. Major features recognized on the sea floor are man-made and include anchor and chain drag marks, well sites, features interpreted as fishing trawler tracks, and a sunken man-made object, possibly a ship. In the western area, the sea floor is also generally smooth. The major features recognized are natural and include a series of low-relief submarine channels characterizing a well-developed submarine fan. Along the northwestern edge of the unit, variations in surface sediment texture are outlined. Just north of the Santa Ynez Unit an apparent fault trace has been mapped on the sea floor. This fault trace trends northeast-southwest for 1,500 feet and then swings to the west-southwest, where it becomes concealed under surface sediment cover.

No sea-floor features indicating recent faulting have been observed within the surveyed portion of the Santa Ynez Unit proper.

This report is accompanied by an interpretive map (pl. 1). A semi-controlled side-scan sonar imagery mosaic of the sea floor, at a scale of 3 inches equal 1,000 feet, has also been constructed. A brief resumé of the procedures used to assemble this mosaic is included as an appendix to this report.

AREA OF COVERAGE

Approximately 577 miles of side-scan sonar records were acquired in the Santa Ynez Unit (fig. 1), resulting in a gross coverage of 172 square miles and a net coverage of 77 square miles. Eighty percent of the area was covered with shadowgrams, and 200 percent coverage was obtained in the critical platform areas. A portion of the western part of the unit was not covered because of drilling activity during the side-scan sonar survey. Half of the sonar coverage is at a 500-foot scale (i.e., the width of the scan on one side covers 500 feet of the sea floor laterally), and half is at a 1,000-foot scale.

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[1]Study authorized by letter of June 17, 1971, from Mr. M. O. Pattison, Humble Oil & Refining Company, Production Department, Western Division.

INTERPRETATION

In the following sections, observable sea-floor features are discussed and illustrated with annotated figures. The features have been divided into natural features, man-made features, and extraneous noise and superimposed images.

The natural features are outcrops, surface sediment variations, areas of rough or irregular surfaces, submarine channels, small depressions or pockets, small mounds or knobs, a fault trace, and small linears. The probable man-made features are trawler tracks, anchor or chain drag marks, well sites, and probable sunken man-made objects. Extraneous noise and superimposed images are discussed briefly and summarized in Table 1.

It is beyond the scope of this report to describe the side-scan sonar equipment and procedures. For this information the reader is referred to the following papers: Hopkins and Green (1969); Hopkins (1969); Cholet et al. (1969); Sanders et al. (1969); and Mudie et al. (1970).

Natural Features

Outcrops

Bedding outcrops occur primarily along the northern margin of the eastern area and extend into the Santa Ynez Unit in portions of tracks 331 through 333 (pl. 1). These outcrops are generally restricted to the area of the shelf-slope break in about 300 feet of water. Two other small, less distinct, areas of probable bedding outcrops occur in the area, one in 150 feet of water in the proposed eastern pipeline corridor, and the other in about 100 feet of water in the proposed western pipeline corridor. Figure 2 illustrates the occurrence of these outcrops. It should be noted that these outcrops are portrayed in sufficient detail that convergent and terminated beds are apparent and indicate the presence of at least one unconformity. Several of the prominent, more resistant beds which stand above the normal sea floor exhibit a distinct enough pattern that they can be traced for 7 or 8 miles along strike.

Surface Sediment Variations

In the northwest corner of the surveyed area there are light and dark tonal variations in the return from the sea floor (line 3 to line 51, pl. 1). These irregular and curved light and dark areas represent reflectivity changes due to differences in sediment type on the sea floor (fig. 3). In general, the darker areas are coarser or denser material as compared with the lighter areas. Most of these changes have a northeast-southwest trend, parallel to the persistent shelf-slope break, and the eastern limit of the changes generally coincides with the upper edge of the break. Westward of the shelf-slope break there appears to be either sand or coarse silt lying on the more ubiquitous silty clay surface. Eastward of this break the sediments are all the same

texture, as shown by the monotonous gray appearance of the shadowgrams. Variations in recording level of the shadowgrams make it impossible to correlate sediment textures from one line to another.

Areas of Rough or Irregular Surfaces

The rough and irregular surface returns noted in the northwest corner of the area (fig. 3) may represent shell and/or rock accumulations or in some places upturned beds. Along the proposed western pipeline corridor there is an extensive area of irregular surface material which probably represents shell or cobble paving. This material was not sampled, and therefore its exact nature is unknown. On the shelf in the Gulf of Mexico, similar features have usually been found to be shell accumulations, algal mats, or portions of carbonate-reef material protruding through the bottom sediments. In the outer Boston Harbor and off the eastern coast of Canada, similar areas were found to be accumulations of gravel or highly jointed and weathered outcrops of unbedded rocks.

Submarine Channels

Submarine channels are numerous in the western half of the Santa Ynez Unit (pl. 1), and three of them cut completely across the area. The majority of the channels are short, noncontinuous features which are partially covered along their path or which shallow and disappear down the slope. The channels (fig. 4) usually have a high bank or levee and a low central depression with occasional minor areas of rough or irregular surfaces along the edge of the banks. Little detail as to the composition and sediment distribution within and around these channels is evident from the shadowgrams. The channels generally have a relief of 15 to 20 feet, although in places some of the larger channels may have a maximum depth of 40 feet. Most of the channels show some asymmetry in cross section, with the western side being steeper than the eastern side.

Small Depressions or "Pockets"

Scattered across the area are small groups of depressions or "pockets" (fig. 5). These features are very common in relatively shallow water areas where the bottom sediments are reasonably fine-grained and unconsolidated. In the Santa Ynez Unit these depressions seldom exceed 40 feet in diameter and appear to have a maximum depth on the order of 4 feet. They are evident on the shadowgrams as oval to circular white areas on an even gray background, and they may or may not have an associated highlight zone. These depressions may result from some type of biologic activity, such as feeding or egg nests winnowed out of the sea floor by fish or other marine life.

Mounds or Knobs

Mounds or knobs occur in small groups, or, in the northwestern part of the area, they tend to occur in weak, poorly defined lines (pl. 1). These knobs generally measure 10 to 15 feet across, and where calculated, they have a maximum height of about 2 feet. In a few places they are concentrated along short segments of channels, but they occur in a sufficient number of other local environments that there is probably no direct relationship between channels and knobs. On the shelf in the Gulf of Mexico, similar features have been sampled and were found to consist of algal material. It is also possible that the knobs could be piles of shells or cobbles.

Fault Trace

Only one fault feature was identified in the study area, on the western end of line 21 and on a nearby segment of line 03 in the proposed western pipeline corridor (pl. 1). The surface expression of the fault (fig. 7) is a narrow submarine ridge rising 10 to 20 feet above the normal sea floor and exhibiting a rough, irregular surface. On line 21, the fault trace strikes northeast-southwest, and on line 03 the fault trace strikes east-northeast to west-southwest, indicating a bend in the fault between these two survey lines. On Plate 1, the extension of the fault trace was mapped using anomalous low ridges or mounds observed on Edo and Super-3 profiler records. Only nine of the fourteen Edo and Super-3 records which crossed the area showed any bathymetric anomalies. Records along the western end of the fault trace generally showed only low mounds. The subbottom profiler record along line 21 (fig. 7b) indicates that the beds on the west side of the ridge are turned up into the ridge, and the beds on the east side are essentially flat lying, giving vertical separation of up on the west side and down on the east side. In contrast, the subbottom profiler record along line 03 indicates that the beds on the southeast side of the fault trace are upturned, and the beds on the northwest side are relatively flat, giving a vertical separation of up on the east and down on the west. This alternating type of vertical separation is quite common along strike-slip faults. The northern end of this mapped fault trace occurs on strike with, and 4,000 feet to the southwest of, the trace of the South Branch of the Santa Ynez fault, a left-lateral strike-slip fault, as shown on the geologic map of the area from the United States Geologic Survey Professional Paper 679A (Vedder et al., 1969).

It should be noted that there are no surface indications of the fault north of line 21 or west of the small mound located on line 31 at approximately grid position 4920. Beyond these points, the trace of the fault appears to be concealed under the recent sediment cover, and, since five of the fourteen Edo and Super-3 records crossing the mapped fault trace also show no signs of disturbance of the normal surface, it appears that the mapped fault trace is also partially concealed under the recent sediment cover. The lack of continuity of the surface features along the fault trace and the restricted extent of those features which were observed are believed to indicate that no major significant movement has occurred along this portion of the fault recently.

Small Linears

Small linears occur in several places in the area (fig. 5). The linears appear as short, light or dark straight lines, as straight contacts between two tonal areas (sediment changes), or as weak lines of knobs or highs. These linears seldom exceed 1,000 feet in length and have a very small width. Except for some of the linears in the northwestern part of the area which show the contacts of the sediment changes, and one which probably corresponds to a local steepening of the shelf-slope break, the linears appear to have no basic geologic significance. The short length and low number of linears present increases the possibility that they may be short segments of trawler tracks at a high angle to the other tracks, short chain or cable drag features, or even segments of lost or discarded ship's rope or pieces of fishing nets.

Man-Made Features

"Trawler Tracks"

A great number of subparallel tracks cross the area in a northwest-southeast direction (fig. 5). These tracks are considered to be fishing-trawler tracks for the following reasons: (1) they tend to follow the bathymetric contours of the sea floor, which implies that during the trawl the nets were not raised or lowered; (2) the tracks are generally restricted to water depths of 300 to 800 feet, a reasonable depth for trawling; and (3) they occur predominantly in the area where the sea floor is smooth, instead of in the outcrop and submarine channel areas, both difficult areas in which to keep nets on the sea floor. There are several places where tracks can be seen to cross the anchor or chain drag marks, which indicate that if the tracks are the result of fish trawling, the activity has continued since these exploratory wells were drilled.

Drag Marks or Anchor Marks

An excellent example of anchor or chain drag marks is shown in figure 5. These features tend to line up around and to point inward toward the actual well sites (pl. 1). Many of the well sites do not have noticeable anchor drag marks around them; this might be explained by the fact that those well sites which do show conspicuous drag marks are ones which were occupied for longer periods of time. At well P-0188-3, near the center of tract 332, drilling was suspended for about one hundred days, and this site has the most obvious and detailed anchor marks aligned around it. While activities were suspended, the drilling barge was anchored above the site. Wind and currents would cause the ship to move slightly off station in one direction or another. When this happened, the anchor cable on the lee side would tend to droop onto the sea floor and sweep back and forth, stirring up the surficial sediments. Those wells which were drilled rapidly with little delay show a few, if any, ill-defined anchor or chain drag marks.

Well Sites and Associated Cuttings

Figure 8 is an example of a well site as seen on the shadowgrams. The light area is the central depression surrounding the borehole. The depression cannot be more than a few feet deep, as shown by the presence of some medium and dark gray reflections within the depression itself. The dark material streaming around the well site probably represents superficial cuttings lying on the sea floor. These cuttings appear not to exceed one foot in thickness and are probably only a few inches thick since they do not have any associated light shadow zones indicative of vertical relief. These cuttings were probably distributed over the sea floor during the first few hundred feet of drilling before surface casing was set in the hole. They stream out a thousand feet to the northwest and only a few hundred feet in other directions. Cuttings around all of the other drill sites have a similar distribution, which indicates that there is probably a persistent, although not necessarily strong, northwest current in the area.

Objects on the Sea Floor

Two man-made objects were observed on the shadowgrams (pl. 1). Figure 9 is an enlarged portion of a shadowgram which shows a probable man-made object along the northern edge of tract 332. Such objects are generally recognized by a very strong, black highlight area, an equally strong white shadow area, and very distinct geometric forms, such as straight lines, arcs, and sharp angles. Measurements and calculations of the dimensions of the object illustrated in figure 9 show that it is approximately 64 feet in length and has a height of 8 feet on the west, 14 feet in the center, and 7 feet on the east. The relationships are such that the object is probably a small ship resting on its port side with its bow pointing to the west-southwest, the height on the west being the foredeck, the height on the east being the aftdeck, and the higher segment in the center being the cabin. This identification is speculative, and other interpretations are possible.

Extraneous Noise and Superimposed Images

In addition to the natural and man-made features observed on the shadowgrams, there are extraneous noise and superimposed images which must be recognized before an interpretation of the shadowgrams can be carried out. Table 1 lists twelve types of noise and images which are not caused by natural and man-made features on the sea floor. All but three of these types are illustrated on the figures, but all types occur on the shadowgrams taken in the Santa Ynez Unit. None of these noises and superimposed images materially interfere with the interpretation of the shadowgrams, with the possible exception of the gain control and time-varied gain changes, which prevented detailed mapping or correlation of the sediment variations observed in the northwest part of the area.

EXTRANEOUS NOISE AND SUPERIMPOSED IMAGES

Type	Appearance	Cause	Illustration
Profiler noise	Small, symmetrical dotted lines	Profiler electrical interference	Fig. 4
Paper wrinkles	Dark and light zones across record	Wrinkles in recording paper	Fig. 3
Electrical interference	Faint parallel lines diagonally across record	Profiler and/or outside electrical noise	Fig. 3
Gain control change	Light or dark area vertically across scan	Manual change of gain control	Fig. 5
Time-varied gain change	Light or dark vertical area, decreases in contrast toward "fish"	Adjustment of T.V.G. control	Fig. 5
Recorder image defect	Blank or uneven area of image print	Gain too low or paper dry	Fig. 3
Paper tear	Short unrecorded section on record	Paper caught in recorder	Not shown
Electrical short	Vertical, uneven black lines	Poor connection, usually on slip rings	Not shown
Fish or other marine life	Dark splotch or smear; no shadow area	Reflection from swimming marine life	Not shown
Water surface return	Nearly horizontal line across record	Reflection from air-water interface	Fig. 4
Lateral distance marks	Precise horizontal dark lines	Approximately 50-foot range marks	Figs. 2-9
Navigation positioning marks	Dark vertical lines	Event mark to coordinate positioning	Figs. 2-8

Table 1. Listing of images and nonnatural impressions superimposed on the natural sonar return. Few of these images interfere with interpretation of shadowgrams, except very locally.

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APPENDIX

Construction of Side-Scan Sonar Mosaic

The original side-scan sonar data are recorded on 11½-inch, wet-paper, sepia-colored records. Half the records were at a 500-foot scale, and half were at a 1,000-foot scale. To produce a meaningful mosaic, the following steps were taken:

1) The 500-foot records were reduced 50 percent to equal the scale of the 1,000-foot records, and both sets of records were differentially squeezed in the east-west direction so that the distance between navigation positioning marks (1,000 feet) equaled 3 inches. The distance between navigation positioning marks varied as much as 400 percent because of recorder speed, and wind and current direction. These horizontally reduced and scaled records were film negatives.

2) Positive prints were then made from the above film negatives and trimmed and spliced together to make continuous lines.

3) The preliminary mosaic panels were rerun through the differential squeeze camera, and the north-south direction was scaled to 3 inches equal 1,000 feet, the same as the horizontal scale. This is the minimum scale usable in order to recognize the important observable features on the sea floor. The resulting negatives were trimmed to 9½-inch-wide rolls.

4) The negative rolls were printed through an automatic electronic dodging machine, and the resulting prints were mounted on panels up to 49 inches wide.

5) The finished mosaic is approximately 28½ feet wide and 5 to 7½ feet high. It has an absolute positioning accuracy within about 500 feet and a relative positioning accuracy of about 350 feet.

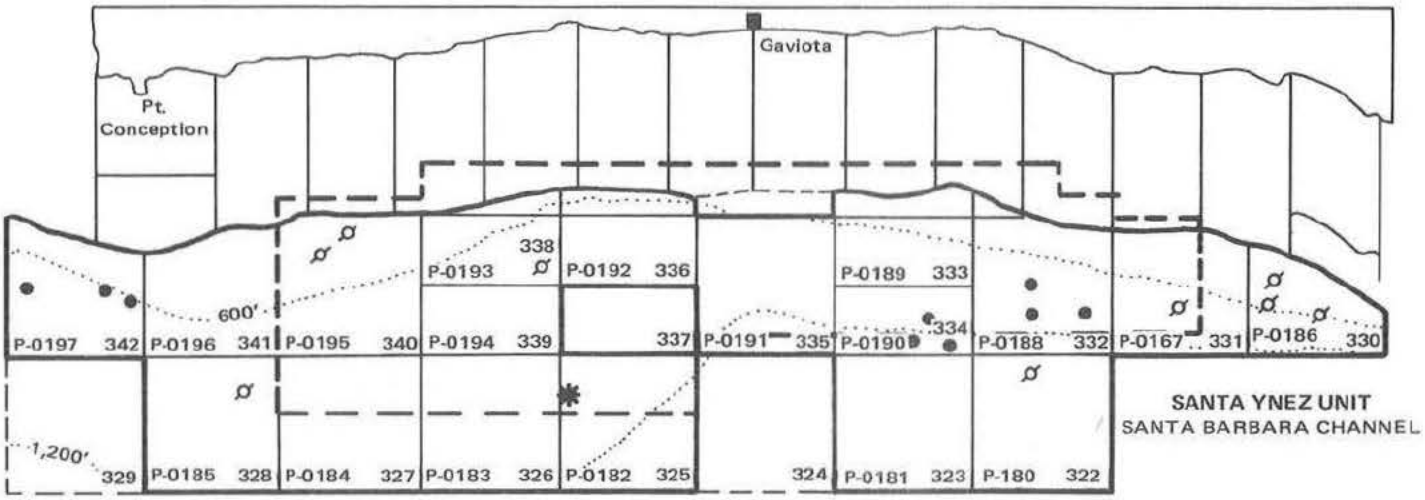


Figure 1. Area of side-scan sonar coverage (heavy dashed line) within the Santa Ynez Unit (heavy solid line). Wells in the unit drilled by November 1970 are indicated by the appropriate symbol.

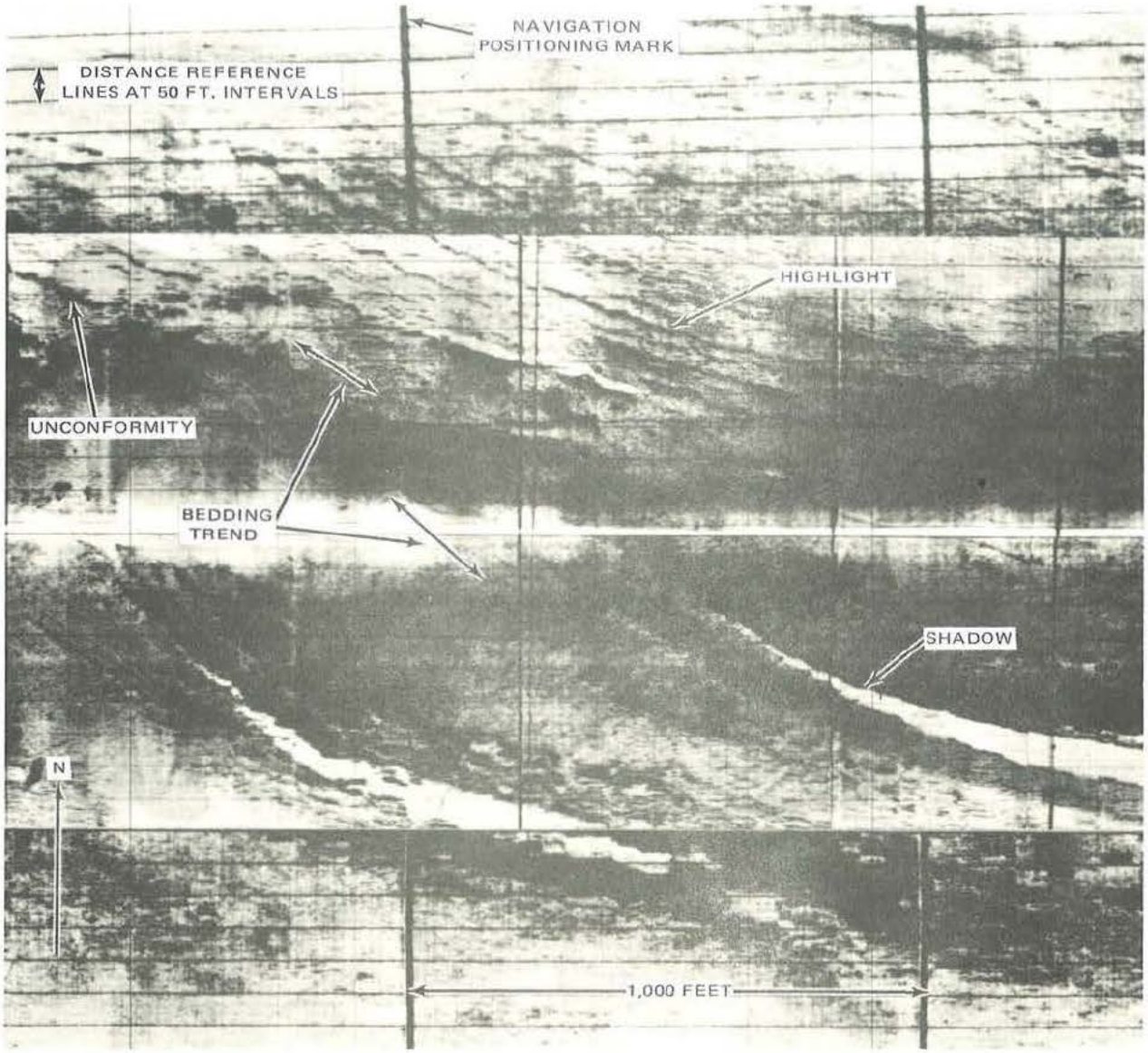


Figure 2. A shadowgram (side-scan sonar image) mosaic of sedimentary beds cropping out on the sea floor. Dark areas are high-energy returns or highlights, and white areas are acoustical shadows. The distinct pattern of high-relief (large shadow) beds and intervening low-relief beds can be traced for several miles along strike. Several unconformities, such as the one illustrated above, can also be traced for some distance. The mosaic is made up of the left and right scans of line 27 at a 500-foot scan in the center and the distance portion of the left and right scan of line 27 at a 1,000-foot scan at the top and bottom. The distance reference lines of the 1,000-foot scan are not parallel to the 500-foot scan reference lines, which indicates that the sonar "fish" was canted slightly to the southwest. The navigation positioning marks also do not coincide on the 500-foot and 1,000-foot scans because less cable was necessary to achieve the proper altitude of the sonar "fish" above the sea floor on the 1,000-foot scan, and consequently the "fish" was 200 feet closer to the towing boat. (For location of figures, see plate I.)

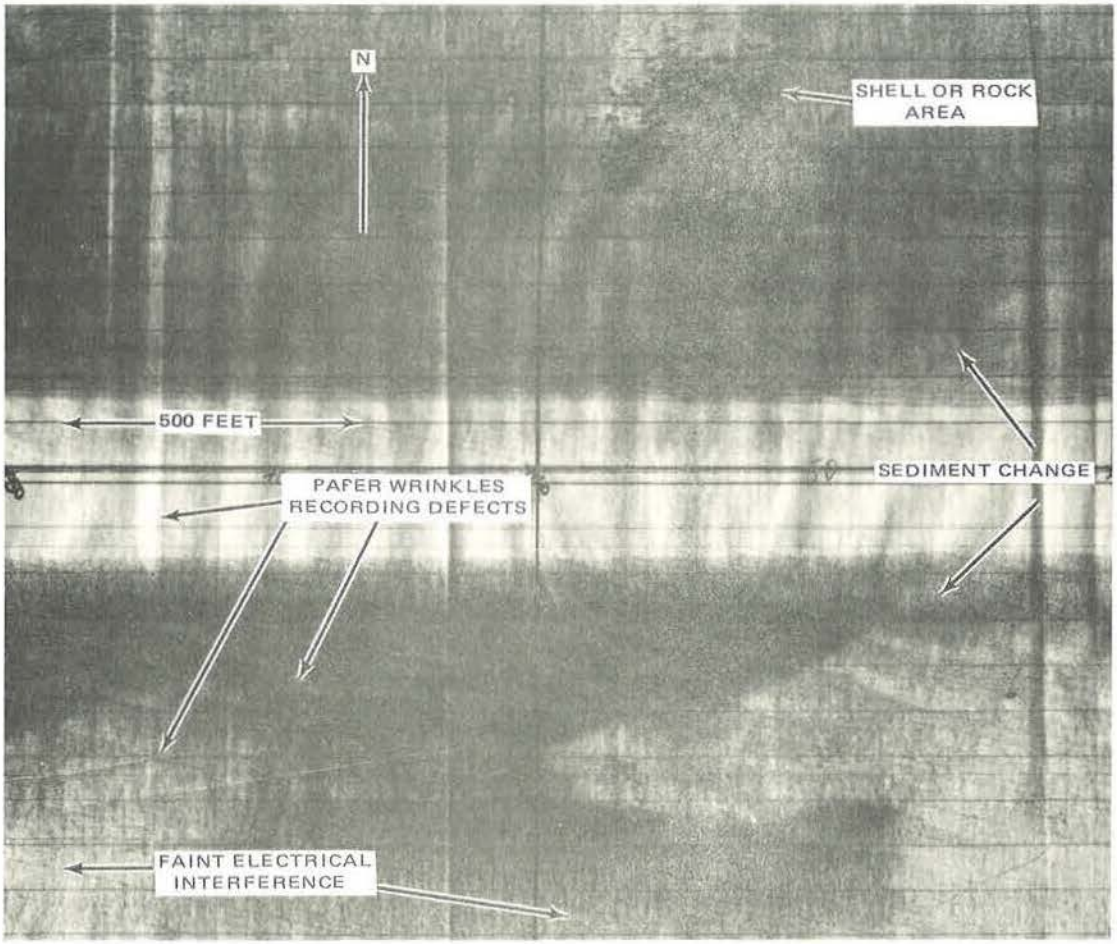


Figure 3. Irregular and curved light and dark areas on shadowgrams represent changes in reflectivity of the sea-floor material. The darker areas delineate relatively coarser or denser material than the lighter areas. The mottled patches along the top of the shadowgram represent an irregular, blocky surface of shell, rock, and probably in places upturned beds. The vertical light and dark stripes and the fine, nearly horizontal lines are wrinkles in the recording paper inherent in any process where wet or damp paper is used. The paper stretches slightly differentially during recording and never quite lies flat. The diagonal wavy bands are probably recording defects caused by uneven treatment or partial drying of the paper. In some cases, slight undulations of the sea floor could give similar results.

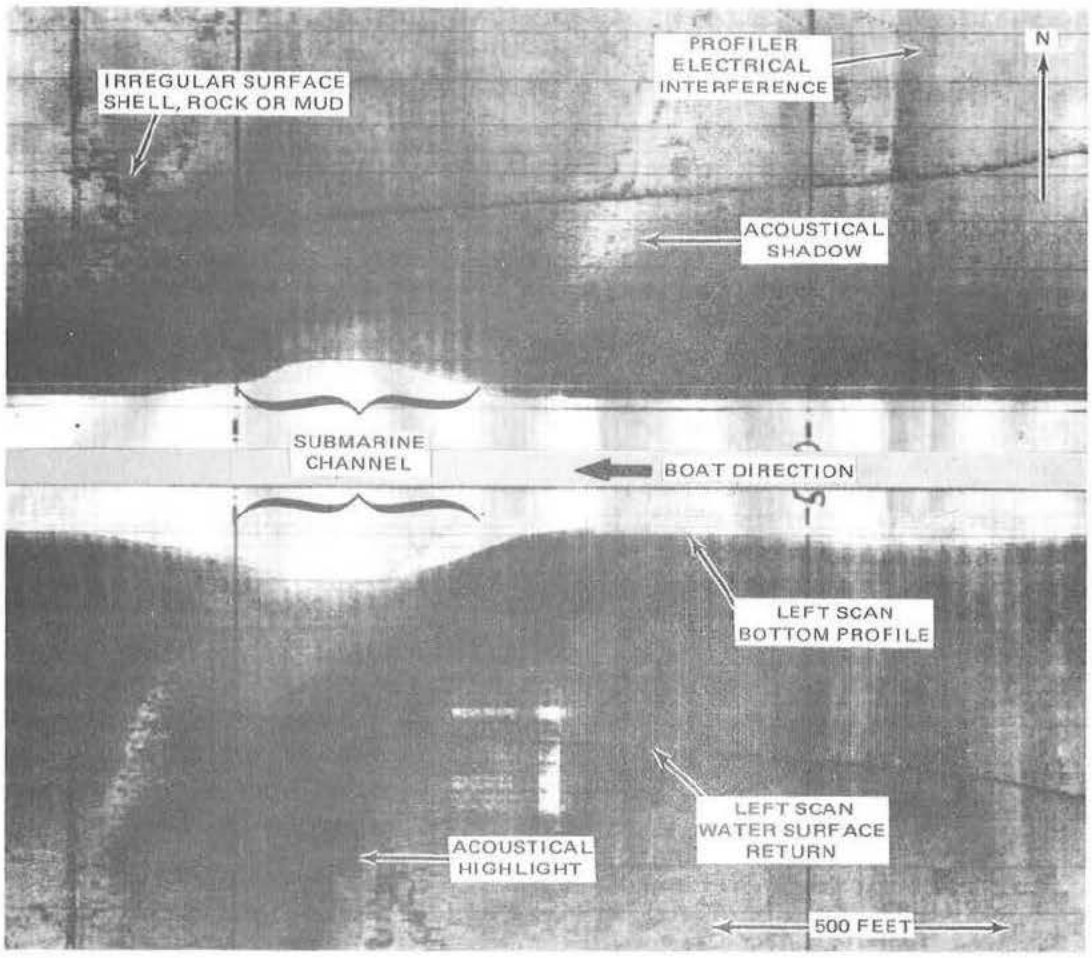


Figure 4. A right- and left-scan shadowgram of a submarine channel trending to the southwest. The upper image defines the channel edge by an acoustical shadow (white) zone on the east, where the sonar is looking over the channel bank, and as a faint highlight trend on the west, where the sonar is looking into the steeper portion of the bank. The reverse is true on the lower image. The west bank can be seen to have an irregular surface with some material standing out within the shadowed area. On either side of the channel are irregular patches of shell or rock. Diagonally crossing the shadowgram are symmetrical rows of dots caused by minor electrical interference from a bottom profiler run concurrently with the side-scan sonar. The dark lines converging to the left are the sonar return from the water surface. The slope of the line indicates that the sonar "fish" was being slowly reeled in as the boat proceeded along the survey line.

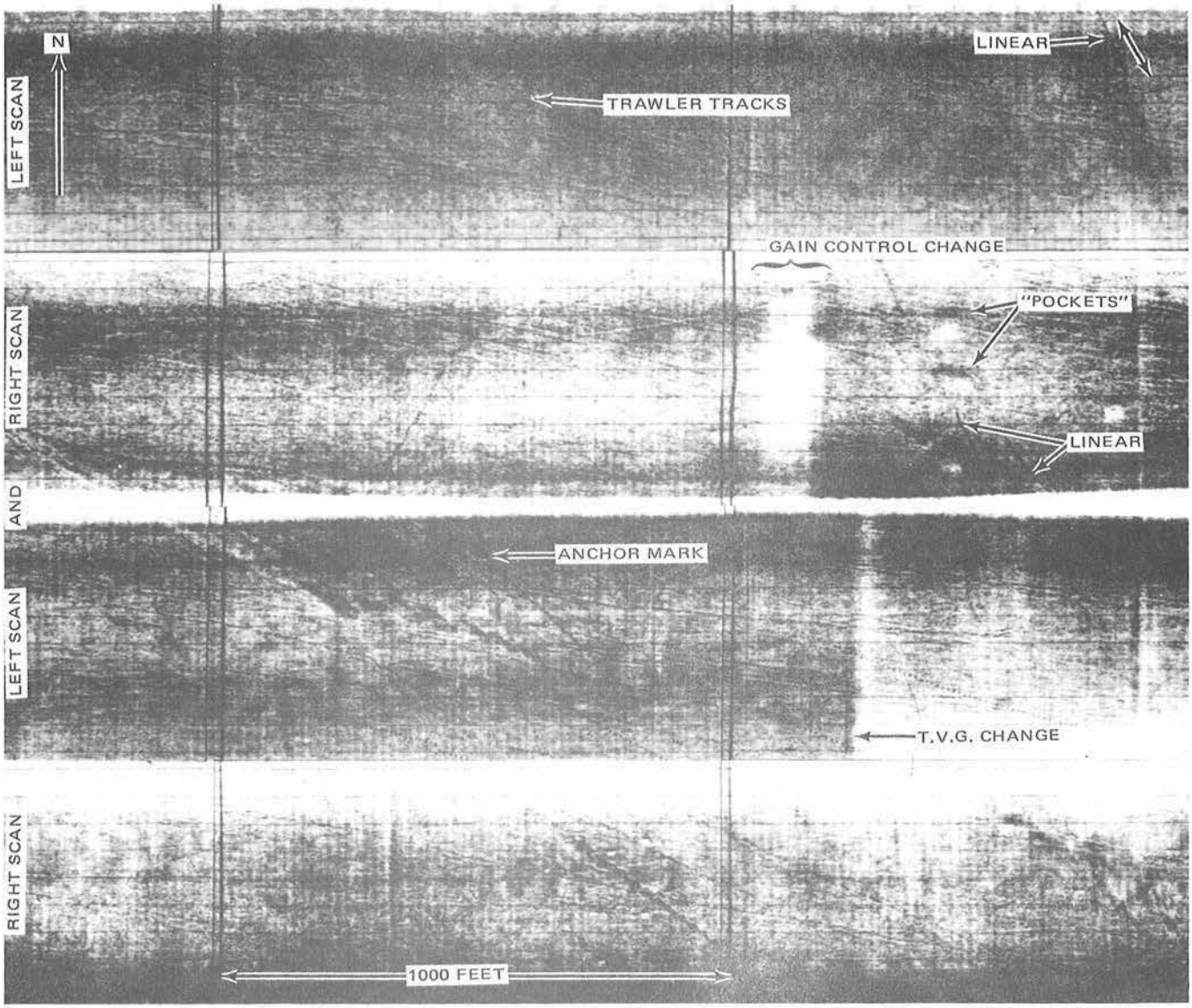


Figure 5. This shadowgram mosaic shows several small depressions or "pockets" approximately 40 feet in diameter, some small discontinuous linears, many subparallel probable trawler tracks crossing from left to right, and a 1,500-foot-long sigmoidal or wing-shaped surficial scar mark caused by dragging an anchor or anchor chain across the sea floor. Two types of recording changes also occur on the mosaic. The manual gain control change affects the amount of amplification of the returning signal equally over one side of the shadowgram and is evident by an abrupt vertical light or dark change. A time-varied gain (T.V.G.) change adjusts the slope of an automatic change which progressively amplifies the returning signal outward from the center of a shadowgram scan to compensate for signal attenuation due to the increased distance from the sea floor to the receiver. This change is evident by a vertical light or dark change which decreases in contrast from the outer to the inner edge of the shadowgram. The center two scans in this mosaic are the left and right scan of one line, and the top and bottom scans are one side of the adjacent lines. When the gain and T.V.G. are adjusted properly, as in the top scan, the whole scan has an even gray-tone appearance. However, when they are slightly out of adjustment, either a dark band will appear along the inside edge, as in the third and fourth scans, or a light band will appear along the outside edge, as in the second and fourth scans.

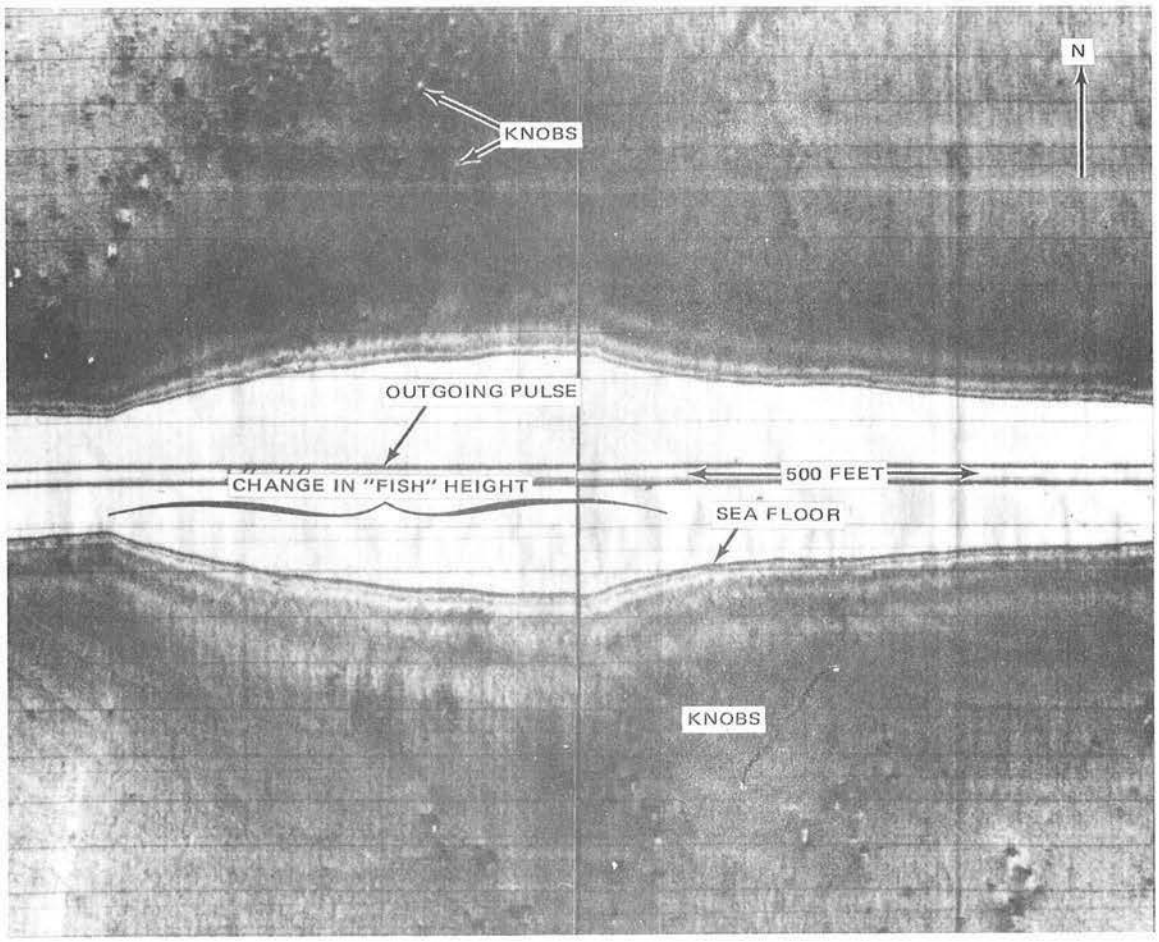
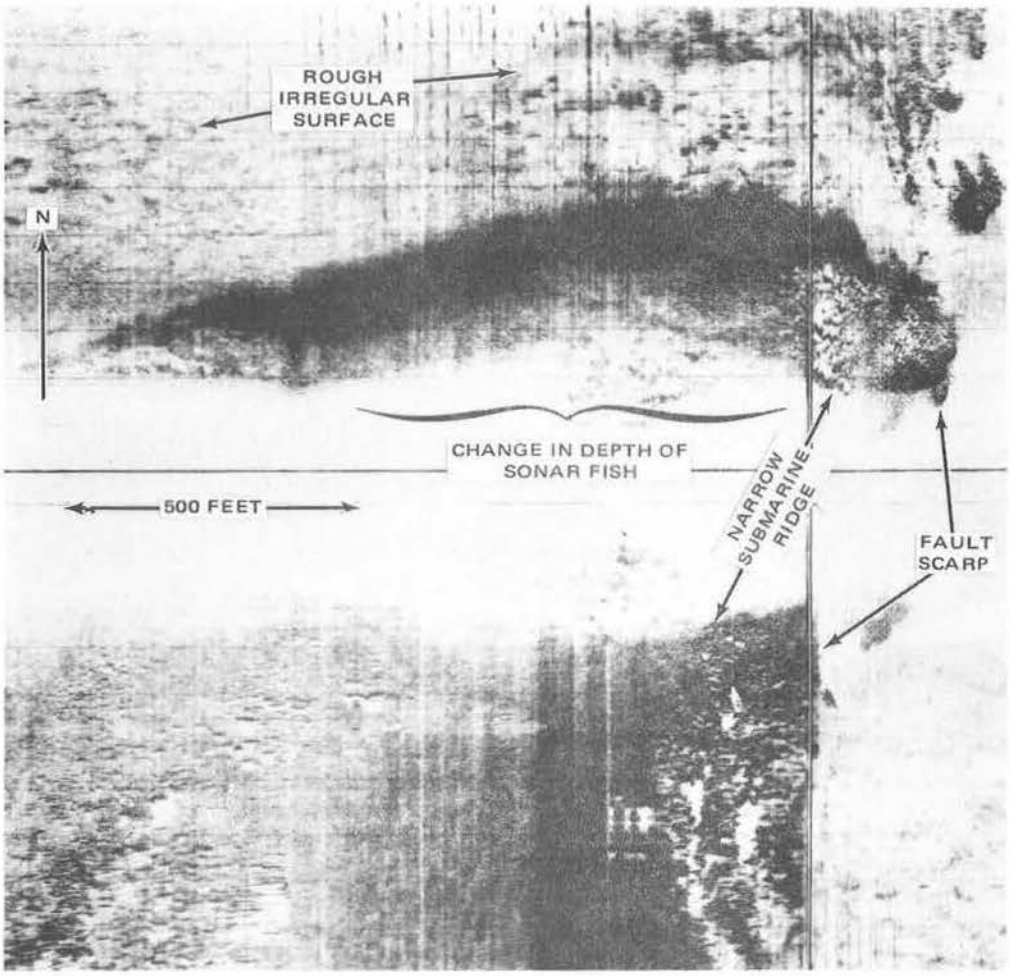
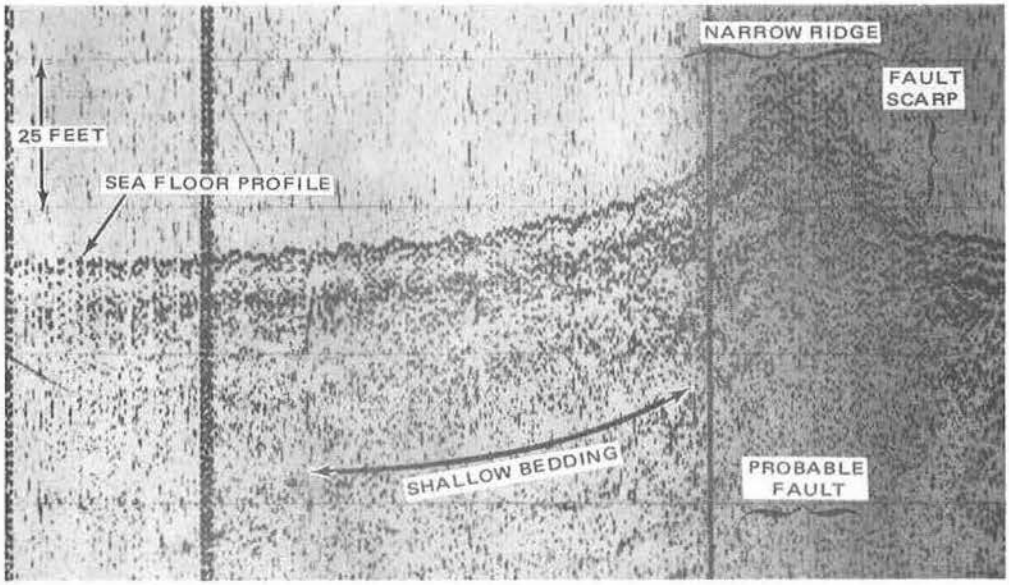


Figure 6. Knobs or mounds, as shown in this left- and right-scan shadowgram, generally occur in groups or patches on the sea floor. They are identified by a small, strong dark reflection with a small to very small white shadow zone behind them, depending on the height and geometry of the knob. The prominent knobs to the left in the upper shadowgram are 10 to 15 feet across and have a maximum height of about 2 feet.



(a)



(b)

Figure 7. The only fault in the area which was identified lies north of the Santa Ynez Unit. The left and right shadowgrams (a) show a narrow ridge with a rough, irregular surface. The accompanying sub-bottom profiler record (b) shows a 300-foot-wide, slightly asymmetrical ridge with beds upturned into the ridge on the west side, giving a vertical separation in this section of up to the west and down to the east.

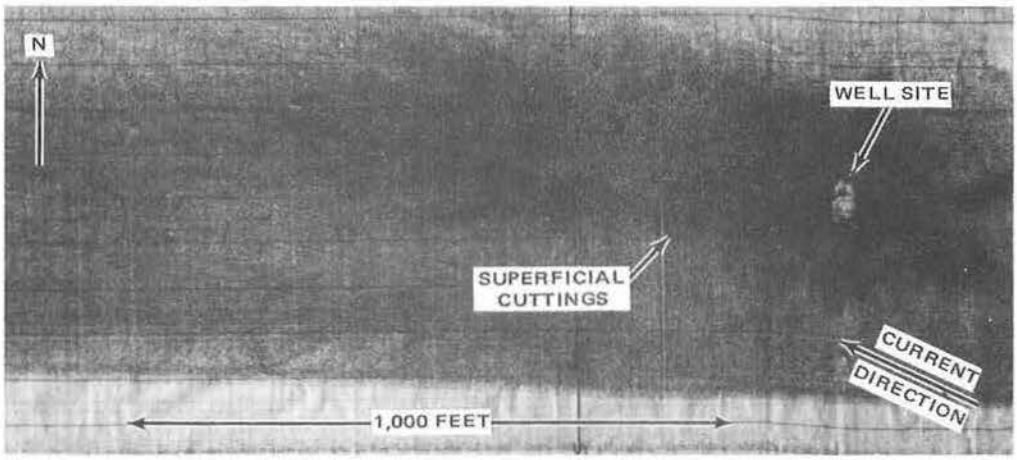
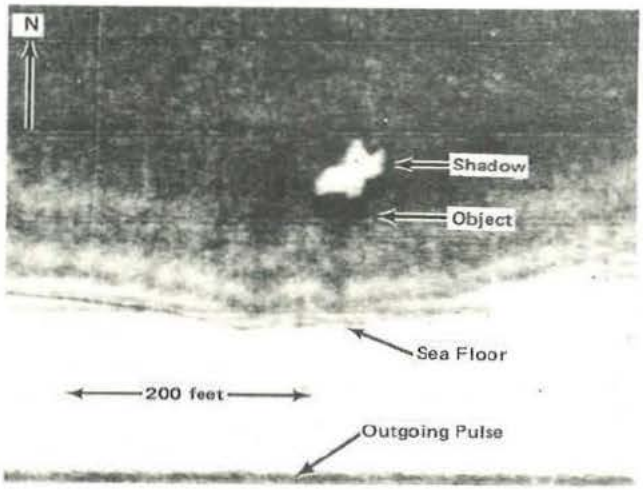
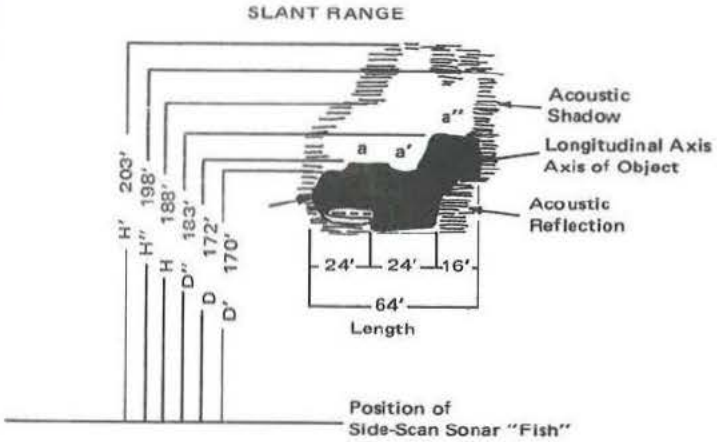


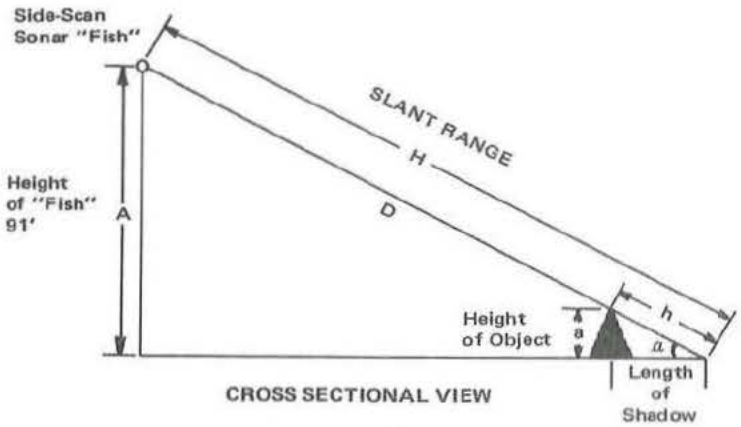
Figure 8. Some well sites and associated cuttings are among the more prominent man-made features observable on the shadowgrams. The well site appears as a distinct hole or depression and is surrounded by cuttings which are coarser or denser than the normal surface material. These cuttings must be only a few inches thick, since they have no associated shadow zone which would indicate relief. The presence of a current moving to the north-west is indicated by the uneven distribution of cuttings, 1,000 feet to the northwest and about 300 feet in every other direction.



SHADOWGRAM



OBLIQUE VIEW



CROSS SECTIONAL VIEW

$\sin \alpha = A/H$

$a = h \sin \alpha$

$h = H - D$

$\therefore a = (A/H)(H - D)$

$a = (A/H)(H - D)$	$a' = (A/H')(H' - D')$	$a'' = (A/H'')(H'' - D'')$
$= (91/188)(188-172)$	$= (91/203)(203-170)$	$= (91/198)(198-183)$
$= .484 \cdot 16$	$= .448 \cdot 33$	$= .460 \cdot 15$
$= 8$ feet	$= 14$ feet	$= 7$ feet

CALCULATIONS OF HEIGHT OF OBJECT

Figure 9. Man-made objects on the sea floor have a very strong highlight (dark) area and distinct white shadow areas and are often recognizable by their geometrie form. The enlarged shadowgram above shows an object with a very angular form. It measures 64 feet in length and has heights of 8, 14, and 7 feet above the sea floor, as shown in the adjacent calculations. The object may be a plane, but it is probably a ship resting slightly on its port side with its bow pointing in a WSW direction.

APPENDIX 1.3

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.3

Near-Surface Geology of the Santa Ynez Unit, Santa Barbara Channel, California

Esso Production Research Company

June, 1971

ADDENDUM TO REPORT 1.3, APPENDIX VOL. 1

Since the writing and submittal of the report by Duncan *et al.* (1971), in which comparisons were made of geological conditions at proposed platform sites in 700 feet of water in OCS lease P-0188 with those in the slide-prone area of OCS lease P-0180, a new platform site has been proposed in 850 feet of water in OCS lease P-0188. Comparisons of the sites on pages 17 and 17a (Table 2) of Duncan, *et al.* (1971) indicated that absence of unfavorable geological conditions at the initially proposed sites in 700 feet of water. The comparison of geological conditions has been extended to include the 850-foot water depth site (Addendum Table 1). Our conclusion that geological conditions are more stable at the proposed platform sites than in the slide-prone area can also be extended to include the new site in 850 feet of water. In comparison with the slide-prone area, the proposed site has (1) sediments with lower moisture contents and higher shear strengths, (2) lower slope gradient, (3) no surface faults, and (4) no past history of sliding.

J. R. Duncan
R. A. Hoover
C. C. Daetwyler

Sediment Properties and Geologic Conditions	OCS Lease P-0180 Submarine-Slide Area	OCS Lease P-0188 Platform Sites, 700-Foot Water Depth	OCS Lease P-0188 Platform Site, 850-Foot Water Depth
Rate of sedimentation (feet/1,000 years)	4.7	1.6	1.6
Sediment age at equivalent depths	Younger	Older	Older
Sediment size	Finer: (Silty clay)	Coarser: (Clayey silt → silty clay)	Coarser: (Clayey silt → silty clay)
Water content in upper 40 feet (percent)	56 → 96	30 → 62	40 → 78
Shear strength at 40 feet (tons/ft^2)	0.20 → 0.29	0.40 → 0.43	0.42 → 0.50
Percent slope	8 → 10	3 → 6	6 → 8
Structure	Faults near surface (active?)	No near-surface faults	No near-surface faults
Site of previous slide	Yes, 80,000 years ago	No	No

Addendum Table 1. Slide-prone area vs. 700-foot and 850-foot platform sites in OCS lease P-0188. (First two columns for slide-prone area and 700-foot water depth platform site taken from Report 1.3, Appendix Vol. 1, Table 2, p. 17a.)

ESSO PRODUCTION RESEARCH COMPANY

NEAR-SURFACE GEOLOGY OF THE SANTA YNEZ UNIT, SANTA BARBARA CHANNEL, CALIFORNIA

J. R. Duncan, R. A. Hoover
C. E. Pflum, J. M. Widmier, C. C. Daetwyler

Offshore Geology Division

June 1971

EPR.49ES.71

PREFACE

This multidisciplined study of the near-surface geology of the Santa Ynez Unit, Santa Barbara Channel, California, represents the contributions of many individuals. The following participants are acknowledged.

J. R. Duncan and R. A. Hoover were primarily responsible for the bulk of the data analysis and synthesis and the writing of this report. C. E. Pflum was initially attached to the Strat.-Paleo. group of Humble's Western Division Exploration Department, where he contributed to the paleontological effort and coordinated the Western Division's work with paleontological studies done at EPR. J. M. Widmier provided EPR liaison with Humble's Electronic Data Processing Center and supervised all data processing and machine contouring of maps performed at EPR.

All basic computer processing of seismic data, as well as initial computer mapping, was undertaken by Humble's Electronic Data Processing Center. G. M. Thomas, J. W. Baugher, and G. Fishbeck directed this major effort.

Foraminiferal paleontological studies, as well as initial splitting and sampling of all core material, were undertaken by the Strat.-Paleo. group of Humble's Western Division Exploration Department, supervised by A. Marianos. In particular, J. G. Marks was responsible for detail planning and sample examination and was assisted by Miss Filipinas Gonzaga. B. Johnson supervised all sample splitting, preparation, and processing.

J. S. Isom, of Humble's Western Division Exploration Department, provided geological liaison with the EPR staff throughout the field and data-analysis phases of this project.

Humble quality-control engineers D. C. Hueske and G. D. Mahaffey provided liaison with GAI-GMX during the seismic surveys.

D. E. Brandon, A. R. Green, M. E. Milling, H. H. R. Sharkey, J. W. Smith, and D. W. Womack of EPR were on board the M/V *Caldrill I* at various times during the coring operations. F. L. Chalmers (EPR) was responsible for all velocity surveys conducted during the coring operations, and G. B. Amery of Humble's Western Division Exploration Department initially interpreted these data.

Examination of selected core-hole samples for coccoliths was undertaken by L. A. Smith (EPR), and paleomagnetic studies were supervised by W. V. Sliter (EPR). D. Perry (EPR) provided clay

mineralogical analyses for selected gravity core samples, and J. W. Smith and D. W. Womack of EPR were responsible for archive core preparation and photography.

C. C. Daetwyler

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NEAR-SURFACE GEOLOGY OF THE SANTA YNEZ UNIT, SANTA BARBARA CHANNEL, CALIFORNIA

J. R. Duncan, R. A. Hoover,
C. E. Pflum, J. M. Widmier, C. C. Daetwyler

SUMMARY AND CONCLUSIONS

The Santa Ynez Unit can be subdivided into two distinct provinces--a submarine fan, comprising the western part of the area and extending along the base of the slope toward the east, and a smooth-slope area bounded on the north by the edge of the continental shelf and on the south and west by the surface of the submarine fan. Marked differences in bottom morphology, sediment type, and both lateral and vertical variability in sediment type can be related to different processes of sediment transport and deposition in the two provinces.

The submarine fan is a broad, arcuate bulge cut by a series of channels converging toward the apex of the fan near the edge of the mainland shelf. Gradients on the fan range from 2 to 5 percent. Channels have been the major transport routes of sediment to the fan surface in the past and may still be subjected to intermittent flow of turbidity currents. Currents are weak in submarine-fan areas between channels. Sediment type on the fan surface and in the shallow subsurface is highly variable both laterally and vertically because of localization of coarse sediment in channels and a complex history of channel activity and positions. Fan sediments consist of interbedded sand, gravel, silt, and mud; thicknesses of individual beds and the proportions of various sediment types can be expected to change abruptly over short distances.

In contrast with the submarine fan, the smooth-slope area has few small-scale irregularities. Slopes generally do not exceed 6 percent except along the outer edge of the continental shelf. Average slopes increase toward the east and are generally greater on the downslope flanks of anticlinal structures. The predominant process of sediment transport and deposition is the settling out of suspended sediment from weak currents flowing along the bottom in a westward or northwestward direction. Sediments on the smooth slope consist of mud and sandy mud; lateral and vertical variations are few and predictable.

Seismic data, combined with paleontologic data from core holes, show that three seismic horizons which are associated with past interglacial or warm climates can be mapped over most of the area. These seismic horizons are approximate time-synchronous surfaces and, in general, are associated with periods of time when sea level was relatively high and sediment accumulation rates were low. Within the

limits of resolution of the seismic data, the mapped seismic horizons represent relatively thin layers of sediment between much thicker sediment intervals deposited during times of low sea level, cold climates, and high rates of sediment accumulation. Paleontologic data indicate that the oldest sediments penetrated by 350-foot cores were deposited less than 500,000 years ago and are probably no older than late Illinoian (300 to 400,000 years).

Because sediments reflect climatic conditions prevailing at the time of deposition, variations in sediment type can be related to positions of seismic horizons. In general, thin sediment layers at or near each of the three seismic horizons mapped are finer grained and have higher moisture contents than sediments in intervals between seismic horizons. Furthermore, maps showing thicknesses between seismic horizons indicate thickening of depositional units downslope and on the submarine fan, reflecting higher depositional rates on the lower smooth-slope area and submarine fan. In contrast with these trends, all units thin considerably on the flanks and crests of anticlinal structures beneath the smooth-slope area because of growth of the structures during deposition.

Major fold and fault trends are east-west in the smooth-slope area. None of the faults extend to the present sea-floor surface in proposed platform site locations. Elsewhere in the smooth-slope area, surface or near-surface gravity faults are present but do not connect with deep-seated major faults. An area of shallow gravity faults and flow folds or creep is located in the southern half of OCS lease P-0189. Movement of near-surface sediment has occurred in response to recent growth of structure during deposition and has been directed predominantly inward from the boundaries of the area on the north and south, rather than downslope. Further downslope movement is unlikely because of the buttressing effect of the north flank of the anticlinal structure against which the folded and faulted sediments rest. Maximum apparent vertical separation (throw) on the deepest seismic horizon occurs along a reverse fault, which is the westward extension of the midslope syncline (250 feet of throw, OCS lease P-0191), and along another reverse fault near the base of the slope in the eastern part of the area (150 feet, OCS lease P-0188). Throw of all reverse faults decreases in successively younger sediments. The most recently active faults, those which displace shallower seismic horizons, are associated with the reverse-fault trend near the base of the slope and are thought to be a contributory factor in the occurrence of submarine slides in the southeastern part of the area. Most faults on the mainland shelf trend east-west or northeast-southwest and are thought to be related to an older, no longer active period of thrust faulting. A possible exception is the southwestward extension of the left-lateral south branch of the Santa Ynez fault on the western shelf.

A submarine slide in which 3.8×10^8 cubic feet of mud moved 3,000 feet downslope has occurred on the lower smooth slope (OCS lease P-0180, 1,300- to 1,700-foot water depth), probably within the past 100 years. The slide moved as a single, plastic mass involving the upper 20 to 30 feet of sediment, rather than by liquefaction. The triggering mechanism is open to question, and the time elapsed from the moment the slide began until it came to rest is unknown.

Partially underlying the recent slide and centered slightly westward from it is a buried slide mass which formed approximately 80,000 years ago. It has about the same size and configuration as the recent slide mass. A linear depression extending to the east, and for a short distance west of the recent slide, is associated with a pair of shallow-subparallel gravity faults on the east side. The presence of the slides and their association with the surface depression and shallow gravity faults may indicate that more slides will occur in the OCS lease P-0180 area in the future. Available data suggest that slides on the smooth slope are infrequent and are confined to OCS lease P-0180 and possibly to areas farther east because of muds with higher moisture content and lower shear strengths, steeper slopes, and proximity to the most recently active faults on the slope. In addition, mapping of the interval between the sea bottom and the slip surface on which sliding occurred shows thickening of the interval in the vicinity of the slide and to the east. In general, the proposed 700-foot-water-depth platform sites in OCS lease P-0188 have more stable soil conditions than the area around the submarine slide in OCS lease P-0180.

INTRODUCTION

Objectives

In a letter dated June 17, 1970, Mr. M. O. Pattison of Humble's Western Division Production Department requested an interpretation by EPR's Offshore Geology Division of a multiple sensor, subbottom survey for platform locations in the Five-Mile Trend of the Santa Ynez Unit, Santa Barbara Channel, The following objectives were subsequently established:

1. Prepare a detailed bathymetric map of the area.

2. Map the distribution of surface and near-surface sedimentary facies and stratigraphic units and relate them to soil-strength properties.

3. Map surface and near-surface faults and folds.

4. Detect areas and horizons along which slumps and slides have occurred involving surface and near-surface sediments.

5. Determine areas least prone to fault activity, slump, or slide failures and thus best suited for platform locations.

Approach

The study was restricted to a 20-statute-mile (east-west) by 7-mile (north-south) area covering the mainland slope and outer mainland shelf. This area includes Federal Track OCS leases P-0180, P-0181, P-0182, P-0183, P-0184, P-0187, P-0188, P-0189, P-0190, P-0191, P-0192, P-0193, P-0194, and P-0195.

A closely spaced grid of approximately 1,590 miles of high-resolution seismic reflection (Super-3 Sparkarray) and 3.5-kHz bathymetric (EDO) profiles, combined with sediment cores from 31 locations, was used to accomplish the above objectives (fig. 1). One-hundred-seventy north-south profile lines were run at intervals of 500 or 1,000 feet, and 21 east-west tie lines were spaced at 2,000-foot intervals. GAI-GMX ran the profiling survey from July 22 to September 16, 1970, under contract to Humble. They also conducted a 577-mile side-scan sonar survey which has been interpreted separately by Hopkins (1971). A high-frequency radio positioning system (Hirex), with an accuracy of ±25-50 feet, was used for navigation, and positions were marked at 500-foot intervals along each trackline. All instrumentation used by GAI-GMX is fully described in their report submitted by Mr. H. C. Sieck on November 30, 1970.

Samples from 19 rotary core holes were obtained for geological purposes; these holes were drilled to a maximum penetration of 350 feet below the mudline using the drillship *Caldrill I* operated by Western Offshore Drilling and Exploration Company. In addition, punch cores from 12 more core holes were obtained for soil-strength tests by McClelland Engineers, Inc., and their test results are compiled in separate reports (see References). Conclusions based on McClelland Engineers, Inc., data are made in our report.

We used computer methods to compile values and perform calculations on the seismic reflection and bathymetric data. The various horizons and values mapped were machine contoured. Lithologies of the cores were analyzed to determine general vertical and lateral trends and relationships with the seismic reflection data. Planktonic foraminifers, coccoliths, paleomagnetic reversals, and radiocarbon dates were studied

to determine sediment ages. Details of all analyses performed and procedures followed are described in appendix A, and the data on file are listed in appendix B.

MORPHOLOGY AND SEDIMENTATION

General Setting

The Santa Ynez Unit of western Santa Barbara Channel lies on the northern flank of the east-west-trending topographic and depositional basin which extends offshore and westward from Ventura basin. Santa Barbara Channel is bounded on the north by the mainland shelf, which varies in width from 3 to 4 miles in the survey area. Average shelf gradients are less than 2 percent in the eastern part of the area and locally steepen only near small topographic irregularities and along the northeast-southwest-trending edge of the Hondo terrace (figs. 2-4).

Over most of the area, the mainland shelf surface is erosional or is covered by a layer of unconsolidated Holocene sediment that varies in thickness from 1 to 125 feet but is rarely greater than 50 feet thick. Steeply dipping upper Miocene and Pliocene rocks outcrop at the surface or unconformably underlie the thin sediment cover.

Sediment above the unconformity thickens at the edge of the Hondo terrace. The edge of the terrace has been referred to as the Hondo scarp (Gatto, 1970) and has been attributed to faulting. Our data do not support a fault directly beneath the edge of the terrace but rather suggest that the present topographic feature is the outer edge of a progradational depositional unit, probably formed during late Pleistocene. A recently active fault, thought to be the seaward extension of the south branch of the Santa Ynez fault, can be traced southwestward on the erosional portion of the shelf to its intersection with the Hondo scarp. Here the fault appears to be buried beneath as much as 100 feet of terrace sediment, and there is no evidence of displacement of these overlying younger beds.

The outer edge of the mainland shelf occurs at an approximate depth of 280 feet in the eastern part of the area (figs. 2, 3) and is cut by two submarine valleys near the eastern edge of the Hondo terrace. West of the valleys, the average depth of the shelf-edge break is approximately 180 feet but deepens again to 280 feet near the western limit of the survey area.

The outer edge of the shelf is the updip limit of a thick wedge of unconsolidated Holocene and late Pleistocene sediments which underlie the northern Santa Barbara basin slope and which represent more or less continuous filling of the basin since the formation of its present physiography and approximate geographic limits during mid-Pleistocene tectonic activity (Vedder, *et al.*, 1969).

Mainland-Slope Provinces

The mainland slope of the Santa Ynez Unit consists of two morphologic-sedimentation provinces--a submarine fan to the west and a smooth slope to the east (fig. 2). The boundary between the two provinces is gradational and trends diagonally across the slope from the shelf edge southeastward toward the basin floor.

Submarine-Fan Province

Included in the submarine-fan province are all of OCS leases P-0182, P-0183, P-0184, P-0193, P-0194, and P-0195, and southwestern portions of P-0180, P-0181, P-0191, P-0192. The areal extent of the fan can be recognized on the bathymetric map (fig. 3) as a broad, arcuate bulge of irregular contours which radiate outward from the shelf edge in the western part of the area. Distal portions of the fan extend south of the area mapped as well as to the east along the slope base. Gradients on the fan, which are contoured in the percent-slope map (fig. 4), generally are between 2 and 4 percent. Converging toward the apex of the fan are elongate trends of steeper gradients of 4 to 8 percent. These trends outline channels on the fan and reflect the steepness of the channel walls and levees rather than their longitudinal gradients.

The fan is readily recognized on 3.5-kHz EDO and Super-3 Sparkarray profiles as a province of relatively little acoustic penetration and poor reflection continuity (compare figs. 5 and 6). These differences in reflection characteristics are probably due to marked sedimentary facies variations and the diffraction of energy off surface and subsurface irregularities produced by depositional processes on the submarine fan.

Students of submarine fans generally agree that these morphologic features represent piles of turbidity-current sediments deposited as a result of a marked decrease in slope at the mouths of submarine canyons or valleys (Menard, 1955; Normark, 1970). In the continental borderland off southern California, much of this turbidity-current deposition is believed to have occurred during glacial periods in the

Pleistocene when sea level was substantially lower than at present, the shelf was exposed, and rivers were dumping their sediments directly into adjacent submarine canyons (Moore, 1969).

At present, only the eastern part of the fan may be subject to minor and intermittent turbidity-current flows. Evidence for turbidity-current activity is the presence of two small, leveed channels, each about 1,000 feet wide, that cut diagonally across the fan surface from the shelf-slope break southwestward toward the basin floor, covering a distance of no more than 15 miles. Maximum relief from channel bottom to levee crest is 80 feet; the average relief is about 20 to 30 feet. In the vicinity of the shelf edge, these channels merge into submarine valleys that extend back onto the shelf. The bottoms of these valleys have been eroded to depths of no more than 100 feet below the shelf surface.

Although these two valley-channel systems may be active, the present high stand of sea level, the absence of a large littoral-drift or river supply of sediment to the heads of the valleys, and the relatively small size of the channels suggest that turbidity-current activity is minimal. Since no direct evidence of turbidity-current activity has been observed in the Santa Ynez Unit, the periodicity of these events is unknown but is believed to be infrequent. In Santa Monica basin, where five well-developed canyon-fan systems and sediment supplies are present, small flows are believed to occur once every 1 to 10 years, but major currents, capable of transporting fine sand and silt to the center of the basin, occur at 400-year intervals (Gorsline and Emery, 1959). Furthermore, if flows do occasionally occur on the submarine fan in the Santa Ynez Unit, they most likely are confined by the levees to the channels, and the interchannel areas should not be subject to such flows.

Several discontinuous channels are present on the fan. They are generally less than 20 to 30 feet deep and no longer than 2 miles. These discontinuous channels are thought to be channel remnants, representing older, partially buried systems on the fan which are no longer active sediment-transport routes.

Fan sediments consist of interbedded sand, gravel, silt, and mud; thicknesses of individual beds and the proportions of various sediment types can be expected to change abruptly over short distances. This abrupt lateral and vertical variability is due to the localization of coarse sediment in channels and a complex history of development and abandonment of numerous channel systems.

Smooth-Slope Province

Included in the smooth-slope province are OCS leases P-0187, P-0188, P-0189, and P-0190 and the northeastern portions of P-0180, P-0181, P-0191, and P-0192. Contrasting with the submarine-fan province, the smooth slope is devoid of channels, and only a few small-scale irregularities exist (figs. 2, 3); the EDO and Super-3 Sparkarray profiles exhibit good reflection continuity and penetration characteristics (compare figs. 5 and 6). Side-scan sonar imagery reveals that many of the surficial markings present are manmade features, such as anchor and chain drag marks, well sites, and fishing-trawler tracks (Hopkins, 1971). However, in the northeastern part of OCS lease P-0180, a 6,000- by 8,000-foot area has been disturbed by surficial sliding. Details of this slide and related features are thoroughly discussed in a separate section of this report (p. 15).

Gradients on the smooth slope are greater than on the submarine fan but generally do not exceed 6 percent (fig. 4). They are locally greater on the downslope flanks of anticlinal structures and along the outer edge of the shelf. Average gradients increase toward the east with maximum slopes of 8 to 10 percent on the lower slope.

Smooth-slope sediments consist of mud and sandy mud with minor and predictable lateral variability. Higher percentages of sandy muds occur upslope near the shelf-slope break; mud becomes more abundant downslope. The predominant process of sediment transport and deposition is the settling out of suspended silt and clay particles from weak currents drifting along the bottom. These sediments come from a different source than do those on the submarine fan. Current-drift evidence on the side-scan sonar images (Hopkins, 1971) and studies of the distribution of river-flood deposits (Drake, *et al.*, 1971) indicate that weak bottom currents move westward or northwestward carrying fine suspended sediments from eastern sources, the Ventura and Santa Clara Rivers.

STRATIGRAPHY AND ITS RELATION TO SOIL-STRENGTH PROPERTIES

Stratigraphic Column

Paleontological studies of the sediment cores have provided biostratigraphic correlation throughout the study area by establishing the Pleistocene-Holocene contact and other distinct units within the Pleistocene. A stratigraphic column (fig. 7) has been constructed primarily on the basis of the coiling direction of a planktonic

foraminifer, *Globigerina pachyderma*. Standard geologic-age terminology[1] and Humble Western Division correlation points (SIa, SIa_1, SIa_2, etc.) were picked from correlative points on the coiling-direction curves (Marks, *et al.*, 1971). Warm intervals (interglacial stages) are indicated by right-coiling *G. pachyderma*, and cold intervals (glacial stages) are indicated by left-coiling forms. Coccolith investigations support the climatic intervals indicated by *G. pachyderma*. The absence of the coccolith *Scyphosphaera pulcherrima* in the stratigraphically oldest sediments penetrated by the 350-foot cores indicates that these sediments were deposited less than 500,000 years ago and are probably no older than late Illinoian. Analyses of paleomagnetic reversals in the cores support the paleontologic interpretations, inasmuch as all the samples were within the Brunhes normal epoch.

Four seismic horizons (A, B, C, and D) were mapped mainly in the smooth-slope area. Because of shallow penetration and poor reflection continuity, these seismic horizons on the submarine fan cannot be traced in the same manner as on the smooth slope (compare figs. 5 and 6). The relative stratigraphic positions of the four horizons are shown in the stratigraphic column (fig. 7) and are traced on the EDO and Super-3 Sparkarray profiles for line 88 (fig. 6). Horizon A, the shallowest reflector, was identified on the EDO profiles; its significance is discussed on page 16. Horizons B, C, and D were traced on the Super-3 Sparkarray profiles.

Seismic data, combined with paleontologic data from the core holes, show that horizons B, C, and D are associated with past interglacial or warm climatic intervals. These seismic horizons are approximate time-synchronous surfaces and, in general, are associated with periods of time when sea level was relatively high, and sediment accumulation rates were low. Horizon D, the deepest reflector mapped, is probably no older than 300 to 400,000 years (late Illinoian). Within the limits of resolution of the seismic data, the mapped seismic horizons represent relatively thin layers of sediment between much thicker sediment intervals deposited during times of low sea level, cold climates, and high rates of sediment accumulation.

Trends

Subtle, but predictable, lateral and vertical trends in sediment texture and moisture content occur in the smooth-slope sediments.

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[1]The Illinoian and Wisconsinan intervals are glacial stages, and the Sangamonian is an interglacial stage. An interstadial unit represents a period of time when the advance or retreat of an ice sheet is halted temporarily. Interstadial II (?) is the younger of two interstadial units in the late Illinoian.

These trends are related to position on the slope (upslope vs downslope) and climatic interval conditions (glacial vs interglacial) prevailing at the time of deposition (fig. 8). Laterally, starting at the shelf edge and progressing downslope, the sediments tend to change from sandy mud and coarse mud (silty sand, sandy silt, clayey silt, and some silty clay in McClelland Eng., Inc., terminology) to find mud (clayey silt, silty clay, and clay); moisture content generally increases downslope from 22-50 to 56-96 percent.[1] Vertically, finer sediments (silty clay and clay) with higher moisture content were deposited during warmer climatic intervals. In contrast, sediments deposited during cold intervals are coarser (silty sand, sandy silt, clayey silt, silty clay) and have a lower moisture content. The moisture content is probably a function of sediment size; finer grained sediments have greater initial porosity and therefore relatively higher moisture content. Because seismic horizons B, C, and D are associated with stratigraphic positions of sediment deposited during warm intervals, the maps of sediment thicknesses between the water bottom and each horizon (figs. 9, 10) can be used to predict approximately where intervals of finer grained, higher moisture content sediments occur in the section. Note particularly the position of horizon B with respect to a very strong warm interval in the engineering cores illustrated in figure 8.

Maps showing thicknesses between seismic horizons indicate thickening of depositional units downslope and on the submarine fan, reflecting higher depositional rates on the lower smooth-slope area and submarine fan (figs. 9, 10). In contrast with these trends, all units thin considerably on the flanks and crests of anticlinal structures beneath the smooth-slope area because of growth of the structures during deposition.

Time is an important factor in establishing full consolidation of muddy sediments under their existing overburden pressures (Fisk and McClelland, 1959). Inasmuch as sediment type is fairly uniform in the smooth-slope area, maps of sediment thicknesses between the water bottom and the seismic horizons can be used to predict relative shear strengths at given subsurface depths at various positions along and down the slope. When comparing strengths at equal subsurface depths, areas with relatively thin sediment units between the water bottom and horizons B, C, and D should have a tendency toward higher shear strengths than those areas with thicker units. Because the seismic horizons approximate surfaces along which the sediments are of equal age, less time for consolidation has elapsed since the deposition of the sediments at a designated depth interval where the mapped units are

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[1]Percent moisture = $\frac{\text{wt. water lost}}{\text{dry weight of soil}} \times 100.$

thicker. This soil-property trend is illustrated in Table 1 where *in situ* shear strengths of sediments at the 350-foot depth in each of six core holes are compared with depths to the seismic horizons in each core hole.

Also, in core 190C, where the oldest sediments were encountered (subbottom depth to B = 37 feet, to C = 82 feet, and to D = 147 feet), we observed that the sediments were much more consolidated than in all other cores examined.

STRUCTURAL GEOLOGY

Regional Setting

Santa Barbara Channel is a submerged portion of the Transverse Range province of southern California, in which structural trends are predominantly east-west. The channel area is bounded on the north by the Santa Ynez Mountains and on the south by the Channel Islands. Both of these land areas are intensely deformed, uplifted land masses characterized by nearly vertical, east-west-trending left-lateral faults and high-angle reverse faults. For further regional information, refer to Vedder *et al.* (1969), Dibblee (1966), and other publications treating the geology of the Transverse Range province and Channel Islands.

Faulting

Smooth-Slope Province

Two major zones of east-west-trending reverse faults are present. One is located about midway down the basin slope in OCS lease P-0191 and represents the westward extension of a prominent syncline (fig. 11). Maximum apparent vertical separation (throw) is 250 feet on horizon D. Throw on the fault decreases upward. The fault shows minor displacement on horizon C and does not cut horizon B (fig. 12). Throw decreases both to the east and west, and deformation of horizon D is expressed on either side as a syncline with an anticline nearly parallel to it on the downslope and downdip side. The midslope fold trend dies out abruptly near the eastern boundary of OCS lease P-0189, and faulting along the zone again appears to be predominant in OCS lease P-0188, although the faults are disconnected short segments showing a variety of trends. Where this transition occurs, the zone of deformation is not clearly expressed on horizon D; it is probably much deeper in the

Core*	Sediment Overburden Thickness in Feet above Horizon			Estimated *in situ* shear strength at 350 feet (tons/ft^2)**
	B	C	D	
190A	97	182	300	2.4
188G	104	228	362	2.3
190E	132	197	365	2.3
188-2	122	255	418	2.0
188H	151	268	468	2.1
191H	183	329	670	2.0

*Cores are listed by increasing overburden thickness to horizon D.

**Shear strength values were taken from available McClelland Engineers, Inc., reports.

TABLE 1. Comparison of depth with seismic horizons and shear strength at 350 feet.

section and appears to converge toward the southeast with the lower slope zone.

A predominantly east-west-trending zone of reverse and normal faults occurs near the base of the slope, extending eastward from the southeast corner of OCS lease P-0191. With respect to seismic horizon D, this zone of deformation is discontinuous and is expressed by individual fault segments that trend northeast-southwest and northwest-southeast (fig. 11). It is interrupted by an area of monoclinal flexure near the southern boundary of OCS lease P-0191 and by a north-south-trending graben located on the boundary between leases P-0181 and P-0180. In general, the zone consists of reverse faults dipping toward the south and normal faults near the base of the basin slope which also dip toward the south, resulting in uplifted blocks bounded on the north by reverse faults and on the south by normal faults (fig. 13).

The zone of deformation near the base of the slope includes faults which have moved since deposition of sediments above horizon B (fig. 14), that is, in the past 80,000 years. However, none of these faults has moved recently enough to have any expression on the present sea floor.

Maximum throw observed on the reverse faults is 150 feet (on horizon D) on the fault near the southwest corner of OCS lease P-0188, just east of the graben. Maximum throw on horizon D occurs along the graben faults, where vertical separation may be as great as 350 feet. The faults bounding the graben, however, do not displace seismic horizons shallower than horizon D.

A small, northwest-southeast-trending, uplifted block occurs near the center of OCS lease P-0190. It is complexly faulted, with subparallel, nearly vertical faults bounding both sides (fig. 15). The sedimentary section thins considerably over this structure, and most of the faults lie beneath horizon D. Only two are observed to cut horizon C, and in the shallower section, the structure is usually expressed as a sharply defined, narrow fold.

In addition to the two major zones of deformation described above, a number of normal faults occur in the upper and midslope areas of OCS leases P-0187 and P-0188. Most of these occur near the eastern limit of our data and appear to be increasing in numbers farther east as the overall dip of all mapped horizons increases. The faults are downthrown toward the south (fig. 16) and have minor throw (usually less than 50 feet) on horizons B and C but may displace horizon D by as much as 100 feet. None appear to displace the sea floor.

Near-surface faulting on the basin slope is confined to two areas of gravity-slide-type faults. A single, continuous gravity-slide fault (fig. 17) extends from the southeast corner of OCS lease P-0188

eastward along the southern boundary of lease P-0187 (fig. 18). Slightly to the south are discontinuous segments of a second fault parallel to the first. These faults have surface expression as a shallow sinuous depression extending eastward from the detachment scarp of a recent submarine slide (see p. 16). If not the cause of the slide, they probably formed at the same time and in response to the same stresses which produced failure at the surface. Vertical displacement on the faults is generally less than 20 feet. The fault surfaces are curved and die out in reflection events just above horizon B.

An area of shallow gravity faults and flow folds occurs in the southern half of OCS lease P-0189 (fig. 18). This area contains numerous gravity faults on a scale too small to map. They have small vertical displacements and consist of many short, east-west-trending segments. Deformation in the shallow sediments extends from the southern flank of the east-west-trending syncline onto the crest of the adjacent anticline to the south (fig. 19). Deformation of young sediments in this area probably represents minor adjustments to recent upward movement of the anticline. Movement on small normal faults is directed inward from both the northern and southern boundaries of the disturbed area, rather than downslope. The position and growth of the anticline, in addition to being a cause of deformation, seem also to provide a buttress against massive downslope movement of the fractured and folded sediments.

Submarine-Fan Province

In the western part of the area, our data indicate only the absence of surface faulting on the present submarine fan and are inadequate to define shallow subsurface structures that may lie beneath the fan. The presence on the western shelf of a recently active fault suggests that the continuation offshore of the south branch of the Santa Ynez fault (or other strike-slip faults) may be a major factor controlling structure farther west and beneath the submarine fan.

Mainland Shelf

Near-surface faults showing significant displacements are confined to the mainland shelf, where they have been exposed by erosion (fig. 18). A series of subparallel thrust faults, locally trending northwest-southeast in an *en echelon* pattern, characterize the shelf structure along with similar patterns of folds. These faults are probably related to the mid-Pleistocene uplift of the Santa Ynez Mountains and are no longer active. They displace rocks of Pliocene and late Miocene age.

The only shelf fault that may have been recently active occurs in State Parcels 2 and 3 (PRC 2725.1 and 2726.1). It trends northeast-southwest and may be the southwestward offshore extension of the south branch of the Santa Ynez fault. Topographic evidence and amount of displacement are discussed in a report on side-scan sonar data (Hopkins, 1971). Other evidence from arcer and 3.5-kHz data was obtained independently and compared with that from side-scan sonar data.

Folding

Smooth-Slope Province

Two major folds, an anticline and adjacent syncline to the north, dominate the structure in the midslope area (fig. 11). In OCS lease P-0189, traces of the axial planes of the two folds are nearly parallel on horizon D. The axial traces converge westward on all horizons and upward by shifting of the position of the anticlinal axial trace northward in successively shallower sediments (fig. 19). Both folds plunge toward the west in OCS lease P-0189. West of the boundary of P-0189, the direction of plunge changes several times, reflecting the occurrence of two doubly plunging synclines and anticlines along the major fold trend.

The syncline is asymmetric, with the steeper flank on the north (fig. 19). The position of the axis does not change appreciably with depth, and the axial plane coincides with the trace of a major high-angle reverse fault, upthrown on the south side, in the deeper subsurface.

Two smaller fold zones occur in the mid- and lower-slope areas. One was mentioned above in the section on Faulting (p. 11). It occurs in the northern half of OCS lease P-0190 and consists of a doubly plunging anticline and syncline trending northwest-southeast. The anticline is sharply defined (fig. 15) and shows extreme thinning of the sedimentary section over its crest, suggesting continuous, fairly rapid growth during deposition. This small anticline lies on the southwest or southern flank of the major anticline. In contrast with history of the small anticline, growth of the large anticline seems to have been slower in relation to sediment-accumulation rates. Continued growth of structures is indicated by subtle changes in slope and by an overall convex-upward profile on the present sea floor (figs. 3, 4).

The other small set of folds occurs in the southeast corner of OCS lease P-0191 and represents drag folding against a reverse fault near the base of the slope.

Where the sediments are not faulted near the base of the slope, the subsurface structure is characterized by a monoclinal flexure, with the steeper limb on the upslope side.

Mainland Shelf

Fold trends on the shelf generally follow the east-west or northwest-southeast trends of thrust faults. Most of the folds are asymmetric with steeper southern flanks on synclines and steeper northern flanks on anticlines.

Interpretation

Although evidence of strike-slip faulting is difficult to discern in continuous reflection profiles from which individual fault traces were mapped, there is a lack of evidence in the pattern of shallow subsurface faults and folds that would indicate large lateral movements along major wrench faults in the past 500,000 years. The shallow structure thus suggests that most of the recent structural movement has been in response to overall north-south compression, with the vectors of compressional stress inclined downward to the south. This interpretation is consistent in the eastern part of the area with parallel trends of major folds and high-angle reverse faults in the deep subsurface.

SUBMARINE SLIDES ON THE LOWER SMOOTH SLOPE

Surface Slide

The surface mud in a 6,000- by 8,000-foot area of the lower slope in the northeastern part of OCS lease P-0180 has recently been disturbed by sliding. The area involved in sliding can be seen on the bathymetric map (fig. 2, 1,300- to 1,700-foot water depths), the perspective view of the slope (fig. 2), and the percent-slope map (fig. 4); the various features associated with the slide are sketched in figure 20.

The morphologic components of the slide are clearly visible in EDO profile 68 (fig. 21), in which the vertical scale is exaggerated ten times. A <u>detachment scarp</u>, approximately 20 feet high, marks the <u>crown</u> or top of the slide. The <u>slip surface</u>, a smooth, planar surface,

is exposed immediately downslope from the detachment scarp. The slide bulge consists of material that was removed from the stratigraphic interval above the slip surface.

Horizon A on EDO profile 68 is a trace of the subsurface reflector that appears to be a continuation of the exposed slip surface. Although this subsurface continuation is acoustically recognizable, no unique sediment properties were observed in the cores along reflecting horizon A.

A map of sediment thickness between horizon A and the water bottom (fig. 22) indicates that approximately 4.0×10^8 cubic feet of mud has been removed from the area of the exposed slip surface and that 3.8×10^8 cubic feet of mud has accumulated in the slide bulge. Taking into consideration the resolution of the data used, the volumes of sediment removed and accumulated are identical.

The above calculations indicate that the removed sediments traveled no more than 3,000 feet downslope. The slide moved as a single unit involving the upper 20 to 30 feet of sediment; these sediments deformed plastically rather than by liquefaction.

The triggering mechanism is open to question, and the times required to trigger the slide, to move it, and for it to come to rest, are unknown. Earthquake tremors or wave motion from tsunamis could be likely triggering mechanisms.

The slide probably occurred within the last 100 years. This estimate is based on the fresh, sharp appearance of the surface and on sedimentation-rate calculations using the 11,000-year B.P. *Globigerina pachyderma* coiling shift as a reference horizon. Sediments have been deposited in the vicinity of the slide at a rate of 4.7 feet/1000 years, and less than 0.5 foot of post-sliding sediment cover has accumulated on the exposed slip surface.

Ancient Slide

Partially underlying the recent slide but centered 3,000 feet westward of it is a slide bulge (fig. 20) which formed as a sea-bottom feature about 80,000 years ago. It is now buried under 300 to 400 feet of sediment and lies immediately below horizon B (fig. 21). Its size and configuration are approximately the same as those of the surface slide.

Limited Area Prone to Sliding

Available data suggest that sliding on the smooth slope was infrequent in the past and confined to the northern part of OCS lease P-0180. Factors which made this area prone to failure are (1) sedimentation rates are higher, and the buried sediments therefore tend to be less consolidated at a given depth because of the relatively short time since deposition; (2) the slope is generally steeper (8-10 percent) than the rest of the smooth-slope area (3-6 percent); and (3) the most recently active faults, those which displace horizon B, are close to the slides (fig. 14).

Future Slides

A sinuous depression, 2 to 10 feet deep and 50 to 300 feet wide, extends 2,000 feet to the west and 15,000 feet to the east of the detachment scarp of the surface slide. On the east side, the depression is associated with a pair of shallow, subparallel gravity faults (figs. 17, 18), a relatively thick sediment overburden above horizon A, and steep slopes. The presence of the slides and their association with the surface depression and shallow gravity faults may indicate that more slides will occur in OCS lease P-0180 and the adjacent federal lease track to the east.

Although the slides appear to be confined to the lower part of the slope, the possibility of progressive slumping upslope from the recent slide cannot be ruled out.

SLIDE-PRONE AREA VERSUS THE 700-FOOT PLATFORM SITES IN OCS LEASE P-0188

In general, the platform sites on OCS lease P-0188 have more stable soil conditions than the area immediately upslope and to either side of the submarine slide on OCS lease P-0180. Sediment properties and geologic conditions of the two areas compared in table 2 show that the platform sites have (1) sediments with lower moisture contents and higher shear strengths; (2) lower slope gradients; (3) no surface faults; and (4) no past history of sliding.

Sediment Properties and Geologic Conditions	OCS Lease P-0180 Submarine-Slide Area	OCS Lease P-0188 Platform Sites, 700-Foot Water Depth
Rate of sedimentation (feet/1,000 years)	4.7	1.6
Sediment age at equivalent depths	Younger	Older
Sediment size	Finer: (Silty clay)	Coarser: (Clayey silt → silty clay)
Water content in upper 40 feet (percent)	56 → 96	30 → 62
Shear strength at 40 feet (tons/ft^2)	0.20 → 0.29	0.40 → 0.43
Percent slope	8 → 10	3 → 6
Structure	Faults near surface (active?)	No near-surface faults
Site of previous slide	Yes, 80,000 years ago	No

TABLE 2. Slide-prone area vs 700-foot platform sites in OCS lease P-0188.

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APPENDIX A - METHODS

Part 1. Core-Hole Program
C. C. Daetwyler

Objectives

The core-hole program was conducted in order to satisfy the following objectives:

1) Obtain sufficient subsurface information within the Santa Ynez Unit to adequately describe near-surface stratigraphic and facies relationships.

2) Obtain detailed soils engineering data at all proposed platform and installation sites.

3) Obtain soils engineering and geological data within and adjacent to areas of slope instability.

Approach

The *Caldrill I*, owned and operated by the Western Offshore Drilling and Exploration Company (Fluor Corporation) of Los Angeles, was used to drill the geological core holes and foundation engineering borings. The *Caldrill I* is a converted twin-screw, diesel-powered, AKL-type Army vessel (176 feet long, with a 33-foot beam and a 10-foot draft) equipped for center-well drilling. It carries automatic dynamic positioning equipment (taut-line system) designed to hold the ship on location under any weather or sea conditions in which it is possible to conduct safe drilling operations.

Both the geological core holes and the foundation engineering borings were limited to a maximum permissible penetration of 350 feet below the mudline. Geological core holes were cored continuously utilizing rotary coring methods. Fifteen-foot, 2½-inch-diameter cores were cut using a Hycalog core barrel. Cores were obtained in plastic liners, subsequently cut into 3-foot lengths, and boxed for shipment. Care was given to keep the core segments vertical during shipboard storage and shipment.

Foundation borings and special soils engineering core holes were obtained with punch coring methods; the coring operations were supervised by personnel of McClelland Engineers, Inc. Engineering cores were sampled in the field for subsequent paleontological examination.

The *Caldrill I* was positioned at specific coring sites with an electronic positioning system (Autotape) operated by Lewis and Lewis Offshore, Inc., of Ventura, California.

A geologist was onboard the *Caldrill I* during all phases of the core hole program. Pertinent field data for all core holes were recorded as follows:

1) Shipboard Summary Sheet - Brief summary of pertinent coring information.

2) Shipboard Event Log - Detailed log of coring operations.

3) Shipboard Core Log - Detailed inventory of cores, core segments; includes brief field descriptions of lithologies.

Copies of the above summary sheets for all core holes were distributed as necessary and remain on file. Additional copies are available if the need arises.

Core-Hole Summary

Included (table 3) is a detailed summary of pertinent core-hole information. The core-hole program was conducted between October 13 and December 3, 1970. Forty-two individual core holes were drilled at 31 locations. Rotary coring techniques were used at 19 locations, and punch coring methods were used at 12 locations (McClelland Engineers, Inc., borings). Water depths at these locations ranged from 352 to 1,686 feet. Total depths of core holes ranged from 15 to 350 feet (maximum permissible penetration). A total of 4,558 feet was cored with rotary methods, and 3,456 feet was recovered (76 percent).

Part 2. Preliminary Processing and Macroscopic Description of Geologic Cores

J. R. Duncan, R. A. Hoover

Upon receipt of the continuously cored intervals in Humble's Western Division laboratory, each 3-foot core segment was split lengthwise with a band saw. One half was sampled at 1-foot intervals for foraminifers, coccoliths, and paleomagnetic determinations; the remaining portion of this sampled core half is stored in the Western Division's sample warehouse. The second half of each core segment was sprayed immediately

with zephran chloride to prohibit fungal growth, wrapped in aluminum foil, and heat-sealed in plastic sleeving. This portion was then sent to the Esso Production Research Company laboratory, where it was cleaned with an electro-osmotic knife, photographed (black and white, plus color), described, and filed in the EPR sample archives.

The sediments were mainly of terrigenous origin, and their textures were defined according to the classification set up by Folk (1954). Particular emphasis was placed on the following: (1) observing lithologic changes associated with the mapped seismic horizons (A, B, C, and D), *Globigerina pachyderma* coiling intervals, and morphologic provinces; (2) detecting zones in the cores disturbed by rotary coring; and (3) detecting the presence or absence of tar particles. Complete macroscopic descriptions of the cores are on file.

Part 3. Biostratigraphic and Paleomagnetic Correlations

C. E. Pflum, L. A. Smith, W. V. Sliter

Selection of Samples

In the geologic cores, a 3-inch section of one-quarter of the core was extracted for foraminiferal investigation at 1-foot intervals. Engineering cores (1 to 2 feet long) were recovered continuously to a depth of 50 feet and at about 10-foot intervals thereafter. The top and bottom of each of these cores were sampled for foraminifers. Coccolith and paleomagnetic samples were taken adjacent to the foraminiferal sample in the geologic cores. Where a sharp break in physical properties (lithology, color, bedding, etc.) occurred in a core between regularly sampled intervals, additional samples were collected.

Globigerina pachyderma Coiling Analysis

The foraminiferal samples were washed over a 200-mesh sieve, oven-dried, and placed in envelopes. The samples were examined by pouring the entire sample onto a tray in order to have all size fractions of foraminifers available for identification and counting. Foraminiferal data were recorded and put on file.

After a few cores were examined, biostratigraphic units were recognized from the curves formed by plotting the ratio of left-coiling to right-coiling specimens of *Globigerina pachyderma* against the depth in the core. Each unit was made up of an appreciable sediment interval in which the curve was strongly biased to the left or right. The curve

Drill Stem Test Data

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

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is developed by plotting the percentage of left-coiling specimens in each sample. Usually, 40 or more specimens chosen from a representative portion of the examining tray are counted, and their coiling direction noted, i.e., "32/8," or 32 left-coiling and 8 right-coiling specimens. The percentage of left-coiling specimens is then recorded (80 percent in the above example) and plotted on a form designed for this project.

The biostratigraphic units based on *G. pachyderma* coiling curves can be correlated throughout the area of the project. Since they form the main element of correlation, their origin and meaning are worthy of some explanation.

In cold Arctic and Antarctic waters nearly all living *G. pachyderma*, small planktonic foraminifers, are left coiled. In warmer seas, individuals of the species are generally right coiled. The critical temperature for separation of water masses that bear left- or right-coiling populations is about 7 degrees Centigrade (45 degrees Fahrenheit). In zones of convergence, where warm and cold waters mix, the ratios of left- and right-coiling individuals are variable.

Sediments accumulating on the sea floor in water depths greater than approximately 300 feet receive a fairly steady rain of dead *G. pachyderma* tests. The ratio of left- to right-coiling specimens of *G. pachyderma* in each sample is assumed to represent the relative predominance of cold or warm water over the site of deposition during the period when that sample was deposited. Evidence to support this hypothesis of temperature control is that assemblages in which right-coiled forms dominate often contain other species of relatively warm-water planktonic foraminifers, whereas the assemblages marked by left-coiling populations generally do not.

The coiling-change reversals of *G. pachyderma* occur between such short intervals of each core that a change in water mass during the time of deposition must have been the cause. In a 1-foot interval, a coiling-change reversal may be from 100 percent in one direction to 100 percent in the other direction. Because the sedimentary units are clearly defined by left- and right-coiling populations and are of considerable thickness, it is also suggested that the respective water masses remained in the area for thousands or tens of thousands of years at a time. Apparently, continental glaciation, eustatic sea-level changes, and basin topography had profound effects on the routing of the California and Davidson currents over the present Santa Barbara slope. The Santa Barbara Channel area may be unique in this respect because it has the ideal latitude, basin position, and proximity of contrasting water masses.

Benthic Foraminifers

In general, the cores taken were within one bathymetric zone (upper bathyal), and only minor paleobathymetric variations were noted from study of the benthic foraminifers. These variations indicated a slightly deeper environment during the right-coiling intervals (warm intervals) of the cores. One benthic species, *Florilus labradoricus*, has a first downhole occurrence immediately above the first left-coiling interval (Pleistocene-Holocene contact) of *Globigerina pachyderma*. This occurrence can be correlated over the entire area investigated and is considered to be a reliable biostratigraphic marker.

Coccoliths

Calcareous nannofossils (coccoliths, discoasters, and associated forms) are marine planktonic coccolith-bearing organisms that are known from all modern oceans. They commonly occur in great abundance in many Jurassic and younger deposits. Calcareous nannofossils also are major constituents of many calcareous clays and shales, and related forms are very abundant in many Recent pelagic deposits. Coccoliths are disassociated skeletal elements (platelets) of flagellate algae called coccolithophores; in life many of the platelets are arranged to form an armorlike case, the coccosphere, enclosing the soft parts of the organism.

The laboratory preparation for detailed optical examination of coccoliths requires a somewhat complicated technique; particulate material in the desired size range must be carefully concentrated and extracted. A detailed description of laboratory procedures is on file.

Calcareous nannofossils are, at present, thought to be the best available indicators of age in the Quaternary sections of California. Since earlier work to establish a time-stratigraphic framework for the California Pleistocene is lacking, the calcareous nannofossil assemblages are being compared with standards established in the Gulf of Mexico. The Gulf of Mexico sections have been dated with planktonic foraminifers and correlated with type and reference sections of Europe, North America, and oceanic sediments of the Atlantic, Caribbean, and Pacific. It is believed that ranges of calcareous nannofossils along the California coast will be quite similar.

The Santa Ynez Unit samples yielded coccoliths considered younger than 500,000 years before present. The *Scyphosphaera pulcherrima* datum, for example, a biostratigraphic marker for the top of the early Illinoian, was not found in these samples. Markers for the late Pleistocene (Sangamonian-Wisconsinan) were recovered.

Paleotemperature interpretations based on calcareous nannofossil assemblages in the Santa Ynez Unit agree very closely with interpretations based on the ratio of right- to left-coiled *Globigerina pachyderma*. The two inferred paleotemperature records were, however, arrived at independently. In the case of the coccoliths, a method was used which incorporated both floral species diversity and species dominance.

Diversity increases with temperature, and, seemingly, the higher the diversity, the warmer the oceanic waters. The lowest temperatures detectable are suggested by the occurrence alone of species of the genus *Coccolithus*. *Coccolithus pelagicus* occurs virtually alone near the Arctic and Antarctic convergences. The addition of other genera indicates warming, and assemblages are dominated by genera other than *Coccolithus* as one approaches tropical waters.

Paleomagnetics

Samples for the study of paleomagnetism were extruded and cut to fit tightly into 2-centimeter-square nonmagnetic plastic boxes, identified by sample number, oriented by an arrow pointing to the top of the core, and sealed by tape to prevent desiccation. Detrital remnant magnetism of the core and outcrop samples was measured with a 5-cycle/second magnetometer (Foster, 1966). Unstable components of magnetism were minimized by the application of 150 to 200 oersteds using a biaxial demagnetizer device (McElhinny, 1966). From each set of data for each specimen the total-field intensity measured in electromagnetic units per gram and the direction of magnetization in terms on inclination and arbitrary declination were computed. Declination is calculated with respect to the X axis, or direction of the magnetic field, which is assumed to be 0°. Inclination is measured in the plane of declination with respect to the horizontal, so that a negative inclination is upward and a positive inclination is downward in the northern hemisphere. Negative inclination is thus reversely magnetized, and positive inclination is normally magnetized.

The processed magnetic data for each sample locality were then arranged by stratigraphic position. Inclination and field-intensity measurements for each data point were plotted in relation to depth. Samples having declination variation were identified. Declination values cannot be used for polarity determinations in the present core holes because no horizontal orientation was taken. However, declination values should be more or less uniform within individual core-hole segments between polarity transitions, indicating a continuity in deposition. Fluctuating values with or without corresponding changes in inclination values were noted as possible intervals of sediment disturbance. All polarity reversals resulting from this examination of inclination, declination, and intensity values were then indicated on

a polarity log for each sample locality. To test the internal consistency of these changes in polarity, each polarity log was then compared with the lithologic character of the corresponding sample locality for evidence of sediment distrubance or breaks in deposition. This involved recording the sediment type and sedimentary breaks; color changes; presence or absence of laminations; and, if present, whether the laminations were parallel or disturbed. Additional information recorded included presence of burrows, sandy intervals, and turbidite layers.

The entire interval sampled for paleomagnetics is believed to be in the Brunhes Normal interval, or younger than 0.69 million years. Two small reversals near the top of the core may be the Lachamp and Blake reversals seen in several locations around the world and reported by EPR in the Gulf of Mexico. The polarity data are of excellent quality and are closely similar both before and after demagnetization at 50 oersteds, indicating a high magnetic stability. This stability exists in spite of variations in total-field intensity, especially in core hole 190B, where some intensities vary by a remarkable factor of 10,000. In fact, a few of these samples are as magnetic as basalts. The single-sample reversals noted in both core holes are most probably related to sediment disturbance rather than to paleomagnetic behavior.

Part 4. Gravity Cores, OCS Leases P-0188 and P-0180

C. C. Daetwyler

Twenty-one short gravity cores were obtained on two north-south traverses crossing OCS leases P-0188 and P-0180. Seventeen cores were obtained along survey line 68 in water depths ranging from 445 to 1,679 feet, and four cores were located along survey line 88 in water depths ranging from 1,181 to 1,642 feet.

Cores were collected by GAI-GMX personnel from the M/V *Sea Tender*. A high-frequency radio positioning system (Hirex) was used to position the vessel on preselected coring stations. The gravity corer (Scripps Institution of Oceanography design) utilized a 6-foot core barrel with 1 7/8-inch plastic liner inserts. The plastic liners containing the cores were sealed on board the vessel and subsequently shipped to EPR for examination.

At EPR, the cores were split lengthwise with a band saw. One half of each core was sent to Humble's Western Division laboratory for subsequent paleontologic studies. The other half of the core was selectively sampled for grain size, clay mineralogy, and moisture content measurements. After sampling, the cores were stored in sealed plastic sleeving. Approximately one week after the cores were opened,

Drill Stem Test Data

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vane shear measurements were made on 14 cores. Included (table 4) is a summary of pertinent gravity-core information. All analytical data are on file.

Part 5. Radiocarbon Dates
C. C. Daetwyler

Table 5 summarizes pertinent information concerning six samples submitted to Teledyne Isotopes for age dating.

Core Hole	Core Segments	Interval Sampled (feet)*	Type Material	Radiocarbon Date**
OCS P-0188				
188K	1B, 2A, 2B	354-355	Molluscan debris	15,240 ± 620
188K	4A, 5A, 5B	358-361	Molluscan debris	17,880 ± 300
188K-A	1B, 2A, 2B, 3A	374-376	Molluscan debris	18,180 ± 400
188K-A	20A, 20B, 20C, 22A	412-414.5	Molluscan debris	17,170 ± 360
OCS P-0193B				
193B	12A to 12F	874-889	Foraminiferal debris	>33,500***
193B	13AA to 13E	889-904	Foraminiferal debris	Not enough material to date

*Feet below sea floor.
**Age in years before present.
***No finite date.

Table 5. Radiocarbon dates.

Part 6. Seismic and 3.5-kHz Echosounder Data: Corrections, Interpretation, and Preparation for Computer Processing

R. A. Hoover

Seismic Data

Dry-paper, field-monitor sections were obtained from the GAI-GMX 3,000-joule Super-3 Sparkarray system. These records were filtered on shipboard with 100-cps low-cut and 200-cps high-cut filters. Unfiltered data were recorded on 1/2-inch analog tape but had not been processed at the time of writing of this report. The field-monitor sections were reproduced as paper autopositives, and Ozalid prints were obtained for use as work sections.

Before interpretation, all sections were marked to indicate the hydrophone cable center position above the sea floor rather than the Hirex antenna position of the boat, which was recorded and marked on the sections every 1,000 feet in the field. This correction is referred to as the stepback correction. The following stepback corrections were used for the dates listed below:

Date	Stepback Correction
July 22 through August 9	200 feet
August 10 through August 27	300 feet

Three seismic horizons were chosen for interpretation and mapping based on detailed analysis of reflection events on nine north-south or dip lines spaced uniformly across the area. The three seismic horizons were chosen on the basis of the following criteria: (1) ease of identification and continuity throughout as large a part of the survey area as possible; (2) the necessity for including a deeper horizon that would adequately represent structural relief; and (3) whether the horizon represents a nearly time-synchronous surface above or below which significant thickening or thinning of the sediments has occurred by means of onlap, offlap, or truncation of reflection events.

A 2,000-foot grid spacing of seismic lines was chosen for initial interpretation and mapping. While interpretation was in progress, the option to utilize more closely spaced lines was built into our data file system, should the need arise. The first series of machine-contoured maps indicated the need for better definition of structures in the eastern smooth-slope area, and, accordingly, more closely spaced data points were added.

The initial 2,000-foot grid spacing proved more than adequate for stratigraphic control. On the basis of the principle that seismic reflection events are parallel to acoustic interfaces caused by differences in density and other physical properties above and below the interface, individual reflectors seen on continuous reflection profiles can be considered as bedding surfaces in a general sense. This is not strictly true because the return signal recorded as a reflector is a composite of many, smaller scale reflection events of various wave lengths and amplitudes. Nonetheless, when a single surface is traced around a series of closed loops constituting the 2,000-foot grid, the individual reflectors cannot be indiscriminately crossed. They must be considered as bounding surfaces or sets of bounding surfaces between which the horizon consistently occurs. With closely spaced grids, additional restrictions are placed on interpretive license frequently exercised in conventional, widely spaced seismic data. The interpreter is bound to honor common depth points for all mapped horizons at each line crossing. Thus, for each crossing of a north-south profile with an east-west profile, the position of the crossing on the two profiles must be verified independently by checking for a common water depth and consistent positioning data. Once verified, the depths from the sea floor to the mapped horizons must be the same on the two profiles where they cross each other. Using these techniques, a closely controlled network of data points can be established, and interpretation between them minimized.

The three seismic horizons (designated B, C, and D in order of increasing depth) were drawn on all profiles in the 2,000-foot grid where they could be identified and traced from controlled line crossings. None of the horizons could be traced over the entire survey area because of shallow penetration and complex seismic character of the submarine fan and because of steeply dipping reflectors near the base of the smooth-slope area.

After horizons had been drawn on the profiles, travel-time measurements to the nearest millisecond (0.001 second, two-way travel time) were made at each 500 feet of horizontal distance along the profiles for each seismic horizon. These times were measured with plastic overlays subdivided in 2-millisecond increments and were recorded on Fortran coding sheets along with line numbers and shot-point numbers for identification and merging in the data file with x-y coordinate data.

Faults were identified in the seismic sections down to subbottom depths of 1,000 feet. Conventional criteria for identification of faults in continuous reflection profiles were used. These include offsets of reflection events, changes in amplitude of reflection events where they cross fault surfaces, positions of diffractionlike events originating from truncated beds on either side of a fault, and closed-loop control on mapped seismic horizons. Fault surfaces were not digitized; they were mapped on separate overlays to be used in conjunction with machine-contoured maps. Even though additional data points on both sides of faults were added to define throw, there remains an inherent tendency

to average the data values near small-scale irregularities in any surface-approximation mapping technique in which a single, continuous surface is mapped. Thus, a more accurate representation can be obtained using fault overlays.

3.5-kHz EDO Data

Dry-paper, field-monitor sections were obtained from the 3.5-kHz EDO system on shipboard and were reproduced as paper autopositives and Ozalid prints. The following stepback corrections were applied before interpretation:

Date	Stepback Correction
July 22 through August 27	100 feet
August 27 through September 16	200 feet

In addition to the stepback correction, a vertical correction was added to data values on each line to correct for towing depth of the transducer. The towing depth was measured on all north-south profiles as follows: near the northern end of each line the arrival of the first water-bottom multiple is visible. If the transducer fish had been towed at the water surface, the two-way arrival time of the first water-bottom multiple would have been exactly twice the two-way arrival time indicated for the water bottom. The difference between the value for twice the two-way arrival time for the water bottom and the measured two-way time for the first multiple represents the towing depth of the transducer in two-way travel time. This value (in milliseconds) was added to all values measured on the profile and later converted to one-way time (and depth), along with other data, in the computer data processing.

The EDO recorder used in the survey was set to record 0.5 second of data. When the recorder was "edge keyed," time zero was recorded at the paper edge at the same instant that the outgoing pulse was transmitted. When "center keyed," time zero for a given outgoing signal should have been recorded in the center of the paper 250 milliseconds before the full 0.5 second of recording began in which the bottom return for that outgoing pulse was recorded. The program change from edge keying (in shallower water) to center keying (in deeper water) produced an apparent depth difference of 2 milliseconds two-way travel time. The change made the bottom return appear 2 ms shallower over the center-keyed portion of the record. The edge-keyed portion was assumed to be correct, and 2 ms was added to all data values measured in the center-keyed portions of the profiles.

A second program change was made in the field to record the deep portions of the profiles. In water depths greater than 0.5 second (approximately 1,800 feet), the recorder was programmed to key the outgoing pulse 0.5 second before the return from the pulse was recorded. This change produced an apparent depth difference of 4 ms two-way travel time. The change made the bottom return appear 4 ms deeper than it appeared on the adjacent center-keyed portion of the record. Inasmuch as the center-keyed portion appeared 2 ms too shallow, this second program change represents a net difference of 2 ms (too deep) with respect to the original edge-keyed part of the record. Accordingly, 2 ms had to be subtracted from data values obtained over those portions of the profiles.

All data were corrected to a datum of mean low low water (MLLW) using tide tables for lease OCS P-0187 provided by Oceanographic Services, Inc., for hourly intervals during the survey period.

All north-south 3.5-kHz lines were utilized in compiling data for the bathymetric map and one subbottom reflector (horizon A). Two-way travel times were measured to the nearest millisecond (0.001 second) every 500 feet of horizontal distance using a plastic overlay with 2-millisecond subdivisions. In addition to these data, all peaks, depressions, and changes in slope which occurred between the 500-foot-spaced points were entered in the data file. Travel times were recorded on Fortran coding sheets for keypunching along with identification by line and shot-point number.

Part 7. Data Processing and Machine Contouring
J. M. Widmier

The maps included as illustrations in this report, as well as numerous supplementary maps listed in Appendix B, are computer-contoured maps which were generated in two basic steps. First, the Humble Exploration Computer System was used to create a master data file by merging the Offshore Navigation, Inc. (ONI), x-y coordinate data with Super-3 Sparkarray and 3.5-kHz EDO echosounder interpretive data (fig. 23). Then, using a specially formatted data tape made from the master data file, surface operations (time-to-depth conversion, isopach and percent-slope calculation, etc.) and map contouring were done by the surface approximation and contour mapping system (SACM), a system developed at Esso Production Research Company. This latter step was done in two phases (fig. 24) which were separated by a critical review by Humble's Western Division staff.

This section describes these two basic processing steps and the data editing and correction procedures used in each one. In both steps Esso Production Research Company assumed responsibility for data

capture and editing for errors. Displays for editing during the first step and data storage, retrieval, and correction were made through use of programs of the Humble Exploration Computer System. The actual data storage and retrieval were handled by a part of this system known as the Humble Information System (HIS).

In making the master data file of Humble ONI x-y coordinate data were first entered and then followed by the EDO and Super-3 interpreted data, respectively (fig. 23). The ONI tape contained x-y coordinates and line and shot-point identifications for every fifth shot point. As an initial step, a preliminary master file of the x-y data was created, and a shot-point base map was made from this file for data editing. Errors detected on the base map were then corrected in the master data file. The final step in making the x-y master data file was a linear interpolation between the surveyed shot points (every fifth shot point) to obtain an x-y coordinate for each intermediate shot point.

Line and shot-point numbers and interpreted horizon times on the EDO and Super-3 sections were hand-digitized on coding forms for key punching, and the punched IBM cards were then merged with the x-y master data file. Manual digitizing was selected over machine digitizing because the nonlinear horizontal and changing vertical scales presented formidable obstacles to efficient machine digitizing. To edit carefully the numerous errors inherent in manual digitizing, a cross-section profile of each line was printed on an IBM printer-plotter. Errors detected on these plots were corrected before the horizon data were merged with the x-y master data file.

Two-way reflection times to water bottom and horizon A were digitized on the EDO sections. In addition, a combined correction for towing depth, tide, and scale or keying changes was also entered for each shot point at this stage. Similarly, two-way reflection times to horizons B, C, and D were recorded for Super-3 sections, but no correction factor was necessary for these sections. As indicated in figure 23, the EDO and Super-3 digitized data were merged separately into the master data file.

Upon completion of the master data file, computer programs were used to apply the EDO correction to calculate the true water bottom and horizon A reflection times and then to make a tape with proper format for use in the SACM mapping system in the second basic step of the processing procedure.

In the second step (fig. 24), SACM (surface approximation and contour mapping) was used to convert horizon reflection times to depths, to do basic isopach and structure calculations, to calculate special surfaces such as percent slope and trend surfaces, and to generate plot tapes of these surfaces for display on a CalComp plotter. The first two operations in SACM are (1) data preparation, in which input data are re-ordered on the basis of increasing x coordinates, and (2) grid generation, in which a uniform grid of values is calculated for each horizon from the irregularly spaced input points.

For this project two sets of grids were calculated. A grid having grid corners at 600-foot spacing was calculated for the EDO water-bottom and horizon A reflections, whereas a 400-foot grid was used for Super-3 horizons B, C, and D. Since the EDO water-bottom reflection was used as the valid bathymetry measurement, it was also necessary to generate a 400-foot grid of it for calculation of horizon B, C, and D structure and isopach maps (see discussion below). All maps of the Super-3 horizons are thus made from 400-foot grids, whereas bathymetry, percent slope, and horizon A maps are made from 600-foot grids.

The surface operations performed on these grids and the output of these operations are summarized as follows:

1) (1/2 horizon two-way time) - (1/2 water-bottom two-way time) = water bottom to horizon isochron.

2) (Water bottom to horizon isochron) x (5,400 ft/sec sediment velocity) = water bottom to horizon isopach in feet.

3) (Water bottom) x (4,800 ft/sec water velocity) = bathymetry.

4) (Bathymetry) + (water bottom to horizon isopach) = horizon structure.

5) [Horizon (X+1) structure] - [horizon (X) structure] = isopach between horizons.

6) First derivative of bathymetry = percent-slope map.

7) (Bathymetry) + (isopach between horizons) = approximation of paleostructure. As an example, bathymetry plus the isopach from horizons C to D gives an approximation of horizon D structure at the time of deposition of horizon C. This estimate of paleostructure will be no better than the key assumption that present-day bathymetry is the same as that at the time of deposition of horizon C.

8) (Horizon structure) - (horizon trend surfaces) = residual structure. This was done for horizon D using both second- and fourth-order trend surfaces.

9) (Horizon structure) - (smoothed horizon structure) = residual structure. In this method, which is an alternative to (8) above, a second-order polynomial is fitted to the horizon grid intersections within a circular area having a radius determined by the severity of smoothing desired. This surface is then subtracted from the original horizon surface to get a residual-structure map.

10) Plot of profiles parallel to the x coordinate with perspective geometry calculated = perspective views. This was done for the bathymetry and horizon D structure for the whole area and, for area 8, detailed bathymetry.

Of these ten operations, the first six and their output maps were run in the first phase of the machine-mapping step. The procedure and maps were then reviewed. Obvious data errors still remaining, and additional data, led to updating of the first master data file and subsequent creation of the second master data file (fig. 24).

In the second phase of mapping, all ten surface operations were performed, and maps were machine-contoured. A few errors remained after the first run of this second phase, but, upon correction of the SACM data tape, a final set of maps was obtained. On completion of these maps a final update, including calculation and storage of horizon depths, was made on the master data file through use of the Humble Exploration Computer System.

Part 8. Map Accuracy
R. A. Hoover

Nonsystematic Observational Errors

The following are estimated limits of observational error for bathymetry, percent-slope, and horizon A maps:

1) Profile-reading error = ±1 ms or ±2.4 feet at 4,880 feet/second

2) Towing-depth-correction error = ±1 ms or ±2.4 feet

3) Instrumental error = ±1 ms or ±2.4 feet

4) Tide-correction error = ±1.0 feet

5) Instrument resolution = ±1 ms or ±2.4 feet

Maximum cumulative error ±10.6 feet

The maximum cumulative error would occur only when all error factors for a single data value were either positive or negative maximum values. Because it is very unlikely that this would happen, the actual cumulative errors were probably much smaller.

For data taken from Super-3 Sparkarray profiles (seismic horizons B, C, and D), the observational-error limits are estimated to be as follows:

Profile-reading error	= ±2.5 ms or ±6.7 feet at 5,400 feet/second	
Instrumental error	= ±1 ms or ±2.7 feet	
Instrument resolution	= ±4 ms or ±10.8 feet	
Maximum cumulative error on 3.5-kHz EDO profiles[1]		±10.6 feet
Maximum cumulative error		±30.8 feet

Profile-reading errors and the towing-depth-correction error are attributable to scale inaccuracies (on the profile and on the overlay used for time measurements), inaccurate reading, and rounding of the towing-depth correction to the nearest millisecond.

Instrumental error accounts for delays in transducer and recorder circuits and fluctuations in voltage and frequency of the shipboard power supply.

Tide corrections were obtained from tables which listed hourly tide heights (above or below MLLW). An average tide height was chosen to represent the tide correction for each north-south bathymetric profile over the period of time that it was run (usually about 1 hour). Because the tide height was changing continuously during surveying, the average height chosen does not precisely represent the tide height at the beginning and end of the line. The rate of change of tide height did not exceed 0.5 foot/hour during the survey period, and the difference between the average height chosen and the actual height at the beginning and end of the line is probably no greater than 0.25 foot. The tide correction in feet was converted to time in milliseconds (using 4,880 feet/second) and rounded to the nearest millisecond. The error caused by rounding and use of the nominal 4,880-foot/second velocity is probably no larger than 0.75 foot.

Instrument resolution can be determined empirically by examining records to find the smallest change in depth recorded over a short record length of a few sweeps. Ignoring regularly spaced "waves" in the record caused by ship motion, the smallest features visible on the 3.5-kHz EDO profiles are about 1 ms high. Thus, the instrument resolution can be considered as ±1 ms at the worst. Similarly, instrument resolution on Super-3 Sparkarray profiles is estimated to be ±4 ms.

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[1] The maximum cumulative error on 3.5-kHz EDO profiles must be added because two-way times for subsea depths to seismic horizons B, C, and D were obtained by adding the water-bottom two-way time to the difference between each two-way time for the seismic horizon and the water bottom.

Systematic Errors and Their Correction

Depth Error Resulting From Positioning Inaccuracy. This error is nonsystematic in its occurrence but can be considered in terms of a systematic or predictable relation between range accuracy of the positioning system and percent slope (fig. 25). Positioning is more critical on steeper slopes, but it should be noted that within the survey area, where slopes do not exceed 20 percent, the magnitude of the depth error resulting from positioning inaccuracy does not exceed the maximum cumulative observational error (10.6 feet) for bathymetry on 3.5-kHz EDO profiles.

Depth Errors Resulting from Use of Constant Average Velocities. The velocity structures of both the water column and subsurface sediments are complex. Velocity of sound in water varies with salinity, temperature, and depth. Depending on the complexity of layering in a water mass, any nominal average velocity chosen to represent the velocity of sound is an approximation, the accuracy of which depends on water depth.

Data on velocity of sound in Santa Barbara Channel are sparse. Figure 26 shows variations in average velocity with water depth calculated from temperature, salinity, and interval velocities in two vertical profiles. The profiles are approximately 3 nautical miles apart and were run within two years (1964 and 1965) during the winter. With respect to these data, the nominal velocity of sound in water ($\bar{V}$) chosen for this study is too low in water depths less than 1,400 feet.

In order to make a better evaluation of the error in depth caused by use of constant average velocities, figure 27 shows corrections which could be applied to increase (positive values) or decrease (negative values) water depth at a particular map location, where the water depth is shown in terms of $\bar{V}$ = 4,880 feet/second. A number of other constant average velocities are shown for comparison. The observed $\bar{V}$ range was constructed by finding the intercepts of the two average-velocity profiles with each of the constant average velocities (vertical lines) in figure 26. Had an average velocity of 4,930 feet/second been chosen, for example, all water depths below about 200 feet would have appeared too deep. The amount of correction for map water depth necessary using a nominal average velocity of 4,880 feet/second can be read on the figure by finding a depth (for example, 800 feet) and moving upward along a vertical line (about 2.5 feet) until the point falls near the center of the observed $\bar{V}$ range based on the data available. This value (2.5 feet) should be added to all points on the map where the water depth is shown as 800 feet. Figure 27 also shows, however, that the error resulting from this choice of nominal velocity is well within the limits of maximum cumulative observational error. When better velocity data are available, all the maps in the survey can be recomputed, if necessary, using a different average velocity and the two-way times stored in the master data file.

The velocity of sound is much more variable in sediments than in water. Velocity depends on degree of consolidation, porosity, amount of entrapped water, internal pore pressure, grain size, and incipient cementation, all of which affect elasticity and density--bulk properties which can be related directly to velocity. Despite wide variation in properties, velocity can be fairly accurately estimated in terms of an average velocity in the upper 1,000 to 2,000 feet of unconsolidated sediment. Data on interval velocities from a sonic log in the upper 1,500 feet of sediment in well OCS P-0188, No. 3 were analyzed, and an average velocity of 5,400 feet/second was determined. As with the water velocity data, if new data are obtained and they indicate the necessity for use of a different average velocity, all subsurface maps can easily be recomputed.

Depth Corrections for Sloping Surfaces. The sound cone that emanates from a modern echosounding transducer, such as the one used to obtain the 3.5-kHz EDO profiles, has an apical angle of 30°. On sloping surfaces, the arrival of sound energy with the shortest travel path, i.e., perpendicular to the surface, is recorded as the two-way time to that surface (fig. 28). Our measurements of water depth and subsurface depths are represented in terms of vertical distance. In order to represent accurately the depth at a specific location, an amount must be added to depths shown on the maps, because the actual depth (vertical distance) is deeper than the shortest ray-path distance (perpendicular to the surface). The amount to be added depends on angle of slope (Θ) or percent slope (S) and apparent water depth (D). The true water depth (H) can be calculated as follows:

$$\cos \Theta = \frac{D}{H},$$

$$H = D \left(\frac{1}{\cos \Theta}\right) = D\sqrt{1 + \tan^2\Theta}.$$

Percent slope, S, = 100 tan Θ,

$$\text{or } \tan \Theta = \frac{S}{100} = S \times 10^{-2}.$$

$$\text{Then, } H = D \sqrt{1 + S^2 \times 10^{-4}}.$$

Using this relationship, a table of map correction values (table 6) for various apparent water depths (D) and percent slopes (S) has been compiled. The values in the table are to be added to depths indicated on the map. They represent the differences between true and apparent water depths,

$$(H - D) = D(\sqrt{1 + S^2 \times 10^{-4}} - 1) ,$$

and are always positive values.

A dashed line has been drawn, separating the areas of the table in which the values of (H-D) are greater than and less than the maximum cumulative observation error. In general, in mapped areas where percent slope is less than 10 percent, the correction to be added is less than the observation error. This is also true, regardless of percent slope (up to 20 percent), in water depths less than 500 feet.

APPARENT DEPTH, D, IN FEET	PERCENT SLOPE 2	4	6	8	10	12	14	16	18	20
100	.02	.08	.18	.32	.5	.7	1.0	1.3	1.6	2.0
200	.04	.16	.36	.64	1.0	1.4	2.0	2.6	3.2	4.0
300	.06	.24	.54	.96	1.5	2.1	3.0	3.9	4.8	6.0
400	.08	.32	.72	1.28	2.0	2.8	4.0	5.2	6.4	8.0
500	.10	.40	.90	1.60	2.5	3.5	5.0	6.5	8.0	10.0
600	.12	.48	1.08	1.92	3.0	4.2	6.0	7.8	9.6	12.0
700	.14	.56	1.26	2.24	3.5	4.9	7.0	9.1	11.2	14.0
800	.16	.64	1.44	2.56	4.0	5.6	8.0	10.4	12.8	16.0
900	.18	.72	1.62	2.88	4.5	6.3	9.0	11.7	14.4	18.0
1000	.20	.80	1.80	3.20	5.0	7.0	10.0	13.0	16.0	20.0
1100	.22	.88	1.98	3.52	5.5	7.7	11.0	14.3	17.6	22.0
1200	.24	.96	2.16	3.84	6.0	8.4	12.0	15.6	19.2	24.0
1300	.26	1.04	2.34	4.16	6.5	9.1	13.0	16.9	20.8	26.0
1400	.28	1.12	2.52	4.48	7.0	9.8	14.0	18.2	22.4	28.0
1500	.30	1.20	2.70	4.80	7.5	10.5	15.0	19.5	24.0	30.0
1600	.32	1.28	2.88	5.12	8.0	11.2	16.0	20.8	25.0	32.0
1700	.34	1.36	3.06	5.44	8.5	11.9	17.0	22.1	27.2	34.0
1800	.36	1.44	3.24	5.76	9.0	12.6	18.0	23.4	28.8	36.0
1900	.38	1.52	3.42	6.08	9.5	13.3	19.0	24.7	30.4	38.0
2000	.40	1.60	3.60	6.40	10.0	14.0	20.0	26.0	32.0	40.0

Maximum cumulative observation error

Maximum cumulative observation error

Table 6. Depth corrections for sloping surfaces. All corrections are positive and should be added to values of apparent depth, D, to obtain true depth. All depths are in feet.

APPENDIX B - LIST OF MAPS AND DATA

I. Regional Maps; Scale, 1 Inch = 2,000 Feet.

A. Shot-point base map, location of high-resolution arcer and 3.5-kHz tracklines, GAI-GMX survey, 1970.

B. Machine-contoured maps.

1. Bathymetry, contour interval (CI) = 20'
2. Bathymetry, CI=20', smoothing level 2
3. Bathymetry, CI=40'

4. Percent slope, CI=2%

5. Horizon A structure, CI=20'
6. Horizon B structure, CI=50'
7. Horizon C structure, CI=50'
8. Horizon D structure, CI=50'

9. Thickness between water bottom & horizon A, CI=10', smoothing level 2
10. Thickness between water bottom & horizon B, CI=50'
11. Thickness between water bottom & horizon C, CI=50'
12. Thickness between water bottom & horizon D, CI=50'
13. Thickness between horizon A & horizon B, CI=50'
14. Thickness between horizon B & horizon C, CI=50'
15. Thickness between horizon C & horizon D, CI=50'
16. Thickness between horizon B & horizon D, CI=50'

17. Residual of horizon D structure, trend method, 4th order
18. Residual of horizon D structure, smoothing method, level 8

19. Paleostructure of horizon B at time of deposition of horizon A, CI=50'
20. Paleostructure of horizon C at time of deposition of horizon B, CI=50'
21. Paleostructure of horizon D at time of deposition of horizon C, CI=50'

II. Machine-Contoured Detailed Area Maps; Scale, 1 Inch = 1,000 Feet.

	Lambert Zone VI Coordinates	
	X	Y
Bathymetry, Area 1, CI=5'	839,400 to 847,800	829,000 to 834,400
Bathymetry, Area 2, CI=5'	829,800 to 838,200	830,200 to 835,600
Bathymetry, Area 3, CI=5'	826,800 to 835,200	826,000 to 831,400
Bathymetry, Area 4, CI=5'	815,400 to 823,800	827,200 to 832,600
Bathymetry, Area 5, CI=5'	796,800 to 805,200	829,000 to 835,000
Bathymetry, Area 6, CI=5'	775,200 to 783,600	819,400 to 824,800
Bathymetry, Area 7, CI=5'	766,200 to 774,600	829,000 to 834,400
Bathymetry, Area 8, CI=5'	829,800 to 845,400	814,600 to 830,200

Percent slope, Area 1, CI=1%
Percent slope, Area 2, CI=1%
Percent slope, Area 3, CI=1%
Percent slope, Area 4, CI=1%
Percent slope, Area 5, CI=1%
Percent slope, Area 6, CI=1%
Percent slope, Area 7, CI=1%
Percent slope, Area 8, CI=1%

III. Acoustic Profiles, GAI=GMX (EG&G) Survey, 1970.

A. Super-3 Sparkarray (3,000-joule arcer) field-monitor profiles.

B. 3.5-kHz EDO echosounder field-monitor profiles.

C. High-resolution boomer field-monitor profiles.

D. Side-scan sonar field-monitor records.

E. Field operations sheets.

IV. Offshore Navigation Inc., Positioning Data.

A. Field sheets.

B. Post-plot sheets with final computed survey positions.

C. Magnetic tape 1.

Magnetic tape 2 -- Includes line number, shot point, and x-y coordinates for each 5th-numbered shot point in Humble S-6 shot-point format.

V. Core-Hole Data, Caldrill I Coring Program.

A. Core log sheets - depth, core recovery, core segment numbers, brief shipboard descriptions.

B. Shipboard event log.

C. Shipboard summary sheets.

D. Laboratory descriptions - graphics logs and descriptions of lithology for all geologic coring sites.

E. Core photographs - 4" x 5" negatives and prints in black and white and color for all material from geologic coring sites.

VI. Paleontologic Data - *Globigerina pachyderma* coiling-direction ratio curves for all geologic coring sites.

V. Paleomagnetic Data - All basic and interpreted data.

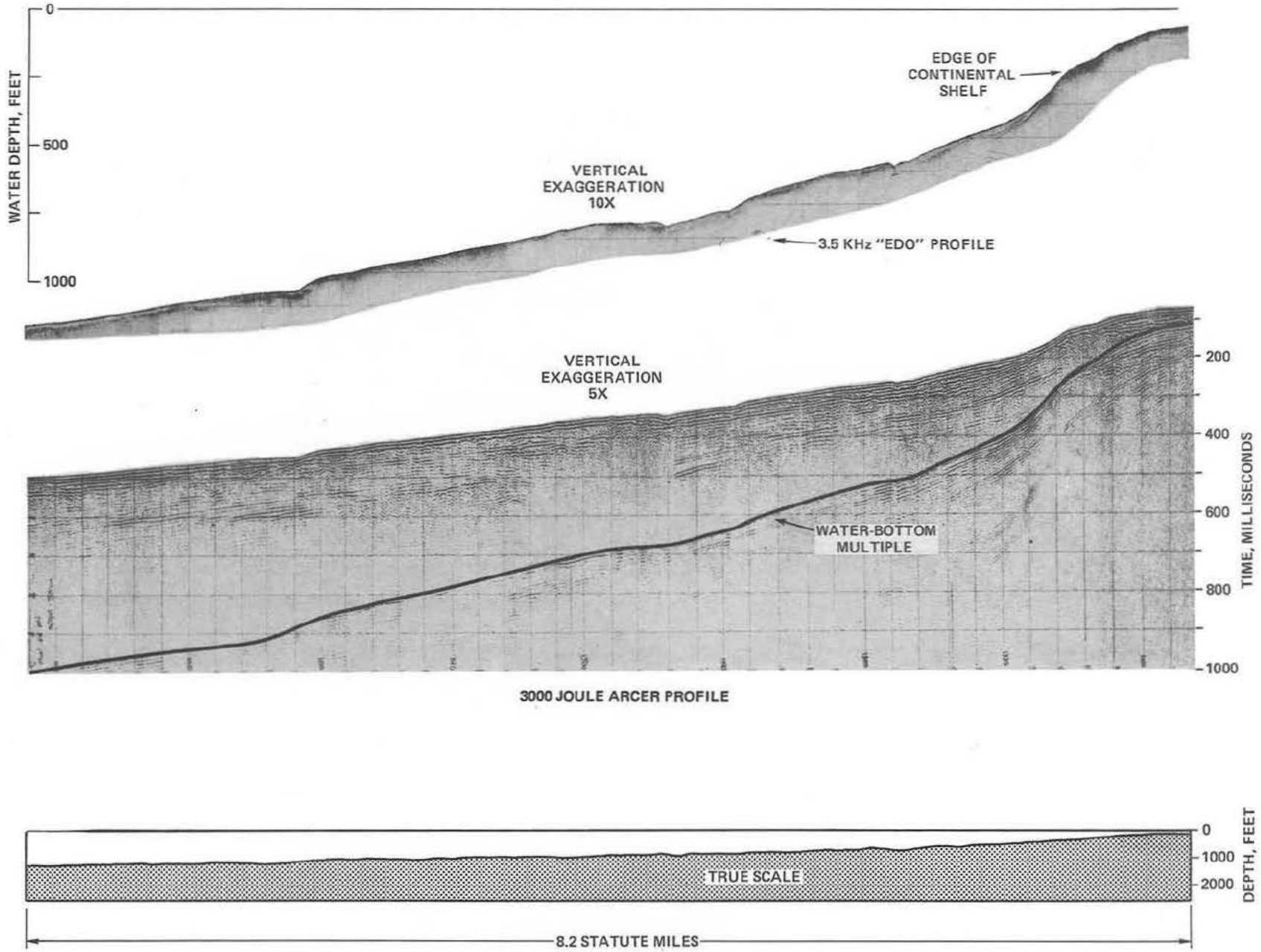

Figure 5. Line 306, submarine fan area. Super-3 Sparkarray (3000 joule arcer) and 3.5 KHz EDO profiles.

Bottomhole Locations

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

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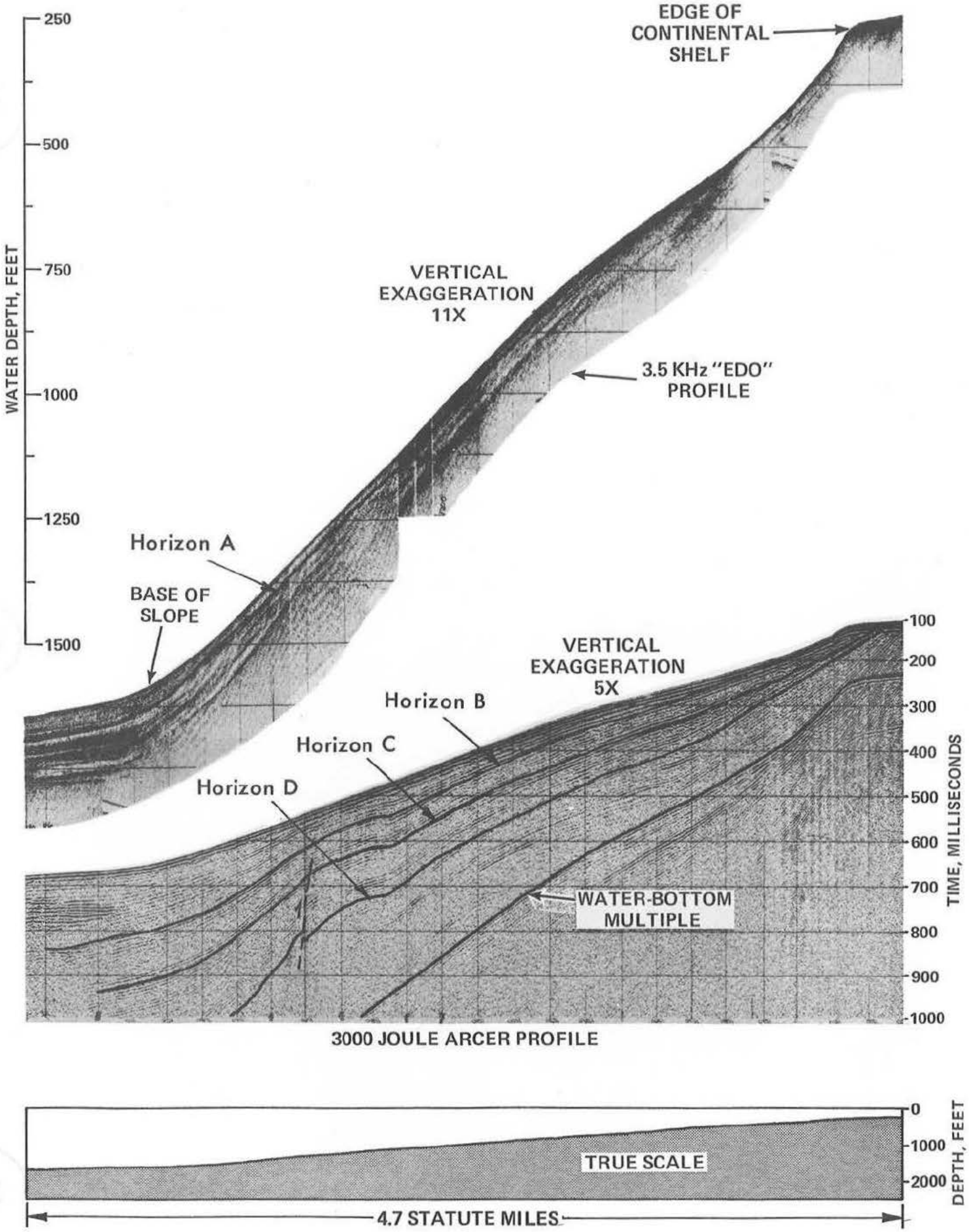

Figure 6. Line 88, smooth slope area. Super-3 Sparkarray (3000 joule arcer) and 3.5 KHz EDO profiles.

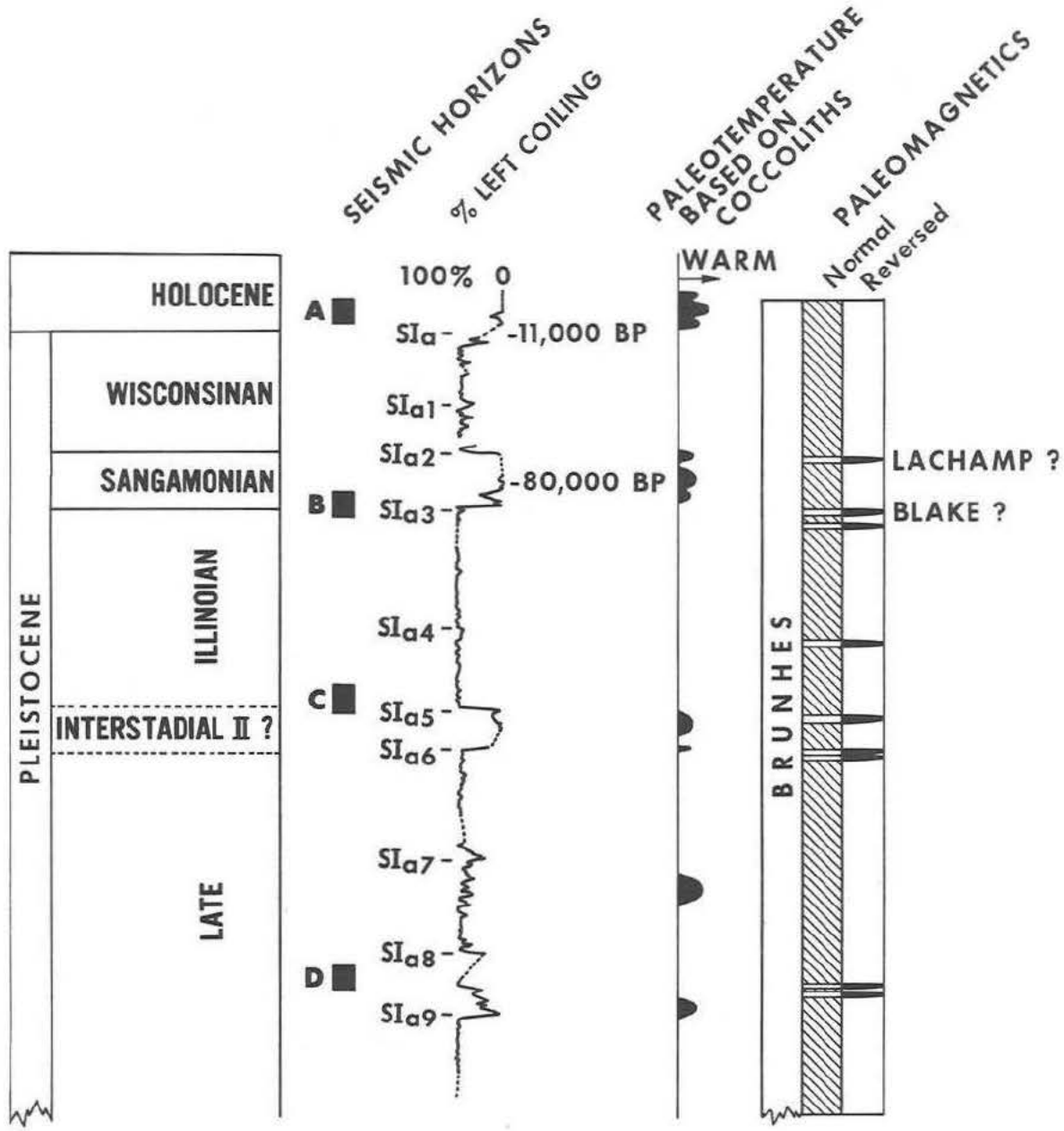

Figure 7. Stratigraphic column, core hole 190-B.

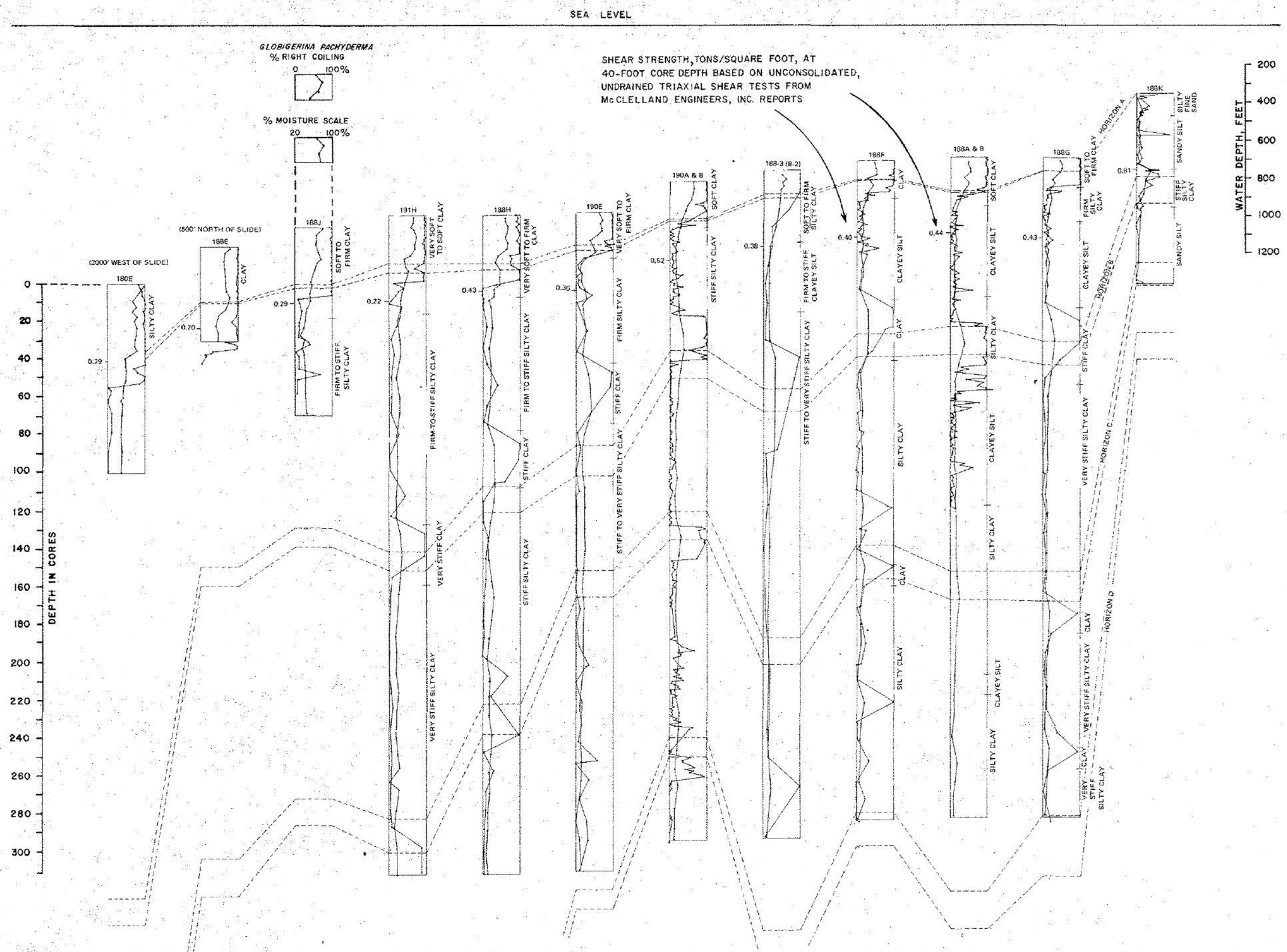

Figure 8. Relationships of Globigerina pachyderma coiling curves and seismic horizons (A, B, C, and D) to soil properties at 11 coring sites. Lithologic descriptions, percent moisture, and shear strengths are taken from McClelland Engineers, Inc. reports.

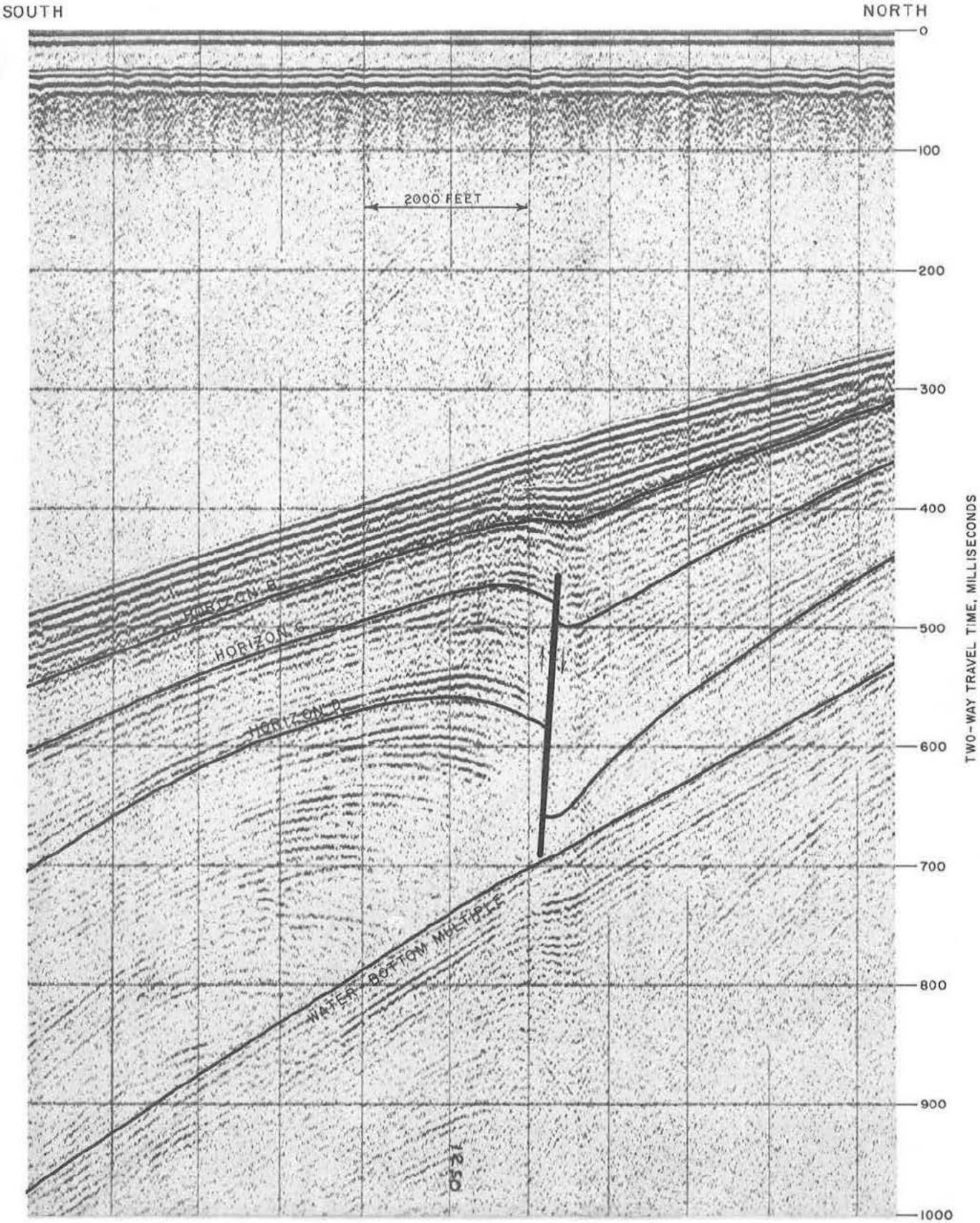

Figure 12. Super-3 Sparkarray Profile 184, showing a reverse fault with approximately 250 feet of throw on Horizon D. Profile location is shown on figures 11 and 18.

Bottomhole Locations

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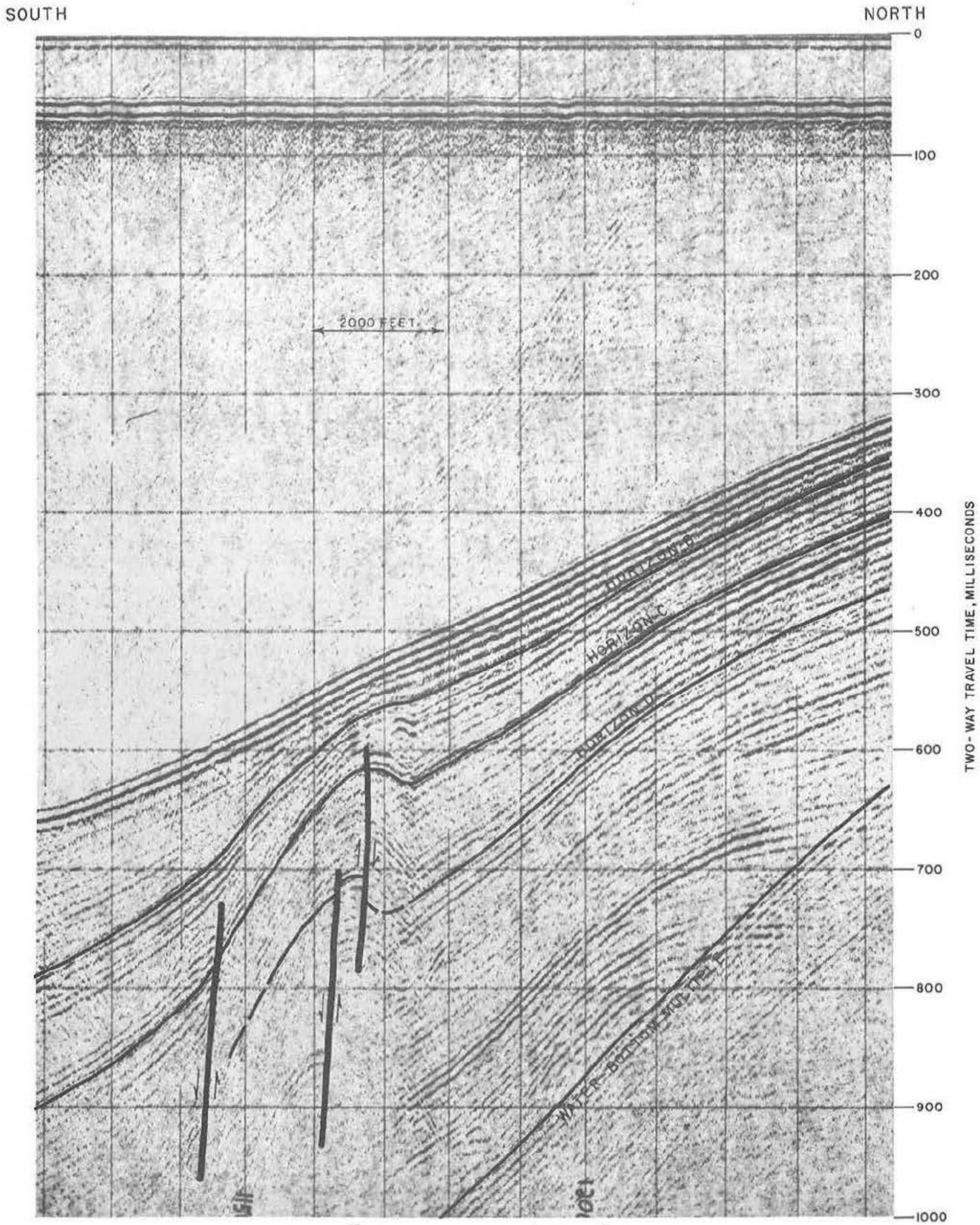

Figure 13. Super-3 Sparkarray Profile 98, showing normal and reverse faults near the base of the basin slope. Profile location is shown on figures 11 and 18.

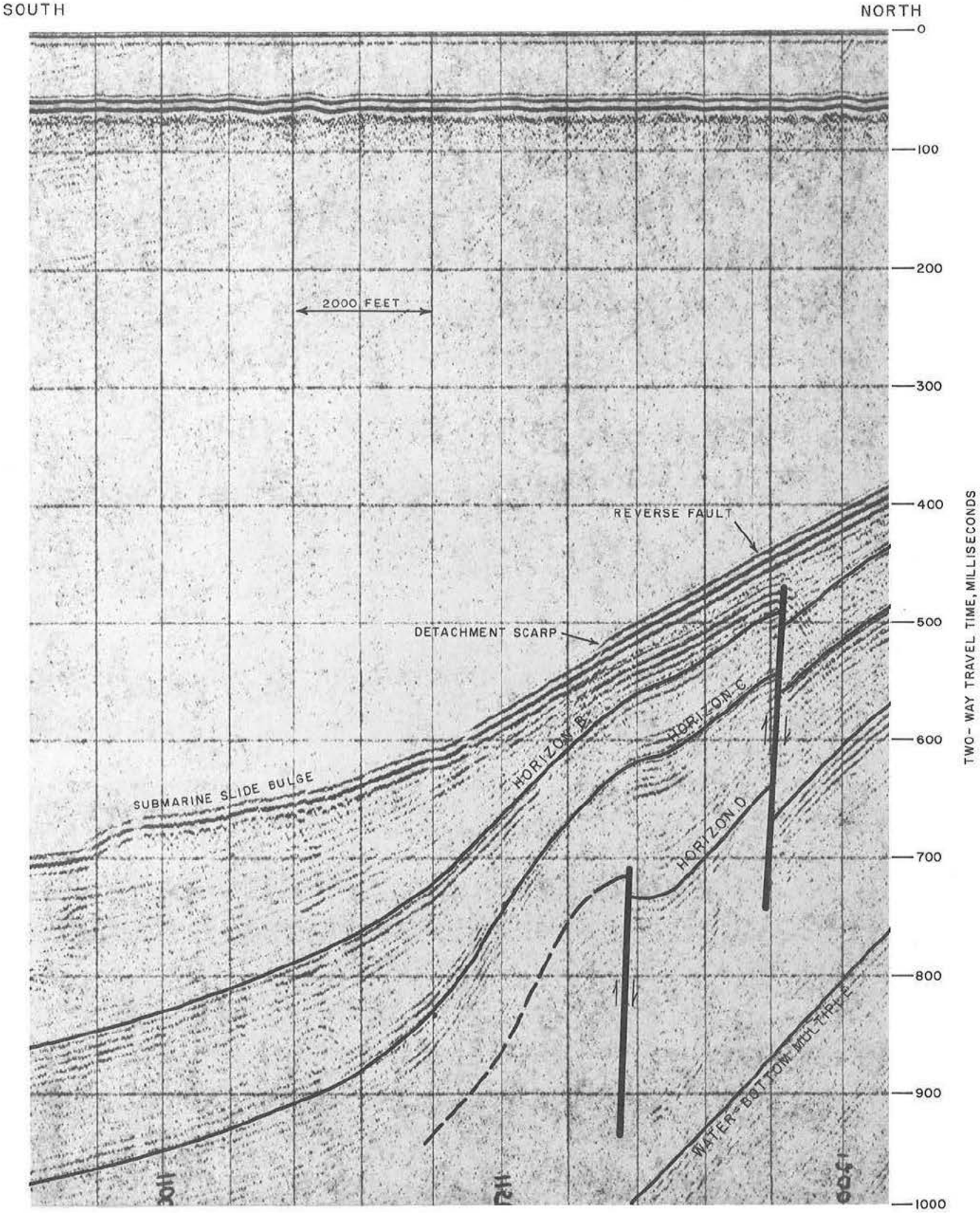

Figure 14. Super-3 Sparkarray Profile 62, showing a reverse fault cutting Horizon B upslope from submarine slide. Profile location is shown on figures 11 and 18.

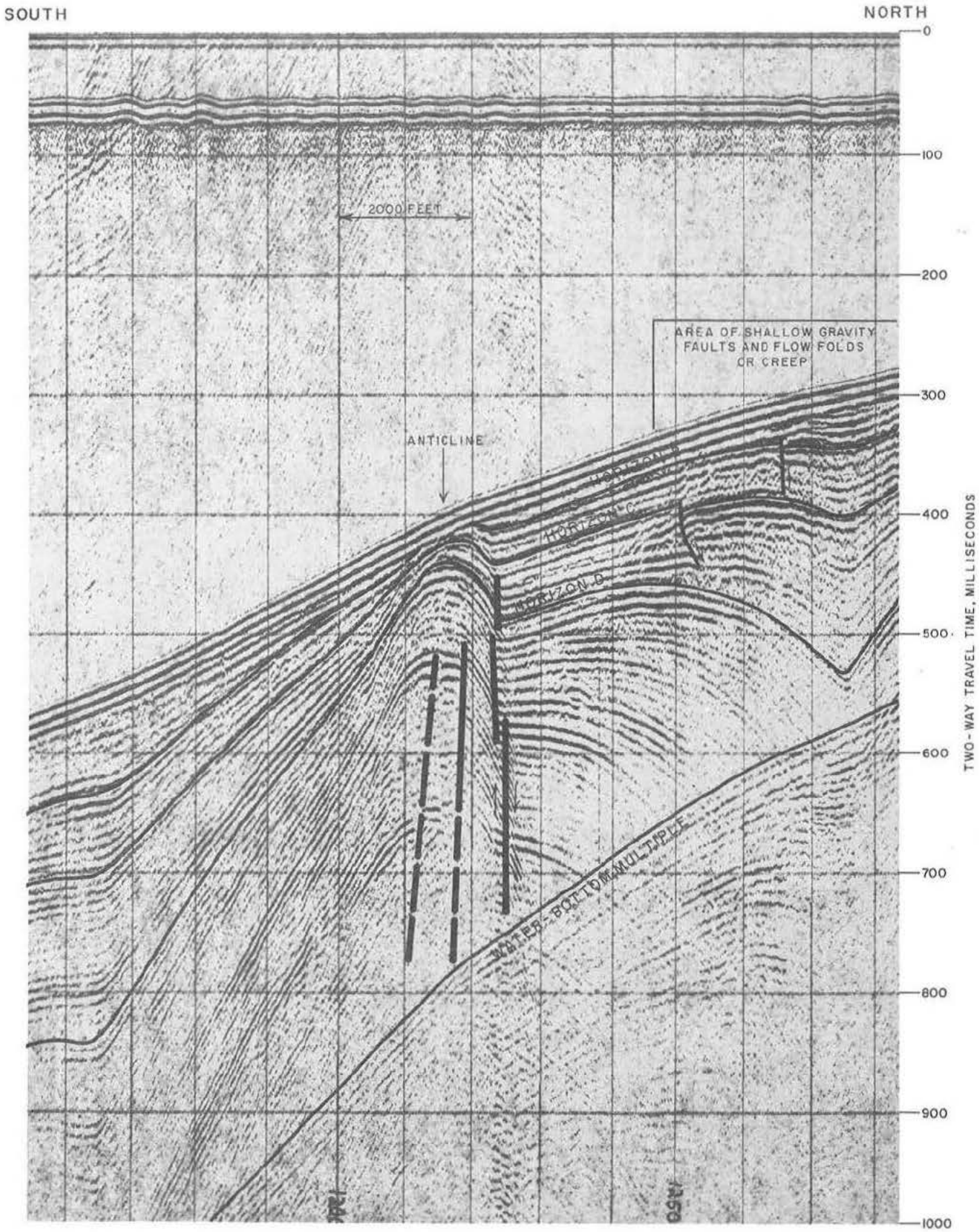

Figure 15. Super-3 Sparkarray Profile 138, showing northwest-southeast trending anticline uplifted against a series of reverse faults on the northeast flank. Profile also crosses area of small gravity faults and flow folds or creep (cf. figure 19). Profile location is shown on figures 11 and 18.

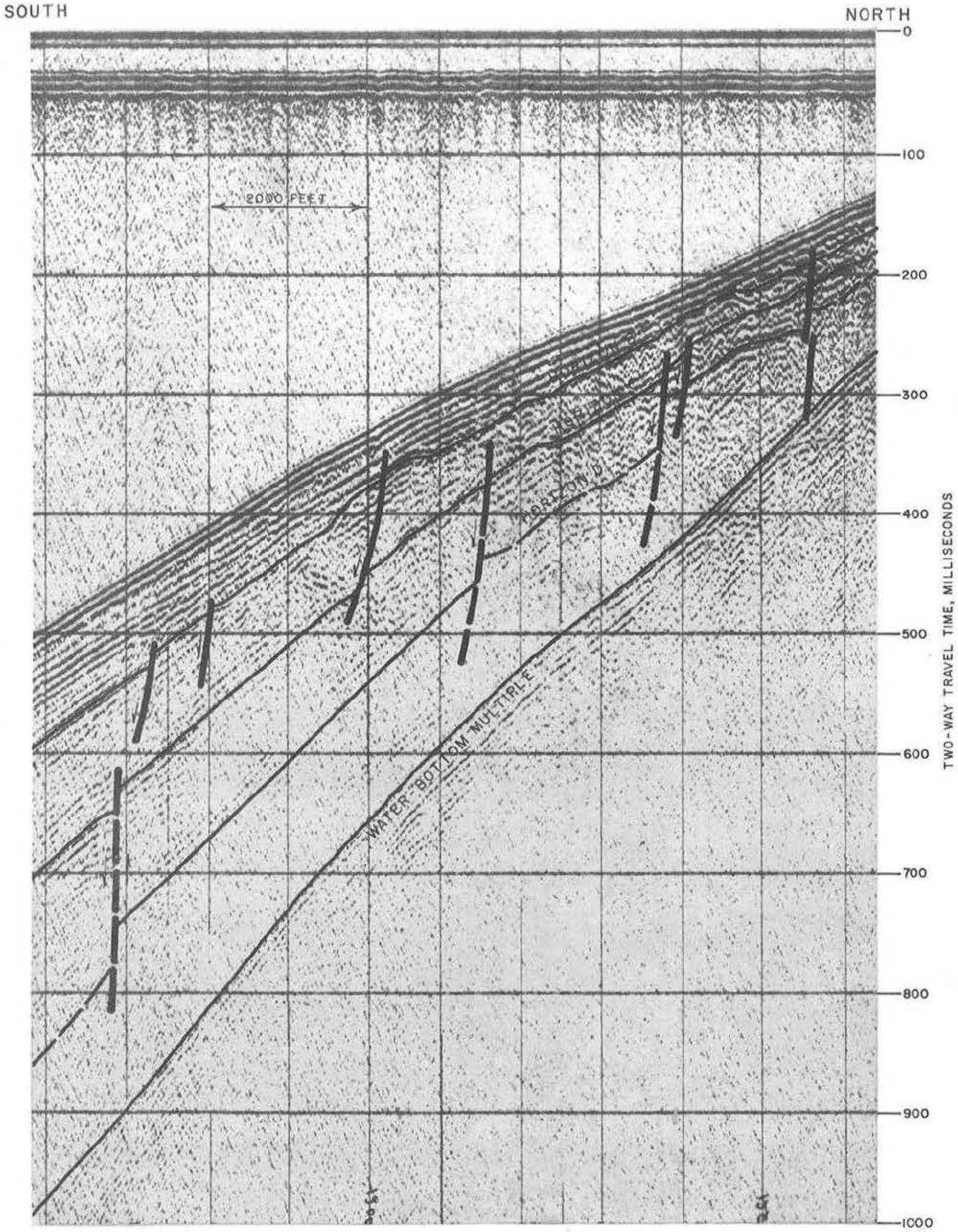

Figure 16. Super-3 Sparkarray Profile 4, showing normal faults downthrown to the south on the eastern basin slope. Profile location is shown on figures 11 and 18.

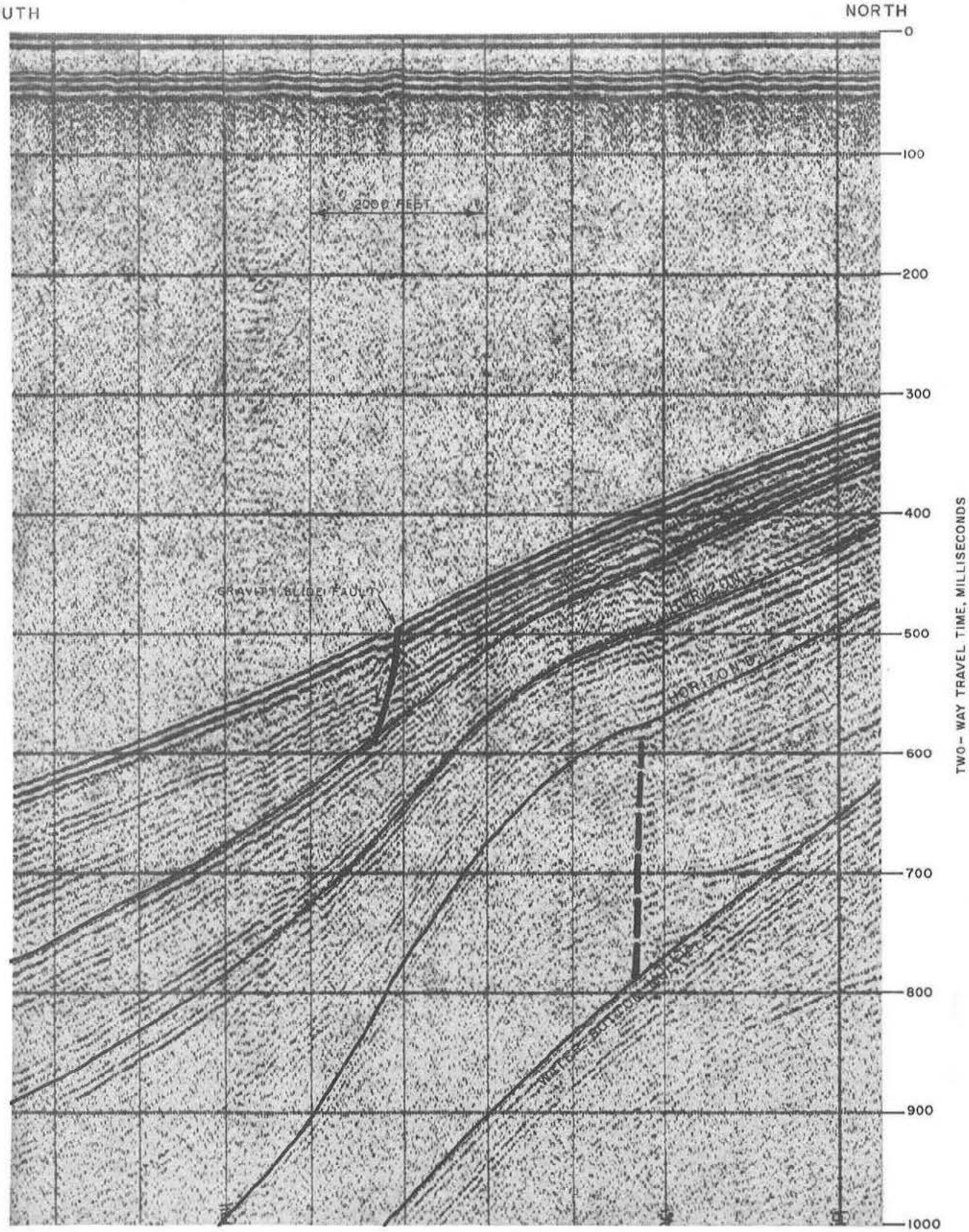

Figure 17. Super-3 Sparkarray Profile 44, showing gravity slide fault associated with a surface depression extending eastward from submarine slide detachment scarp. Profile location is shown on figures 11 and 18.

Bottomhole Locations

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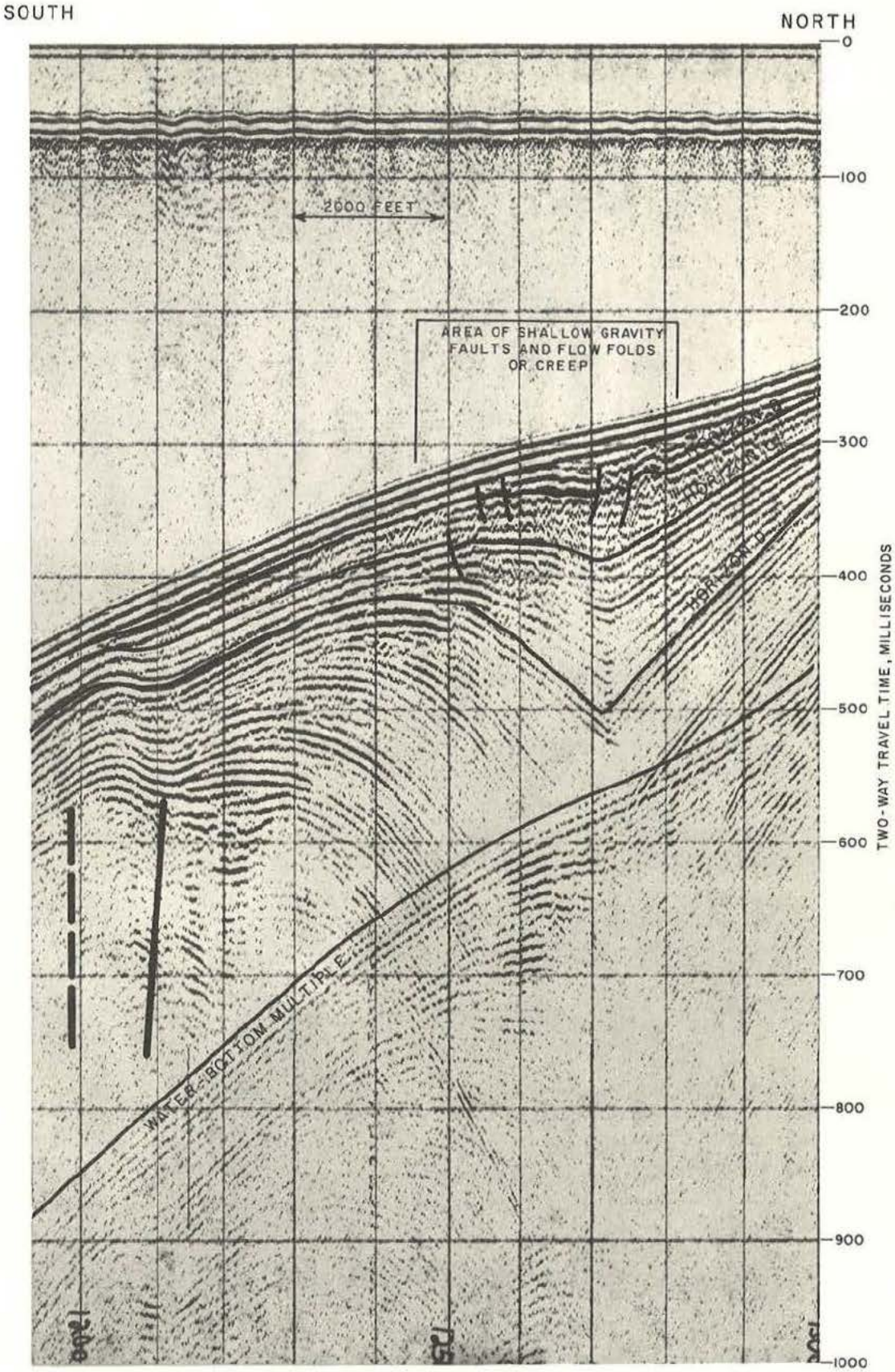


Figure 19. Super-3 Sparkarray Profile 126, showing area of shallow gravity faults and flow folds or creep. Profile location is shown on figures 11 and 18.

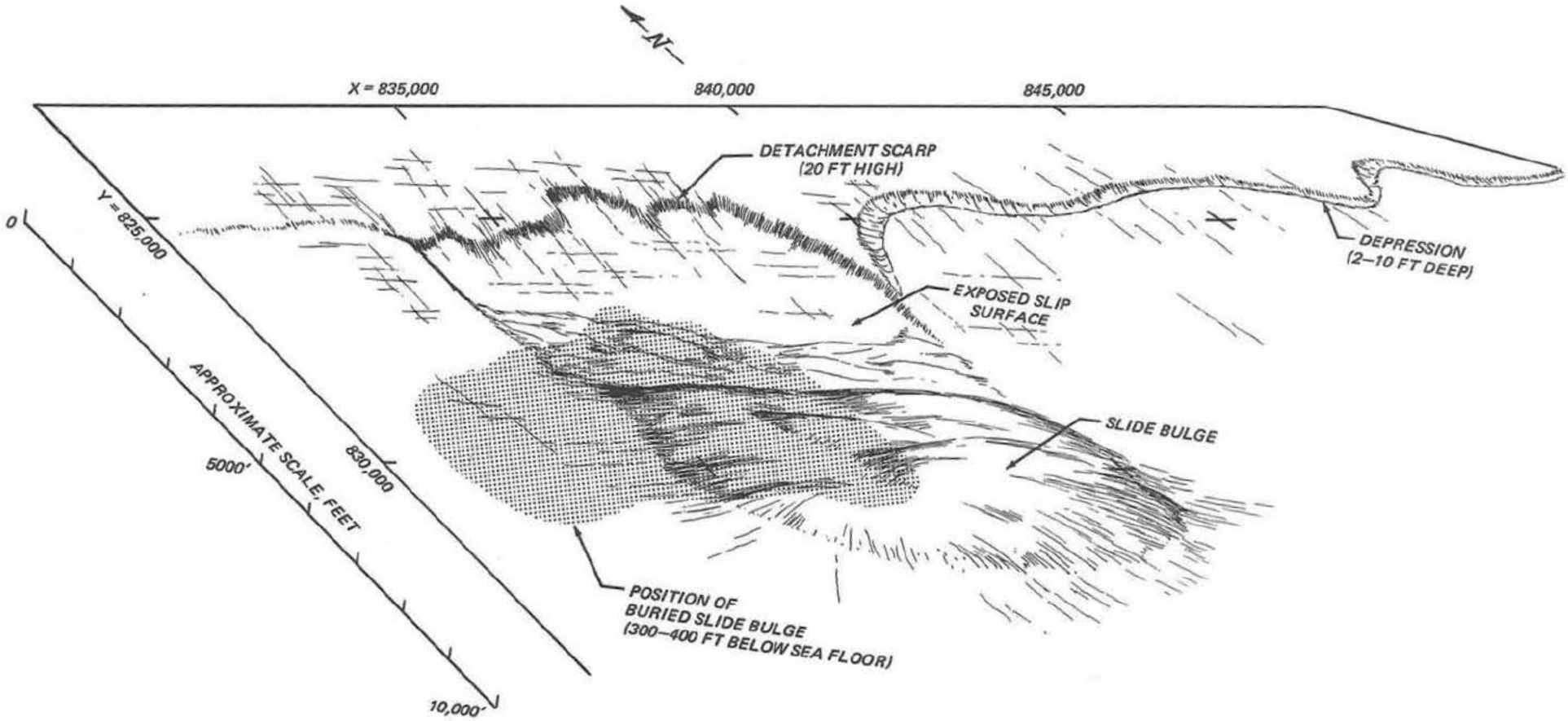


Figure 20. Diagrammatic sketch of submarine slide area. Scale and coordinate positions are approximate.

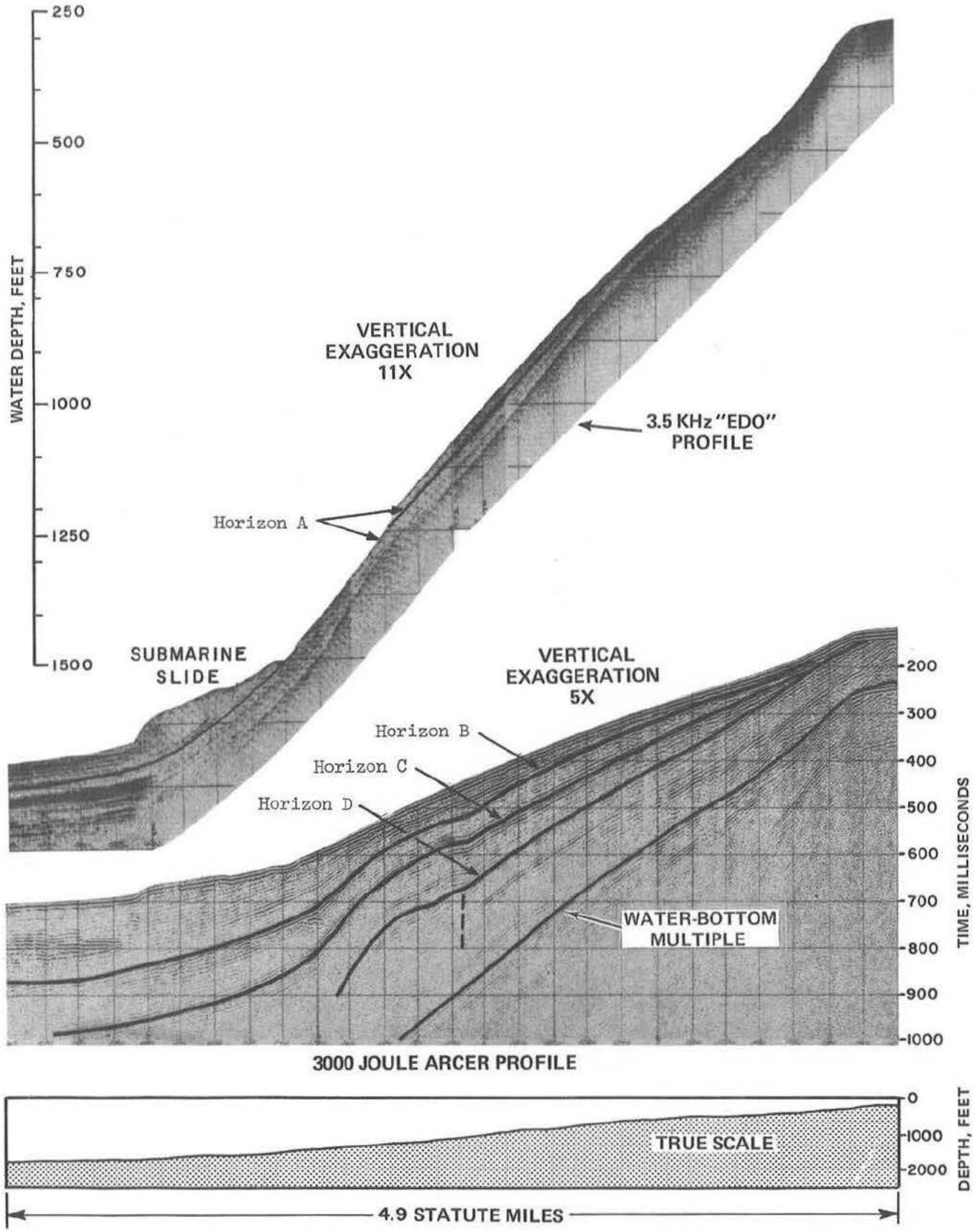


Figure 21. Line 68, Super-3 Sparkarray (3000 joule arcer) and 3.5 KHz EDO profiles.

Bottomhole Locations

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

Proprietary

Not for Public Release

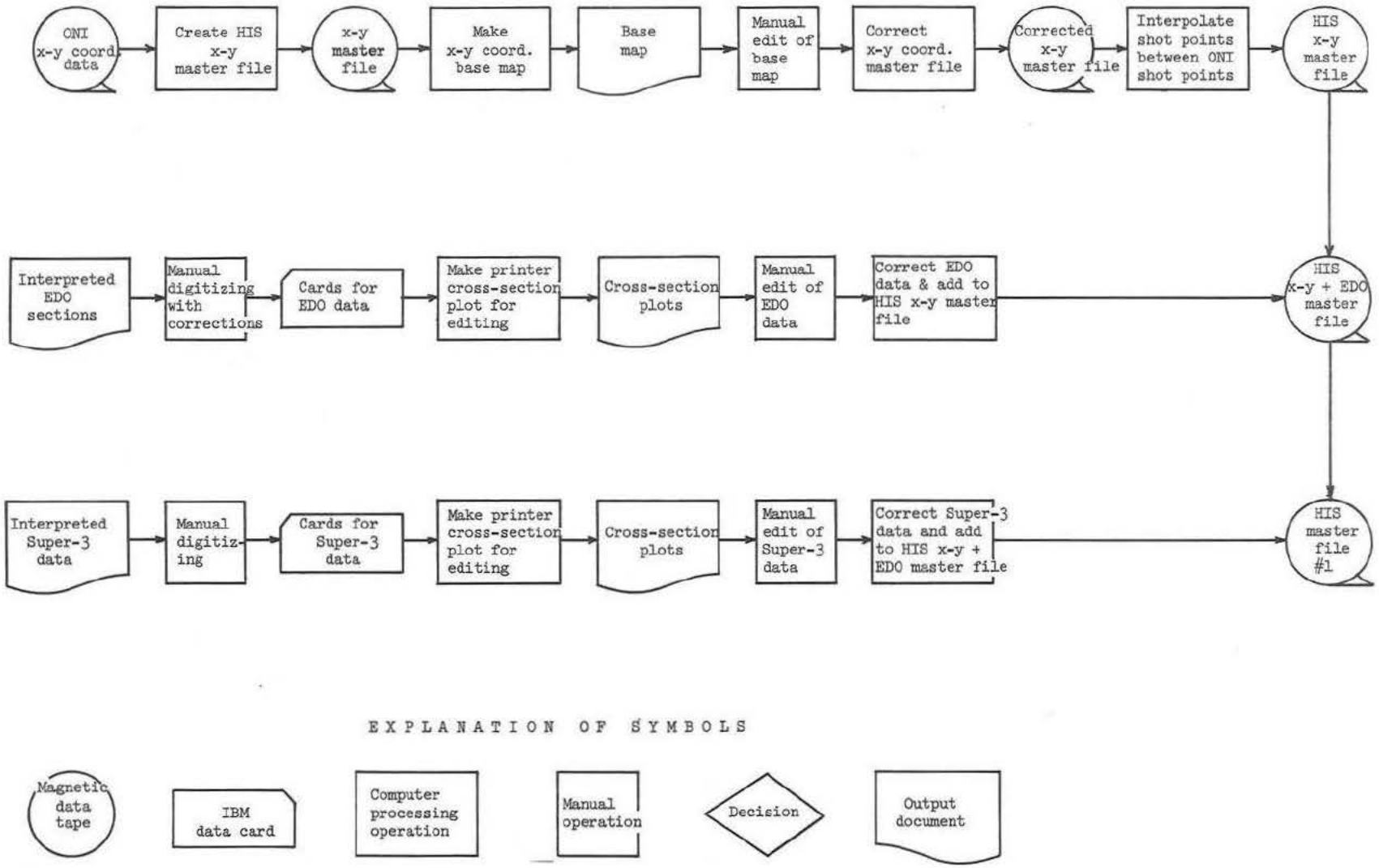


Figure 23. Flow chart for creating a Humble Information System (HIS) master data file.

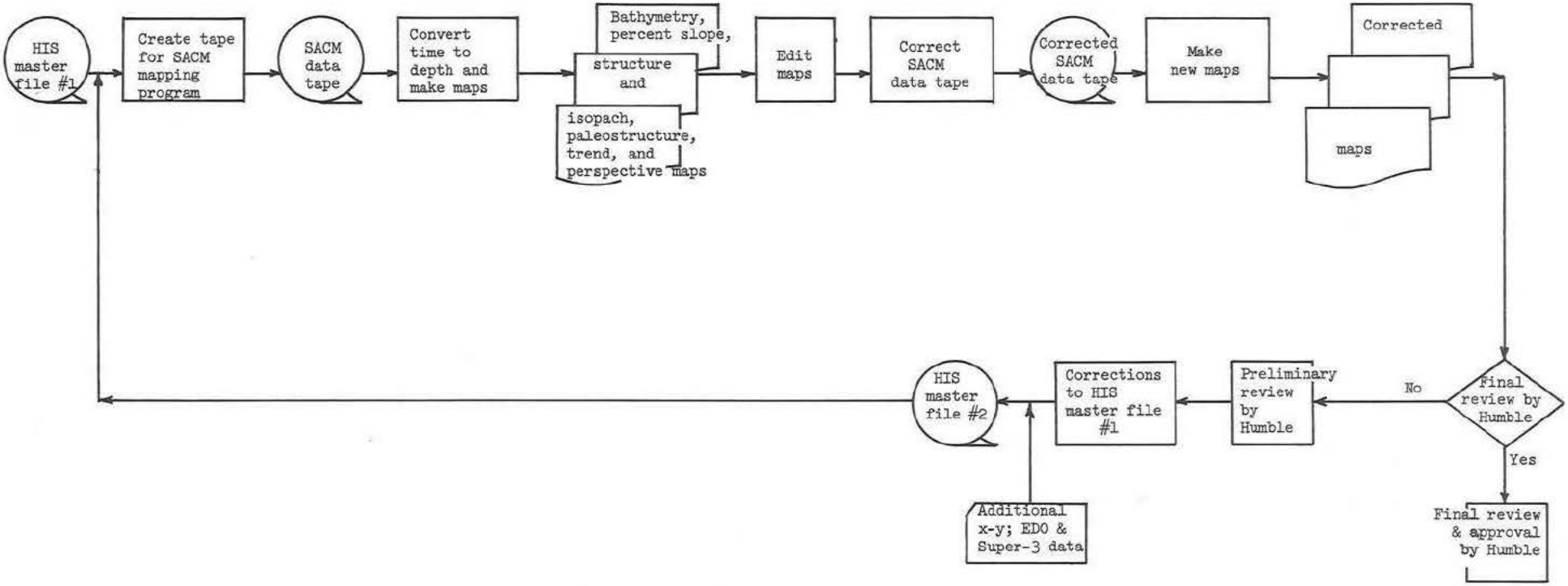


Figure 24. Flow chart for making machine-contoured maps from the HIS master data file.

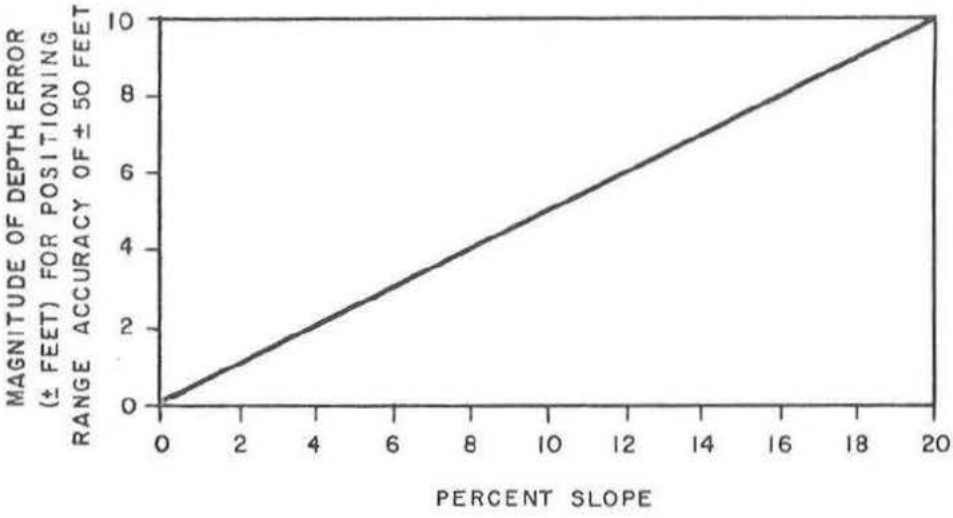


Figure 25. Possible depth error resulting from positioning error as a function of percent slope.

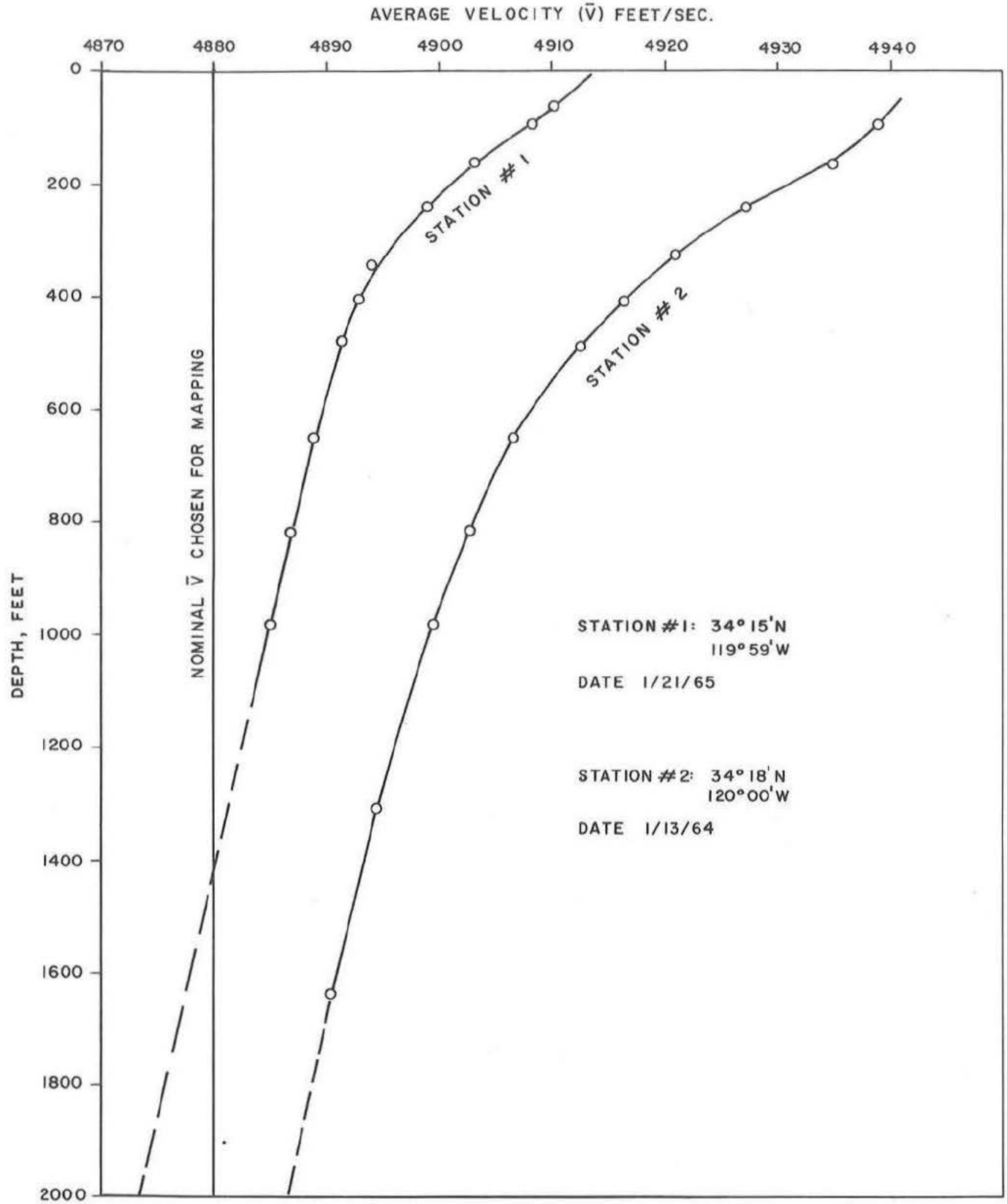


Figure 26. Santa Barbara Channel, average velocity of sound vs. depth for two stations.

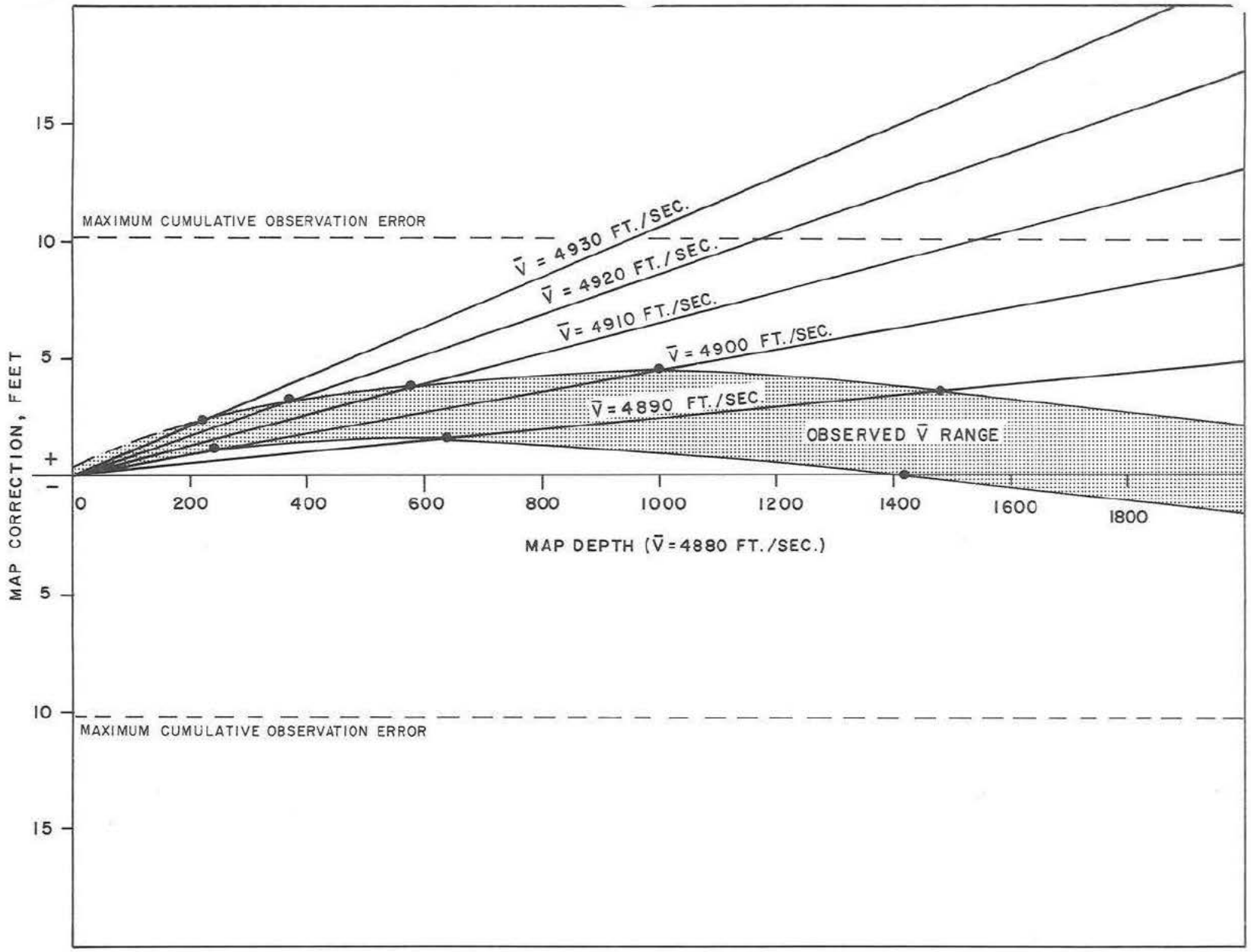


Figure 27. Map correction vs. water depth for several constant average velocities.

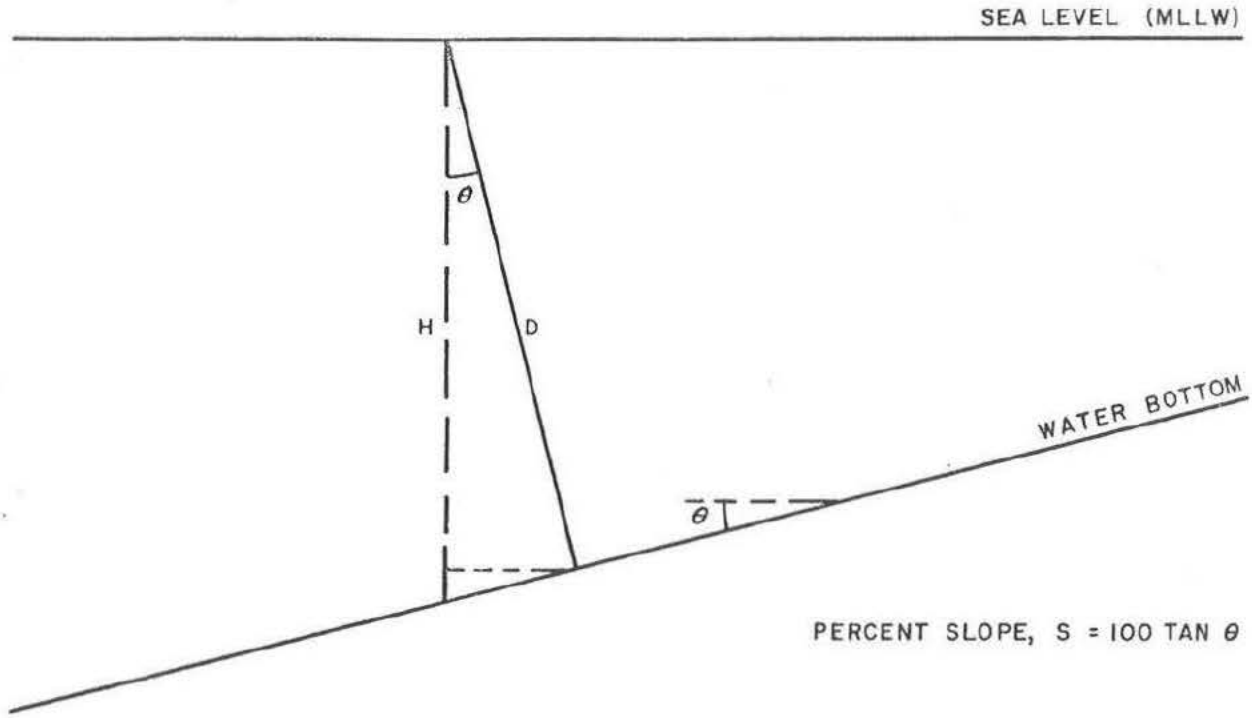


Figure 28. Relationship between true depth, H, and apparent depth, D. Angle θ is the angle of slope. Distance D represents the shortest ray path, perpendicular to the sloping water bottom.

APPENDIX 1.4

SUPPLEMENTAL PLAN OF OPERATIONS

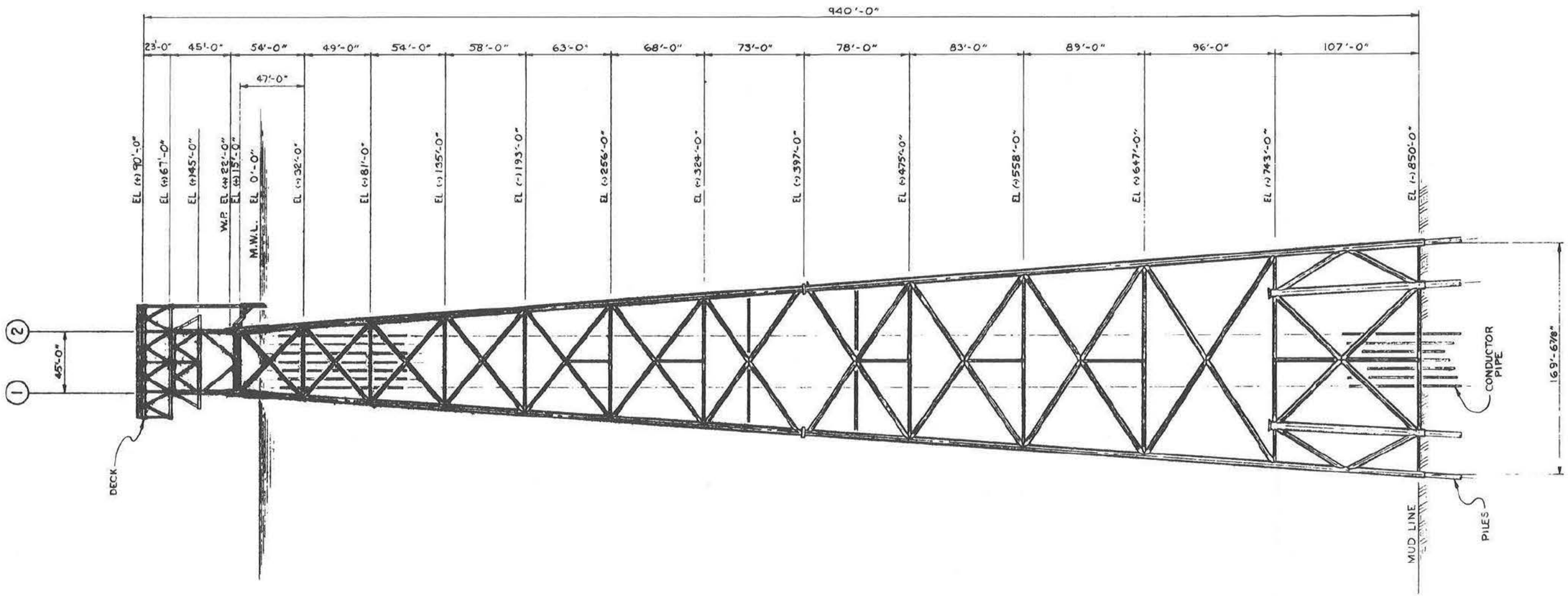
SANTA YNEZ UNIT

APPENDIX 1.4

Platform Drawings HQE 215 - 1 through 13

Humble Oil & Refining Company

(Section Revised)



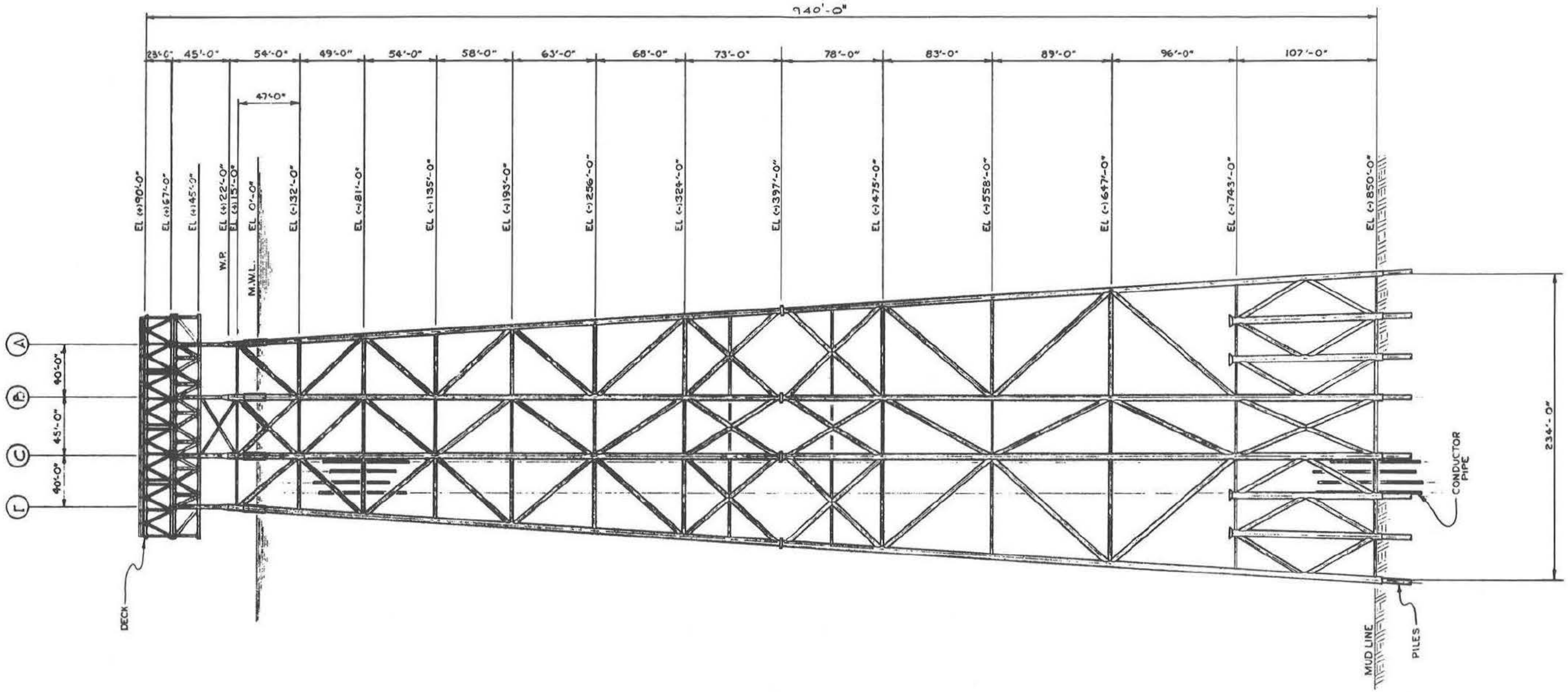
SOUTH ELEVATION

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85'x 68' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN R.E. COLE
ENGR. DIRECTION
CHECKED
APPROVED
SCALE 1" = 40'
DATE 8-30-73
JOB NO.
FILE NO. HQE 215-1



EAST ELEVATION

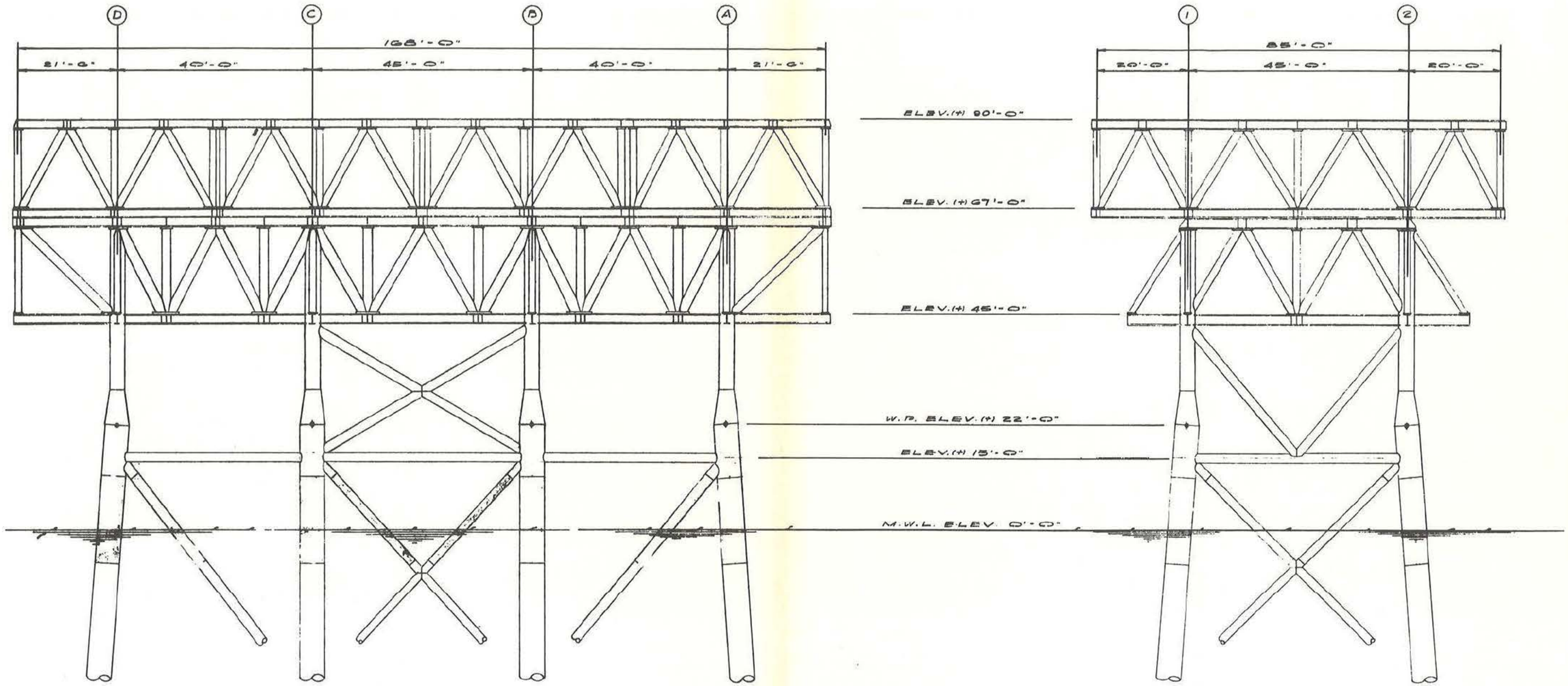
NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

86'x168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

DRAWN R.E. COLE
CHECKED K. Cole
EXPR. ENGTHGR. W.J. Berg
APPROVED

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

SCALE 1" = 40'
DATE 8-9-72
JOB NO.
FILE NO. HQE 215-2



EAST ELEVATION

3/32" = 1'-0"

SOUTH ELEVATION

3/32" = 1'-0"

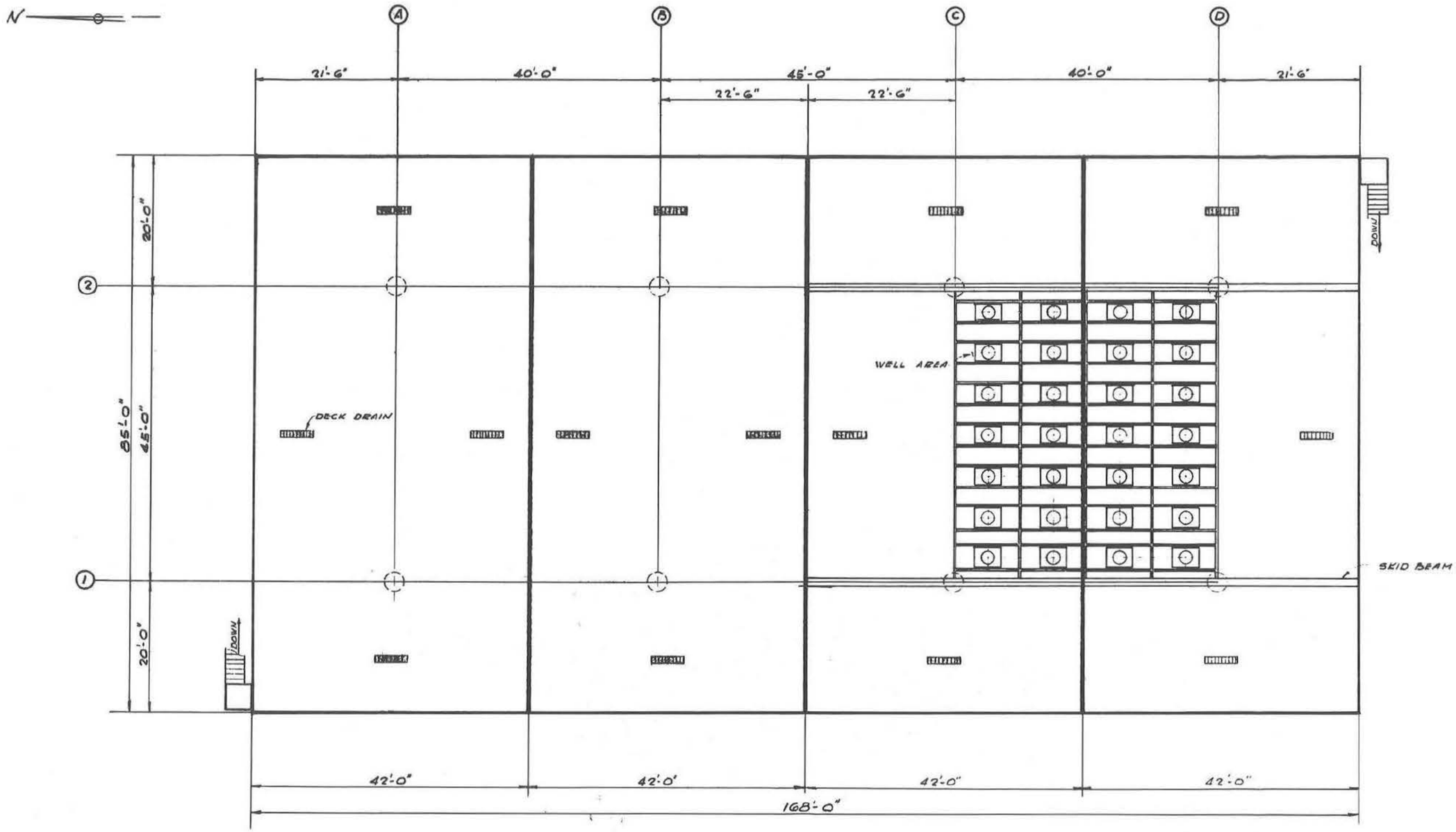
DECK ELEVATIONS

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

155'x170' GOWELL DRILLING PLATFORM
840' WATER SANTA YNEZ UNIT
OCS-P0188 'A'

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN: PAT C.
CHECKED: R. Cole
SUPR. SECTION: W. Perry
APPROVED: [illegible]
SCALE: NOTED
DATE: 5-5-72
JOB NO.
FILE NO. HOE-215-B



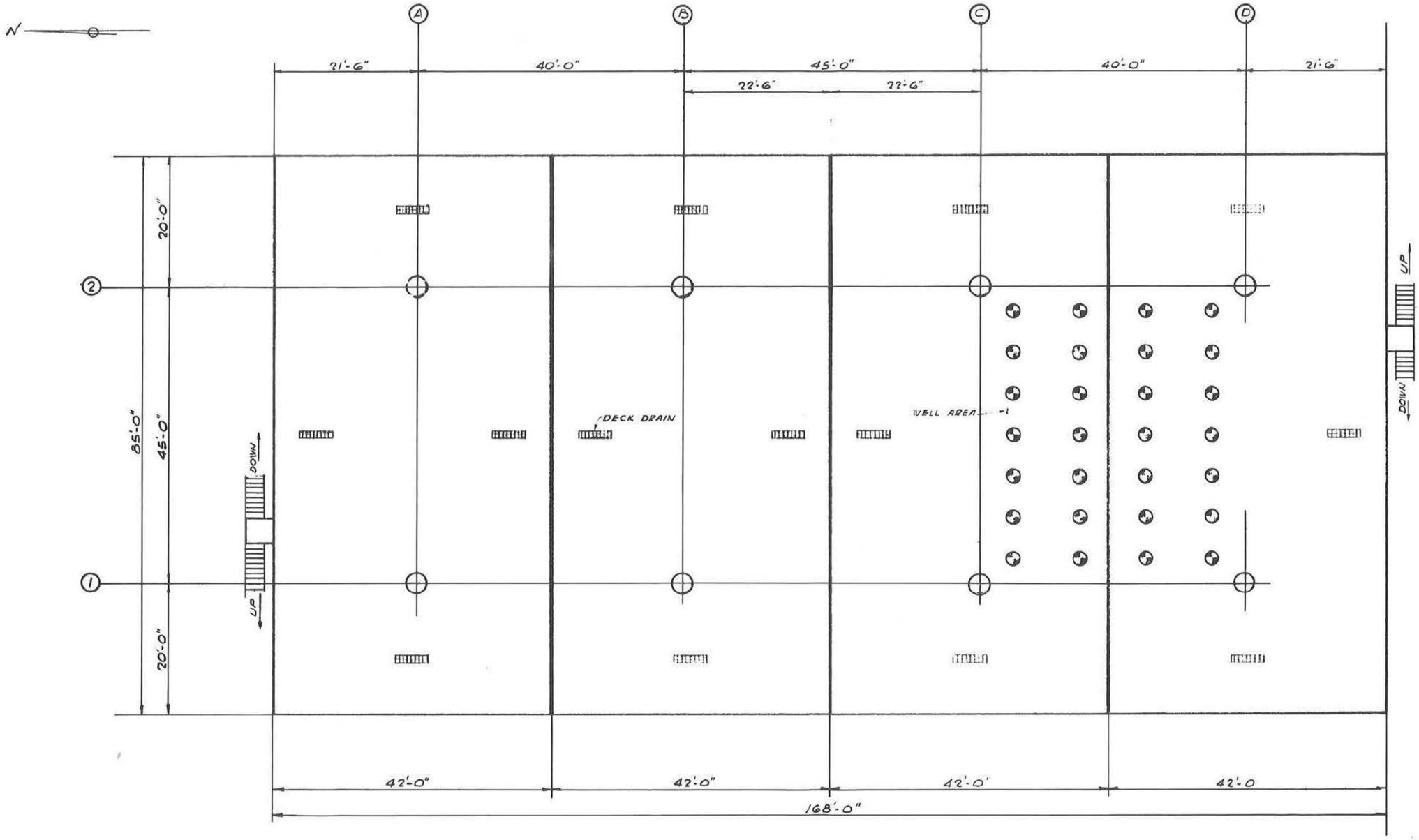
DRILLING DECK PLAN

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85'×168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN R. E. DAVIES
CHECKED R. Cole
DIV. ENGR. SECTION M. J. Vance
APPROVED A. K. Reid
SCALE 1/8" = 1'-0"
DATE 5-9-72
JOB NO.
FILE NO. HQE-215-4



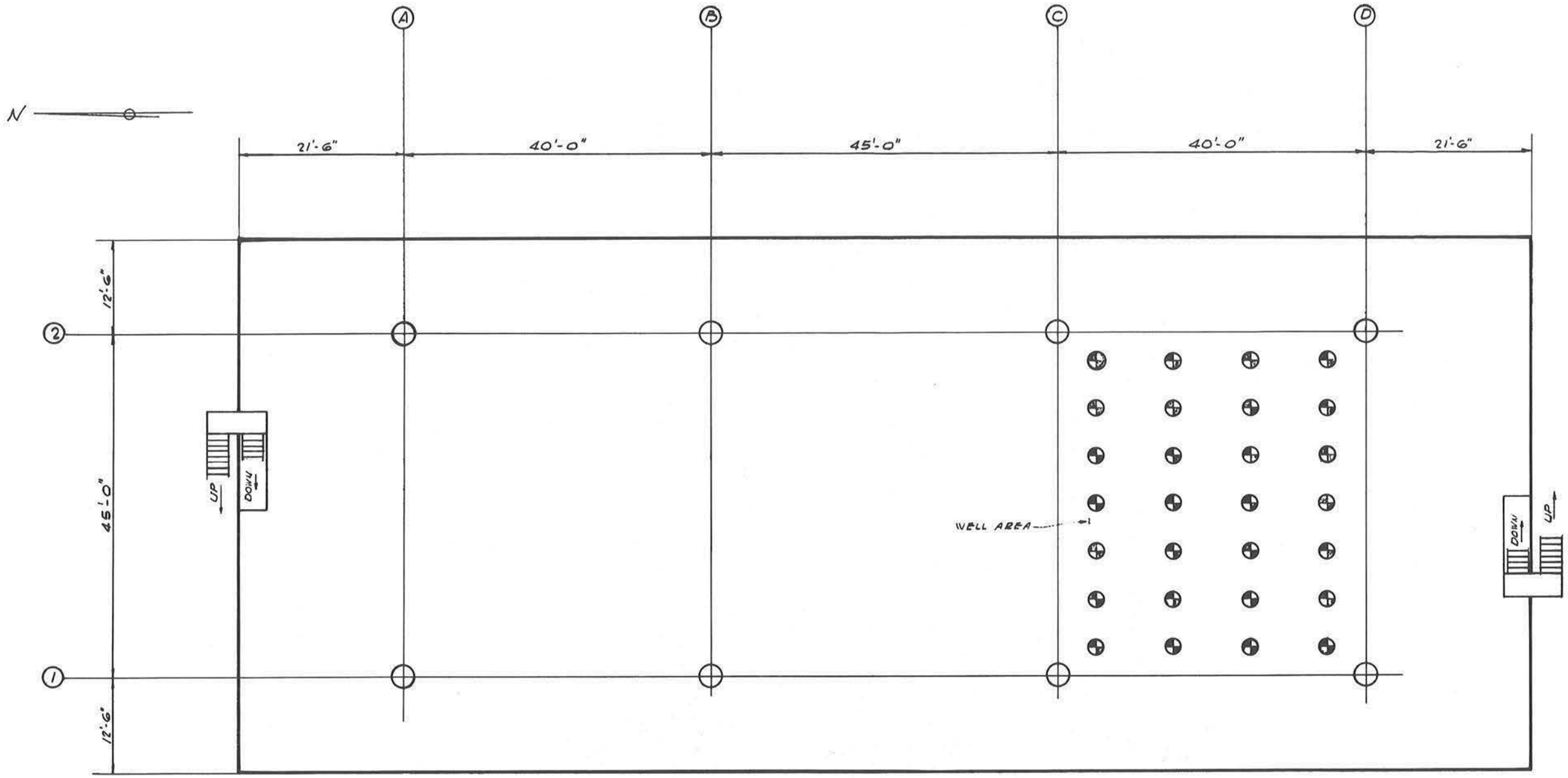
PRODUCTION DECK PLAN

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85'x168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

DRAWN R.E. DAVIES
CHECKED R.S. Cole
ENGR. SECTION W.H. Dunn
APPROVED O.K. Riley
SCALE 1/8"=1'-0"
DATE 5-9-72
JOB NO.
FILE NO. HOE-215-5

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION



CELLAR DECK PLAN

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

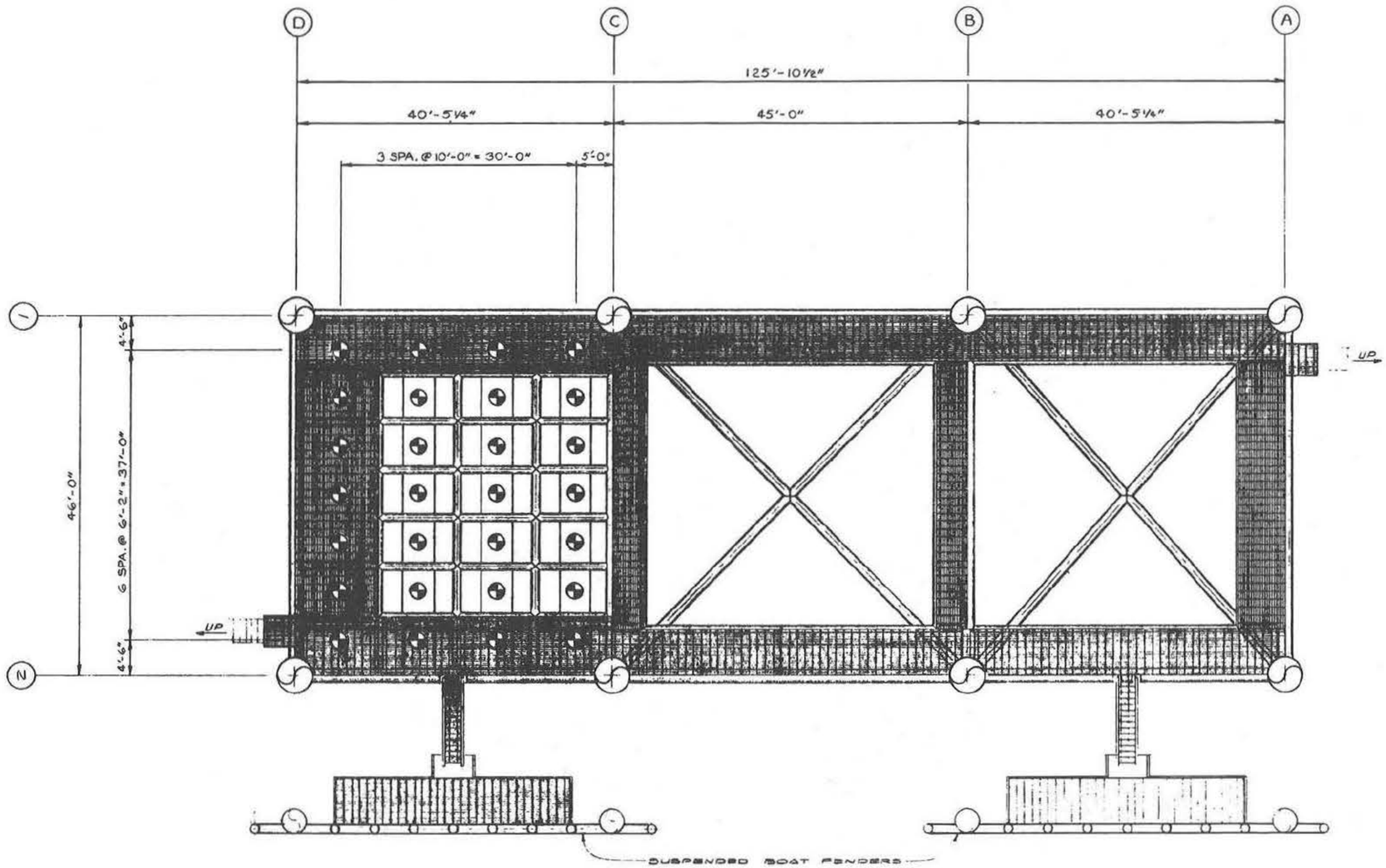
85'×168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

DRAWN R.E. DAVIES
CHECKED G.C.G.
DIVISION
APPROVED

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

SCALE 1/8" = 1'-0"
DATE 5-4-72

HOE 215-6



HORIZONTAL FRAMING @ EL. (+) 15'-0"

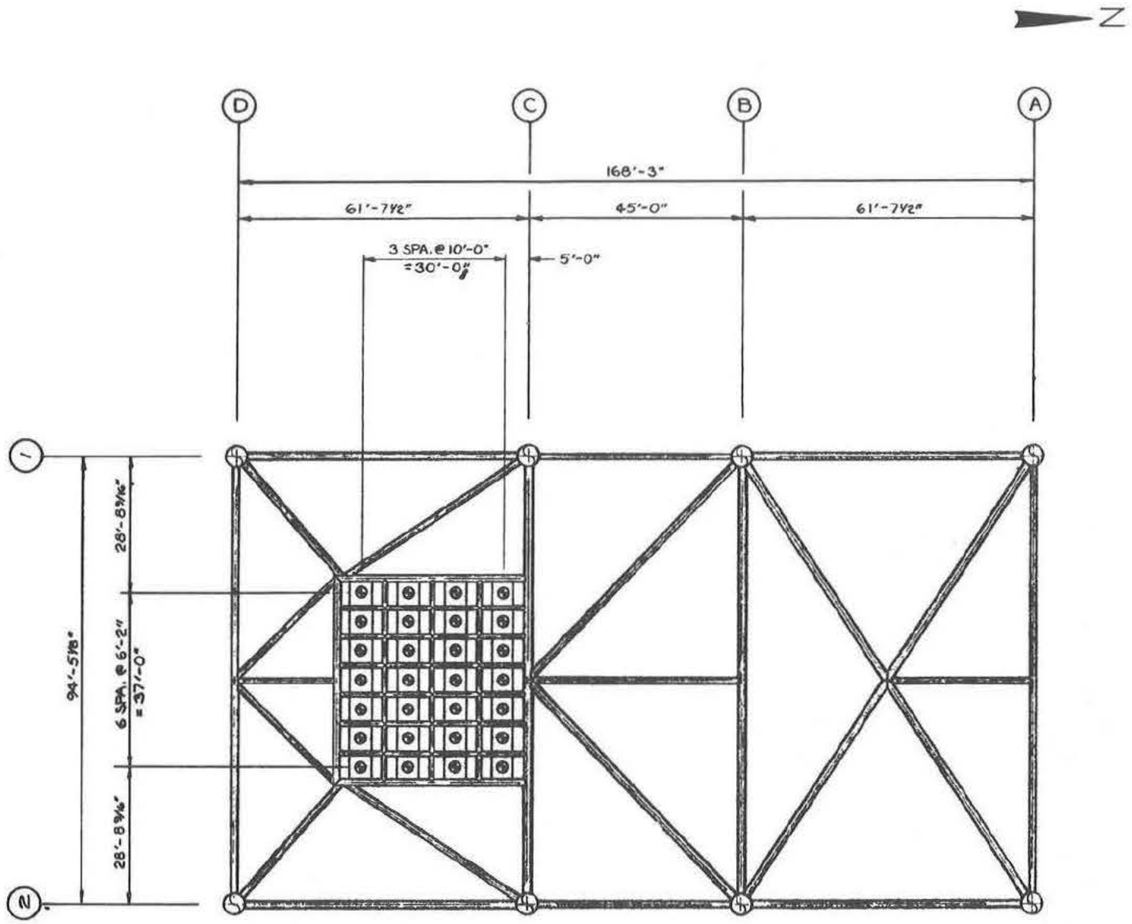
NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85x168'-28-WELL DRILLING PLATFORM
BSC WATER SANTA YNEZ UNIT
OCS-PC-98 A

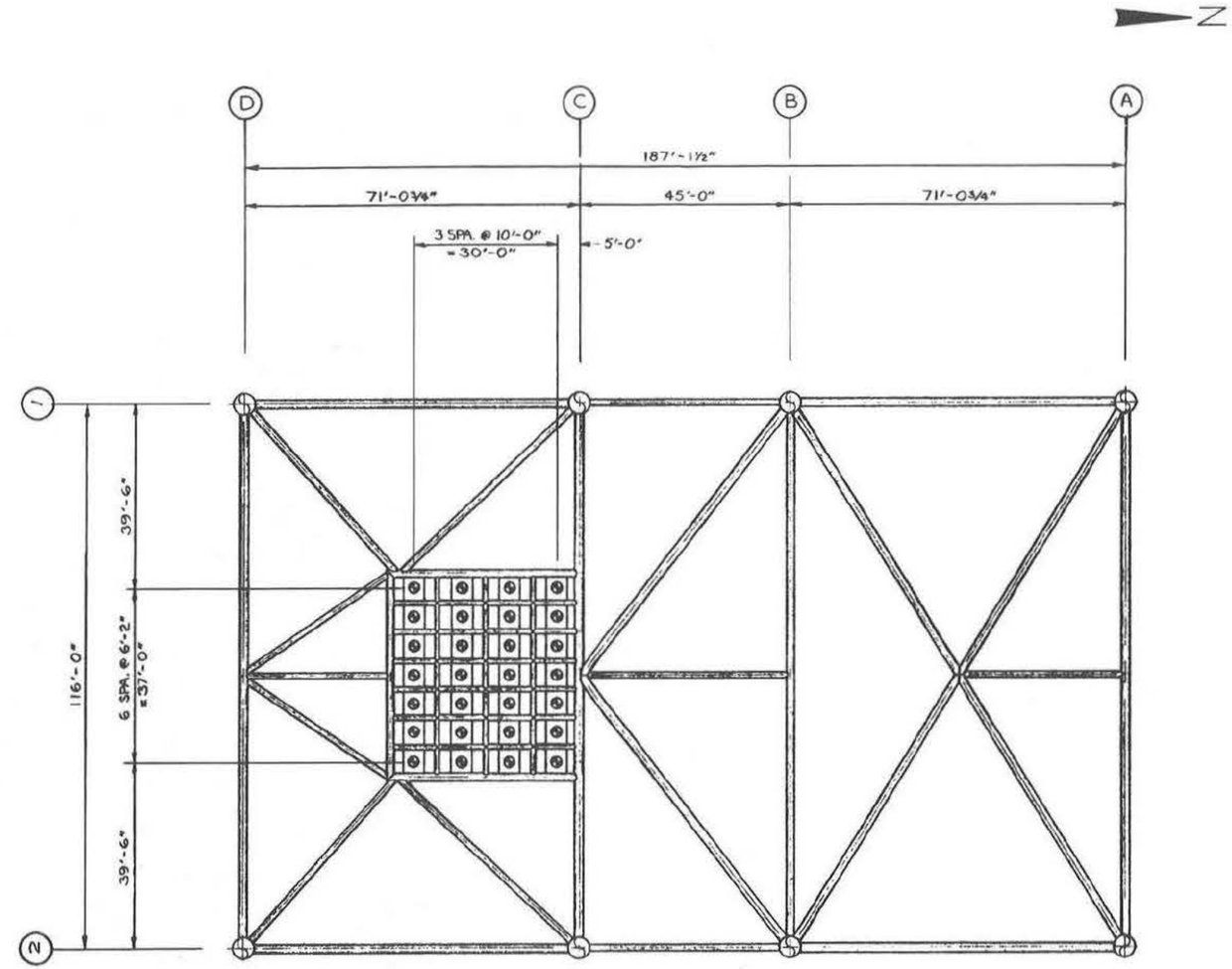
DRAWN R.E. COLE
CHECKED RCC
DESIG. SECTION
APPROVED

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

SCALE 1/8" = 1'-0"
DATE 8-9-72
JOB NO.
FILE NO. WGE-2.5-7



HORIZONTAL FRAMING @ EL. (-) 324'-0"



HORIZONTAL FRAMING @ EL. (-) 475'-0"

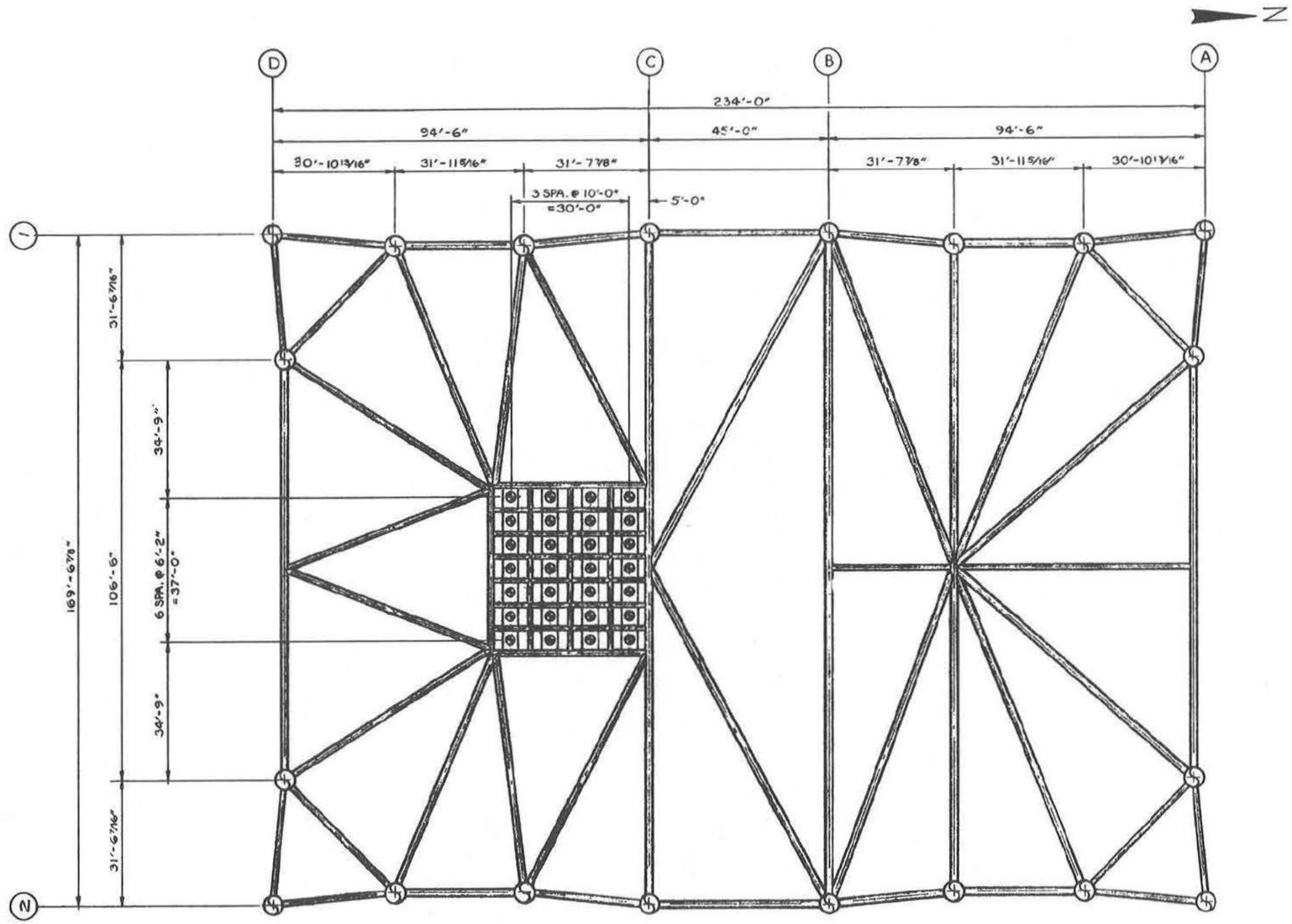
HORIZONTAL FRAMING @ EL. (-) 324'-0" & EL. (-) 475'-0"

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85'x168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
CCS-PO188 A

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN R.E. COLE
CHECKED R. Cole
DIVISION
APPROVED
SCALE 1/16"=1'-0"
DATE 8-9-73
JOB NO.
FILE NO. HCE-2185-8



HORIZONTAL FRAMING @ EL. (-) 850'-0"

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85'-68' 28-WELL DRILLING PLATFORM
SSC WATER SANTA YNEZ UNIT
[illegible]

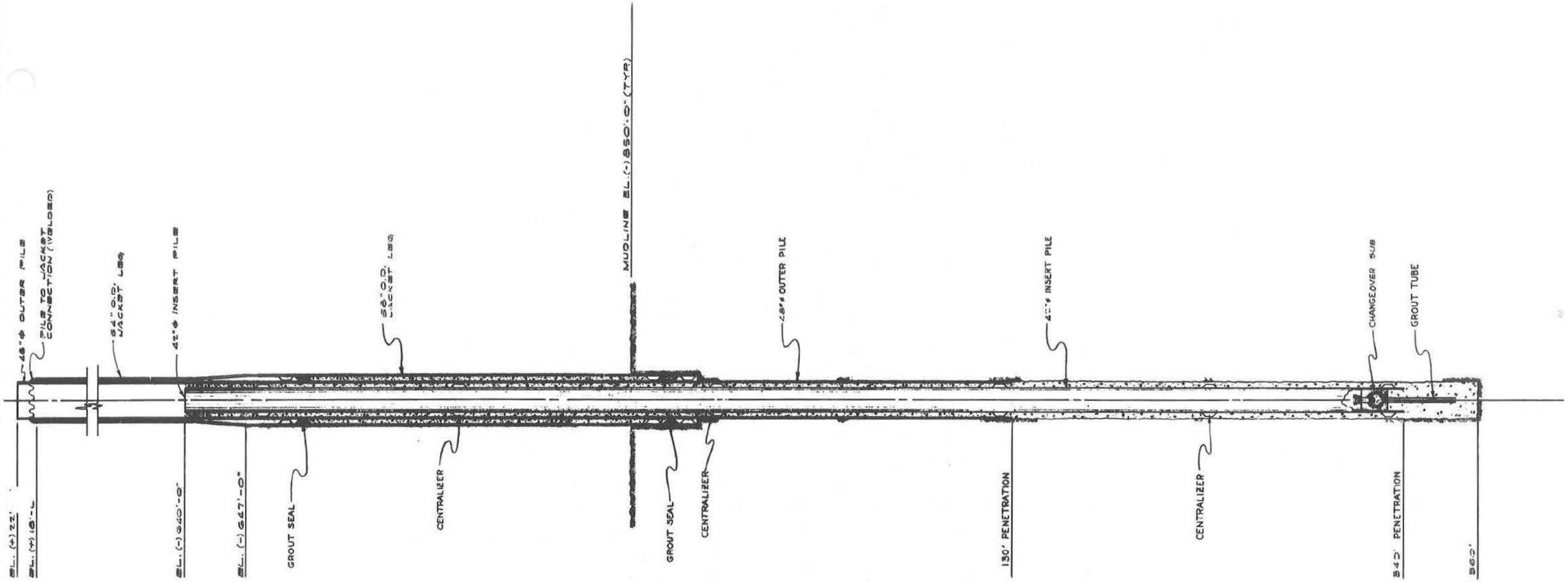
DRAWN R. E. COLL
CHECKED [illegible]
ENGR. SECTION [illegible]
APPROVED [illegible]

SCALE 1/16"=1'-0"
DATE [illegible]

JOB NO.

FILE NO. [illegible]

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION



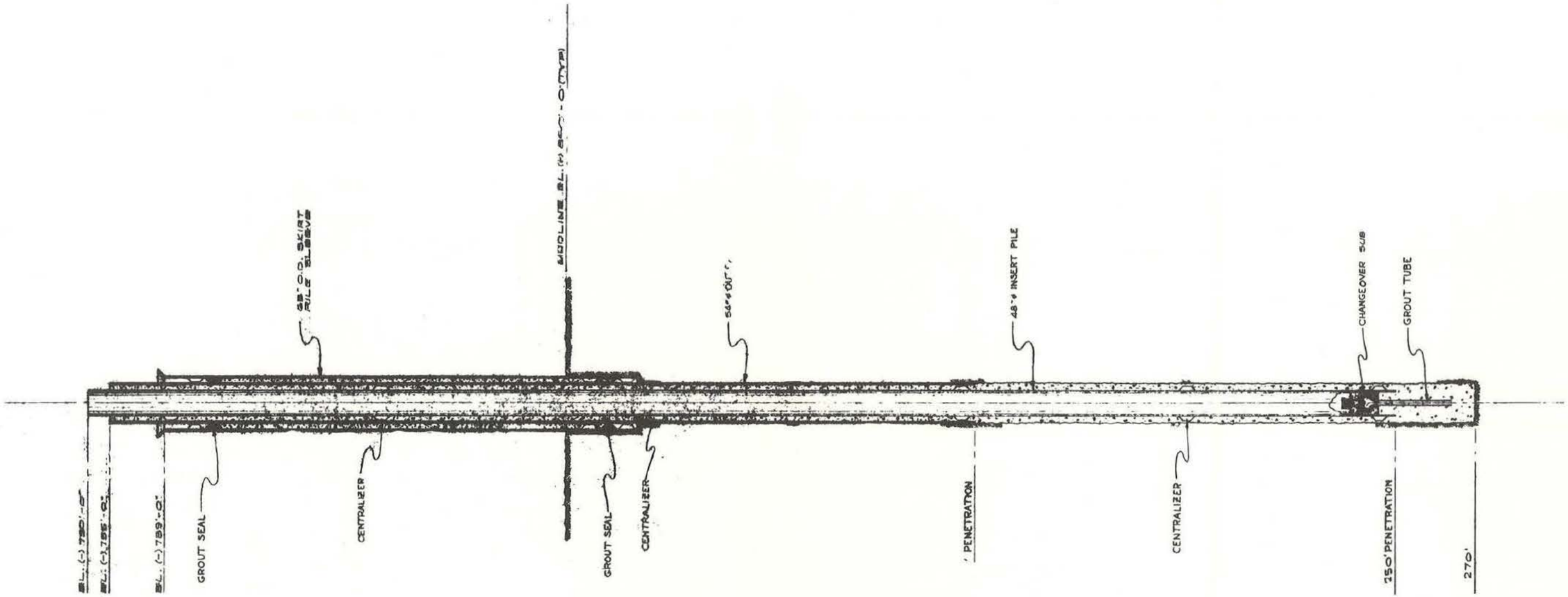
COMPOSITE MAIN PILE SECTION

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85' x 168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN LVB
DESIGN SECTION
DESIGNED
APPROVED
SCALE NONE
DATE 12-9-73
JOB NO.
FILE NO. HOB-216-10



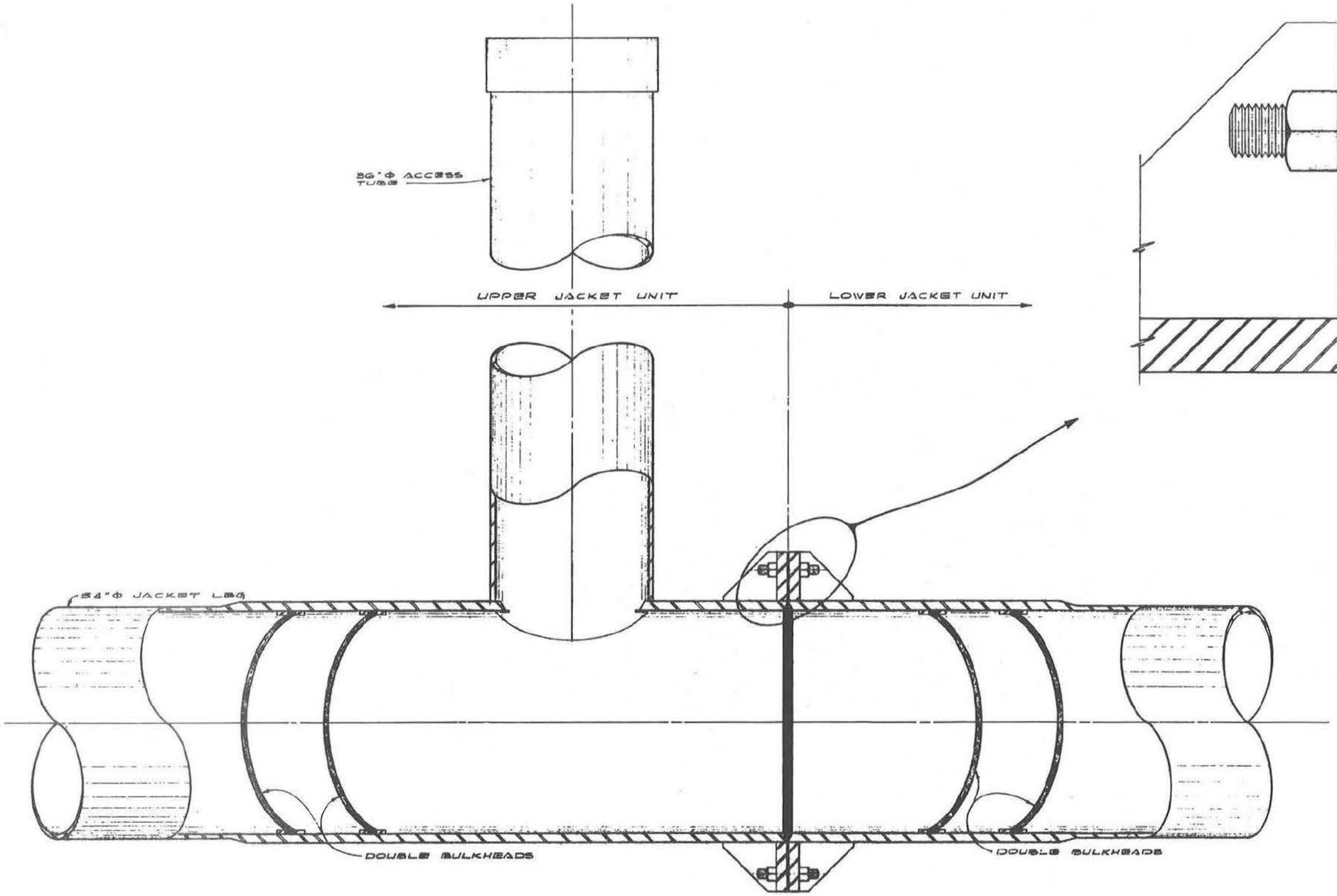
COMPOSITE SKIRT PILE SECTION

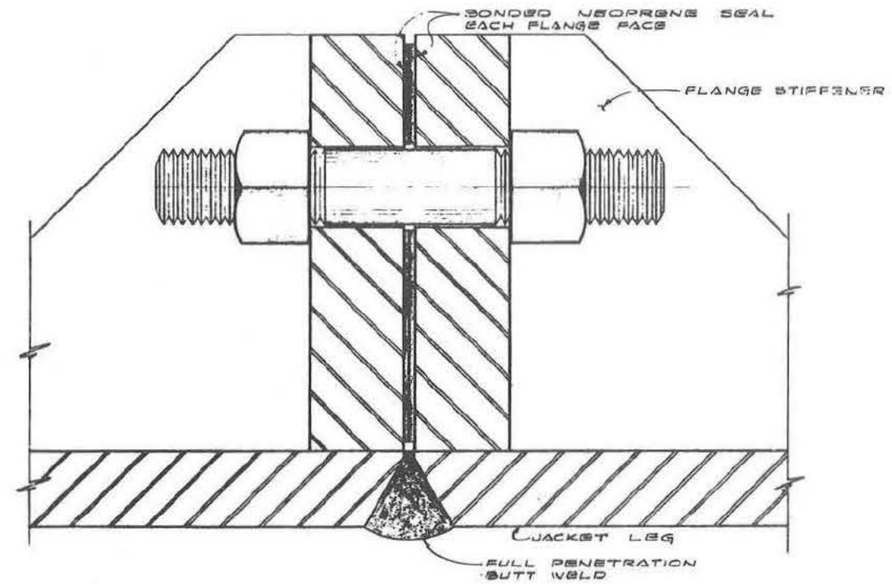
NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

85' x 168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN: LVB
DESIGNED: K. Cole
ENGR. SECTION: [illegible]
APPROVED: [illegible]
SCALE: NONE
DATE: 5-8-75
JOB NO.
FILE NO. HOB-215-1





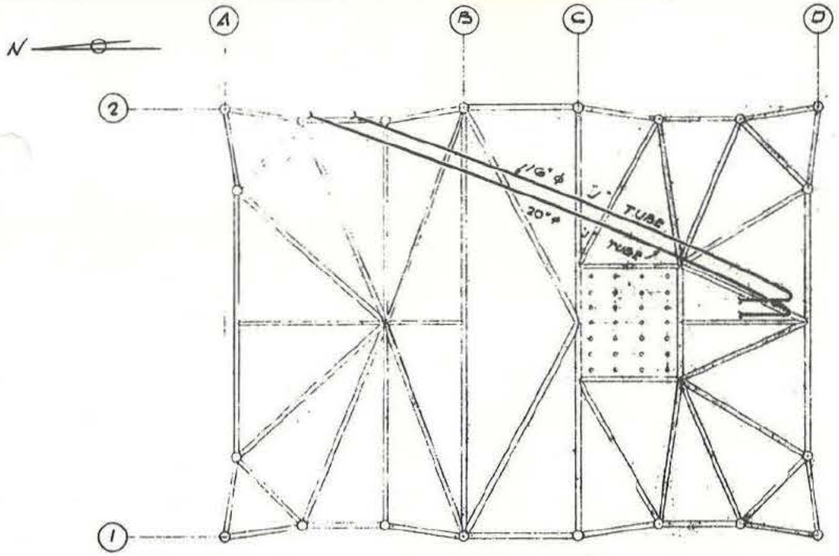
JACKET CONNECTION DETAIL

NO.	DATE	REVISIONS	BY	CHK.	APPD.	NO.	DATE	REVISIONS	BY	CHK.	APPD.

85' x 168' 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

DRAWN: WB
CHECKED: R. Cole
DIVISION EDITOR: W. A. Bond
APPROVED: [illegible]
SCALE: NONE
DATE: 6-9-72
HOE-2:8-12



SECTION A-13 - A-13

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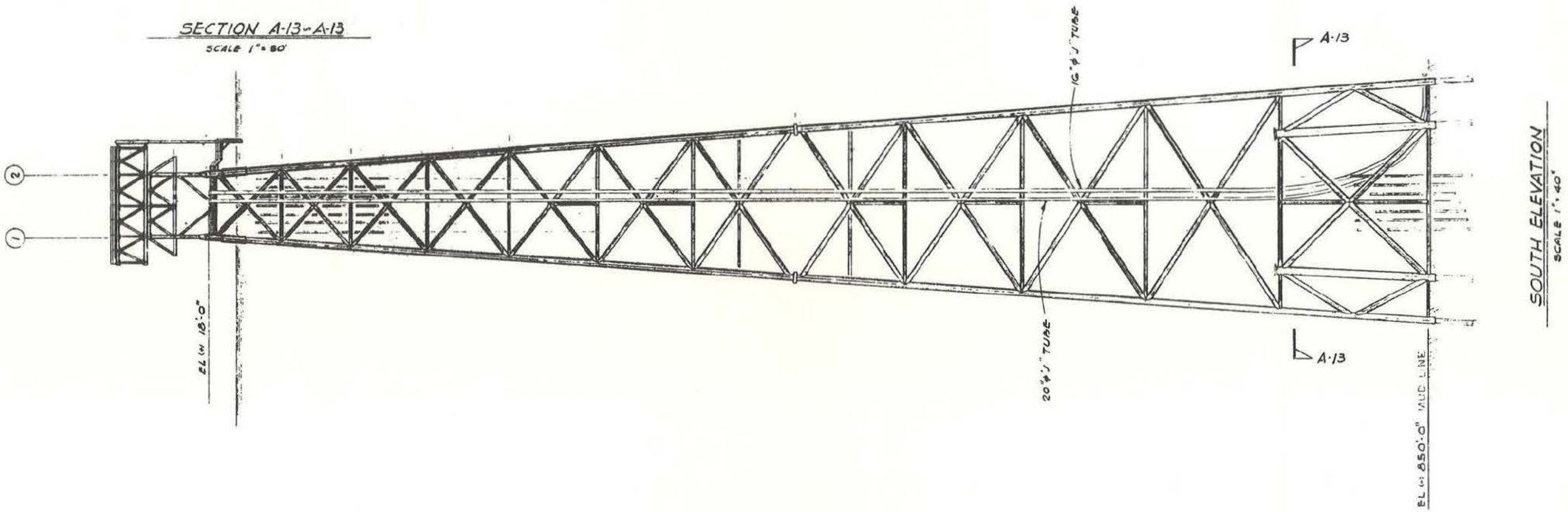

SOUTH ELEVATION

SCALE 1" = 40'

"J" TUBE ELEVATION & SECTION

NO.	DATE	REVISIONS	BY	CHK.	APPR.	NO.	DATE	REVISIONS	BY	CHK.	APPR.

EPHIGH 28-WELL DRILLING PLATFORM
850' WATER SANTA YNEZ UNIT
OCS-P0188 A

DRAWN R.E. COLE
CHECKED R.E.C.
ENGR. SECTION W.A. Perry
APPROVED J.R. Alley Jr.

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

SCALE VARIES
DATE 5-9-72
JOB NO.
FILE NO. HOE 215-13

APPENDIX 1.5

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.5

Specifications for Construction of a Self-Contained Platform for Drilling and Producing Operations, Santa Barbara Channel

(Section Revised)

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

SPECIFICATIONS
FOR
CONSTRUCTION OF A SELF-CONTAINED PLATFORM
FOR
DRILLING AND PRODUCING OPERATIONS
SANTA BARBARA CHANNEL

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Appendix B - Specifications for Protective Coatings
Appendix C - Specifications for Cathodic Protection
Appendix D - Specifications for Flooding System Piping
Appendix E - Soil & Foundation Investigation

SPECIFICATIONS
FOR
CONSTRUCTION OF A SELF-CONTAINED PLATFORM
FOR
DRILLING AND PRODUCING OPERATIONS
SANTA BARBARA CHANNEL

1.0 GENERAL

1.01 Scope of Work

These specifications and attachments cover the land phase construction and the water phase transportation and construction of a self-contained platform to be installed in the Santa Barbara Channel offshore from California, in water depth of about 850 feet.

1.02 Description

The platform consists of the following basic components:

1.021 Deck Units

1.022 Jacket Unit

1.023 Piling

1.024 Conductor Pipe

1.025 Fender System

1.03 Plans and Specifications

1.031 It is not the intention of the individual sections of the specifications to mention or otherwise enumerate each and every item of work or appurtenances thereto that are required for the particular section. The plans and specifications are intended to be complementary, one to another, and anything mentioned in the specifications and not shown on the plans, or vice

versa, shall be of like effect as if shown or mentioned in both. Contractor shall comply with the true intent and meaning of the plans and specifications taken as a whole and shall not avail himself of any manifest errors or omissions to the detriment of the work.

1.032 The plans furnished are the property of Humble and shall not be used for any purpose other than that contemplated by the specifications.

1.033 Contractor shall prepare shop drawings for specific fabrication details and for land and water phase construction procedures, and shall submit same to Humble for approval. Humble's approval shall not relieve Contractor of the responsibility for correctness and conformity of the shop drawings with the plans and specifications.

1.04 Referenced Specifications

The following referenced specifications, codes, and standards or the latest revisions thereof are incorporated into these specifications in whole or in part as is applicable to the work to be performed. In cases of conflict between these specifications and the referenced specifications, these specifications, shall govern.

1. American Institute of Steel Construction (AISC):
   Code of Standard Practice for Steel Buildings and Bridges.
   Specification for the Design, Fabrication, and Erection of Structural Steel for Buildings.

2. American Society for Testing Materials (ASTM):

A6-67 - General Requirements for Delivery of Rolled Steel Plates, Shapes, Sheet Piling, and Bars for Structural use.

A20-67 - General Requirements for Delivery of Steel Plates for Pressure Vessels.

A36-67 - Structural Steel.

A53-68 - Welded and Seamless Steel Pipe.

A105-65 - Spec. for Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for High-Temperature Service.

A106-68 - Spec. for Seamless Carbon Steel Pipe for High-Temperature Service.

A123-68 - Zinc Coatings on Products Fabricated from Rolled, Pressed, and Forged Steel Shapes, Plates, Bars and Strips.

A181-65 - Spec. for Forged or Rolled Steel Pipe Flanges, Forged Fittings, and Valves and Parts for General Service.

A193-68 - Spec. for Alloy-Steel Bolting Materials for High-Temperature Service.

A194-68 - Spec. for Carbon and Alloy Steel Nuts for Bolts for High-Pressure and High-Temperature Service.

A216-68 - Spec. for Carbon-Steel Castings Suitable for Fusion Welding for High-Temperature Service.

A234-65 - Spec. for Factory-Made Wrought Carbon Steel and Ferritic Alloy Steel Welding Fittings.

A435-67 - Longitudinal Wave Ultrasonic Inspection of Steel Plates for Pressure Vessels.

A533-70 - Manganese-Molybdenum and Manganese-Molybdenum-Nickle Alloy Steel Plate, Quinched and Tempered for Pressure Vessels.

A537-70 - Carbon Manganese-Silicon Steel Plates, Heat Treated for Pressure Vessels.

A572-70 - High Strength Low Alloy Columbium-Vanadium Steels of Structural Quality.

A578-68 - Spec. for Longitudinal Wave Ultrasonic Inspection of Plain and Clad Steel Plates for Special Applications.

3. American Welding Society (AWS):

D1.0-69 - Code for Welding in Building Construction.

D2.0-69 - Specifications for Welded Highway and Railway Bridges.

4. American Petroleum Institute (API):

STD-2B - Specification for Fabricated Structural Steel Pipe.

STD-5L - Specification for Line Pipe.

STD-601 - Metallic Gaskets for Refinery Piping.

STD-1104 - Standard for Welding Pipelines and Related Facilities.

RP-2A - Recommended Practice for Planning, Designing, and Constructing Fixed Offshore Platforms.

5. Steel Structures Painting Council (SSPC):

SP-1 - Solvent Cleaning.

SP-5 - White Metal Blast Cleaning.

6. U.S.A. Standards Institute (USAS):

B 2.1 - Pipe Threads

B16.5 - Steel Pipe Flanges and Flanged Fittings.

B16.11 - Forged Steel Fittings, Socket Welding and Threaded.

B31.3 - Pressure Piping, Petroleum Refinery Piping.

B36.10 - Wrought-Steel and Wrought-Iron Pipe.

1.05 Company Representative

Humble will designate an individual to act as Humble's representative in the inspection and approval of work done by the Contractor. Contractor shall provide separate office facilities for Humble's representative and his staff at each job site.

The Contractor shall provide Humble's representative and his staff free access to all portions of the work in progress. The Contractor shall keep Humble advised of the current status of the work to enable Humble to provide for inspection thereof. Humble's representative shall be the final authority in resolving all questions which arise regarding interpretation of plans and specifications and the acceptability of any procedure proposed by the Contractor.

1.06 Pollution and Waste Disposal

Contractor will comply with all provisions and the intent of U.S. Geological Survey OCS Order No. 7, Pollution and Disposal of Waste Material, during offshore work.

2.0 MATERIAL FURNISHED BY CONTRACTOR

2.01 General

Contractor shall furnish all material required or reasonably implied by the plans and specifications.

Materials designated on the plans and specifications shall meet the following requirements.

2.02 Rolled Shapes and Plates

The material designations of rolled shapes and plates are given in the plans. All materials designated as:

2.021 A-36 - Shall conform to the requirements of ASTM A-36 and the general requirements for delivery of ASTM A-6.

2.022 A-533 - Shall conform to the requirements of ASTM A-533, Grade 2, Class 3 and the general requirements for delivery of ASTM A-20.

2.023 A-537 - Shall conform to the requirements os ASTM A-537, Grade A, the general requirements for delivery of ASTM A-20, and the following special requirements.

A. The carbon equivalent based on ladle analysis using the formula CE = C + Mn/6 shall not exceed 0.43.

B. The transverse Charpy V Notch properties from two plates in each heat representing the thinnest and thickest sections rolled shall be determined. Each

test shall consist of three specimens. The test temperature shall be 32°F. Both impact energy and percent shear fracture shall be reported. Minimum average values of 30 ft-lbs of energy and 50% shear fractures are required. In the case of plates used to form hemispheres these values shall be determined after forming and post forming heat treatment.

C. All plate used in fabricating tubular joints including the components of "X" joints shall be ultrasonically tested in accordance with ASTM A-578, Level 2.

D. Mill test reports shall be sent to Humble at the same time they are sent to Contractor.

2.024 A-572 - Shall conform to the requirements of ASTM A-572, Grade 50, the general requirements for delivery of ASTM A-6, and the following special requirements:

A. The ultimate strength of the material as measured by the standard tensile test shall be restricted as follows:

(1) Rolled Plate

Up to 0.500" Thick - No Restriction

0.625" to 1.000" Thick - 65 to 90 KSI

1.125" to 2.000" Thick - 60 to 85 KSI

(2) Rolled Shapes

Up to 0.500" Thick at Welding Point - No Restriction

With Flanges Up to 1.250" Thick - 65 to 90 KSI

B. Mill test reports shall be sent to Humble at the same time they are sent to Contractor.

2.03 Tubular Steel

The material designations of the tubular steels are given in the plans. All materials designated as:

2.031 A-36 - Shall conform to the requirements of one of the following specifications.

A. API Std. 5L, Grade B.

B. ASTM A-36 and API Std. 2B.

C. ASTM A-53, Type E, Grade B or Type S, Grade B.

2.032 A-533 - Shall conform to the requirements outlined in 2.022 above and API Std. 2B.

2.033 A.537 - Shall conform to the requirements outlined in 2.023 above and API Std. 2B.

2.034 A.572 - Shall conform to the requirements outlined in 2.024 above and API Std. 2B.

2.04 Marking

2.041 Whenever a rolled shape, plate, or tubular member is cut the markings required under ASTM A-6 and A-20 shall be transferred to each resulting portion of the original.

2.042 Each rolled shape, plate, and tubular member entering the fabrication yard shall be color-marked to identify the individual specifications of 2.02 and 2.03 above. Color markings shall be distinct and of sufficient size to be clearly visible.

3.0 WORK PERFORMED BY CONTRACTOR

3.01 General

Contractor shall furnish all materials, equipment, tools, labor, and supervision necessary to contract said platform in accordance with the plans and specifications. The work shall be divided into land phase construction, transportation, and water phase construction.

3.02 Land Phase Construction

3.021 Land phase construction shall be in accordance with API RP-2A, Section 5, amended and supplemented as follows:

Tolerances - Dimensional tolerances and straightness of rolled shapes and plates shall conform to the requirements of ASTM A-6 and ASTM A-20.

All rolled sections to be used as web members of the deck trusses shall conform to the rquirements for straigtness of columns of API RP-2A.

All tubular structural members shall conform to the requirements for straightness of columns of API RP-2A.

Dimensional tolerances of built-up members, including deviation from straightness and deviation from specified camber, shall conform to the requirements of Paragraph 407 of Section 4 of AWS D1.0-69.

Fabricated tubular members shall meet the tolerance restrictions of both 1 and 2 below.

1. Maximum permissible difference between major and minor diameters shall be as follows:

Up to 36"	1/4"
Above 36"	3/8"

2. The diameter, as measured with a circumferential tape, shall not vary from the theoretical by more than ± 1/8".

Tolerances for the assembly of the individual members of the structure between the panel points or working points of the structure shall conform to the requirement of Paragraph (h) of Section VII of the AISC Code of Standard Practice for Steel Buildings and Bridges, that the "individual pieces are considered plumb, level, and aligned if the error does not exceed 1:500."

The intent of the preceding paragraph is to establish a tolerance for the relative location of panel points one to another, particularly with regard to fabrication of the jacket. In a completely triangulated structure such as this one, variation in the relative locations of the panel points requires either that the length of the member closing each triangle to be varied correspondingly or that the centerlines of members meeting at closing joints do not intersect all at one point. Either or both methods of accommodating variations in relative panel point locations may be used providing:

the maximum perpendicular offset from the centerline of any member to the intersection of the centerlines of the other members at a joint shall not exceed 1/500 of the theoretical length of that member between panel points.

Welding - All welding shall be in accordance with Humble's Specifications for Structural Welding, Appendix A.

Wherever the surfaces of two structural shapes are in contact with one another, a sealer bead shall be placed at the edges so as to completely seal the contacting surfaces from the outside atmosphere. Whenever two or more structural shapes are in such close proximity as to prevent the proper cleaning and/or application of protective coatings on all surfaces of said structural shapes, then 3/8-inch thick plate(s) shall be fitted and welded between the structural shapes so as to completely seal off the inaccessible surfaces from the outside.

All joints shown on the plans to be full penetration welds shall be accomplished using the weld configuration shown, if the weld is detailed in the plans, or using the indicated configuration or, upon approval by Humble, another AWS pre-qualified configuration, if the weld is indicated by symbol. All butt joints in all tubular members, rolled shapes, plate or built-up

3.022 Protective Coatings

The surface of all steel members above elevation minus 8' MLLW shall be coated in accordance with Specifications for Protective Coatings, Appendix B.

3.023 Special Provisions

Pressure Testing - Each water-tight compartment of the jacket and each skirt pile sleeve shall be pressure tested for 24 hours at the pressure indicated on the plans for that compartment and all leaks shall be repaired to Humble's satisfaction.

Final Clean-Up - Prior to acceptance of any component by Humble, Contractor shall remove all debris and foreign objects.

Prior to final testing of any water-tight compartment, Contractor shall thoroughly clean, with vacuum-type cleaner, that compartment.

Shipment - Land phase construction shall be complete when Contractor has prepared all platform components for transportation to the offshore erection site. All fabricated components shall be prepared and loaded in such a manner as to facilitate field erection without undue rehandling of the fabricated parts at sea.

3.03 Transportation

3.031 General

Contractor shall furnish all materials, equipment, tools, labor and supervision necessary to transport all platform components to the erection site in accordance with the plans and specifications.

3.032 Jacket Transportation - The jacket has been designed to barged from the construction site to the connection site and towed under its own buoyancy from the connection site to the erection site. The jacket will be fabricated as two units of approximately equal length and weight. Contractor may load the two units on separate launch barges or may use a single barge and make two trips from the construction site to connection site. After both units have been launched, Contractor will make the permanent connection in accordance with the plans and specifications, and then tow the single unit to the erection site. Calculations for the single unit indicate that a reserve buoyancy of 20% is adequate to provide stability for the cross channel tow. Final weight of the jacket will not be known until after launch and connection; however, Humble's design is based on providing a minimum of 20% reserve buoyancy. It shall be the Contractor's responsibility to maintain this minimum reserve buoyancy during land phase construction.

When the jacket is complete, Contractor shall calculate the "as built" reserve buoyancy and develop "Static Stability Curves" for the tow. The towing stability shall be made satisfactory to Humble, insurance carriers, and appropriate governmental agencies before towing can begin.

Maps shall be furnished to Humble outlining the proposed route from the construction site to the connection site and from there to the erection site along with time of departure and time of arrival charts for each leg and the acceptable weather conditions under which the Contractor would make the tows.

3.033 Component Transportation - The loadout and transportation of all other components of the platform as described by the plans and specifications shall be scheduled to permit installation of the complete platform as expeditiously as possible.

All components shall be prepared and loaded in such a manner as to facilitate water phase construction without undue rehandling of the components at sea.

3.04 Water Phase Construction

3.041 General

Contractor shall furnish all materials, equipment, tools, labor, and supervision necessary to install platform in accordance with the plans and specifications.

The connection and erection sites shall be surveyed by Humble and marked by a buoy or buoys prior to the connection and the upending of the jacket. Humble may elect to furnish a survey party to control precise location of the jacket during these operations. During water phase construction the Contractor shall exercise extreme care to prevent loss overboard of any material or equipment.

3.042 Jacket Connection

The jacket will arrive at the connection site in two units. After both units have been launched, connection will begin. Connection will consist of the following operations as detailed in the plans.

(1) Positioning of the two units within the mooring spread.

(2) Trimming of the two units to bring into alignment stabbing cones and connection flanges.

(3) Connection of the two units at the four stubbing cone assemblies.

(4) Connection of the two units at the eight legs by bolted flange connections.

(5) Sealing of the eight leg chambers that form watertight welder habitats.

(6) Connection of the two units by full strength butt welding of the eight jacket legs from inside the welder habitats.

After the eight structural welds have been completed and inspected, the single jacket will be towed from the connecting site to the erection site.

Any basic deviation from the procedure detailed in the plans and outlined by their specification which is contemplated by the Contractor shall be submitted with the bid proposal. Immediately after award of contract, Contractor shall submit for Humble's approval a comprehensive written description of his connection procedure with supporting engineering calculations and drawings. Humble's approval of Contractor's procedure will not relieve Contractor of his responsibility for the adequacy of the method and the tools employed.

3.043 Jacket Installation

The jacket will arrive at the erection site floating horizontally under its own buoyancy and will be unended by controlled flooding. Each of the compartments in the eight legs is provided with flooding valves and vent valves to control the flooding. Each of the valves has a hydraulic operator and piping for remote control. All control lines and instrument lines shall terminate in an operating console provided by the Contractor. The design and location of the operating console shall be selected by the Contractor and approved by Humble. The manner in which the controlled flooding procedure is handled shall be outlined and submitted with the bid proposal.

Any basic deviation from the procedure outlined by the plans and specifications which is contemplated by the Contractor shall be submitted with the bid proposal. Immediately after award of contract, Contractor shall submit for Humble's approval a comprehensive written description of his installation procedure with supporting engineering calculations and drawings. Humble's approval of Contractor's procedure will not relieve Contractor of his responsibility for the adequacy of the method and the fools employed.

Jacket must be installed approximately level. Maximum permissible deviation is 1 degree from plumb.

3.044 Pile Installation - After the jacket has been satisfactorily placed jacket piles shall be installed at the four corners for support while carrying out the remaining water phase construction. These piles must be driven to the penetration shown in the plans and welded to the structure at elev (+) 15'-0 MLLW before additional work can proceed. Following this the four interior jacket piles shall be driven and welded. After this the twelve skirt piles shall be driven to grade and then all piles shall be grouted to the structure. A cement slurry, mixed to the same proportions as specified below shall be pumped into place through grout lines shown on plans. Water shall be pumped through the grout lines prior to cementing to insure that lines and annuli are clear. The contractor

shall mix and pump a volume of slurry equivalent to 150% required to completely fill each annulus. Contractor shall verify that each annulus is full by method approved by Humble prior to the grouting operation.

Piles shall be installed as two concentric strings; jacket piles 48"OD and 42"OD, and skirt piles 54"OD and 48"OD. The first string shall be driven through the relatively unconsolidated near surface soils to the penetration shown on the plans. This pile string shall serve as a conductor for drilling to required depth of penetration plus 20 feet for the second pile string. This drilled hole shall be the diameter of the first string or larger.

The hole shall be cleaned with salt water and the water displaced with a high viscosity gel selected by Contractor and approved by Humble. The second pile string, equipped with centralizers, shall be lowered into drilled hole. The annulus between second pile string and drilled hole or first pile string shall be filled with cement slurry; i.e., the second pile string shall be cemented to its top. Grouting procedure is detailed in the plans. The cement slurry shall be mixed in the following proportions:

a) One sack (84 pounds) of Pozmix 50-50 A cement as manufactured by the Halliburton Oil Well Cementing Company, mixed with:

b) 2.5 pounds of calcium chloride, mixed with:

c) 4.7 gallons of fresh water.

The above one-sack mix will yield 1.1 cubic feet of cement slurry.

Contractor shall submit, with bid proposal, an outline of his tentative procedure for driving, drilling and grouting piles, including principal equipment. Immediately after award of contract, Contractor shall submit for Humble's approval his detailed procedure. This procedure shall include methods of verifying that cement slurry has completely filled each annulus as required.

Humble's approval of Contractor's procedure does not relieve Contractor of his responsibility for the adequacy of the method and the tools employed.

Pile penetration is based on soils data shown in Soil & Foundation Investigation, Appendix E. If it develops that drilling is not required and that piles can be driven, one pile shall be completely driven to its total design penetration before any other piles are started. This pile shall serve as a test pile. Contractor shall keep complete driving records on each pile driven and shall furnish a copy of these records to Humble's representative.

3.045 Deck Installation - In preparation of the plans, it was assumed that a 500-ton capacity derrick barge would be used. A derrick barge of at least this capacity must be supplied to set the deck sections. If the Contractor's

method for installing deck sections is different from that indicated in the plans, Contractor shall outline his requirements at the time he submits his bid proposal.

The installation of the prefabricated deck sections shall be closely coordinated with Humble so that production and drilling equipment that is to be installed on the deck units can be delivered to the job site when needed. Contractor will be compensated for setting such equipment.

3.046 Conductor Pipe Installation - Contractor will not be required to install conductor pipes. Contractor shall prepare conductors for installation in the number and manner shown on the plans.

3.047 Appurtenances - Contractor shall install the fender system, walkways, stairways, handrails, and other appurtenances to complete the platform in accordance with the plans. Contractor shall install aids to navigation which will be supplied by Humble.

3.048 Protective Coatings - Contractor shall coat those areas above the splash zone not coated during the land phase construction. Contractor shall repair any damage done to the coating in the water phase construction. All coatings shall be in accordance with Specifications for Protective Coatings, Appendix B.

3.049 Clean-Up - At completion Contractor shall leave work broom-clean.

3.05 Cathodic Protection

A galvanic anode type cathode protective system shall be installed by Contractor for corrosion control on the underwater steel surfaces of the platform. This system shall be in accordance with Specifications for Cathodic Protection, Appendix C.

3.06 Photographs

Contractor shall take a series of color photographs of the work at 5% increments. Photographs, with negatives, shall be dated and sent to Humble as soon as practical after each shooting.

APPENDIX A

SPECIFICATIONS FOR STRUCTURAL WELDING

I. MATERIALS

1.1 Tubular Steel

This specification shall apply to welding of tubular steel conforming to API Std. 5L Grade "B", API Std. 5LX Grades X42 through X52, API Std. 2B fabricated from ASTM A-36, A-533, A-537 and A-572 steel plate, or modifications of these steels as specified.

1.2 Structural Steel

This specification shall apply to welding of structural shapes or plates of steel conforming to ASTM A-36, and A-572 or modifications of these steels as specified.

1.3 Filler Metal and Fluxes and Gases

1.31 Electrodes for manual shield metal-arc welding, submerged arc welding, and gas metal-arc welding shall conform to the requirements of AWS D2.0.

1.32 Storage and Handling

Filler metals and fluxes shall be stored in unopened original containers, and they shall be handled so as to avoid damage to them and to the containers in which they are shippped. Those in opened containers shall be protected from deterioration and filler metals which are coated shall be protected from excessive moisture changes. Use of "Hot Boxes" is strongly recommended for all electrodes and is required for all low-hydrogen electrodes. Filler metals and fluxes which show signs of damage or deterioration shall not be used.

Shielding gases shall be kept in the containers in which they are supplied and these shall be stored away from extremes of temperature. Gases shall not be field intermixed in their containers. Gases which are of questionable purity and those in containers which show signs of damage shall not be used.

II. WELDING PROCEDURES

2.1 General

Written procedures shall be established and qualified at Contractor's expense for each type of welded joint. Each procedure shall

stipulate type of steel to be welded, type of weld, steel thickness, type of welding process, equipment settings, type and size of electrodes, type of gas or flux if any, number and sequence of beads and preheat and interpass temperatures. A copy of each written procedure shall be furnished to Humble's Inspector and it shall be adhered to at all times.

2.11 Structural Shapes & Plate

All welding procedures involved in the welding of structural shapes and plate shall be in accord with AWS D2.0. All butt welds shall be complete penetration butt welds as described in AWS D2.0.

2.12 Pipe

All welding procedures involved in the welding of pipe shall be in accord with API Std. 1104. All butt welds shall be complete penetration butt welds as described in API 1104.

2.13 Automatic Welding

Where automatic welding procedures are used the written procedure shall stipulate all equipment settings such as rate of travel, rate of electrode feed, etc. Humble's Inspector shall have the option of requiring qualification tests of individuals operating automatic welding equipment in accordance with API Std. 1104.

2.2 Alignment

The alignment of abutting pipe ends shall be such as to minimize the offset between pipe surfaces. For pipe of the same nominal wall thickness, the offset shall not exceed 1/16-inch. Any greater offset caused by dimensional variation shall be equally distributed around the circumference of the pipe. Hammering of the pipe to obtain proper line up should be held to a minimum.

2.3 Surface Condition

Surfaces to be welded shall be free from loose scale, rust, grease, paint and other foreign materials. On surfaces previously painted, all paint shall be thoroughly removed to expose clean steel for a distance of at least 2 inches on either side of the joint. The surfaces, included bevelled surfaces, shall also be smooth, uniform, and free of fins, tears, and other defects which adversely affect proper welding.

2.4 Root Bead for Manual Welding

The entire root bead, for either roll welding or position welding, shall be made with the pipe in a stationary position. It is manda-

tory that at least two welders be used, operating simultaneously and in opposite quarters, when welding root beads for all sizes of pipe 14 in. and larger.

2.5 Pipe, Plate & Strucutral Shapes

2.51 All welds which connect main members shall be full strength continuous welds unless otherwise noted on plans.

2.52 All welds, which connect members having a cross sectional thickness of one inch or more, or members having a minimum specified yield strength of 40 KSI or greater, shall be made with low hydrogen process or electrodes. Low hydrogen process or electrodes need not be used for root bead or hot pass providing weld is maintained at 150°F minimum until first low hydrogen pass is made. Weld connecting members of different yield strengths shall meet the requirements of the higher strength member.

2.53 Gas Metal-Arc Welding

2.531 General

Gas metal-arc welding may be used on pipe, rolled structural shapes and plates near ground elevation. It may also be used on all welding performed indoors or at any outside location where the welding is completely shielded from wind, to the satisfaction of Humble's Inspector.

2.532 Edge Preparation, Fit-up, and Tacking

Root face shall not be greater than 1/16-inch.

Pipe shall be fitted to a minimum of 3/32-inch and a maximum 1/8-inch root opening. If backing rings are sued on butt welds, the root opening should be increased to a minimum of 3/16-inch.

Tack welds should be a minimum of 3/4-inch long and preferably in the order of 1-inch long. Tack weld must be made with gas metal-arc or heliarc; shield metal-arc welding for tacking is unsatisfactory due to possibility of porosity. Ordinarily, four tacks will be necessary. Both ends of all tacks shall be feathered by grinding to remove defects in the ends of the tacks, and to reduce mass of metal at the ends of the tacks.

After ends of tacks have been ground, the weld area shall be sand blasted to white metal before root pass is started.

III. QUALITY OF WELDS

3.1 There shall be complete penetration of the root bead and complete fusion between filler metal and base metal and between successive passes throughout the joint. The completed weld shall be uniform in appearance and shall contain no valleys or indentations on the crest or at the edges. All craters shall be filled to the full cross section of the welds. Welds shall be free from overlap and visible porosity, and the base metal shall be free from undercutting.

3.2 Weld metal shall be solid throughout except that small gas pockets and small inclusions of oxide or slag as allowed by AWS D2.0 or API Std. 1104, as applicable, will be acceptable.

3.3 No weld containing cracks, regardless of size or location, shall be acceptable except when repaired as directed by Humble's Inspector.

IV. QUALIFICATION OF WELDERS

4.1 General

All welders employed in the construction work covered by these specifications shall have had previous structural and tubular welding experience, and shall have complete working knowledge of welding equipment, and the procedure of welding this type of job. All welders may, at the discretion of Humble, be required to pass a qualifying test for making postion welds. This test is described in Section 4.2 herein.

4.2 Qualification Test

Qualification tests shall be conducted under the supervision of Humble's Inspector and at Contractor's expense. Each welder tested shall be required to make one position pipe weld with the axis of the pipe inclined 45 degrees from horizontal, in accordance with API Std. 1104, amended and supplemented as follows:

4.21 Test Nipples

Test nipples 4-1/2 inches long shall be cut from 14", 63.4 lb./ft., API Std. 5L Grade B seamless pipe, unless otherwise specified by Humble's Inspector. The edges to be welded shall be machine bevelled.

4.22 Inclined Position Weld Test

4.221 Position of Nipples

Two test nipples shall be placed with their axes inclined at an angle of 45° from horizontal and

with their welding groove at right angles to the pipe axis. The pipe shall not be rolled or turned during welding, thus requiring the operator to deposit the weld metal from a flat, vertical and overhead position.

4.222 Test Specimens from Horizontal Fixed Test

Six test specimens shall be cut from the welded nipples. Four of the specimens shall be taken 90 degrees apart, one from each side and one from the top and one from the bottom of the pipe. The remaining two specimens are to be taken from opposite sides of the pipe approximately midway between the other specimens. Specimens are to be approximately 1-1/2 inches wide by 9 inches long. The edges shall be ground smooth to an approximate radius of 1/16 inch, and the weld reinforcement shall be ground flush with the base metal.

4.223 Bend Testing of Specimens from Horizontal Fixed Test

Face bends shall be made on the specimens taken from the top and from one side of the pipe. Root bends shall be made on the specimens taken from the other side and from the bottom of the pipe.

4.224 Nick-Break Test of Specimens from Horizontal Fixed Test

Nick-break test or tensile test, at Humble Inspector's option, shall be made of the other two specimens. Nick-break specimens shall be hacksaw notched 1/4-inch in from both edges, at the center of the weld.

V. INSPECTION AND TESTING OF PRODUCTIVE WELDS

5.1 Rights of Inspection

Humble shall have the right of inspection of all welds by visual means, by radiographic or other non-destructive methods and by destructive testing. The inspection may be made both during the welding operation and after the weld has been completed. Humble shall have the right to accept or reject any weld not meeting the requirements of the specifications described above.

5.2 In the event of rejections, the expense of installing new welds or repairing in accordance with directions of Humble's Inspector shall be borne by the Contractor, and cost of subsequent radiographs or ultrasonic inspections of repaired welds shall be borne by the Contractor. The cost of replacing sound welds ordered removed by Humble's Inspector will be borne by Humble.

5.3 Each radiograph or ultrasonic inspection will be interpreted in accordance with requirements above for full penetration, complete fusion, porosity and slag inclusions, and for cracks which are not permitted.

5.4 Destructive Testing

Humble shall have the privilege of making any tests to check the quality of welds made by each welder, and the right to order sections containing complete welds or any part thereof to be cut from finished work that, in the opinion of Humble's Inspector appears to be defective. The Contractor shall prepare specimens from any such weld and deliver them to Humble for testing. Humble will at its option, test such specimens by the nick-break, or bending tests described in Section 4.22 of these specifications.

If the weld does not conform to the prescribed tests, or is otherwise unsatisfactory, the welder or welders may be disqualified from further work on this project and the Contractor shall bear all cost of cutting samples and rewelding or repairing joint, as directed by Humble's Inspector. If the weld is found satisfactory, Humble shall bear the above-mentioned cost in accordance with prices shown in the contract or otherwise agreed upon in writing by both parties concerned.

VI. SAFETY

On Humble equipment, and with regard to Humble's materials, all welding and torch work shall be performed by procedures and in locations acceptable to Humble's Inspector. A proper regard for safety precautions necessitated by the presence of air-hydrocarbon or other flammable materials shall be observed by Contractor's personnel at all times. Prior approval to proceed on particular phases may be required at the discretion of Humble's Inspector.

APPENDIX B

SPECIFICATIONS FOR PROTECTIVE COATINGS

A. GENERAL

These specifications cover all protective coatings and other corrosion protection to be applied above elevation minus 8' MLLW. All jacket legs, diagonal braces and conductor pipes shall be incased with Neoprene or Monel sheath in the splash zone interval as indicated on the plans. Above elevation minus 8' MLLW, all members shall be incased in Neoprene or Monel, painted or galvanized as specified below.

All hangers for piping systems and all brackets for electrical terminal boxes and conduit shall be welded to structural steel members before epoxy paint coats are applied.

B. SURFACE PREPARATION

All surfaces to be coated shall be prepared in accordance with the latest edition of "Surface Preparation" issued by SSPE. Heavy deposits of oil or grease shall be removed prior to blasting by "Solvent Cleaning" in accordance with SSPC - SP 1. All rust, mill scale, electric weld spatter, paint, etc., shall be removed by "White Metal Blast Cleaning" in accordance with SSPC - SP 5. Sand shall be dry, shall pass through a 16 mesh screen and shall be retained on 35 mesh screen, U. S. Sieve series. All sheared and other excessively sharp edges shall be slightly rounded by grinding. After cleaning, surfaces shall be kept free of all oil, grease, dirt, and moisture until protective coating has been applied..

C. GALVANIZING

All steel hardware, fencing, handrails, and grating shall be galvanized in accordance with ASTM A-123. Handrails and fences shall be fabricated in appropriate sections and galvanized after fabrication has been completed.

D. SYNTHETIC RUBBER SHEATING

1. General
   As indicated on plans, steel members shall be incased or sheathed with 1/2-inch thick vulcanized neoprene elastomer or derivative of neoprene elastomer.

2. Neoprene Elastomer
   The elastomer shall be one of the types compounded by Mark Tool Company, Oil States Rubber Company, Rubber Applicators, Empire Rubber Company or other companies subsequently approved by Humble for corrosion protection of steel in the splash zone of an offshore sea environment.

3. Application

Pipe shall be sandblasted in accord with section B. SURFACE PREPARATION above, before adhesive or bonding compounds are applied. Neoprene sheathing shall be vulcanized to the pipe. The application process shall result in adhesion to the steel pipe, as strong as the neoprene. The ends of the sheathing shall be beveled or chamfered on 45 degree angle and shall be 100 percent bonded to the pipe at both ends of the sheathing.

E. MONEL SHEATHING

1. General

As indicated on plans, steel members shall be tightly wrapped with arc-welded, airtight, watertight sheath of International Nickel Company's 18-ga. Economy Monel Sheet in the splash zone noted.

2. Cleaning

Rust, mill scale, and all foreign material shall be removed from all steel surfaces underlying monel and monel to steel welds by sandblasting to white metal. Steel jacket leg welds must be ground smooth.

3. Application

a. Welding of the monel sheet shall be performed and supervised by acceptable to Humble's Inspector. Electrodes shall be stored in a warm, dry place to prevent imbibing. The circular monel-to-steel welds at each end of the sheath shall be made with one bead using 1/8-inch INCO No. 130 or Eutec Trode 2000 monel electrodes or by gas tungsten-arc welding with INCO No. 60 monel wire filler metal. Longitudinal welds shall be made with 3/32" INCO No. 130 rods or Eutec Trode 2000 monel electrode or by gas tungsten-arc welding without filler metal.

b. The monel sheet shall be applied cigarette fashion with an overlap of not less than one inch along the longitudinal circumferential monel-to-monel seams. During welding, the monel sheet shall be tightly held around the members to be covered by means of clamps or ropes not injurious to the monel sheet. All monel shall be applied on the structure so that the longitudinal monel welds face the center of the templet. All monel sheets and welds which are left incomplete or unsealed must be wrapped to prevent moisture accumulation under the sheets.

c. The tungsten arc process may be used as an alternate on monel-to-monel welds. Extreme care shall be taken to protect this welding operation from wind.

d. No protective coating or marking material of any kind shall be applied to the steel surface beneath the monel sheath or monel welds. Protective coatings may overlap the monel sheaths if such coatings are applied after the monel is welded in place.

e. All weld slag shall be removed after the welds are completed. All weld will be visually inspected by Humble's Inspector, and areas showing defects such as cracking slag entrapment, undercut, miswelded joints, or porosity shall be rewelded at the contractor's expense.

F. PAINTING

1. General
All black steel surfaces above elevation -8' MLLW shall be painted with Enjay product using one of the multicoat systems specified below. Each coat shall be allowed to dry properly before application of a succeeding coat. No paint shall be applied before fabrication has been completed.

2. The top surface of all steel deck plating shall be coated with the following multicoat paint system:

	Dry Film Thickness (Mils)	Min. Drying Time per Coat (Hour)
1st Coat - Rust Ban 191	3.0 - 5.0	24
2nd Coat - Rust Ban EX 6666 (Yellow Primer)	1.0 - 2.0	16
3rd Coat - Rust Ban EM 6664 (Oxide Red)	3.0 - 4.0	24
4th Coat - Rust Ban EM 6665 (Dark Gray)	3.0 - 4.0	24
5th Coat - Rust Ban EX 6671 (Light Gray) 2/1 lb/gal. Enjay Non-Skid Additive 6149 Min. Dry Film	1.0 - 2.0	16
	14 Mils	

3. All other black surfaces shall be coated with the following multicoat paint system:

Epoxy System	Dry Film Thickness (Mils)	Min. Drying Time per Coat (Hour)
1st Coat - Rust Ban 191	3.0 - 5.0	24
2nd Coat - Rust Ban EX 6666 (Yellow Primer)	1.0 - 2.0	16
3rd Coat - Rust Ban EM 6664 (Oxide Red)	3.0 - 4.0	24
4th Coat - Rust Ban EM 6665 (Dark Gray)	3.0 - 4.0	24
5th Coat - Rust Ban EX 6671 (Light Gray)	1.0 - 2.0	16
	14 Mils	

4. Rust Ban 188 applied with a dry film thickness of 3.5-5.0 mils can be used in lieu of Rust Ban 191 in the above two paint systems.

5. Galvanizing damaged by welding and weld metal joining two pieces of galvanized steel or joining galvanized steel to black steel shall be painted with one or two brush coats (Total dry film of 3.0 - 5.0 mils) DEVCON Z (95% pure zinc and 5% epoxy binders) manufactured by Devcon Corporation, Danvers, Massachusetts.

6. Application

Storage, mixing, straining, thinning and application of paint shall be in accord with manufacturer's recommendations. Coating shall not be applied to areas in which coating will be damaged by water phase welding or cutting. Such areas will be designated by Humble's Engineer or Inspector.

Coating shall be applied in not less than the number of coats specified above to a dry film thickness of not less than the indicated thickness as measured by a properly calibrated Elcometer, Coatingage, or Mikrotest coating gauge. A stripe coat of Primer shall be brush applied. If the required thickness is not obtained in the specified number of coats, additional finish or mastic coats shall be applied until the required thickness is obtained. The last coat on any surface shall be the finish coat indicated above. Total dry film thickness before application of the mastic coat shall be not less than the total indicated minimum thickness of underlying coats.

Contractor shall check the entire coated surface with a Tinker and Razor M-1 holiday detector or approved equal. Areas containing holidays shall receive additional finish coats until holiday-free.

G. MILL-WRAPPED PIPE

1. General

All 20-inch diameter conductor pipe shall be mill-wrapped from elevation minus 20' MLLW to minus 680' MLLW.

2. Surface Preparation

All piping shall have the entire surface prepared as follows:

a. All weld spatter, burrs, loose mill lacquer, loose rust, loose scale, oil, grease, dust, dirt, moisture, and other foreign matter shall be removed from the exterior surface of the pipe. Sharp points shall be removed or peened smooth. A bright surface is not required.

b. After cleaning, the pipe shall be kept free of all foreign matter. Oil or grease deposited on the pipe during fabrication or handling shall be removed by wiping with clean rags saturated with primer thinner specified for the primer or with a non-oily solvent. Kerosene, gasoline, and similar solvents which leave a film on evaporation shall not be used. Surfaces shall be dry before application of field primer.

3. Mill-Wrapping

a. Pipe shall be mill-wrapped using suitable automatic machinery as follows:

(1) Apply one coat of Bitumastic 70-B or equal coal-tar primer.

APPENDIX C

SPECIFICATIONS FOR CATHODIC PROTECTION

The underwater and buried portions of the platform shall be protected by the application of cathodic protection currents. Protection is achieved when the structure has a potential with respect to sea water equal to or more negative than (-)0.85 volts as measured by a copper, copper sulfate reference cell. The current to achieve protection shall be obtained by the solution of galvanic aluminum anodes.

The anodes shall be Galvalum as manufactured by the Dow Chemical Company. Each anode shall contain 1,500 pounds of aluminum and shall be dimensioned and mounted within the structure as shown in the plans. The number of anodes shown is sufficient to provide the required protective current of 10 ma/sq.ft. in the water and 4 ma/sq.ft. below the mudline for 20 years.

After dissipation of the galvanic anodes they will be replaced with additional anodes or with an impressed current system using rectifiers and suitable impressed-current type anodes. Provisions for the installation of the impressed current system are incorporated into the design of the platform.

APPENDIX D

SPECIFICATIONS FOR FLOODING SYSTEM PIPING

I. SCOPE

This specification covers the general requirements for the fabrication, installation, and testing of the jacket flooding piping system.

II. CODE COMPLIANCE

Piping shall be designed in accordance with the American Standard Code for Pressure Piping USAS B31.3, latest revision.

III. MATERIAL

Pipe, flanges, valves, and fittings shall be of the following type and grade.

A. VENT AND BALLAST PIPING

1. General

Service:	Flooding System Vent and Ballast Piping
Design Specification:	USAS B31.3, latest revision
Flange Rating and Facing:	USAS 300 lb., raised face
General Material:	Carbon Steel
Pressure-Temperature Rating:	720 psig at 100°F.-(USAS B16.5)
Temperature Limit:	-20°F. to 750°F.
Dimensional Standards:	Flanges - USAS B16.5 Butt Weld Fittings - (USAS B16.9) Pipe - USAS B36.10 Gaskets - API-601

2. Piping Material

Fittings	2" & Lrgr.	Butt Weld	Smsl., ASTM A234-WPB, wall to match pipe
Flanges	2" & Lrgr.	300 lb. W.N.	ASTM A181-I, bore to match pipe
Gaskets	Flat Ring	Spiral-Wound Asb. & SS	1/8" Thk., JM #913
Bolting	Cadmium-plated Alloy Stud Bolts, ASTM A193-B7,w/ cadmium-plated S.F. Hvy. Hex Nuts, ASTM A194-2H		
Pipe	2" & Lrgr.	Sch. 40, B.E.	Smls., ASTM A53-B, or API 5L-B

3. Valves

The following valves are acceptable.

a. Cameron

(1) Manual Operated

		Tag
(a) 3" & Lrgr.	300# USAS F.O. Flanged R.F. Cameron, Fig. No. 800301-1-20 (nickel plated ball and stainless steel ring with nylon insert)	B2RF
(b) 3" & Lrgr.	300# USAS Flanged R.F. Cameron, Fig. No. 800301-1-20 (nickel plated ball and stainless steel ring with nylon insert)	B2R

(2) Power Piston Operated

10", 4" & 3"	300" USAS F.O., Weld End, Cameron, Fig. No. 800302-6-20 (nickel plated ball and stainless steel seat ring with nylon insert). Cameron high pressure power piston operator No. 7 for 10" valve and No. 3 for 4" valve.

b. Rockwell

(1) Hydraulic Cylinder Operated

(a) 3" & 4"	Fig. 2049-1/2 - Rockwell Hypreseal Lubricated Plug Valve, ANS-300, Cast Carbon Steel Body, ASTM-A-216 grade WCB, Buttweld ends, Short pattern, worm gear operated less gearing, to receive direct stem mounted hydraulic cylinder operator.
(b) 6" & 10"	Fig. A4249-1/2 - Rockwell Hypreseal Lubricated Plug Valve, ANS-300 Cast Carbon Steel body, ASTM-A-216. grade WCB, Buttwell ends. Venturi pattern with steel plug. Worm gear operated, less gearing, to receive direct stem mounted hydraulic cylinder operator.

(2) Manual Operated Valves

(a) 3" & 4" — Fig. 2025-1/4 - Rockwell Nordstrom screwed gland type, short pattern valve, RF X buttweld ANS-300 cast carbon steel body ASTM-A-216 grade WCB, steel plug, fixed adjustment gland with Buna-N stem seal, wrench operated.

(b) 6" — Fig. 4249-1/4 - ditto Item 3., b., (1), (b) except Flange X Buttweld and Complete with gearing, less sealant injector assy.

(c) 10" — Fig. 4249-1/2 - ditto Item 3., b., (1), (b) except complete with gearing modified for underwater service per drawing EKL-764. Less Sealand injector assy.

(3) Hydraulic Cylinder Operator

(a) Hydraulic (or pneumatic) for 3", 4", and 6" valves Scottco, Inc. 'High Tork', Model 4.0, to operate at 60 psi Air, 300 psi test.

(b) Hydraulic (or pneumatic) for 10" valves, Scottco, Inc. 'High Tork' Model 6.0, to operate at 60 psi air, 300 psi test.

4. Reducing Branches Welded Piping

Weldolets F.S. ASTM-II, Sch. 40.

B. CONTROL PIPING

1. General

Service:	Flooding System Control Piping
Design Specification:	USAS B31.3, latest revision
General Material:	Carbon Steel
Pressure-Temperature Ratings:	2160 psig at 100°F.
Temperature Limit:	-20°F. to 750°F.
Pipe Joint Compound:	E.A. Key Co. "Red-D-Mix", or equal
Dimensional Standards:	Fittings - USAS B16.11 Pipe - USAS B36.10 Pipe Threads - USAS B2.1, tapered

2. Piping Material

Fittings	1" & Smlr.	6000 lb. S.W.	F.S., ASTM A105-II
Couplings	1" & Smlr.	6000 lb. S.W.	F.S., ASTM A105-II
Unions	1" & Smlr.	6000 lb. S.W.	F.S., ASTM A105-II CJ, Stl.-Stl. Seat
Plugs	1" & Smlr.	6000 lb. Scrd.	Bull Plug, ASTM ASTM A105-II
Reducers	1" & Smlr	XXS S.W.	Smls., Swage
Pipe	1/4" thru 1"	Sch. 80, P.E.	Smls., ASTM A106-B, or API 5L-B

3. Valves

			Tag
1" & Smlr.	2500#	Screwed F.S. Ball Valves	E2S

C. FLOW METERS

1. General

Type: Turbine

Model: 4CS1-7

Size: 4" 150 ANSI

Max. Press.: 275 psi

Max. Flow: 1050 GPM

Fluid: Salt water (sea water)

Material: Body - Carbon Steel
Bearing - Tungsten Carbide Sleeve
Cone Assy. - Stainless Steel
Note: Aluminum not permitted

2. Accessories

a. Two (2) explosion proof pickup coils with preamplifiers. Pick-up coil leads shall be wired directly to terminal block. Conduit box shall be dehumidified and then filled with epoxy after field connections are made.

b. Model FC-21-F Totalizer. Flow rate indicator unit to have aux. flow contact for telemetry accumulation.

c. Orifice Plate to fix between 4" flanges. Orifice size to be determined when max. pumping is known. Material - 304S.S.

Tag No.: FM A-1, FM A-2, FM B-1, FM B-2

D. LEVEL INDICATOR

1. General

Model:	6200
Range:	0-150 PSIG
Fluid:	Salt water (Transducer will be submerged a maximum of 150# hydrostatic head)
Material:	Tube - 316 S.S. Base Plate - 303 S.S.
Electrical Connection:	Mecca Terminal (waterproof for 150# Hydrostatic head)
Quantity:	Four (4)
Tag Nos.	LI A-1, LI A-2, LI B-1, LI B-2

2. Accessories

Accessories for the transducers are to include two (2) individual monitoring systems, each system consisting of the following:

a. 12" x 10" x 5" hinged front cabinet with gray hammertone finish.

b. Four (4) Simpson No. 3323 meters or equivalent with dual scales; 0-100%, 0-150#, ruggedized and sealed, mounted on front panel of cabinet.

c. One (1) power on light mounted on front panel.

d. One (1) Computer Instruments Corp. power supply with input 115 V 60 hz, output - 0.025 VDC to 5.25 VDC to give linear output from transducer of 0-5VDC available to computer with an input impedance of 1 meg. ohms or more.

e. Internally mounted terminal strips prewired ready for external connections.

IV. FABRICATION AND INSTALLATION

A. Where cold-springing is required, it shall be calculated in accordance with USAS B31.3. All cold-spring shall be noted on Piping Drawings, Isometrics, and pipe Fabrication Spool Sheets.

B. Allowance for expansion and contraction of pipes shall be made in accordance with USAS B31.3, or as called for on Piping Drawings.

C. No X-ray shall be required.

D. Radii of cold pipe bends shall be a minimum of five times the nominal diameter.

E. No miter fittings shall be used unless specifically authorized.

F. Care shall be taken to protect flange faces and pipe threads during erection. Flange faces shall be clean, and pipe shall be clean and free from foreign matter before assembly. Damaged flange faces may be dressed with a medium-cut file if the damage is not sufficient to require new facing. Damaged flange faces should either be re-faced by machining, or else discarded.

G. Open ends of threaded valves shall have a short nipple or a plug inserted to prevent thread corrosion.

H. Bulkhead and compartment shell penetrations shall be as shown on the drawings.

I. Piping shall be supported as indicated on the drawings and with enough flexibility in order to relief excessive strain on the shell.

V. LINE MARKING

A. Each installed line shall be clearly marked at both ends to denote the service, the location, the line number, the line specification, and the nominal line size. Line markings shall be painted, white, block numerals, that correspond to markings shown on plans.

B. Pipe Fabrication Spool Sheets shall be marked with the line number, the line specification and the piece mark.

C. The piece mark together with the proper spool break, either flange break, field weld, or erection weld, shall be shown on the Isometric.

D. The piece mark shall be tagged in at least two places on all fabricated spool pieces. Pipe stenciling shall not be permitted.

VI. CLEANING AND TESTING

A. VENT AND BALLAST PIPING

Piping shall be cleaned by blowing out with compressed air of not less than 80 psi.

B. CONTROL PIPING

Each line shall be disconnected from the power piston operator and acid cleaned. It shall then be flushed with clean, fresh water until the discharge is clean and free from foreign matter.

Each line shall then be filled with clean, fresh water and tested at 1000 psi. Test pressure shall be held long enough for visual inspection of each line.

After testing each line shall be blown with clean, dry air and reconnected to its respective power piston operator.

All piston operators shall be operated with hydraulic fluid and the required operating pressure for each valve noted.

All connections between the control piping and the power piston operators shall be inspected for leaks with soap suds.

C. POWER PISTON OPERATED VALVES

All power piston operated flooding valves shall be tested under simulated actual operating conditions with an exterior water pressure of 500 psi prior to installation in the structure.

Valves shall be checked for leaks and power piston operating pressure noted when valve is opened under test pressure.

APPENDIX E

SOIL & FOUNDATION INVESTIGATION

SOIL AND FOUNDATION INVESTIGATION
LEASE OCS-P-0188, BORING 188EE
SANTA BARBARA CHANNEL, CALIFORNIA

* * *

Report

to

HUMBLE OIL & REFINING COMPANY
Los Angeles, California

* * *

by

McCLELLAND ENGINEERS, INC.
Soil & Foundation Consultants
Houston, Texas

August 1971

McCLELLAND ENGINEERS INC. SOIL & FOUNDATION CONSULTANTS

6100 HILLCROFT • HOUSTON, TEXAS 77036
TEL: 713/774-2527 • TELEX: 762-447

Report No. 71-127-2
August 19, 1971

Humble Oil & Refining Company
1800 Avenue of the Stars
Los Angeles, California 90067

Attention: Mr. M. O. Pattison

Soil and Foundation Investigation
Lease OCS-P-0188, Boring 188EE
Santa Barbara Channel, California

Gentlemen:

This report gives results of our investigation of soil and foundation conditions at the above offshore location in the Santa Barbara Channel. This study was made under authorization provided by your Western Division Contract No. 1034 in accordance with our proposal of May 4, 1971.

Preliminary information relative to soil stratigraphy and soil properties has been submitted and discussed with Humble at various times while this report was being prepared. All basic field and laboratory data are included herein together with our design analysis of piles to support axial loads.

We appreciate this further opportunity to be of service in your offshore program. Please call on us if we may be of additional assistance.

Very truly yours,

McCLELLAND ENGINEERS, INC.

John W. Johnston

John W. Johnston, P.E.

Robert L. Perkins

Robert L. Perkins, P.E.

JWJ/RLP/sac
Copies Submitted:
Humble Oil & Refining Co., Los Angeles (6)
Humble Oil & Refining Co., Houston (3)

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* * *

APPENDIX A: LABORATORY AND FIELD SOIL TESTS
APPENDIX B: SOIL TEST RESULTS
APPENDIX C: CRITERIA FOR PREDETERMINING PILE CAPACITY

SUMMARY

An investigation has been made of the soil conditions at a site in Lease OCS-P-0188 in the Santa Barbara Channel in 841 ft of water. The principal findings and conclusions from our engineering analyses of data secured from a foundation boring and tests on samples from the boring may be summarized as follows:

(1) Foundation soils at the site are essentially fine-grained, cohesive soils varying from clay and silty clay to clayey silt. These soils are somewhat overconsolidated with respect to present overburden pressures and exhibit a relatively high rate of strength increase with depth. Clay soils are generally soft at the mudline and become hard by about 250-ft penetration.

(2) Soil data have been used to compute ultimate compressive and tensile capacities of 36-in.-diameter piles having both driven and grouted sections. An appropriate safety factor must be used in conjunction with ultimate capacity curves in selecting design pile penetrations.

(3) Data relative to in situ soil strength and the stress-strain characteristics of soils to about 100-ft penetration are presented for use by Humble in other related analyses.

(4) Pile installation should be done under close engineering supervision in order that the effects of construction procedures upon pile capacity may be properly evaluated.

INTRODUCTION

This investigation was made for Humble Oil & Refining Company for a potential platform location in Lease OCS-P-0188 in the Santa Barbara Channel offshore from California. The lease area is shown on the vicinity map on Plate 1 and the location of a boring, designated 188EE, made for this study is shown on Plate 2. Lambert Coordinates (California, Zone 6) for the boring are: x = 832,517; y = 830,859. Water depth at the location is 841 ft.

The proposed platform will be a tower-type structure with four large diameter legs. Each leg will have eight external pipe sleeves through which 36-in. pipe piles will be driven. The driven piles will be grouted inside the sleeves. Holes of 36-in.-diameter will then be drilled below the driven piles and 30-in. insert piles will be installed and grouted.

The principal purposes of this study were to develop information on soil conditions at the site and to predetermine the axial capacities of piles. Soil information was obtained from a boring to 350-ft penetration and from tests on soil samples from the boring. These data were utilized in engineering analyses to develop design recommendations.

FIELD INVESTIGATION

The dynamically-positioned drilling vessel "Caldrill 1" was used as a floating base for drilling operations. The normal drilling equipment and crews were used to advance a boring to El -1191, a penetration of 350 ft below the mudline. McClelland Engineers provided soil sampling tools and testing equipment plus technical personnel to assist drill crews and supervise the boring program.

The boring was advanced by wet rotary methods using an open-center bit on the bottom of a 5-in. drill string. No provision was made for recirculation of drilling fluid. A 3-in. wire-line sampler equipped with a 2.5-in.-ID sample tube was operated through the bore of the drill pipe to obtain

samples immediately below the bit. A 300-lb sliding weight incorporated in the sampler was dropped approximately 5 ft a sufficient number of times to secure the desired sample tube penetration, nominally 24 in.

Samples were obtained continuously to 50-ft penetration and then at 10-ft intervals to the final penetration of 350 ft. Samples were removed from the sampling tube at the site and were examined and classified by our engineer. The boring log on Plate 3 shows the samples taken, driving resistances of the sample tube and description of material penetrated. Unconfined compression tests were performed on selected specimens as they were recovered from the boring. Representative portions of all samples were sealed to prevent moisture loss and were packaged for shipment to our laboratory in Houston.

A brief chronological description of field operations is shown in a summary on Plate 5.

FIELD AND LABORATORY TESTS

The field and laboratory testing programs were designed to evaluate the pertinent physical properties of foundation soils. Shear strength, the most important property, was investigated by the following tests:

Type of Test	Number of Tests
Miniature Vane	
Undisturbed	9
Remolded	9
Unconfined Compression	
Undisturbed	15
Remolded	10
Unconsolidated-undrained Triaxial Compression	
Undisturbed	26
Remolded	12
Consolidated-undrained Triaxial Compression	
Undisturbed	6

Water contents and unit dry weights were determined for all unconfined compression and triaxial specimens. Additional classification tests performed were as follows:

Type of Test	Number of Tests
Water Content	61
Liquid and Plastic Limit	54
Grain Size	
Sieve and Hydrometer	10
Percent passing No. 200 sieve only	14

Brief descriptions of some of the soil test procedures are given in Appendix A. Strength, water content and plasticity data are plotted on the boring log on Plates 3 and 4. Most of the test data are tabulated on Plates B-1 and B-1a of Appendix B. Grain size curves are presented on Plates B-2 through B-4 and stress-strain curves from strength tests are plotted on Plates B-5 through B-16.

GENERAL SOIL CONDITIONS

Soil Stratification

A generalized summary of the soil strata at this site, based on the boring log on Plate 3, is shown in the following tabulation:

Stratum	Penetration, ft From	Penetration, ft To	Description
I	0	46	Very soft-to-firm gray clay
II	46	78	Gray clayey silt
III	78	328	Stiff-to-hard gray silty clay
IV	328	350+	Gray clayey silt

Modifications to the above general descriptions and variations in texture, plasticity and strength may be observed on the boring log on Plates 3 and 4.

Soil Properties

All soils encountered at this site are fine-grained, with 88 to 99 percent of particles passing a No. 200 sieve. The plasticity chart on Plate 6 shows that plasticity data plot close to the "A-line" and that soils vary from low to high plasticity. Inspection of liquid and plastic limit results on the boring log on Plate 3 reveals that plasticity varies widely within each of the four generalized strata listed above; the descriptions and test data indicate that soils could be further subdivided than shown by stratum lines but that all materials are generally similar.

Soil water content at the mudline is slightly above the liquid limit and decreases with depth within Stratum I to about the midpoint of the plastic range near the lower stratum boundary. Below this depth the water contents tend to decrease slightly with depth and shift closer to the plastic limit. Soil shear strengths reflect the relationships between water content and plasticity. Soils are very soft at the mudline and increase in strength in a generally linear fashion with increasing penetration, becoming hard in the lower portion of the boring.

In Situ Strength Profile

A plot showing our interpretation of the in situ soil shear strength appropriate for computation of axial pile capacity is given on the left graph on Plate 7. This relationship was developed by visually averaging the results of shear strength tests, giving greatest weight to the results considered to be most representative.

DESIGN ANALYSIS

Axial Pile Loads

Soil-Pile Adhesion. The curve of soil-pile adhesion shown in the middle graph on Plate 7 was developed using boring and laboratory data in accordance with criteria outlined in Appendix C. The predicted soil-pile

adhesion corresponds to the interpreted in situ strength in the upper part of the boring where shear strength is 0.5 ton per sq ft or less. Between penetrations of 78 ft and 285 ft the soil-pile adhesion is limited to that expected for a normally consolidated clay having a rate of shear strength increase of 0.007 ton per sq ft per foot of depth. Below 285-ft penetration a maximum adhesion of 2.0 tons per sq ft is used; this is particularly appropriate as a limiting soil-grout adhesion for the grouted portion of a composite pile.

Unit End Bearing. Computations using the in situ strength on the left graph on Plate 7 and the criteria given in Appendix C produced the unit end bearing curve shown on the right of Plate 7. Since the pile tip will probably consist of a 30-in. pipe grouted into a 36-in. hole, utilization of the unit end bearing on the gross end area of a 36-in.-diameter pile will depend upon the adequacy of grouting.

Ultimate Pile Capacity. Ultimate compressive and tensile capacities of 36-in.-diameter piles were computed for various pile penetrations using soil-pile adhesion and unit end bearing values from Plate 7 in accordance with Appendix C. The resulting ultimate pile capacity curves are plotted on Plate 8.

Pile Group Capacity. As proposed, each tower leg will be supported by eight piles in a circular group. The pile spacing will be approximately 8 ft. The capacity of the pile group must be evaluated to determine if the full individual pile capacity can be utilized. This requires information on design loads and penetrations which is not available at present. However, experience indicates that no reduction in individual pile capacity because of group action will be required.

Factors of Safety. A general discussion of factors of safety appropriate for use with ultimate pile capacity curves on Plate 8 is given in Appendix C. For the soil conditions at this site we consider our design criteria to be of average reliability for driven portions of piles. Therefore, factors of safety of 1.5 for maximum design loads and 2.0 for normal operating loads are appropriate.

Experience with long, heavily-loaded driven piles in offshore construction far outweighs that for grouted piles. The applicability of our design criteria to grouted piles depends to a great extent upon the adequacy of construction techniques and procedures. If these are carefully controlled, we expect the same factors of safety given above for driven piles to be appropriate for grouted piles.

Lateral Pile Loads

Analysis of pile foundations subjected to lateral loads was not included as part of this study. However, basic soil data including soil shear strengths and stress-strain characteristics are presented. These may be utilized as input information to reflect soil resistance-pile deflection (p-y) characteristics of the soil for a computer solution based on the difference equation method of analysis.

PILE INSTALLATION

Driven Piles

The 36-in. pipe sections planned for the upper portions of piles will penetrate into relatively strong soils. A pile hammer having a high rated energy will be required. Pile wall thickness must be adequate to limit driving stresses and effectively transmit driving energy to the pile tip; wall thicknesses may need to be greater than required for the maximum combined stresses within the completed structure. We recommend that pile drivability and driving effects be evaluated by wave equation analyses.

Any splice required in the driving sequence should be made with the pile tip at the highest possible elevation. This will minimize pile set-up and relatively hard driving when driving is resumed. Since the contribution of point resistance in soils at this site will be fairly small, little benefit will be gained from removal of the soil plug. Should internal drilling or jetting be

done during driving, it should be limited to a depth of several feet above the tip to avoid possible detrimental effects on soil-pile adhesion.

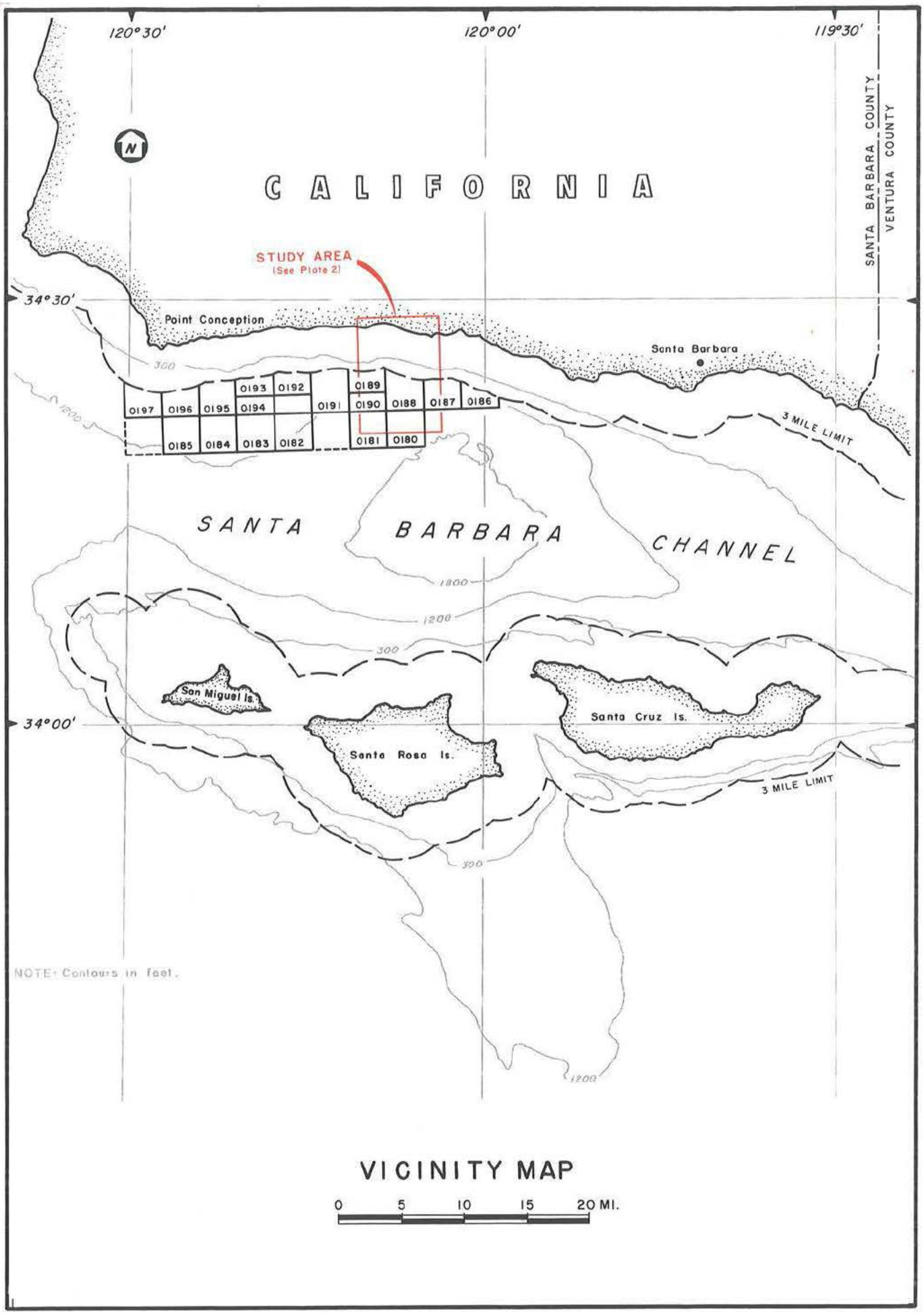
Grouted Piles

Holes of 36-in.-diameter are to be drilled below the driven pile sections, and 30-in. pipe sections are to be installed and grouted in place to complete pile installation. To satisfy the criteria used in this report for pile design, the drilling and grouting procedures must result in development of high soil-grout adhesion, pile end bearing and grout-steel bond. Steps must be taken to assure a grout envelope in intimate contact with the pile and soil. The bottom of the drilled hole must be clean and the inside of the 30-in. pipe must contain a competent plug.

Construction Supervision

We recommend that pile foundations be installed under close engineering supervision. This supervision should be provided by personnel fully cognizant of the possible effects of installation procedures upon the parameters and criteria used for pile design.

ILLUSTRATIONS



VICINITY MAP

McCLELLAND ENGINEERS

PLATE 1

Drill Stem Test Data

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

Proprietary

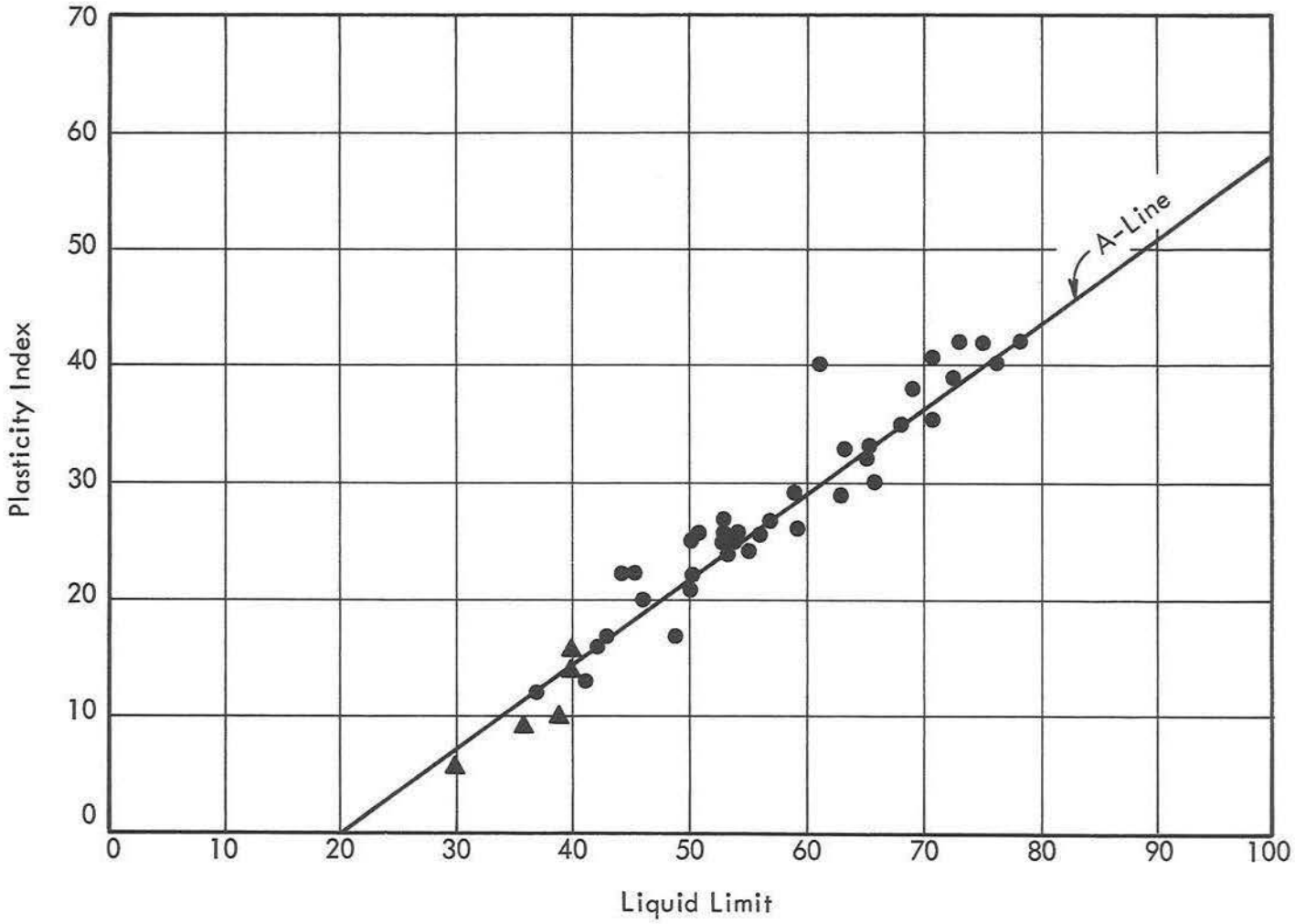
Not for Public Release

Form 100-1 (57) Job No. 71-127-2

Date	Time From	Time To	Description of Activity
May 16, 1971	0	0700	Moving to and positioning vessel on location of Boring 188EE
	0700	0930	Running drill pipe
	0930	2000	Sampling to 70-ft penetration. Lost part of bumper sub, two drill collars & bit in hole
	2000	2400	Cementing and abandoning hole and drilling new hole
May 17, 1971	0	0200	Drilling new hole to 68-ft penetration
	0200	1730	Drilling and sampling to 350-ft penetration
	1730	1930	Cementing hole and pulling drill pipe

SUMMARY OF FIELD OPERATIONS
Santa Barbara Channel
Boring 188EE

McCLELLAND ENGINEERS

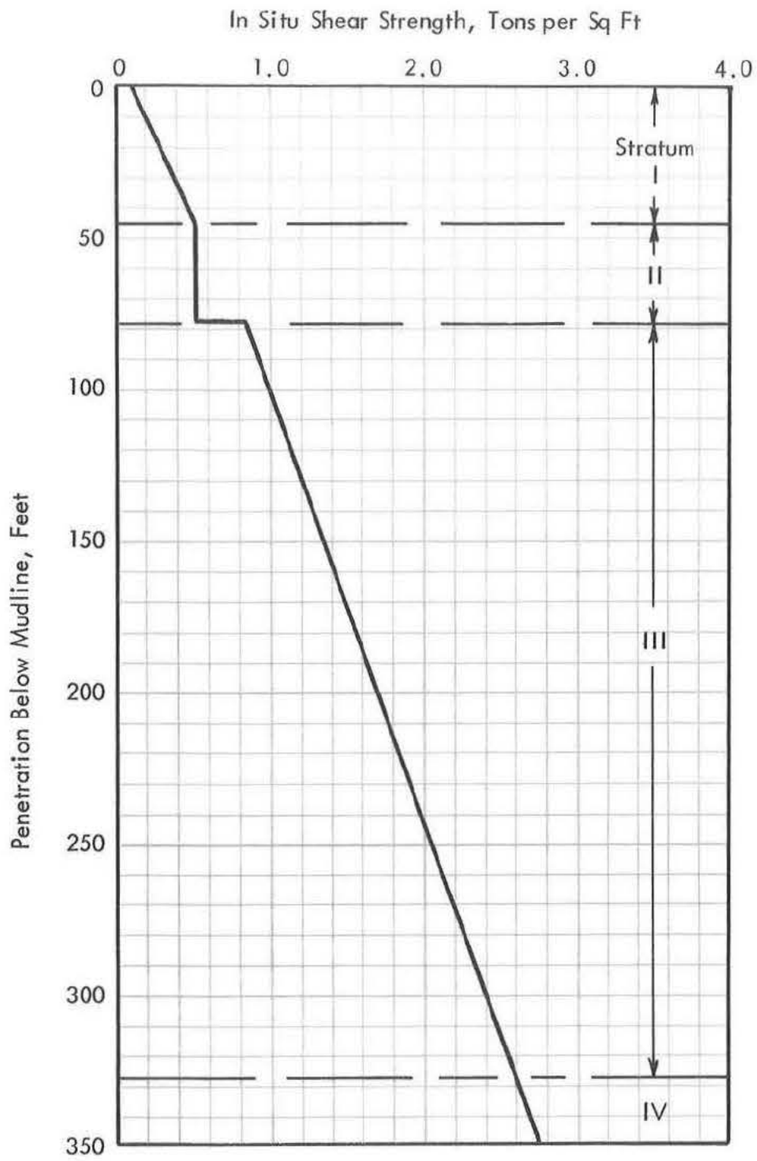


LEGEND

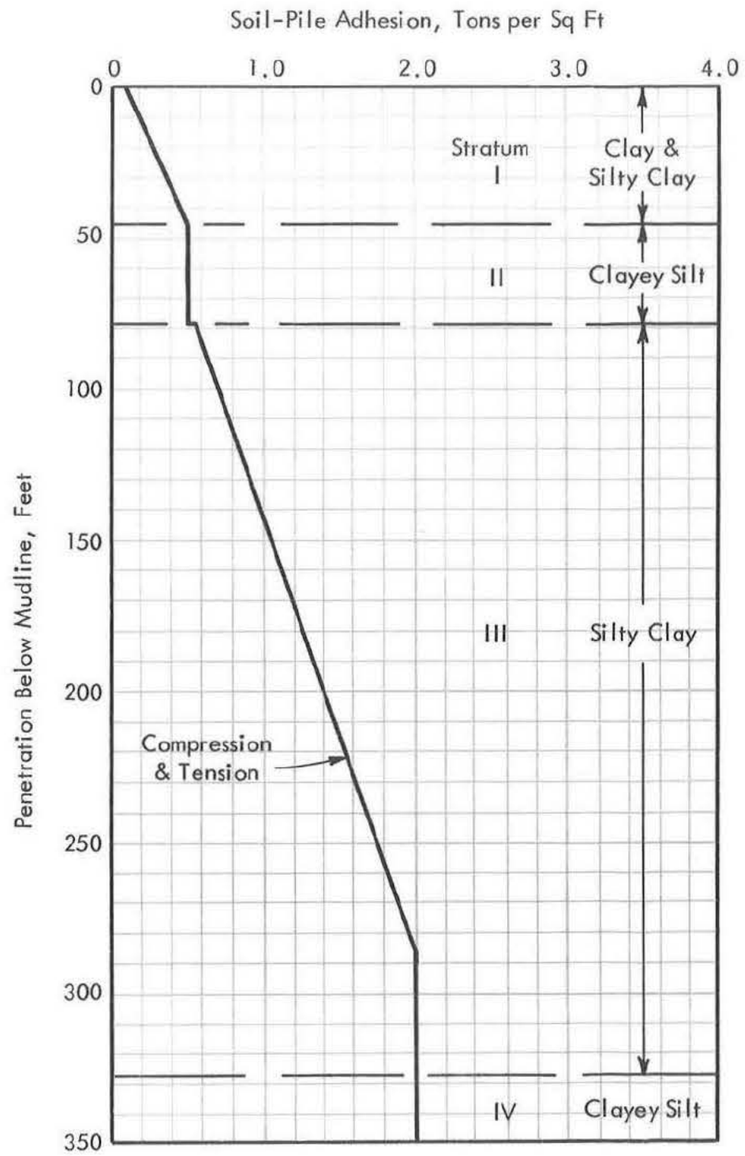
▲ Strata II (46' to 78') and IV (328' to 350')

● Other Strata

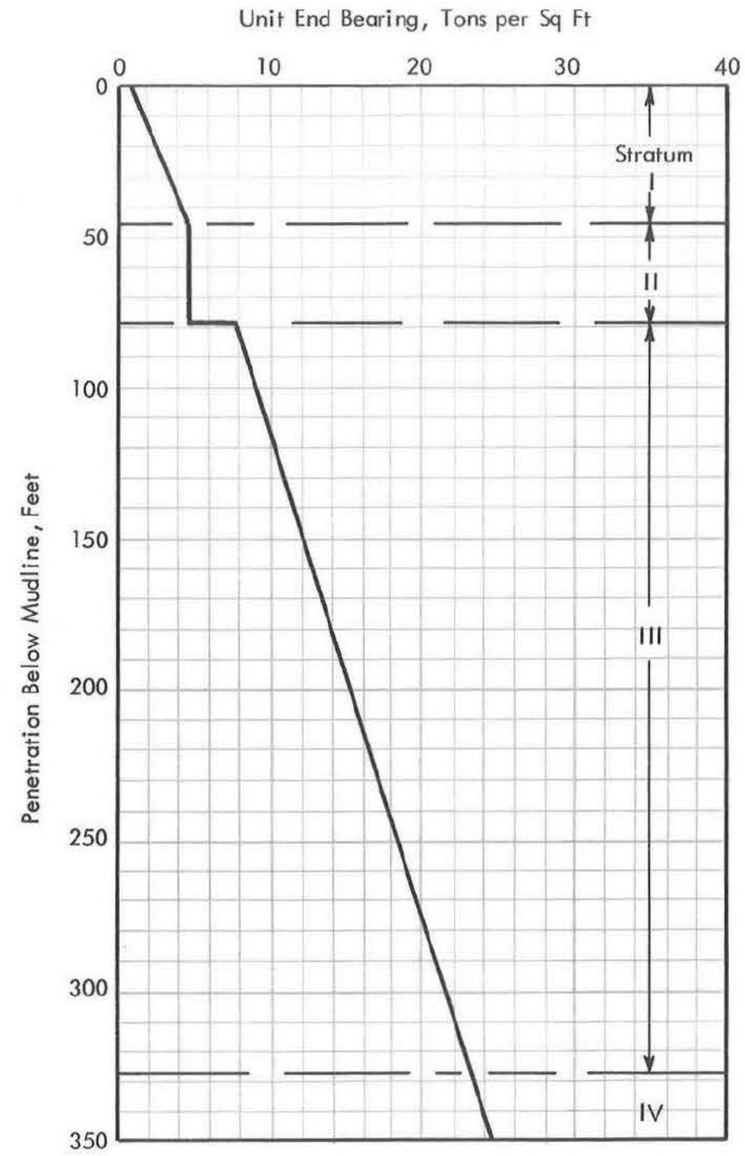
PLASTICITY CHART
Boring 188EE



STRENGTH PARAMETERS



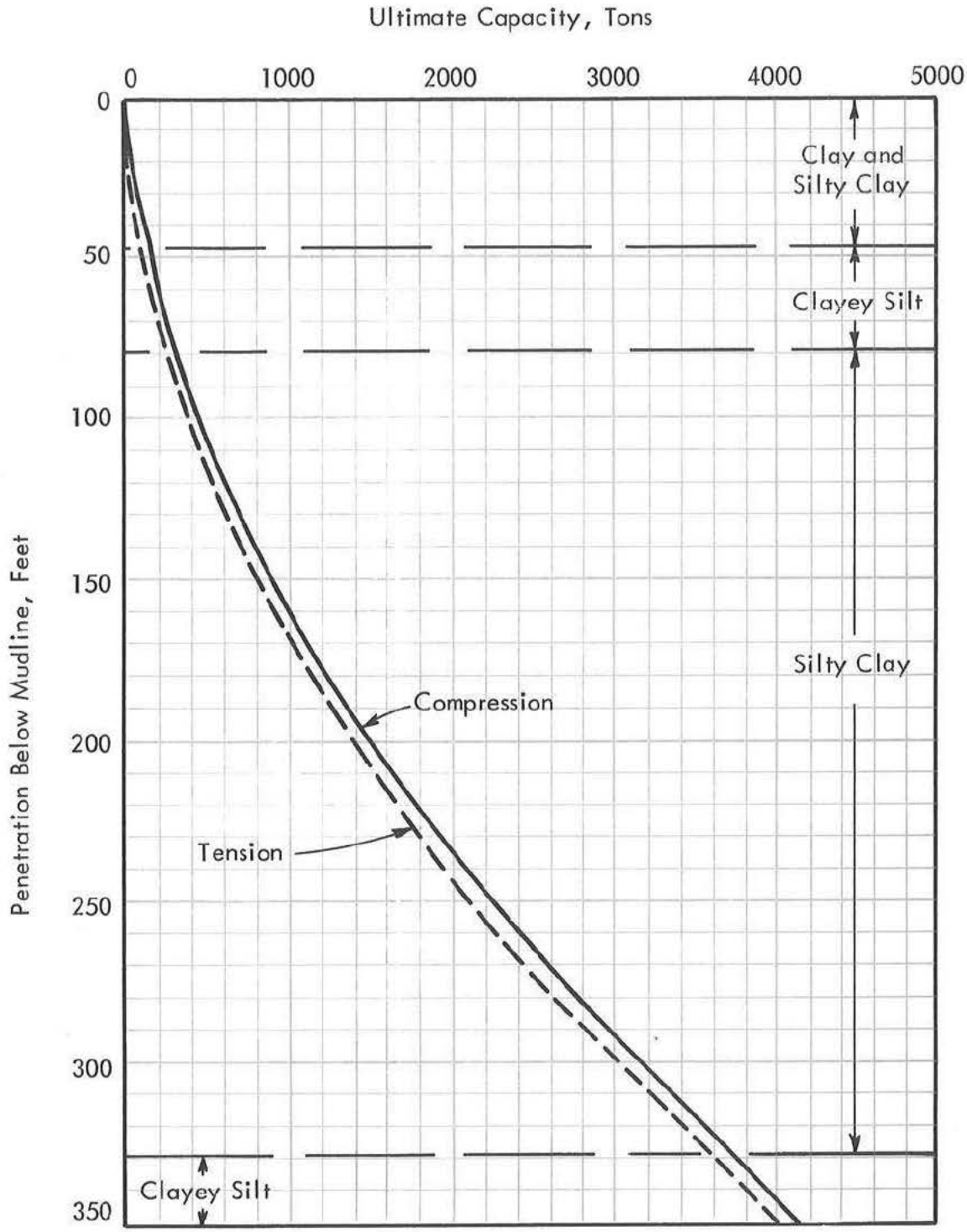
SOIL-PILE ADHESION



UNIT END BEARING

INTERPRETATION OF DATA

Boring 188EE



PILE CAPACITY CURVES
36-in. Diameter Piles
Boring 188EE

APPENDIX A

LABORATORY AND FIELD SOIL TESTS

APPENDIX A
LABORATORY AND FIELD SOIL TESTS

STRENGTH TESTS

Several procedures were used in the field and laboratory to evaluate the strengths of foundation soils. Test procedures are described in the following paragraphs. Cohesive shear strengths determined by the tests are plotted on the boring log on Plates 3 and 4 and are tabulated on Plates B-1 and B-1a of Appendix B. Stress-strain curves from some of the tests are also presented in Appendix B.

Miniature Vane Tests

In this type of test a small 4-bladed vane is inserted into a soil sample. A constant-speed electric motor is used to apply torque to the vane through a calibrated spring. Soil shear strength is computed from the maximum torque required to produce shear failure. Tests for this study were made both on undisturbed samples and on samples completely remolded at unaltered water content.

Unconfined Compression Test

In this test a laterally-unsupported cylindrical soil specimen is loaded axially to failure at a constant rate of strain. Axial load is measured by a calibrated proving ring and sample deformation is monitored on a dial indicator. Cohesive shear strength is computed as one-half the maximum compressive stress. Undisturbed and remolded tests were performed for this investigation.

Unconsolidated-Undrained Triaxial Compression Test

This triaxial test is similar to the unconfined compression test except that the test specimen is enclosed in a thin rubber membrane and subjected to confining pressure before axial load is applied. The confining pressure is

made approximately equal to the computed effective overburden pressure. No consolidation is permitted under the influence of the confining pressure and no drainage is permitted during axial load application. Tests for this study were on both undisturbed and remolded specimens.

Consolidated-Undrained Triaxial Compression Test

The consolidated-undrained triaxial procedure also involves application of a confining pressure to a specimen enclosed in a rubber membrane. In this test the specimen is allowed to consolidate under the effect of the pressure. However, no drainage is permitted during axial load application. Tests for this study were performed on undisturbed samples only. Volume changes associated with consolidation are shown on Plate B-1.

OTHER TESTS

Liquid and plastic limits were determined for most cohesive specimens to aid soil classification. Natural water contents were performed on all specimens used for limit tests. Water contents and unit weights were also determined in connection with all compression tests. Other water contents were made on samples not included in the above testing in order to complete the moisture profiles on Plates 3 and 4. Results of all water content and plasticity tests are plotted on Plates 3 and 4 and results of all supplementary tests are tabulated on Plates B-1 and B-1a.

Grain size testing included complete hydrometer and sieve tests on certain samples and only determination of the percent passing the No. 200 sieve for others. The percents passing the No. 200 sieve are tabulated for all samples tested on Plates B-1 and B-1a. Complete grain size curves from hydrometer and sieve tests are presented on Plates B-2 through B-4.

APPENDIX B

SOIL TEST RESULTS

McCLELLAND ENGINEERS

SUMMARY OF TEST RESULTS

SAMPLE NO.	PENETRATION FT.	CLASSIFICATION TESTS: LIQUID LIMIT	PLASTIC LIMIT	WATER CONTENT %	PERCENT PASSING NO. 200 SIEVE	UNCONFINED COMPRESSION: TYPE OF TEST	WATER CONTENT %	UNIT DRY WT LB/FT³	SHEAR STRENGTH TON/FT²	FAILURE STRAIN %	TYPE OF FAILURE	TRIAXIAL COMPRESSION: TYPE OF TEST	WATER CONTENT, % Initial	WATER CONTENT, % Final	UNIT DRY WT LB/FT³	SHEAR STRENGTH TON/FT²	VOLUME CHANGE %	LATERAL PRESSURE TON/FT²	FAILURE STRAIN %	TYPE OF FAILURE	MINIATURE VANE: TYPE OF TEST	SHEAR STRENGTH TON/FT²
1	1	75	33	78																		
4	4.5	76	36	66	98[a]							1-U[b] 1-R[b]	65 66		58 60	0.12 0.051		0.072 0.072	16.0 20.3	A A	U R	0.061 0.083
7	7.5	71	36	64								1-U[b] 1-R[b]	65 60		58 64	0.20 0.060		0.12 0.12	13.0 20.3	A A	U R	0.17 0.096
8	9.5	73	31	70		U[b] R[b]	66 68	58 60	0.11 0.078	17.0 20.3	A, B A, C											
10	11.5			63																		
11	13	72	33	62								1-U[b] 1-R[b]	64 65		57 62	0.23 0.12		0.21 0.21	15.6 20.3	A, C A	U R	0.22 0.12
12	13.5					U[b]	64	59	0.13	17.0	A											
13	15	76	36	62								2-U	61		64	0.30	1.7	0.24	11.1	A		
14	15.5	78	36	65																		
15	17.5	69	31	58	99							1-U[b] 1-R[b]	58 57		62 66	0.19 0.11		0.28 0.28	14.0 20.3	- A	U R	0.23 0.095
16	18			57																		
18	19.5	53	29	47		U[b] R[b]	44 45	74 76	0.28 0.083	15.0 20.3	A, B -											
19	20.5			44																		
20	23	63	30	50								1-U[b] 1-R[b]	51 52		68 71	0.30 0.16		0.40 0.40	15.0 20.3	A A	U R	0.36 0.16
22	26.5	68	33	57	98[a]																	
24	29	65	32	55								1-U[b] 1-R[b]	55 54		67 68	0.22 0.15		0.48 0.48	18.0 20.3	A -	U R	0.20 0.17
25	31	65	34	50								2-U	50		73	0.54	2.0	0.54	12.2	A		
26	31.5	59	30	48		U[b] R[b]	44 48	73 73	0.36 0.098	17.0 20.3	A, C -											
28	33.5	50	25	39								1-U[b] 1-R[b]	38 48		79 74	0.38 0.19		0.62 0.62	15.0 20.3	- A	U R	0.29 0.16
29	35				97																	
30	36	55	31	44		U[b]	48	72	0.36	13.0	A, C											
32	39	61	21	43								1-U[b] 1-R[b]	43 45		72 76	0.42 0.20		0.74 0.74	11.0 20.3	A A	U R	0.49 0.21
35	41.5	53	27	43		U[b] R[b]	41 42	76 78	0.13 0.11	12.0 20.3	C -											
36	43	52	29	40								2-U	39		79	0.77	5.8	0.83	20.3	A		
37	43.5			34																		
38	45	44	22	34	88[a]							1-U[b] 1-R[b]	38 34		80 86	0.50 0.21		0.87 0.87	12.4 20.3	A A	U R	0.70 0.24
39	45.5			32																		
41	47.5	36	27	32	91							1-U[b]	29		88	0.41		0.93	7.6	A, D		
42	48.5			37																		
43	59	40	26	33	98[a]							1-U[b] 1-R[b]	36 32		80 87	0.25 0.28		1.22 1.22	15.0 20.3	A, C A		
47	68.5			32																		
46	69	39	29	30	91							1-U[b]	28		88	0.50		1.44	7.6	C		
48	69	54	29	37								2-U	37		83	1.40	4.9	1.48	10.8	A		
50	79.5	54	28	38	98[a]							1-U[b] 1-R[b]	39 39		79 83	0.78 0.45		1.73 1.73	12.0 20.3	A, C A, C		
51	88.5	57	30	40	98[a]							1-U[b] 1-R[b]	40 41		78 80	0.83 0.36		1.95 1.95	11.0 20.3	A, C A		
53	98.5	53	26	38	99	U[b] R[b]	38 36	80 84	1.21 0.45	10.0 18.6	C A, C											
54	99	65	32	34								2-U	33		87	2.03	3.8	2.23	9.2	A, B		
55	108.5	43	26	31								1-U	30		89	1.27		2.43	9.0	A, C		
57	119	73	36	45								2-U	45		76	1.46	2.0	2.66	6.8	B		
58	119.5	71	30	44	98	U R	44 44	74 76	1.20 0.48	5.6 13.6	C, D A, C											
60	129	66	36	43								1-U	43		74	1.49		2.92	7.6	A, C		
62	139	65	33	41	98[a]							1-U	42		77	1.76		3.16	6.0	C		

(Continued on Plate B-1a)

LEGEND & NOTES

TYPE OF TEST
- U = Undisturbed Specimen
- R = Remolded Specimen
- 1 = Unconsolidated-Undrained Triaxial
- 2 = Consolidated-Undrained Triaxial

TYPE OF FAILURE
- A = Bulge
- B = Single Shear Plane
- C = Multiple Shear Planes
- D = Vertical Fracture

(a) See Appendix B for Grain-Size Distribution Curve
(b) See Appendix B for Stress-Strain Curve

SANTA BARBARA CHANNEL
BORING 188EE

* * *

Mudline at El -841'

McCLELLAND ENGINEERS

SUMMARY OF TEST RESULTS

SAMPLE NO.	PENETRATION FT.	CLASSIFICATION TESTS: LIQUID LIMIT	PLASTIC LIMIT	WATER CONTENT %	PERCENT PASSING NO. 200 SIEVE	UNCONFINED COMPRESSION: TYPE OF TEST	WATER CONTENT %	UNIT DRY WT LB/FT³	SHEAR STRENGTH TON/FT²	FAILURE STRAIN %	TYPE OF FAILURE	TRIAXIAL COMPRESSION: TYPE OF TEST	WATER CONTENT, % Initial	WATER CONTENT, % Final	UNIT DRY WT LB/FT³	SHEAR STRENGTH TON/FT²	VOLUME CHANGE %	LATERAL PRESSURE TON/FT²	FAILURE STRAIN %	TYPE OF FAILURE	MINIATURE VANE: TYPE OF TEST	SHEAR STRENGTH TON/FT²
										(Continued from Plate B-1)												
64	149	42	26	35								1-U	33		86	1.47		3.41	8.0	B		
66	159.5	50	29	33	94	U R	32 33	86 89	1.23 0.46	6.8 15.2	D A,C											
68	169.5	41	28	30								1-U	31		88	1.76		3.90	8.6	C		
70	179.5	45	23	32	90	U	32	85	1.08	8.0	C,D											
72	189	37	25	30								1-U	30		88	1.84		4.36	6.7	B		
73	199	46	26	33	92[a]																	
74	209	43	26	30	96																	
75	219	56	30	36		U R	36 36	82 85	1.54 0.46	6.4 10.8	D -											
77	229	53	28	35	99							1-U	35		84	1.79		4.85	5.2	C		
78	239	63	34	34		U	35	82	1.82	6.8	D											
80	249	50	28	32	98[a]							1-U	33		86	2.54		5.80	8.1	A,D		
81	259	49	32	34		U R	35 33	83 88	2.05 0.43	7.6 9.5	D C											
82	268.5	54	29	31	99																	
84	279	59	33	38								1-U	37		80	2.25		6.52	8.6	A,C		
85	288.5	57	30	35	99	U	36	82	1.20	6.8	D											
87	298.5	51	26	32																		
88	309	50	28	30	96[a]							1-U	29		88	2.44		7.24	8.8	A,C		
91	319	54	28	31		U R	31 31	88 90	2.12 0.64	6.0 10.2	D -											
92	329	40	24	28	96							1-U	28		90	2.62		7.73	13.7	A,C		
94	339	30	24	27																		
95	348.5	53	27	28	97							1-U	32		86	2.92		8.22	4.8	C		

LEGEND & NOTES

TYPE OF TEST
- U = Undisturbed Specimen
- R = Remolded Specimen
- 1 = Unconsolidated-Undrained Triaxial
- 2 = Consolidated-Undrained Triaxial

TYPE OF FAILURE
- A = Bulge
- B = Single Shear Plane
- C = Multiple Shear Planes
- D = Vertical Fracture

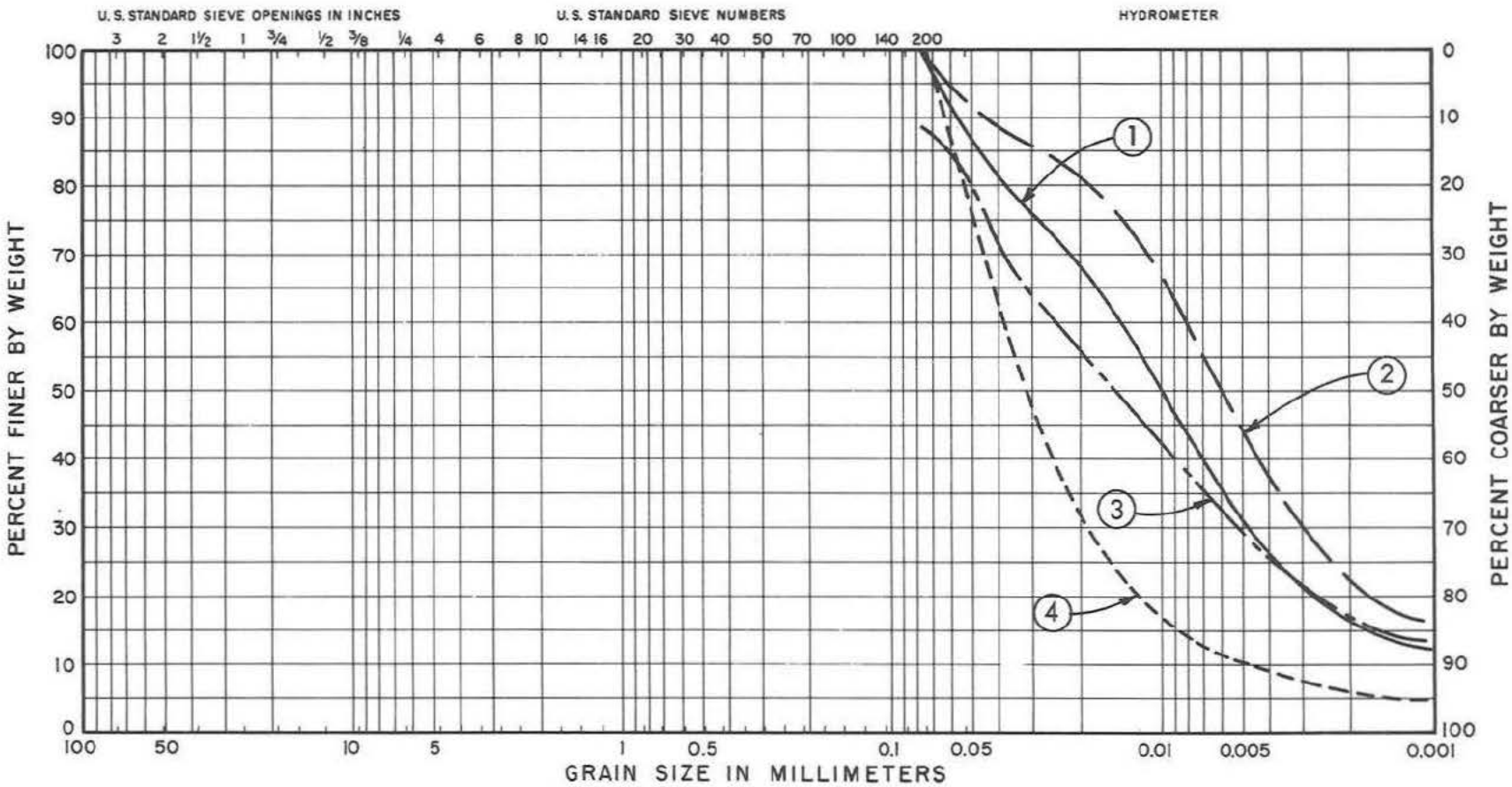
(a) See Appendix B for Grain-Size Distribution Curve
(b) See Appendix B for Stress-Strain Curve

SANTA BARBARA CHANNEL
BORING 188EE

* * *

Mudline at El -841'

GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Curve No.	Penetration, Ft	Material
1	4.5	Greenish-gray silty clay
2	26.5	Greenish-gray silty clay
3	45	Gray silty clay
4	59	Gray clayey silt

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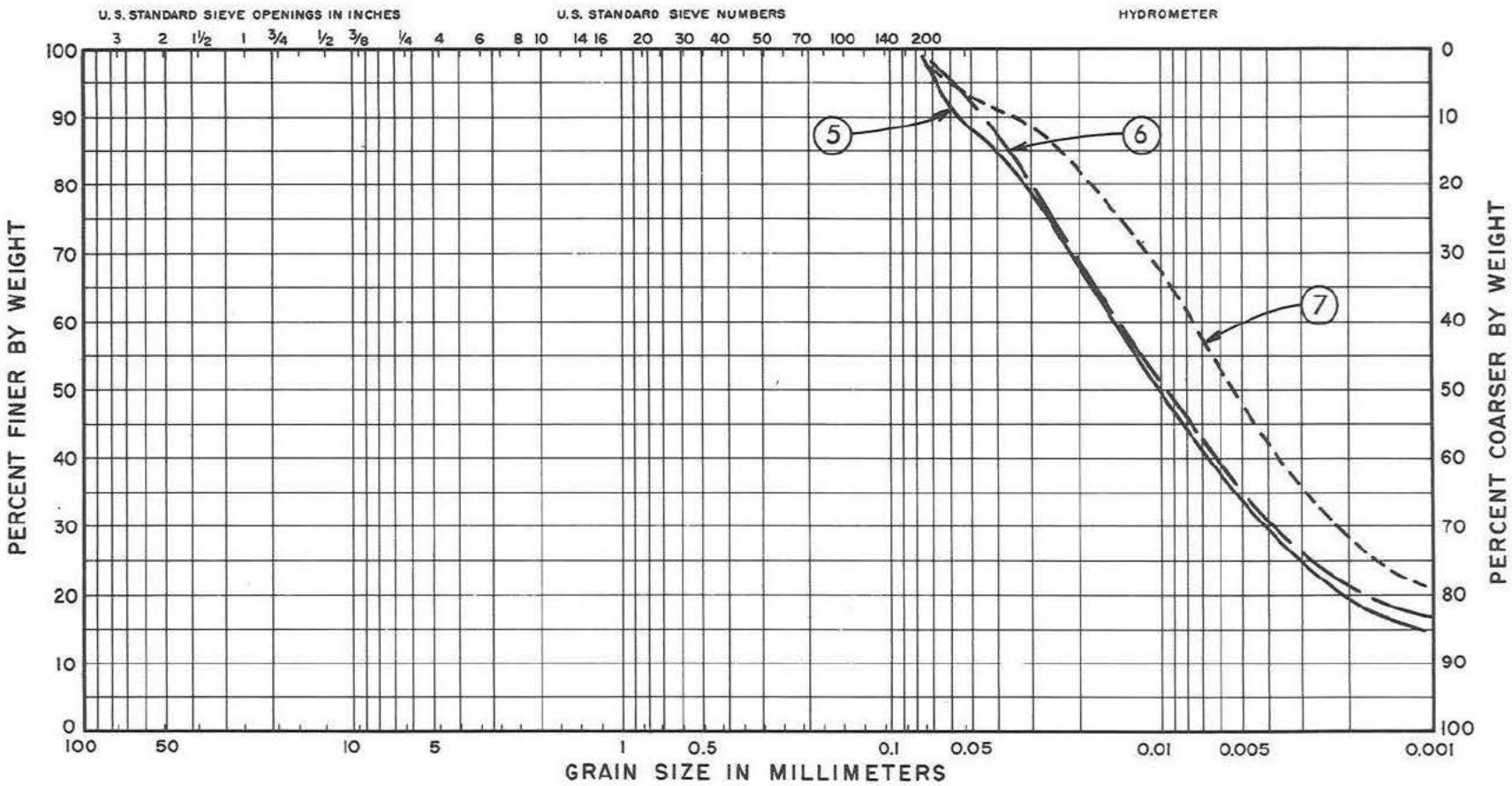
GRAIN SIZE CURVES



GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

Curve No.	Penetration, Ft	Material
5	79.5	Gray silty clay
6	88.5	Gray silty clay
7	139	Gray silty clay

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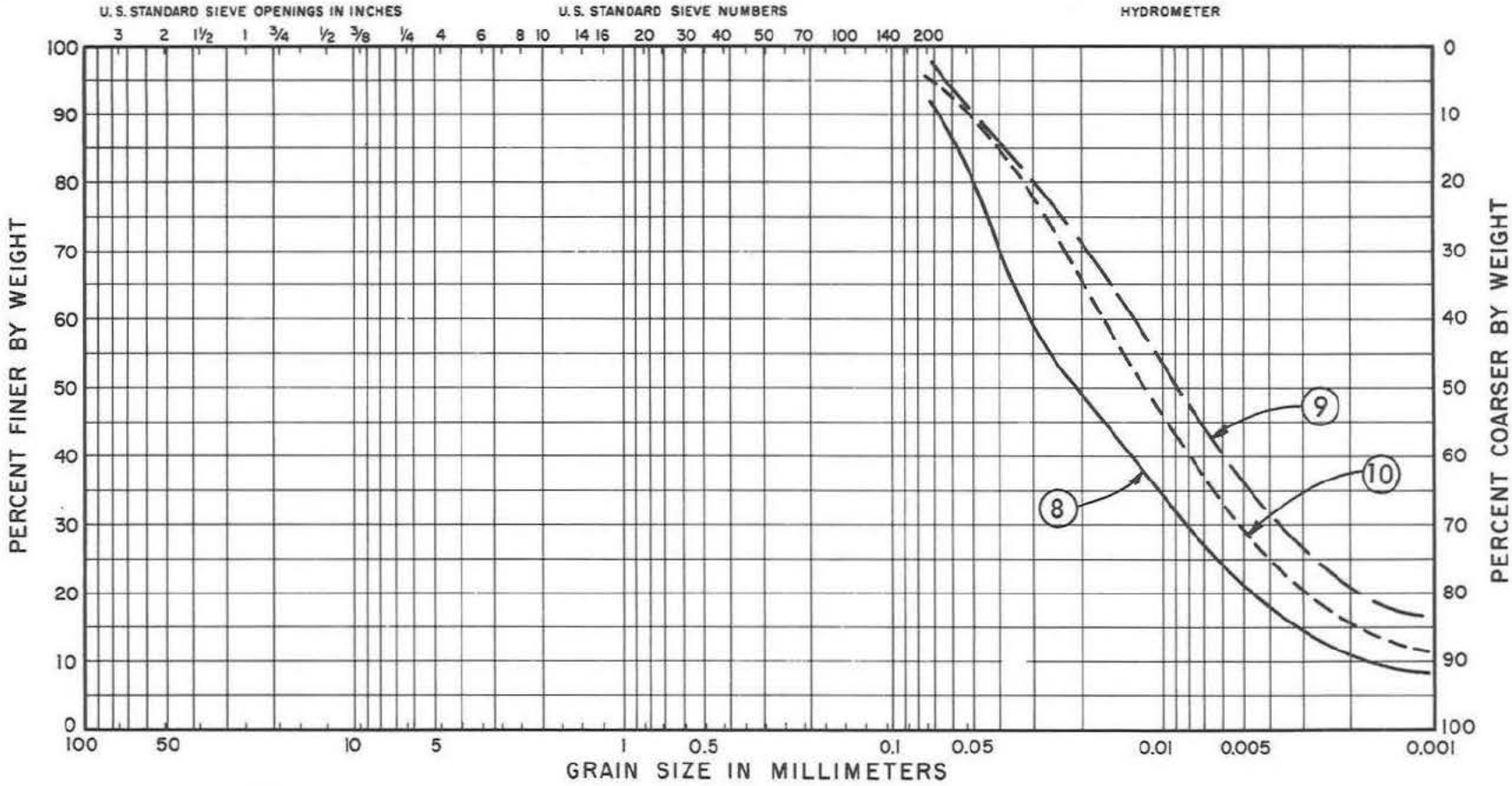
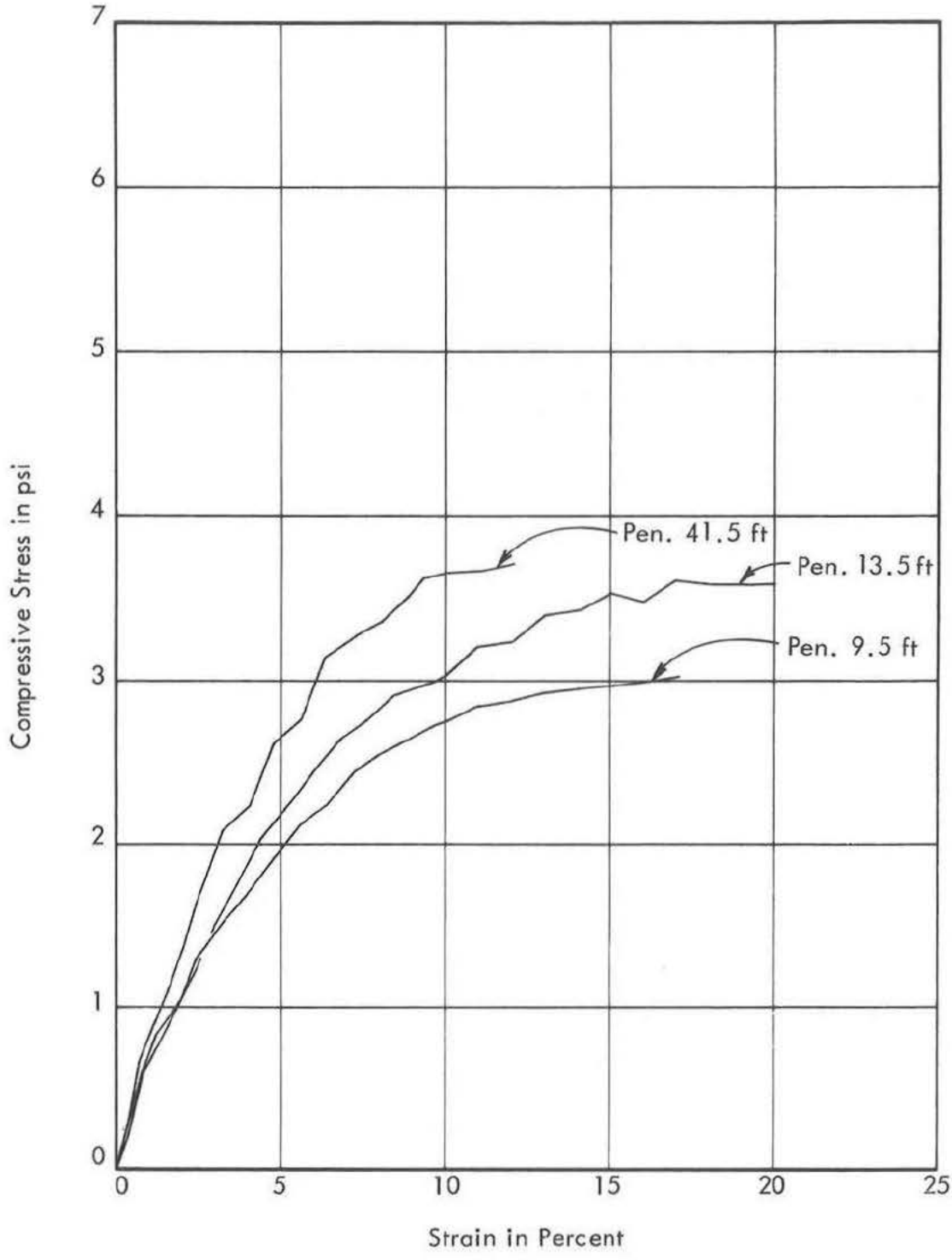
GRAIN SIZE CURVES

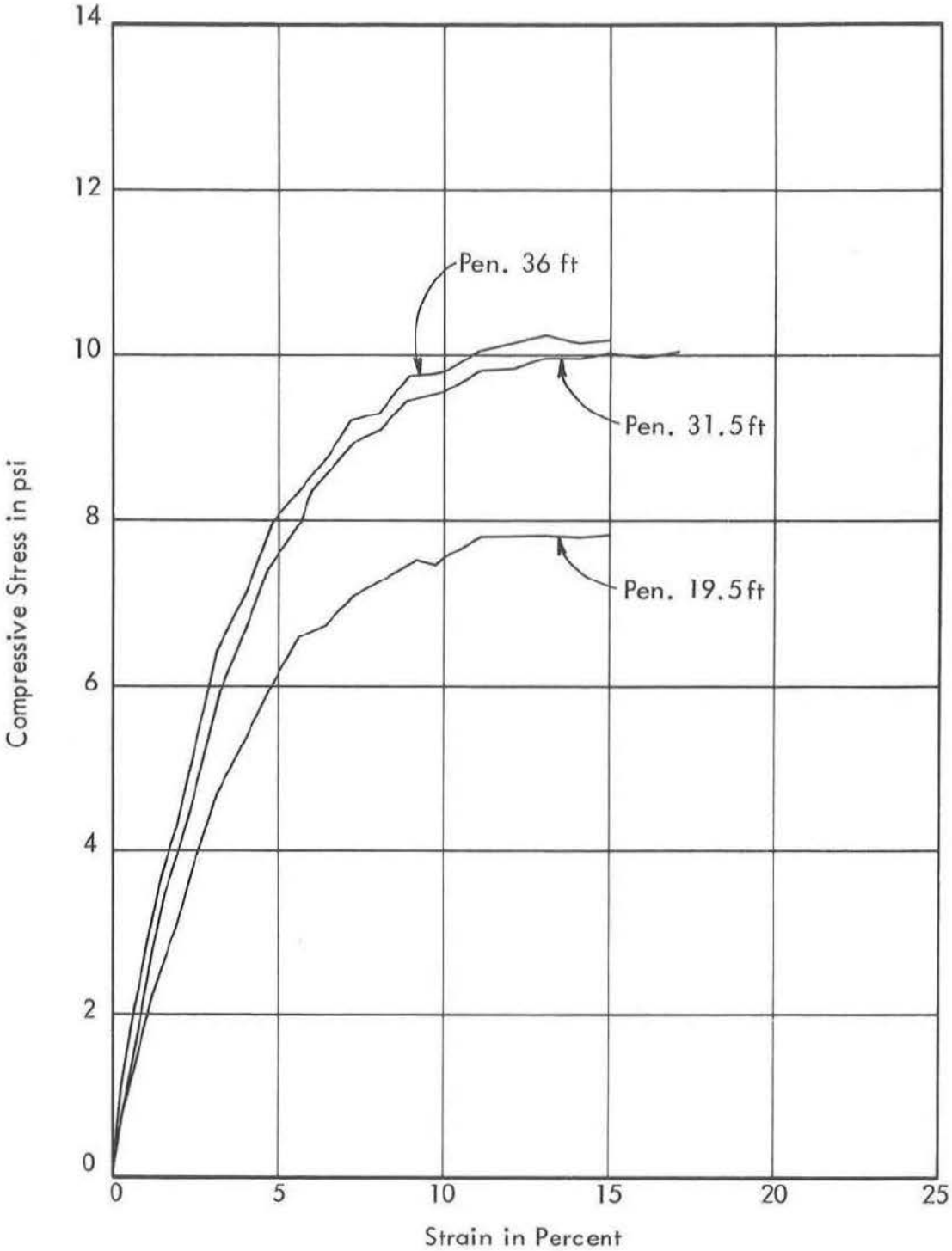


GRAVEL		SAND			SILT or CLAY
Coarse	Fine	Coarse	Medium	Fine	

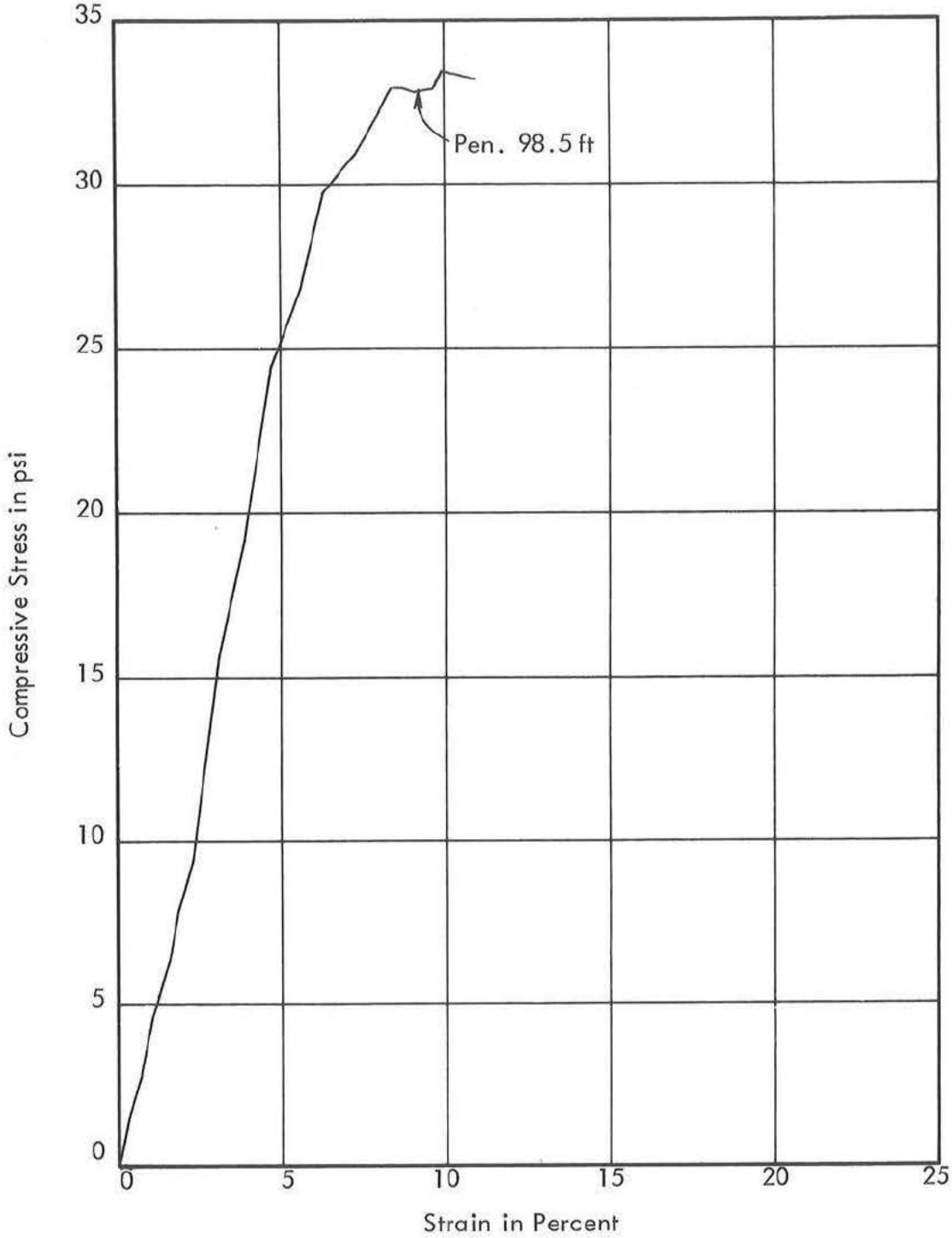
Curve No.	Penetration, Ft	Material
8	199	Gray clayey silt
9	249	Gray silty clay
10	309	Gray silty clay



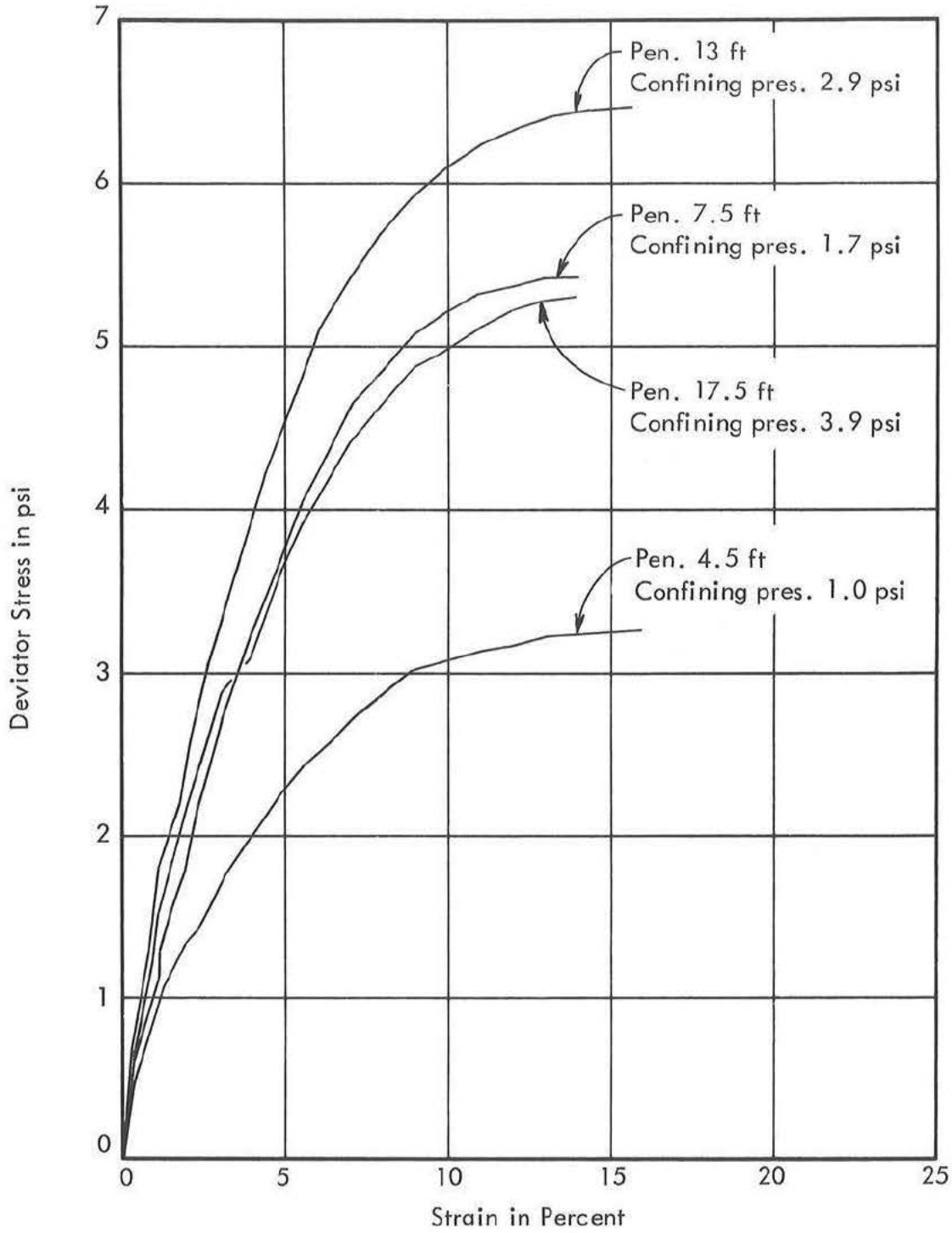
STRESS-STRAIN CURVES
Unconfined Compression Tests
Santa Barbara Channel
Boring 188EE



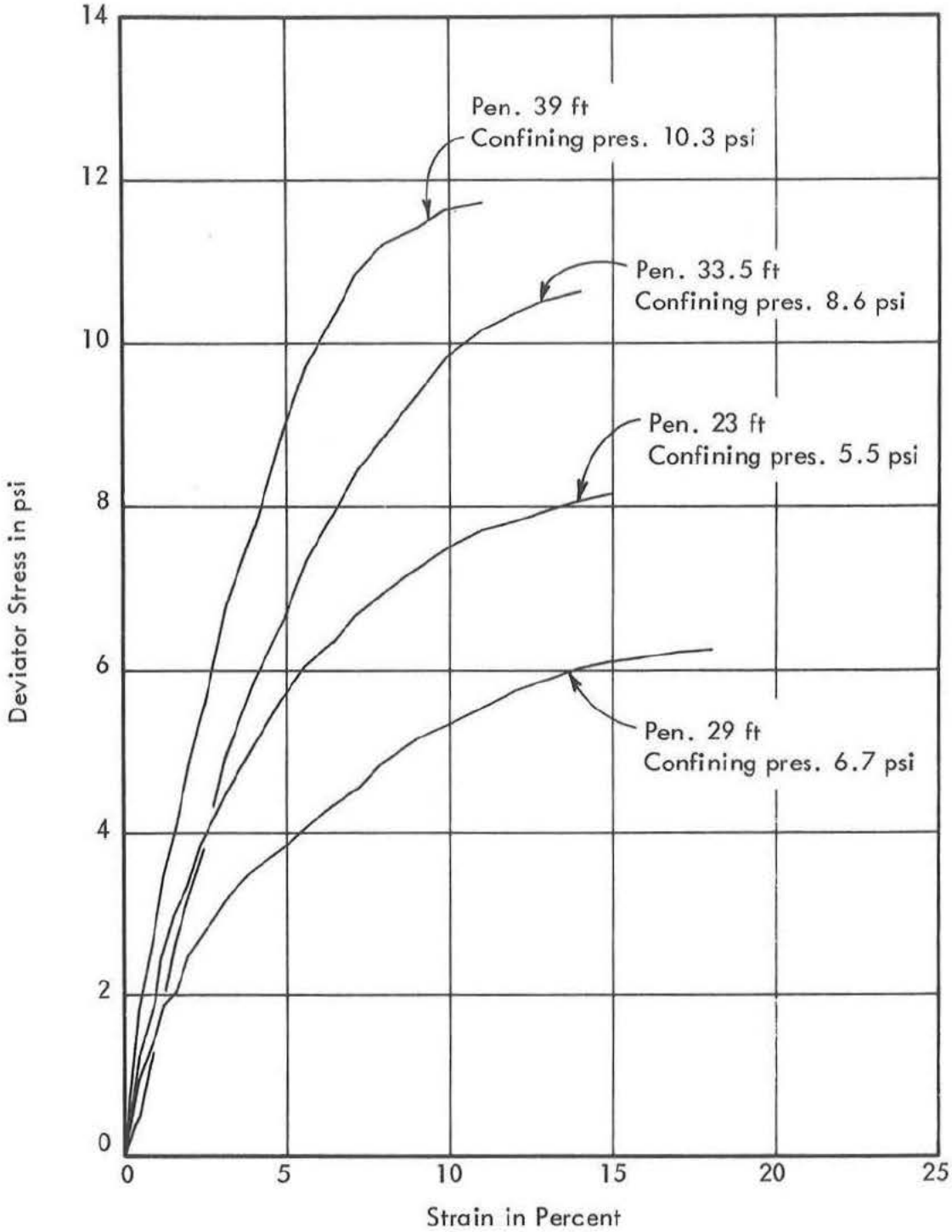
STRESS-STRAIN CURVES
Unconfined Compression Tests
Santa Barbara Channel
Boring 188EE



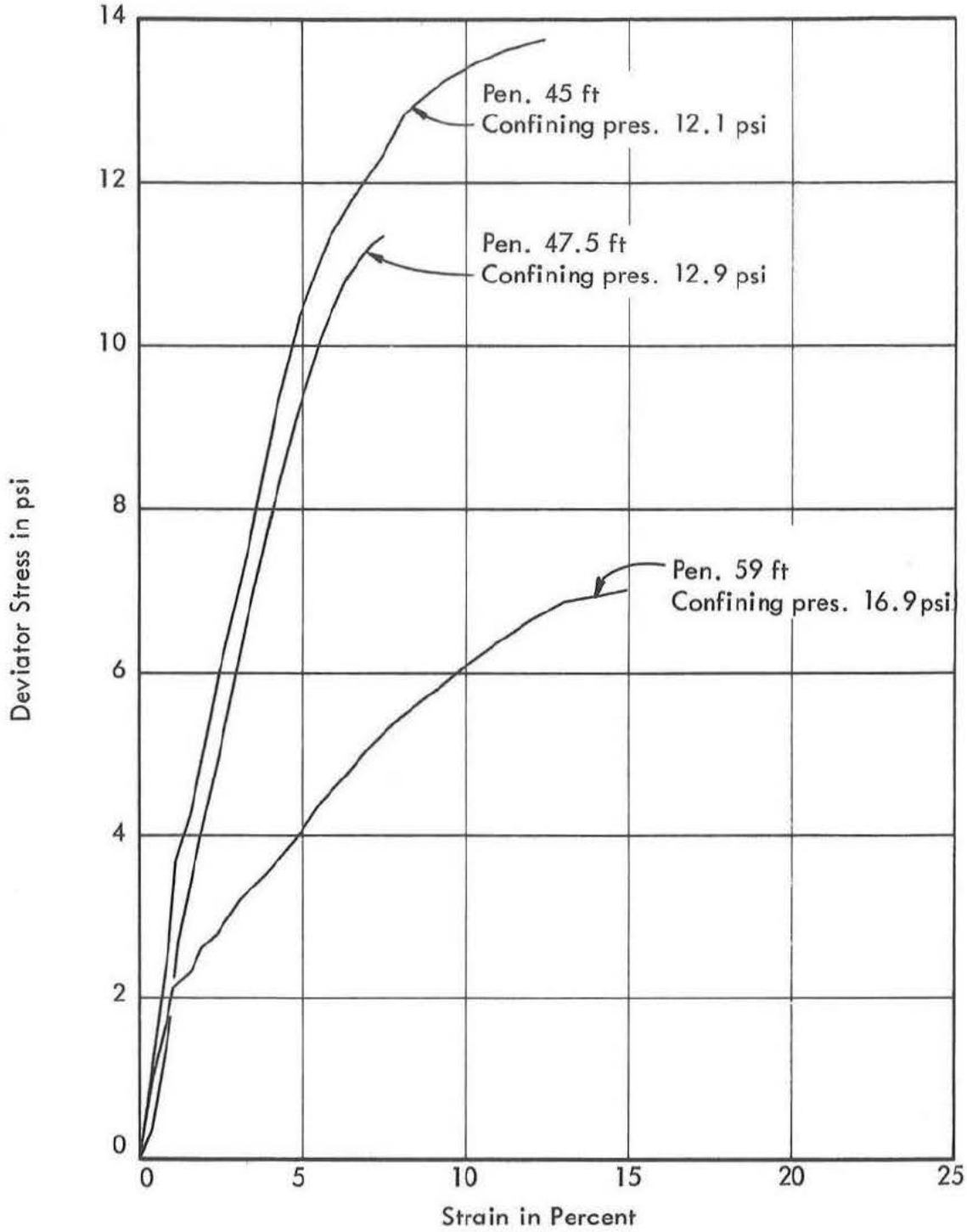
STRESS-STRAIN CURVE
Unconfined Compression Test
Santa Barbara Channel
Boring 188EE



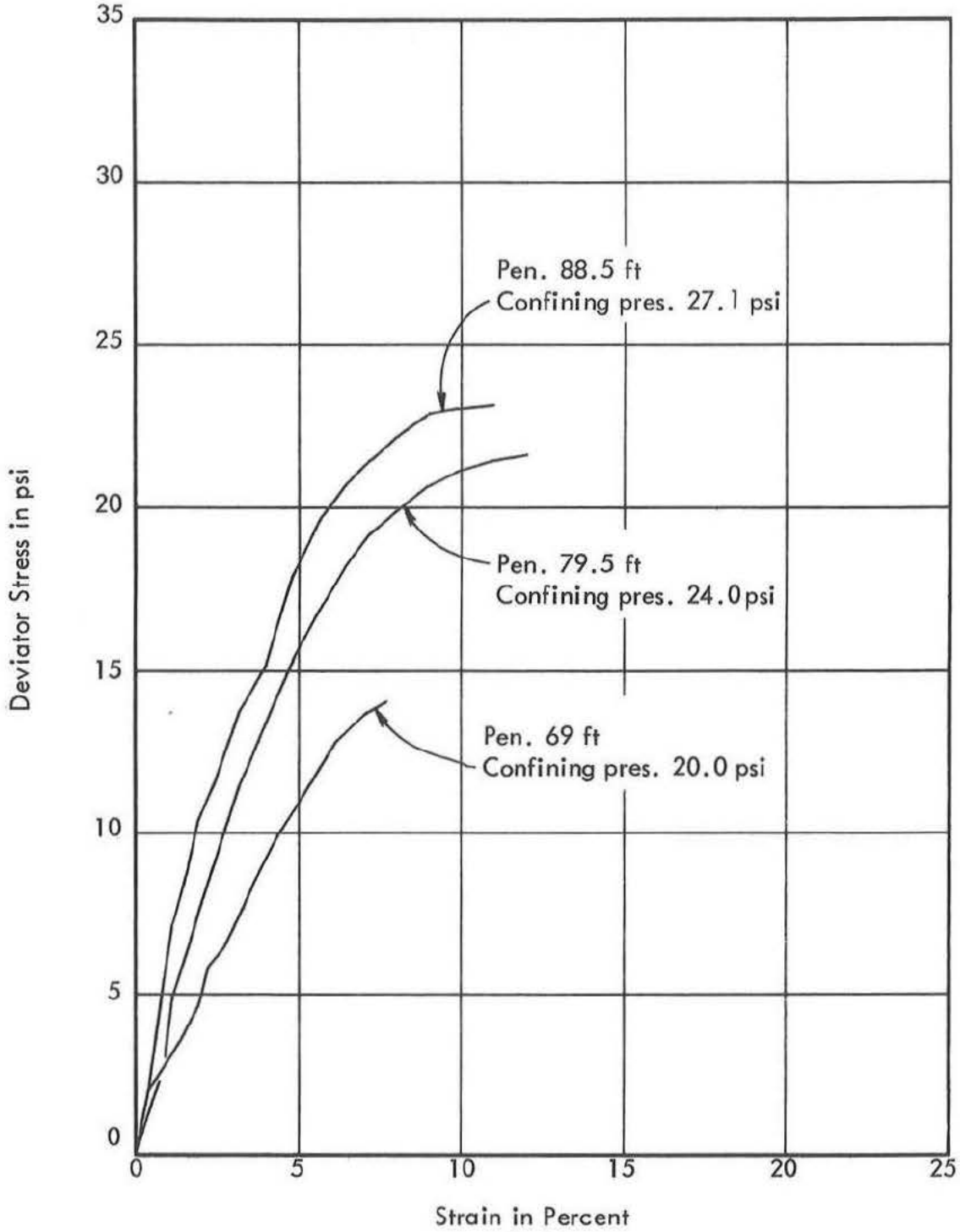
STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests
Santa Barbara Channel
Boring 188EE



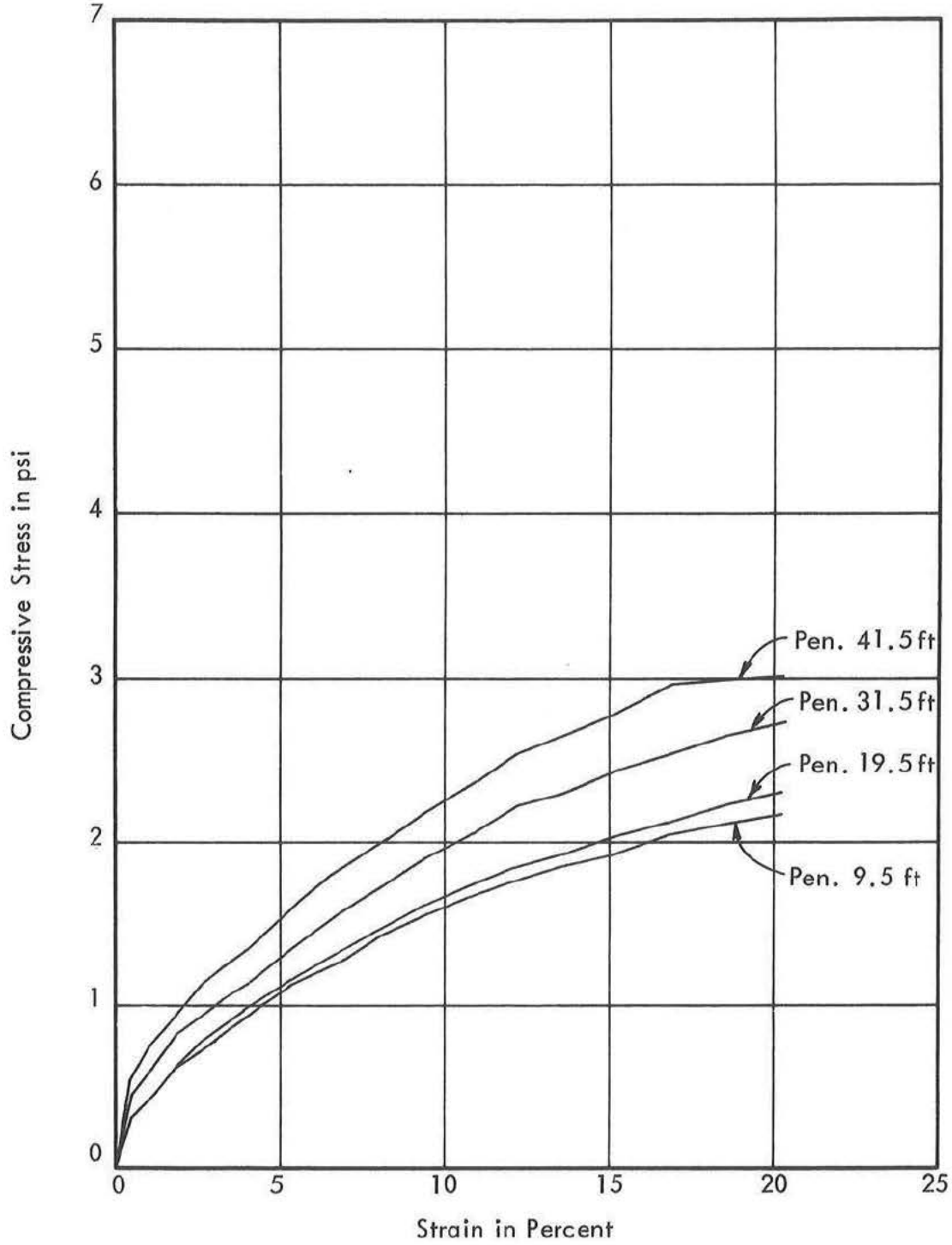
STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests
Santa Barbara Channel
Boring 188EE



STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests
Santa Barbara Channel
Boring 188EE

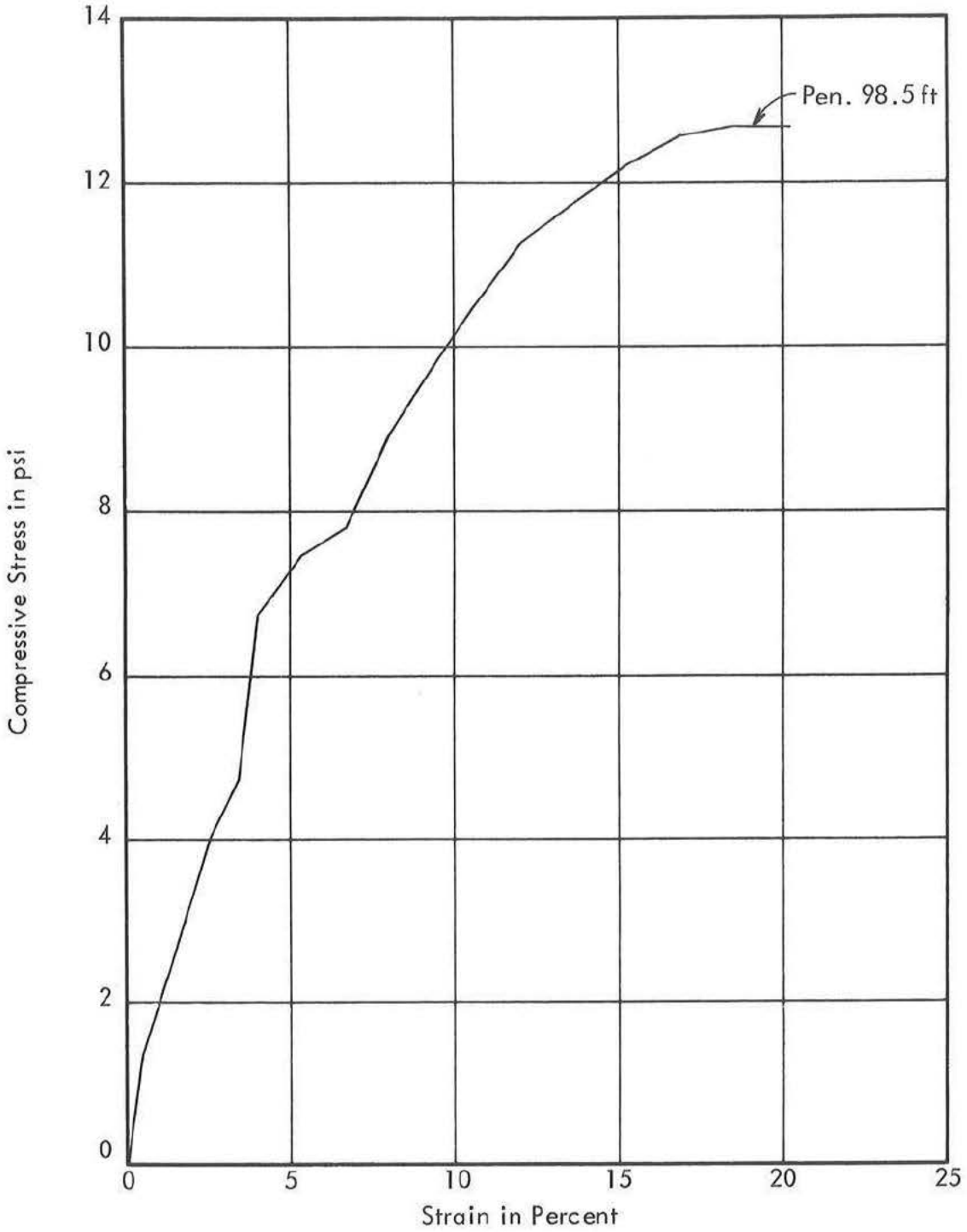


STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests
Santa Barbara Channel
Boring 188EE

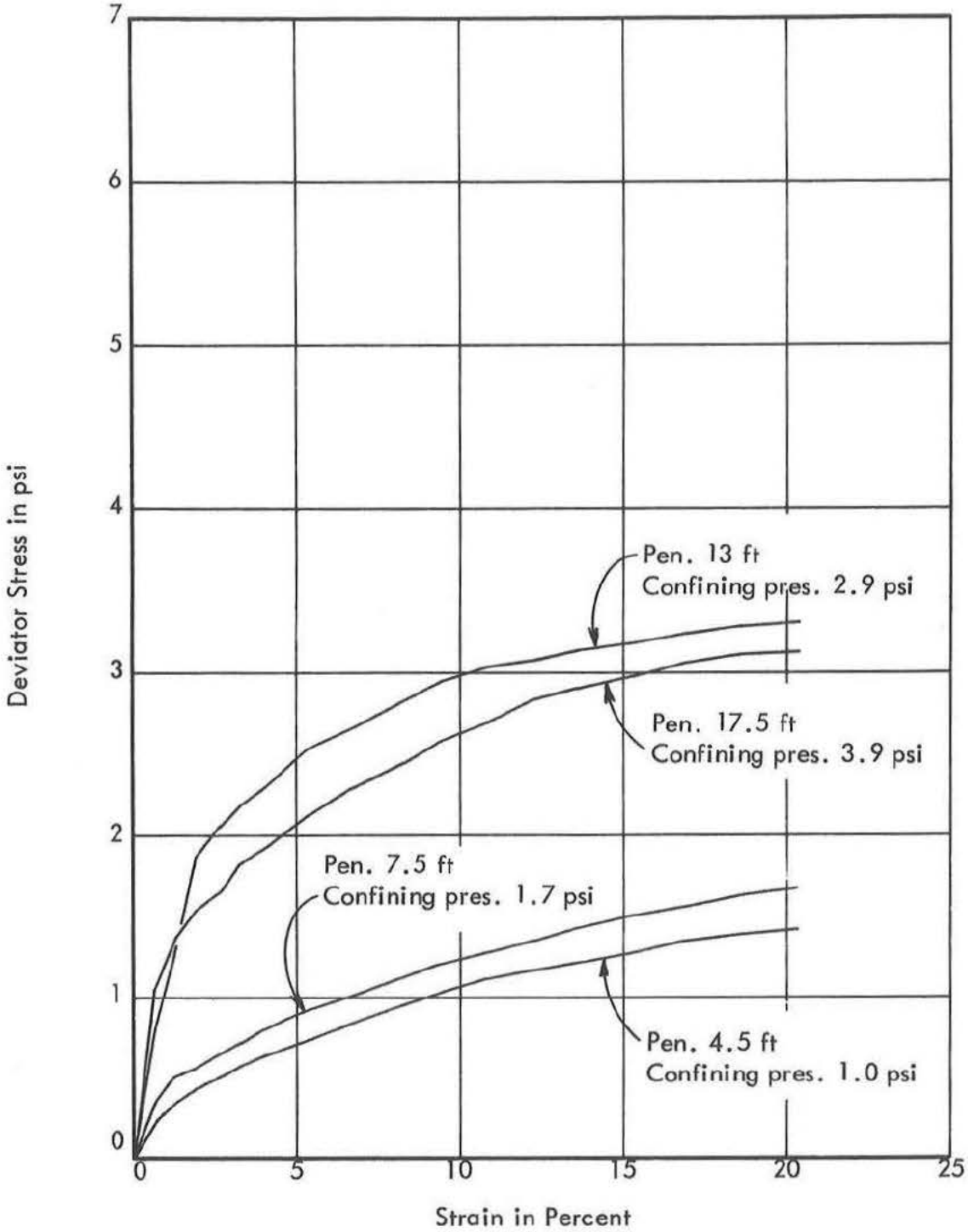


STRESS-STRAIN CURVES
Unconfined Compression Tests (Remolded)
Santa Barbara Channel
Boring 188EE

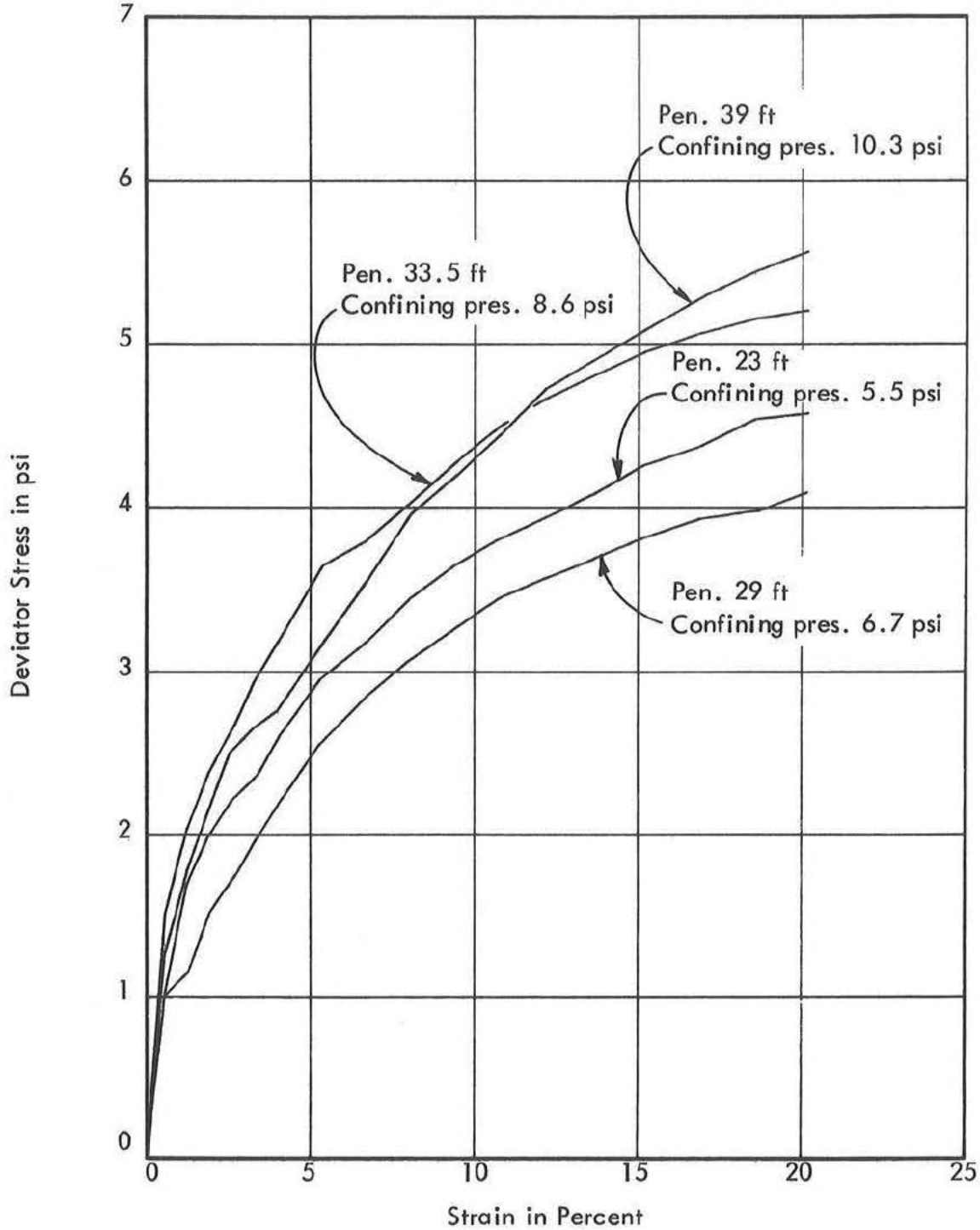
71-127-2



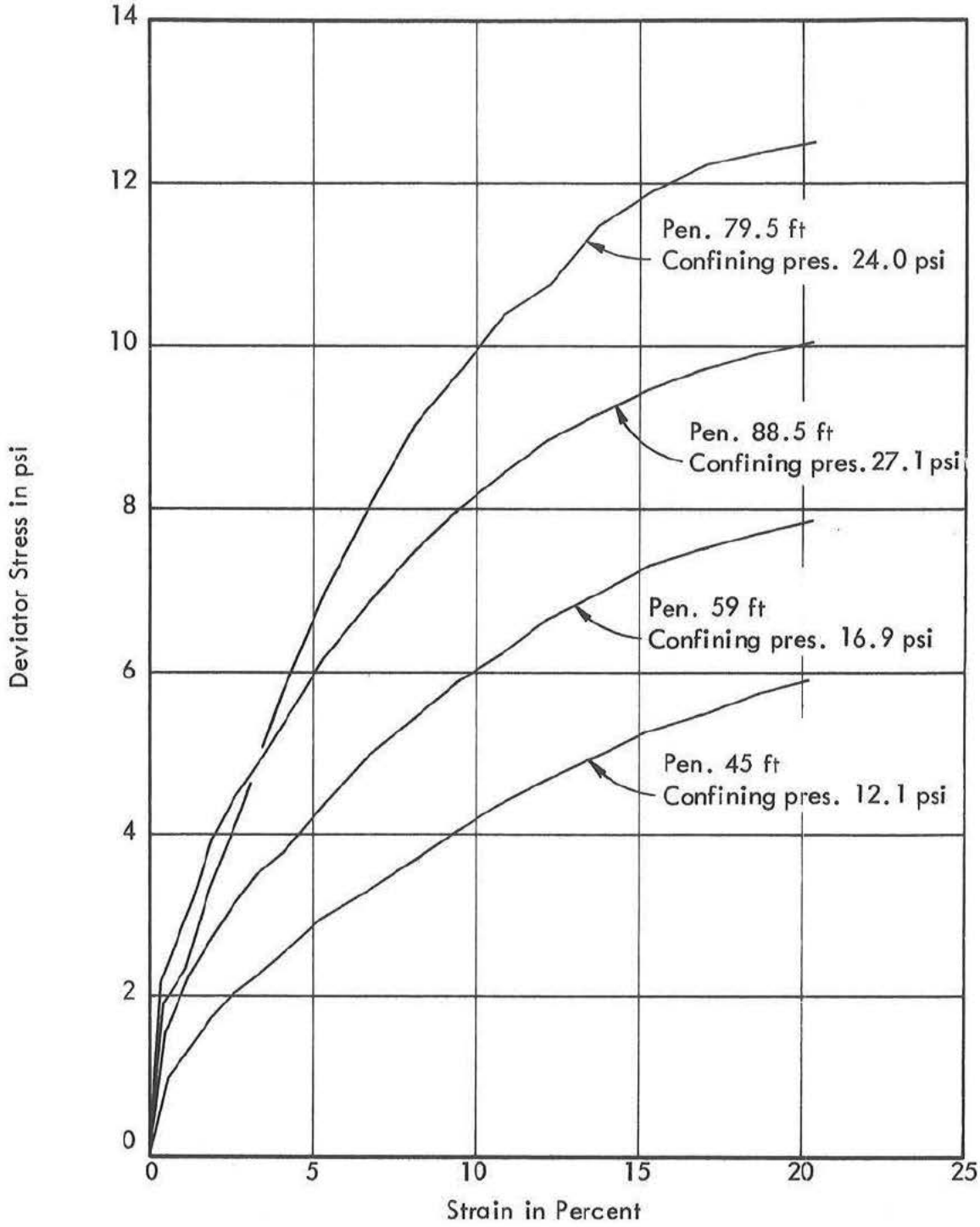
STRESS-STRAIN CURVE
Unconfined Compression Test (Remolded)
Santa Barbara Channel
Boring 188EE



STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests (Remolded)
Santa Barbara Channel
Boring 188EE



STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests (Remolded)
Santa Barbara Channel
Boring 188EE



STRESS-STRAIN CURVES
Unconsolidated-Undrained Triaxial Compression Tests (Remolded)
Santa Barbara Channel
Boring 188EE

APPENDIX C

CRITERIA FOR PREDETERMINING PILE CAPACITY

(Revised Sept. 1967)

APPENDIX C

CRITERIA FOR PREDETERMINING PILE CAPACITY

INTRODUCTION

The static method for predetermining the bearing capacity of piles is based on empirical data gathered from model studies and field load tests and interpreted in accordance with accepted soil mechanics theories. The ultimate pile capacity, Q, at a given penetration, D, is the sum of Q_s, the shaft or skin friction load, and Q_p, the end bearing or point load, so that

$$Q = Q_s + Q_p = fA_s + qA_p \qquad (1)$$

In Eq. 1, A_s and A_p represent, respectively, the embedded surface area and the pile end area; f and q represent, respectively, the unit skin friction or soil-pile adhesion and the unit end bearing. Successful application of the static method depends upon proper selection of values of f and q for the particular combination of soil conditions, pile type, pile dimensions and kind of load.

Most of the load tests on which the static method is based were performed on piles which were less than 150 ft long and which supported ultimate test loads of less than 200 tons. The various methods proposed for interpreting the empirical data give generally compatible pile penetrations for ultimate capacities up to 200 tons, but they yield widely divergent penetrations when extrapolated to ultimate capacities in the order of 2000 tons, as required for many offshore foundation piles.

Presented here are recommended design criteria that are based upon our current appraisal of all available evidence. They are intended to yield, for each set of conditions, a "most probable" relationship between pile capacity and pile penetration for driven open-end steel pipe piles. Only in special cases will the "most probable" also be the "most conservative" of

the available design choices. The criteria stated cover a wide range of soil conditions and are applicable to both compression and tension loads. Revisions in these criteria will be made at any time that available evidence indicates such revisions to be appropriate.

CLAYEY SOILS

Shear Strength Evaluation

The immediate or "quick" shear strength of a clay soil is the most appropriate in-situ strength property for evaluating pile capacity in this type of soil. Typical strength-depth profiles for four types of clay formations encountered offshore are shown on Plate C-1. Usually, the quick shear strength is measured by unconfined compression tests and by miniature vane tests. Experience has shown that results of either test type are influenced by disturbance during sampling and by rate of strain or time-to-failure during the test. In-situ strength in clays of medium sensitivity (such as found in the Gulf of Mexico) can be accurately measured using either unconfined compression or miniature vane tests performed on shelby-tube or fixed-piston samples obtained in one continuous pushing motion, and a time-to-failure of about ten minutes. This rate of loading is readily achieved with the usual unconfined compression devices and with motorized vane devices. Manual operation of the miniature vane device inevitably results in a higher rate of strain and typically yields a higher strength measurement by a factor ranging from 1.1 to 1.4. Samples that are driven by percussion methods, as required in present wire-line sampling, are subject to moderate sample disturbance and consequent reduction in measured strengths to 65 to 85% of undisturbed values. For the combination of sampling and testing techniques that may be employed in current investigations, the strength modification factors indicated in Table 1 are, therefore, recommended for estimating in-situ strength profiles from measured strength profiles.

Table 1

Strength Modification Factors*

Test Type	Samples Obtained By Pushing	Samples Obtained By Driving
Unconfined compression	1.0	1.2
Miniature vane, motorized	1.0	1.2
Miniature vane, hand	0.8	1.0

Results of unconfined compression and miniature vane tests, modified as necessary, are usually analyzed jointly. If the modified results of either test type tend to be consistently greater, those results are given primary weight in constructing a generalized in-situ strength profile.

Soil-pile Adhesion

Rational prediction of soil-pile adhesion for clays by the static method is based on the combination of three concepts:

1. Soil-pile adhesion may be equal to but not greater than the shear strength indicated by the in-situ strength profile.
2. Soil-pile adhesion in stiff, overconsolidated clay at penetrations less than about 100 ft may be as low as (and for design purposes should not exceed) 0.5 ton per sq ft.
3. Soil-pile adhesion in stiff clay below about 100-ft penetration may be as great as the shear strength that would be expected for a normally consolidated clay.

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* The modification factors in Table 1 are based on extensive comparative sampling and testing at an onshore site near Venice, La., and at two Louisiana offshore sites.

The first two concepts were derived from empirical data; the third is a logical extrapolation from data on which the first concept is based.

In normally consolidated or underconsolidated clay formations, the soil-pile adhesion curve coincides with the interpreted in-situ shear strength profile, as shown by Fig. 1 and Fig. 2 on Plate C-2. In overconsolidated clay formations, the soil-pile adhesion curve results from application of all three of the foregoing concepts and the following three strength-vs-depth curves which correspond to them:

(a) the in-situ strength profile,

(b) a constant value of 0.5 ton per sq ft, and

(c) a strength profile expected for a normally consolidated condition.

The rate of shear strength increase with depth in normally consolidated clays has been correlated with the clay plasticity characteristics. This correlation and other considerations are utilized to estimate the strength profile that would be expected for a normally consolidated clay having the same plasticity characteristics as the overconsolidated clay. For the highly plastic, normally consolidated clays in the Gulf of Mexico, shear strength usually increases at the rate of 0.005 to 0.008 tsf per ft of depth. The strength profile expected for a normally consolidated clay is drawn on a common graph with the other two strength curves, as illustrated by Fig. 3 and Fig. 4 on Plate C-2. At any depth, the central strength curve on the graph is the soil-pile adhesion curve for that depth. The soil-pile adhesion curve selected in this manner is then used to compute the skin friction components of pile capacity for driven piles.

End-bearing Capacity

The end-bearing resistance of deep piles in clay may be reliably estimated by the following equation:

$$Q_p = 9\ c\ A_p \qquad (2)$$

in which Q_p is the ultimate end bearing capacity, c is the cohesive shear strength determined from the in-situ strength profile and A_p is the end area of the pile.

GRANULAR SOILS

Soil-pile Friction

The unit skin friction for a pile driven for a limited penetration into granular soil is customarily computed from the following equation:

$$f = K\,p \tan \delta \qquad (3)$$

where:

K = coefficient of lateral earth pressure

p = effective overburden pressure

δ = angle of friction between soil and steel

For open-end driven pipe piles, the value of K should be taken as 0.7 for compressive loads and 0.5 for tensile loads. Other design parameters for pile capacity computations recommended as "most probable" values for the granular soils commonly encountered are tabulated on Plate C-3. In consideration of limited empirical data and in the absence of load test information for piles having large penetrations into granular soils, the unit skin friction computed by Eq. 3 should be limited to the maximum values listed in the table on Plate C-3. The design parameters listed in this table are considered applicable to granular soils in a medium-dense to dense condition. If the formation is loose or very dense, these parameters should be decreased or increased, respectively. For open-end pipe piles that tend to plug, there will be some increase in the value of K, but this increase should be depended upon only in evaluating the capacity of a specific pile for which accurate data is available concerning plug formation during driving. The values of limiting skin friction should not, however, be increased for plugged piles.

The use of jetting or predrilling to aid pile installation may severely reduce the lateral earth pressure and therefore the potential frictional support of a pile. The density of the soil adjacent to the pile will be lessened to an uncertain degree depending upon the actual construction technique. In capacity computations, the influence of jetting or predrilling on friction is usually allowed for by a reduction in the value of K.

Soil-pile adhesion curves for compressive and tensile loads are computed using Eq. 3 and the parameters listed on Plate C-3, adjusted when appropriate. These curves are then used to compute the skin friction components of design pile capacity.

End-bearing Capacity

The unit end bearing of a pipe pile which has driven sufficiently into granular soil to develop a competent plug can be estimated for limited depths by the following equation:

$$q = p N'_q \tag{4}$$

where q is unit end-bearing capacity (tons per sq ft), p is effective overburden pressure (tons per sq ft) and N'_q is a bearing capacity factor (a dimensionless function of ϕ, the angle of internal friction). Recommended design values of N'_q and maximum limiting values of q considered appropriate for medium-dense to dense materials are given on Plate C-3. For a pile with its tip embedded in a loose or very dense granular stratum, these parameters should be decreased or increased, respectively, using other values listed on Plate C-3 as a guide. Total end bearing, Q_p, is obtained by multiplying the unit end bearing, q, times the gross end area of the pile, A_p.

The computed value of Q_p should be included as part of the compressive capacity, Q, of an open-end pipe pile only if the frictional resistance of the soil plug inside the pile is expected to be greater than Q_p. If the soil

plug inside the pile is removed by jetting or drilling to facilitate pile installation, the potential end-bearing capacity of the pile can be positively restored only by constructing a cement-grout plug or other closure for the pile tip. If the plug is not fully restored, end bearing resistance should be discounted.

FACTORS OF SAFETY

The magnitude of the factor of safety to be utilized with a curve of computed ultimate capacity in determining the appropriate pile penetration for a given design load should be chosen after giving consideration to several factors. In general, the factor of safety should increase with:

1) the expected frequency or probability of occurrence of the design load
2) the economic importance of the structure
3) any limitations in the completeness or accuracy of information pertaining to subsurface materials and properties
4) the degree of uncertainty connected with the pile design criteria used in the computations.

In regard to the last two listed factors, results of pile load tests have frequently shown that the capacities of two adjacent similar piles may differ by 10 to 20 percent as a result of natural minor variations in subsurface materials and installation procedures. It follows that computed and actual ultimate capacities may also differ by 10 to 20 percent even when the computations are based on subsurface data and computation procedures of superior reliability. The probability of greater differences must be anticipated for data and procedures of average and less-than-average reliability. Situations that will create lesser degrees of reliability are those which involve large and irregular variations in soil strengths, great extrapolation of current

empirical correlations, installation techniques that alter soil properties, or irregular soil stratification.

For normal operating loads (including the effects of frequently occurring storms) and for economically important structures, we recommend the following factors of safety: (a) 2.0, when there is an average level of confidence in both the available subsurface data and the pile design criteria; (b) 3.0, when there is less than average reliability of either the subsurface data or the design criteria.

For maximum possible design loads that might occur once in the life of a structure or for structures that may be reasonably exposed to a calculated risk of failure, we recommend the following factors of safety: (a) 1.5 to 1.2, when there is average-to-superior reliability of available subsurface data and design criteria; (b) 2.0 or higher, when less-than-average reliability exists with respect to subsurface data or design criteria.

For application of the above recommendations in selecting a safety factor, it is our judgement that the criteria for computation of pile capacities are of less-than-average reliability for granular soils and of average reliability for deep normally consolidated clays. They are considered reliably conservative for stiff-to-hard overconsolidated clay and are most reliable for soft-to-firm clays.

APPENDIX C
ILLUSTRATIONS

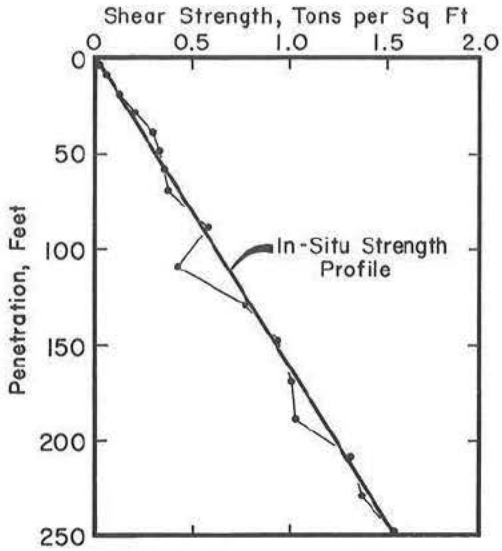

Fig. 1 NORMALLY CONSOLIDATED

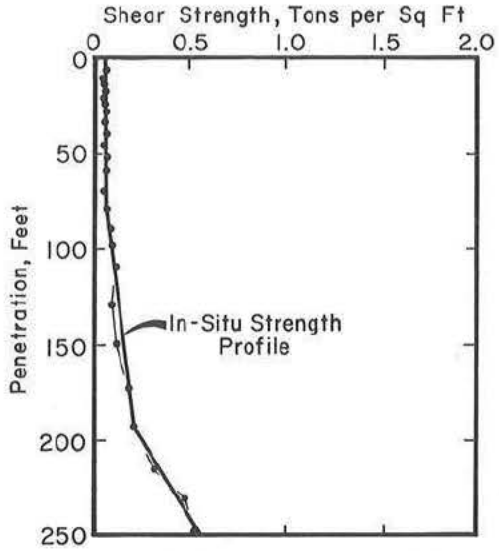

Fig. 2 UNDERCONSOLIDATED

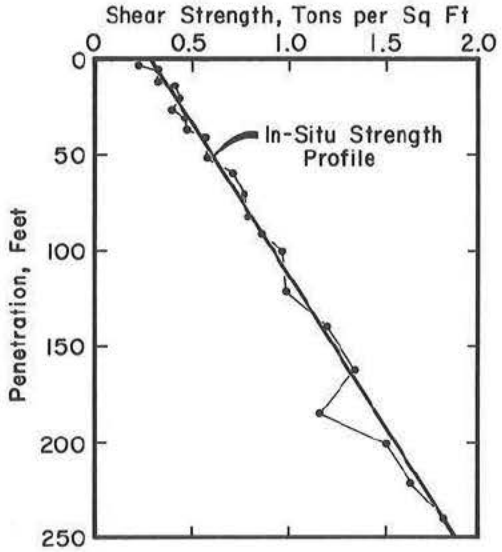

Fig. 3 OVERCONSOLIDATED BY EROSION

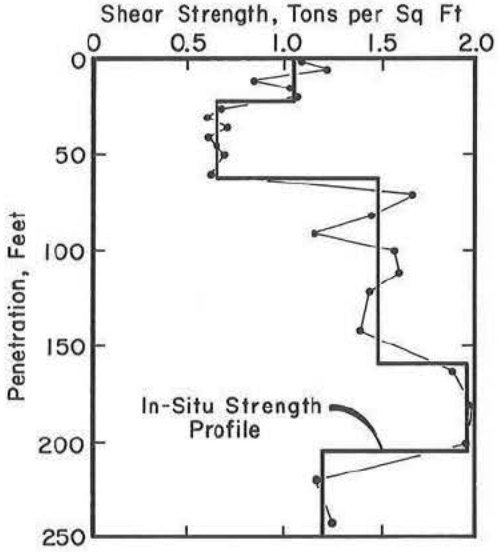

Fig. 4 OVERCONSOLIDATED BY DESICCATION

Notes:

1. Test results shown here represent shear strengths modified in accordance with Table I for the sampling and testing techniques used.
2. Results of unconfined compression and miniature vane tests are usually combined and analyzed jointly.
3. If either test type tends to consistently yield greater strengths, results of that test type are given primary weight.

TYPES OF STRENGTH PROFILES IN CLAY FORMATIONS

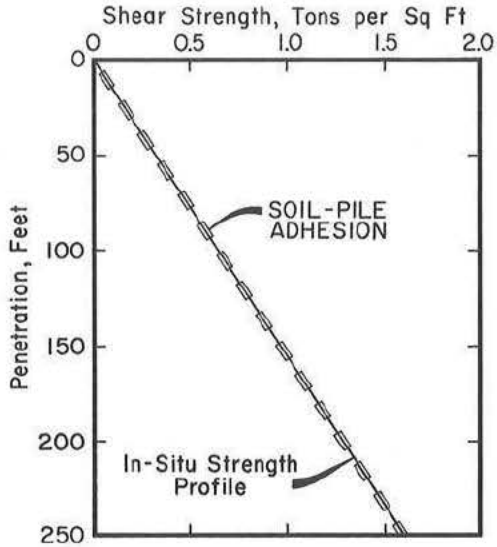

Fig.1 NORMALLY CONSOLIDATED

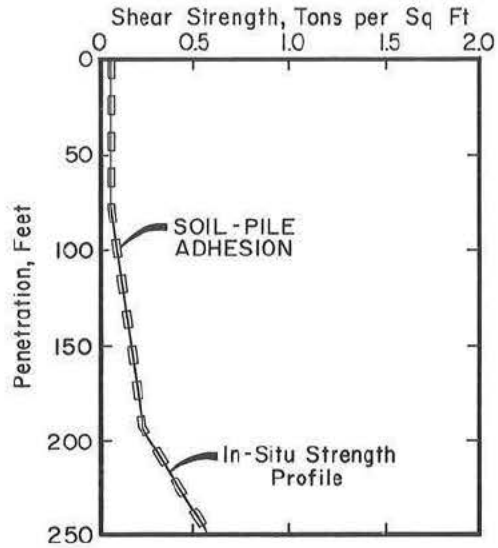

Fig. 2 UNDERCONSOLIDATED

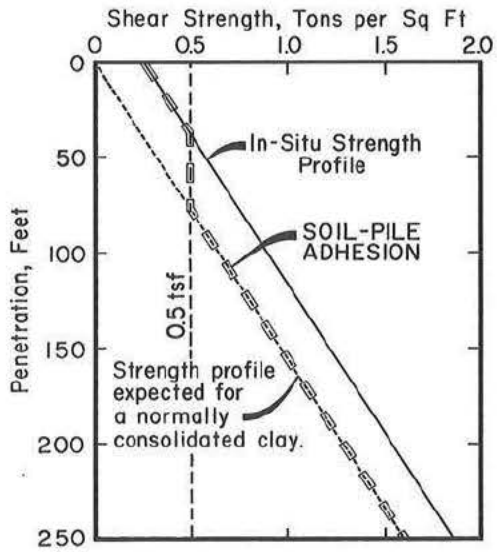

Fig. 3 OVERCONSOLIDATED BY EROSION

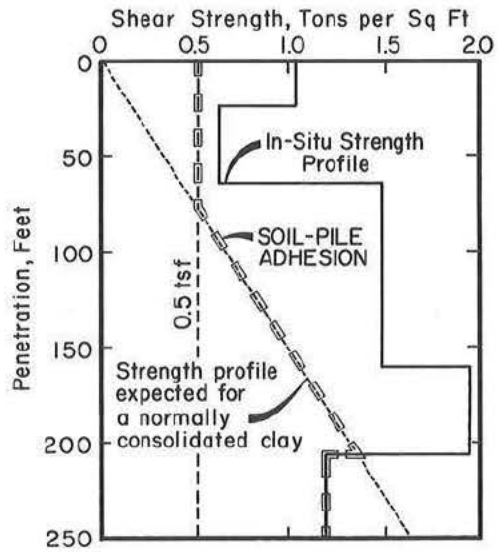

Fig. 4 OVERCONSOLIDATED BY DESICCATION

SELECTION OF SOIL-PILE ADHESION CURVE IN CLAY FORMATIONS

Soil Type	ϕ	δ	tan δ	Limiting Skin Friction f_{max}, tsf	N'_q	Limiting End Bearing q_{max}, tsf
Clean Sand	35°	30°	0.577	1.0	40	100
Silty Sand	30°	25°	0.466	0.85	20	50
Sandy Silt	25°	20°	0.364	0.7	12	30
Silt	20°	15°	0.268	0.5	8	20

Notes:

1. The coefficient of lateral earth pressure, K, should be taken as 0.7 for compressive loads and 0.5 for tensile loads.
2. These parameters are considered applicable to medium-dense to dense granular formations.

RECOMMENDED PARAMETERS OF SKIN FRICTION AND END BEARING FOR DRIVEN PILES IN GRANULAR SOILS

APPENDIX 1.6

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.6

Construction of a Self-Contained Platform for
Drilling and Producing Operations, Canta Barbara Channel

Humble Oil & Refining Company

September, 1971

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

CONSTRUCTION OF A SELF-CONTAINED PLATFORM FOR DRILLING AND PRODUCING OPERATIONS SANTA BARBARA CHANNEL

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YARD LOCATION AND PREPARATION

LOCATION

J. Ray McDermott and Kaiser Steel jointly and Brown & Root independently conducted thorough investigations for possible platform assembly sites on the West Coast and established that the use of existing facilities was not feasible for platforms of the size Humble has under consideration. Therefore, the investigations centered on vacant land which could be economically converted to an assembly yard.

Sites in the Los Angeles Harbor Area were selected as being the most desirable. Principally, this area offers easy access to highway, rail, and water transportation and permits a short tow of the completed jacket through unobstructed navigable waters to the installation site in the Santa Barbara Channel. Potential sites are located in an area of the largest labor pool on the West Coast. The sites available require a minimum amount of development and all utility services are strategically located.

PREPARATION

Preliminary soils information indicates that the sites available are suitable for the graving dock type development that appears to be most attractive as an assembly yard.

It is anticipated that approximately 40 acres will be developed. Grading and excavation will be accomplished to construct a graving dock 350 feet wide at the foot, 950 feet long, and 250 feet wide at the head. The

dock will be excavated to a depth of approximately 5.5 feet below anticipated draft of the jacket. A 2.5-foot gravel blanket will be placed along the bottom to bring the final grade to 3 feet below jacket draft. The slopes of the sides of the dock will be constructed on a one vertical to two horizontal slope. An earthen dike will be left at the foot of the dock and the dike will be protected by riprap.

It is anticipated that ground water will be encountered during both excavation and assembly making it mandatory to install a dewatering system for continuous operation and to control the water level at all times.

A barge docking facility will be constructed and will be serviced by a stiffleg derrick. Necessary access roads will be built to permit movement of machines and materials. The entire area will be fenced to provide maximum security for fabrication operations and protection to the public.

Dredging may be necessary for certain sites from the graving dock to deep water a short distance away. This dredging will provide a channel with a bottom elevation approximately 3 feet below the draft of the jacket.

Utilities will be brought to the site to meet both construction and safety requirements. Improvements to the yard will be temporary--field offices will be established in mobile trailers; warehouse, tool room, change and toilet facilities will be in temporary structures; a parking lot will be provided. Drawings S1 through S3 illustrate yard preparation.

FABRICATION

GENERAL

A thorough analysis was made by interested contractors to determine the most efficient method of fabrication. It was established that the work should be divided into shop subassembly performed at existing contractor facilities and yard assembly performed at the graving dock.

SHOP SUBASSEMBLY

Existing facilities on both the Gulf Coast and West Coast have the capabilities to fabricate routinely all jacket subassemblies visualized. Jacket subassemblies will be fabricated in components weighing up to 150 tons and shipped primarily by barge to the graving dock assembly yard. To facilitate erection, jacket leg and horizontal and vertical bracing subassemblies will be fabricated and shipped in predetermined sequence. Careful attention to the details of planning and scheduling will maintain the continuous flow of work from shop to assembly yard that is required to successfully implement this project.

Certain items such as deck units, piling, conductor pipe, and fenders will be shipped directly from shop to the offshore installation site.

YARD ASSEMBLY

One of the major factors in assembly of a jacket of unprecedented size is the development of an appropriate assembly yard and the utilization of effective and efficient erection equipment.

At the assembly yard jacket subassemblies will be off-loaded at a dock using a large capacity stiffleg derrick and placed aboard special dollies for transporting into the graving dock area where they will be off-loaded and erected.

Specially equipped crawler cranes will erect jacket components below ELEV(-)183 feet while components above this elevation (transition section of jacket) will utilize a 4600 Manitowoc crawler crane with some assistance from a 4000W Manitowoc yard crane. It is proposed that erection below ELEV(-)183 feet will be accomplished using two American 9299 crawler cranes--one with a sky horse attachment and the other with a guy derrick attachment. Both cranes will be used to erect the heavy major leg sections. The crane with the sky horse attachment will be used to erect both the crossbracing and lateral bracing of the jacket. The guy derrick crane will be used to handle falsework as well as other miscellaneous materials.

During assembly the jacket will be supported by saddles bearing on pile foundations. Specially designed falsework bents will be required for temporary support of the elevated heavy leg sections as well as multi-purpose scaffolding to facilitate erection, welding, and painting. Supporting the jacket in this manner is similar to the methods used successfully in assembling the numerous jackets of similar configuration built for service in Cook Inlet, Alaska.

A work area adjacent to the graving dock will be used for fabrication of miscellaneous jacket subassemblies. The 4000W Manitowoc and a 50-ton truck crane can service this area as required.

Upon completion of the jacket and after all necessary testing and inspections, water will be introduced into the graving dock to attain flotation. Once the jacket is afloat and stabilized, the earthen dike at the graving dock entry will be removed and the jacket, with tow lines secured, will be towed out of the dock. Drawings E1 through E9 illustrate the assembly procedure.

TRANSPORTATION

The jacket will be towed from the assembly yard to the erection site under its own buoyancy plus auxiliary buoyancy provided for safe towing in the open sea. Two tugs of at least 6,000 horsepower will be used as prime movers. All other components, such as deck units, piling, conductor pipe, and fenders will be moved by conventional barge methods.

All such components will be prepared and loaded in such manner as to facilitate water phase installation without undue rehandling of the components at sea.

INSTALLATION

GENERAL

The jacket will arrive at the erection site floating horizontally under its own buoyancy plus auxiliary buoyancy. It will be placed in a vertical position on bottom by controlled flooding of compartments in the legs and the horizontal buoyancy tank at ELEV(-)822'-0". It is estimated that upending will take approximately 6 to 8 hours. Each compartment in the jacket is provided with dual flooding valves and a vent line to control flooding. Each valve is hydraulically operated from ELEV(+)30'-0" of the jacket or from the derrick barge. Plumbing and leveling of the jacket on the sloping bottom is accomplished by partial deballasting of certain compartments and by the use of mud mats that have been installed on the jacket parallel to the anticipated bottom slope.

After the platform is on bottom--level and plumb--two 36-inch OD piles will be driven at each corner and welded at ELEV(+)47'-0". These piles serve as temporary support and anchorage while the remainder of the piles are installed and permanently grouted to both jacket and foundation. There will be thirty-two 36-inch OD outer piles driven to a penetration of 160 feet and thirty-two 30-inch OD insert piles drilled to a penetration of 320 feet and grouted to the foundation.

Although the jacket can be installed by controlled flooding and with minimum assistance from floating construction equipment, a 500-ton derrick barge will be required to set deck units and associated equipment. The deck consists of four fabricated units--two weighing approximately 500

tons each and two weighing approximately 250 tons each. Each unit will be lifted with as much production equipment and related piping as possible to facilitate production start-up.

After deck units have been set and secured by welding miscellaneous equipment such as boat fenders, walkways, stairways, and handrails will be installed. Final action requires that contractor repair all protective coatings damaged during installation.

The total field installation has been planned so that a maximum amount of productive effort will be realized from the total days required for installation.

FLOODING CONTROL SYSTEM

The flooding control system for the jacket is used for the following operations:

1. Upending of the jacket from a horizontal floating position to a vertical floating position.
2. Lowering the vertical floating jacket to the sea floor.
3. Limiting the bearing load the jacket imposes on the sea floor before and during pile installation.

The system is designed for remote control and monitoring from a Master Control Unit located on the derrick barge and for manual control from the Remote Terminal Unit in the Control Module located on the jacket at ELEV(+)30'-0". The system is designed with 100% back-up for each operation. Three basic systems are activated during the flooding operation.

Remote Control and Monitoring System

The transfer of data between the derrick barge Master Control Unit and the jacket Remote Terminal Unit can be accomplished by either coaxial cable or VHF or UHF radio; generally, data is transmitted simultaneously over both systems. The Master Control Unit on command will scan the Remote Terminal Unit and display the requested status information. To initiate a command, the operator positions an indicating type switch; the Master Unit then transmits the command to the Terminal Unit. The Terminal Unit verifies the command for correctness and then closes a relay. This action results in: (1) transmittal of a signal indicating the new relay position to the Master Unit and (2) activation of a solenoid valve. The solenoid valve opens allowing hydraulic pressure to the flooding valve which opens or closes depending upon the command.

Hydraulic System

The hydraulic system consists of two high-pressure pumps; one oil reservoir; four pre-charged bladder-type accumulators; 80 two-way, three-position solenoid-actuated control valves; 80 four-way manually operated control valves; and associated control piping.

Electrical System

The electrical system consists of two power supply sources and associated switchgear and wiring. The normal power requirements for operation of the flooding control system is furnished by the derrick barge through a transmission link that supplies power to all pumps, solenoid valves, and radios. Should this link fail or if it becomes necessary to separate from the derrick barge, an automatic transfer

switch will transfer power requirements to a 30KW generator located on the jacket near the Control Module. The emergency generator will be operated continuously during upending for prompt transfer if necessary or desired.

The entire system will be checked before the jacket is floated. All connections will be made to the Remote Terminal Unit in the assembly yard and the transmission link will be attached to the top of the jacket for the tow to the installation site. Simple plug-in connections will then be used to connect the transmission link to the Master Control Unit when the jacket arrives on location.

FLOODING PROCEDURE

The following sequence will be used to activate the flooding control system:

1. Engage the normal power supply from the derrick barge.
2. Start the remote generator on the jacket.
3. Start the hydraulic pumps on the jacket.
4. Actuate the "closing" solenoids of all flooding valves.
5. Check indicating lights to see that all flooding valves are closed.
6. To flood a compartment, actuate the "opening" solenoid of the flooding valve and check indicating light to see that the valve has opened.

In case of a malfunction, the following steps will be taken:

1. If the primary flooding valve (A) fails to open, solenoid will be returned to "close" position and the back-up flooding valve (B) will be opened.

2. If both the normal power and the generator power supplies fail during upending, all solenoids will be de-energized. The solenoid valves will then automatically return to the center position, closing the hydraulic lines to the flooding valve operators. The flooding valves will remain in the position they are in at the time of power failure. If power can not be restored, an operator will go to the jacket and continue the upending by operating the manual control valves with hydraulic pressure stored in the pre-charged accumulators.

FLOODING SEQUENCE

The flooding sequence will be as follows:

1. Check remote control and monitoring system on the derrick barge and jacket.
2. Remove blinds from flooding valve ports and open ports on all free-flood members.
3. Flood compartments A-2-7, A-2-8, and A-9 of the horizontal buoyancy tank. This will cause the jacket to rotate 45° and float in a diagonal position with a maximum draft of 180 feet.
4. Flood compartments A-1-7 and A-1-8 of the horizontal buoyancy tank and A-2-6, A-1-6, A-2-5, and A-1-5 of legs A-1 and A-2. This will relevel the jacket and start the upending process with a maximum draft of 245 feet.
5. Flood compartments B-2-6, B-1-6, B-2-5, and B-1-5. This will place the jacket in or near a vertical position floating 50 to 60 feet off bottom.
6. Flood compartments A-2-2, A-1-2, B-2-2, and B-1-2 with approximately

40 feet of water. This will place the jacket 25 to 30 feet off bottom.

7. Position the jacket at the correct location and with the proper orientation using tugs and the derrick barge.
8. Flood compartments A-2-3, A-1-3, B-2-3, and B-1-3 until the mud mats have come to bear on the bottom.
9. Close all flooding valves.
10. Level the jacket by utilizing the deballasting pumps of compartments A-2-2, A-1-2, B-2-2, and B-1-2.
11. Maintain buoyant control of the jacket while two 36-inch OD outer piles--at each corner--are driven to grade and temporarily welded to the jacket at ELEV(+)47'-0".
12. Ballast the jacket to achieve an effective weight not to exceed the capacity of these piles. This step will also achieve stability against lateral load. As additional piles are driven, the weight will be increased correspondingly until all compartments have been flooded.
13. Open all flooding valves to facilitate future jacket removal.
14. Remove the two auxiliary buoyancy tanks from the jacket.
15. Remove the Control Module and the remote generator from the jacket.

PILE INSTALLATION

The pile installation will be accomplished in two steps. The first step will be to drive a 36-inch OD outer pile to a depth of 160 feet below the mudline and grout the pile to a 42-inch OD pile sleeve attached to the jacket. The second step will be to drill a 36-inch diameter hole below the 36-inch OD pile to a depth of 345 feet below the mudline, install a 30-inch OD insert pile in this hole to a depth of 320 feet, and grout it to the foundation and to the 36-inch OD pile. This procedure will be

repeated--using two drilling rigs working on diagonal corners of the jacket--until all 32 piles are installed.

The 36-inch OD pile will be stabbed through pile guides into the pile sleeve in sections of approximately 120 feet. As each section is added, it will be welded and lowered until its weight is supported by the strength of the soil. At this point a pile hammer will be placed on the pile and driving will begin. The pile will drive approximately 40 feet before it becomes necessary to add another 120-foot section. After this splice is complete, the pile will be driven to the final penetration of 160 feet; temporarily welded to the jacket at ELEV(+)47'-0"; and grouted to the pile sleeve. After the 36-inch OD pile is in place, the 30-inch OD insert pile will be installed. A drilling rig, set on a temporary erection deck at ELEV(+)47'-0", will be placed over the 36-inch OD pile follower and a 30-inch diameter drill bit, followed by a 36-inch diameter underreaming tool will be lowered inside the 36-inch OD pile until it reaches the soil plug. At this point a circulation pump will be engaged and the bit will begin removing the soil plug. Once the bit has drilled below the 36-inch OD pile, the underreamer will be opened and a 36-inch hole will be drilled to a penetration of 345 feet. After this the hole will be circulated to insure that it is clean, drilling mud will be placed in the open hole for wall stability, the drill string will be removed, and the rig will move to another pile location. The insert pile will then be lowered into the 36-inch diameter hole and suspended from drill pipe. The drill pipe will be hung from slips at ELEV(+)47'-0" while the insert pile is grouted in place.

PILE GROUTING

Grouting of the 36-inch outer OD pile to the pile sleeve is accomplished by using grout lines that have been installed in the jacket for this purpose.

The first stage, or plug stage, uses a fast-setting cement that is pumped through a grout line that terminates above the bottom grout seal. This plug, approximately 15 feet long, will set until it has hardened enough to support the weight of the remainder of the grout to be placed in the pile sleeve. The remainder will then be pumped in a single lift through a second grout line that enters the sleeve above the grout plug.

There are two methods used to determine if grout has reached the top of the pile sleeve. The first is the use of a return grout line located near the top of the pile sleeve but below the top grout seal. This line permits grout to return to ELEV(+)47'-0" and is physical evidence that grout has reached the top seal. Grouting will continue until this evidence appears or until it is apparent from grout volume pumped that the method is not working. If the top grout seal fails, grout will not return to the surface through the return line. The second method requires a "cemotop" logging tool be placed at the top grout seal in the 36-inch OD pile prior to starting the grouting operation. This tool can detect the presence of cement through the wall of a pipe and can send a confirmation signal to the logging unit on the deck.

The grouting of the 30-inch OD pile to the formation and to the 36-inch OD pile will be accomplished by pumping grout through the drill pipe

that holds the insert pile in position. The grout will be pumped down the drill pipe until it reaches a changeover sub with grout tube extension. At the end of the tube extension the grout will flow into the open 36-inch hole and return up the annulus between the 36-inch hole and the 30-inch OD pile displacing the drilling mud as it goes. To insure proper grout distribution within the annulus centralizers will be installed on the insert pile periodically. Again--to establish that grout has reached the top of the pile--a "cemotop" logging tool will be deployed. This time it will be set at the top of the 36-inch OD outer pile by wire line. After grout has set the drill pipe holding the 30-inch OD insert pile in position will be disconnected at the changeover sub and removed. Then the 36-inch OD follower used to drive the 36-inch OD outer pile will be disconnected at the top of the pile sleeve and removed.

DECK INSTALLATION

When the pile installation is complete, the four deck units will be set. The derrick barge will not relocate from its original set-up position since all deck units will be set on the jacket from one side. Each unit will be lifted with as much equipment and interconnecting piping as possible to facilitate production start-up.

Each deck unit will be initially placed on the end of the jacket near the derrick barge and then skidded across the deck support trusses to the proper position using the built-in skid rails. These skid rails have the same dimensions as the main skid beams on the drilling deck; therefore, the same hydraulic jacks may be used for deck installation and for skidding drilling rigs. Drawings 001-P through 005-P, SK-1, and SK-2 illustrate the installation procedure.

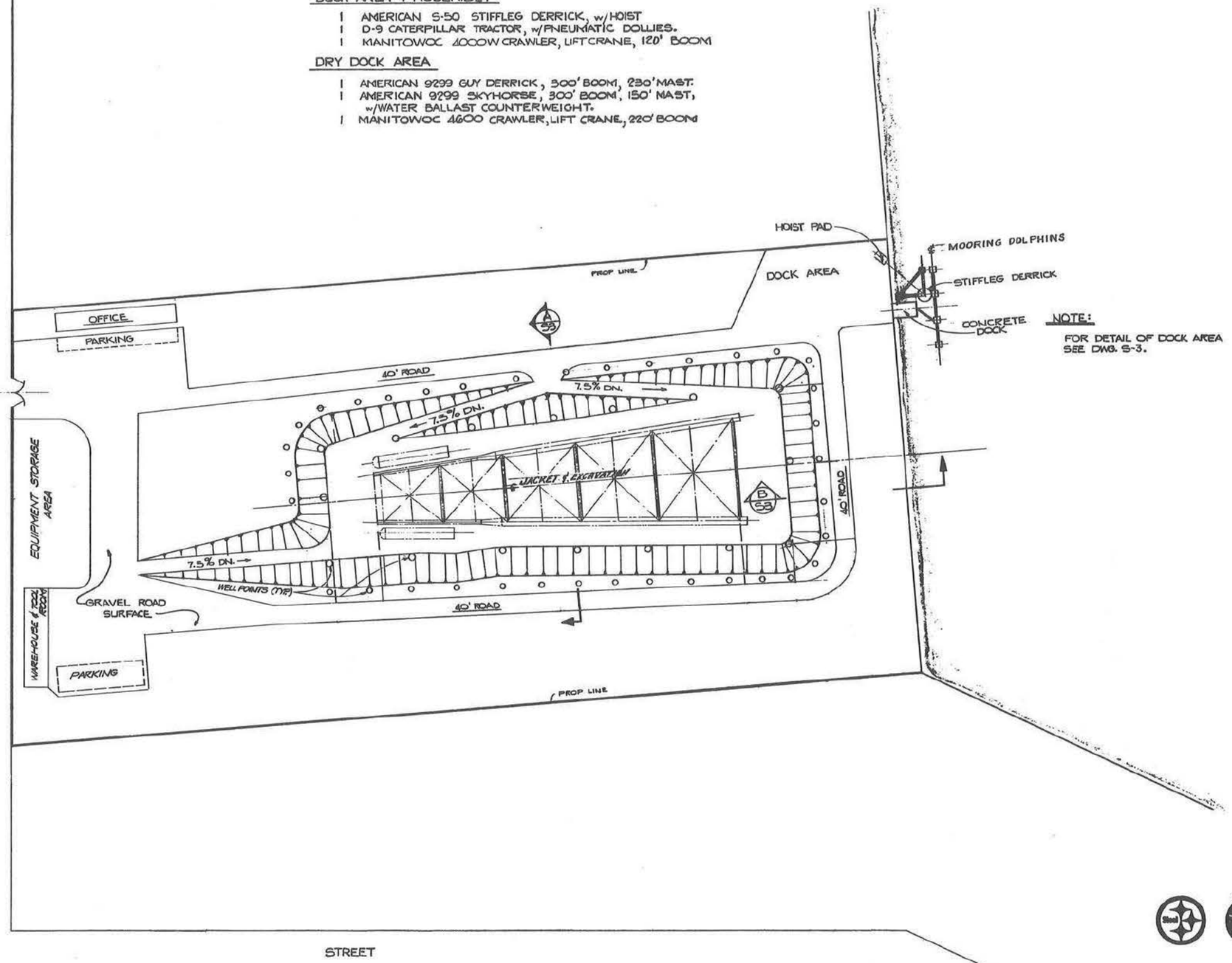
MAJOR EQUIPMENT

DOCK AREA & ASSEMBLY

1 AMERICAN S-50 STIFFLEG DERRICK, w/HOIST
1 D-9 CATERPILLAR TRACTOR, w/PNEUMATIC DOLLIES.
1 MANITOWOC 4000W CRAWLER, LIFT CRANE, 120' BOOM

DRY DOCK AREA

1 AMERICAN 9299 GUY DERRICK, 300' BOOM, 230' MAST.
1 AMERICAN 9299 SKYHORSE, 300' BOOM, 150' MAST, w/WATER BALLAST COUNTERWEIGHT.
1 MANITOWOC 4600 CRAWLER, LIFT CRANE, 220' BOOM



NOTE:
FOR DETAIL OF DOCK AREA SEE DWG. S-3.

REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	BY, PRINTS	FOR WHOM	DATE	BY, PRINTS	FOR WHOM

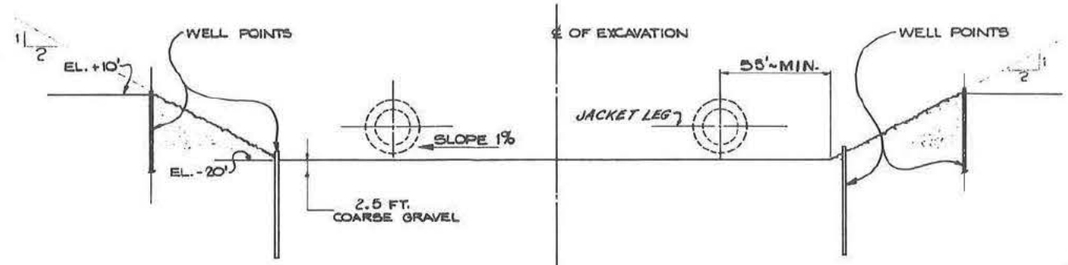
BOLTS
HOLES
PAINT
SCALE: 1" = 100'-0"

KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN B. Ross	DATE 1-27-71	840' W.D. PLATFORM
CHECKED CNC		SITE DEVELOPMENT PLAN
RE-CHECKED Bullmaster		

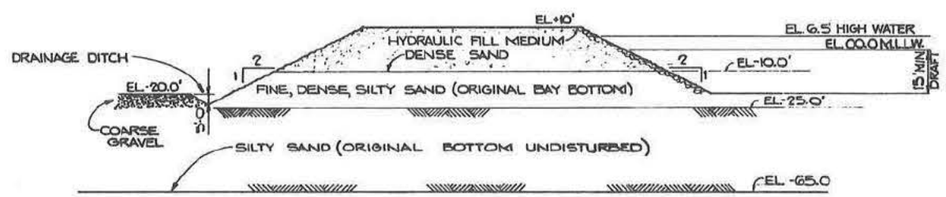
JOB NO.
SI SHT. REV.



SECTION A/S2
1" = 30'-0"

SPECIFIC RECOMMENDATIONS:

1. EXCAVATED SIDE SLOPES 1½ HORIZONTAL TO 1 VERTICAL, MAXIMUM, FOR DEWATERED MATERIAL.
2. ALLOWABLE SOIL BEARING PRESSURE AT THE BOTTOM OF EXCAVATION:
   1000 PSF FOR DEWATERING TO DEPTH OF 5'-0" BELOW EXCAVATION.
   1500 PSF " " " " " 15'-0" " "
   (PILE SUPPORTED FOUNDATIONS ARE RECOMMENDED FOR LARGER POINT LOADS.)
3. WATER WILL BE ENCOUNTERED, AND WILL HAVE TO BE CONTROLLED BY PROPER DEWATERING PROCEDURES.



SECTION B/S2
1" = 30'-0"

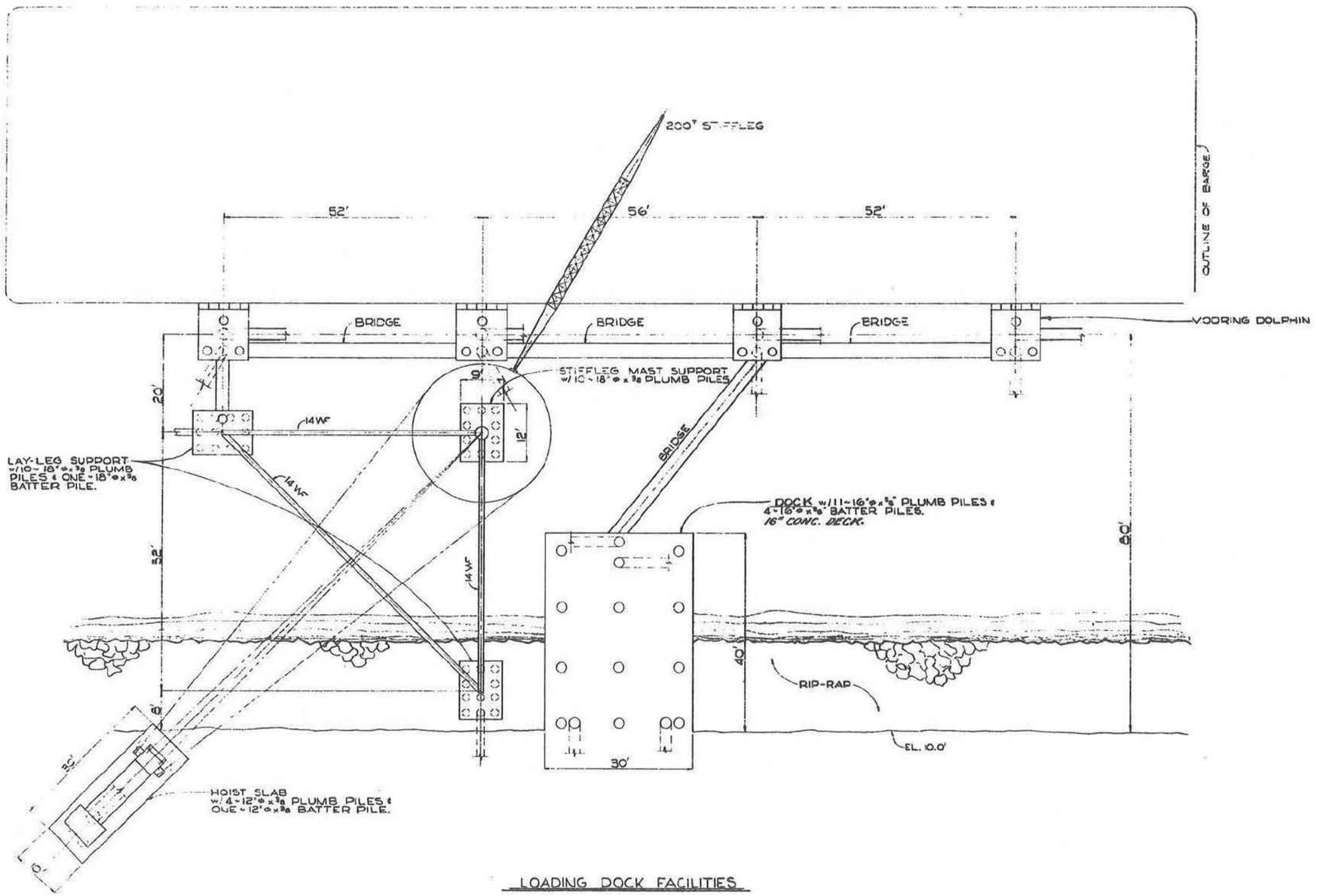
REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	BR. PRINTS	FOR WHOM	DATE	BR. PRINTS	FOR WHOM

BOLTS
HOLES
PAINT

KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN B. Ross DATE 2-8-71	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	SITE DEVELOPMENT	
APPROVED Calhoun	SECTIONS	DWG. S2 REV. A



LOADING DOCK FACILITIES

REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	NO. PRINTS	FOR WHOM	DATE	NO. PRINTS	FOR WHOM

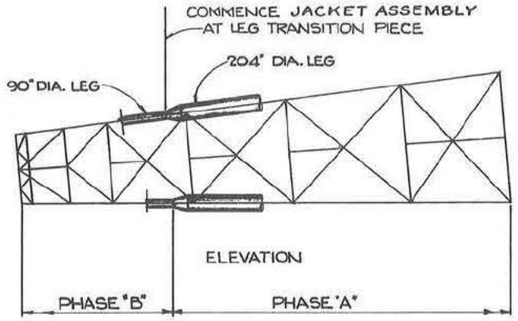
BOLTS
HOLES
PAINT

KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND – CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN	DATE	840' W.D. PLATFORM	JOB NO.
B. Pace	1-26-71		
CHECKED CNC		CONSTRUCTION SITE	
IN CHARGE Fullmore		DOCK AREA	DWG. 93 REV.

CONSTRUCTION PHASES:



PHASE "A"

COVERS THE ASSEMBLY OF THE LOWER PORTION OF THE JACKET INCLUDING ALL LEG SECTIONS, BRACING, AND INTERIOR FRAMING.

MAJOR ERECTION EQUIPMENT:

ONE AMERICAN 9299 CRAWLER WITH GUY DERRICK ATTACHMENT
ONE AMERICAN 9299 "SKYHORSE" CRAWLER.

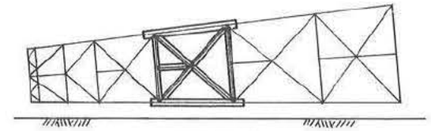
PHASE "B"

COVERS THE ASSEMBLY OF THE UPPER PORTION OF THE JACKET INCLUDING ALL LEG SECTIONS, BRACING, INTERIOR FRAMING, TRUSSES, AND BUOYANCY TANKS.

MAJOR ERECTION EQUIPMENT:

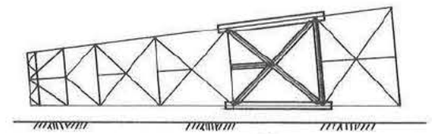
ONE MANITOWOC 4600 CRAWLER.

ERECTION SEQUENCE:



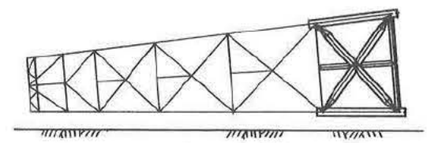
STAGE A1

ASSEMBLE THE JACKET SECTION INDICATED. ASSEMBLY TO FOLLOW THE ERECTION STEPS OUTLINED ON DRAWINGS E2 + E3.



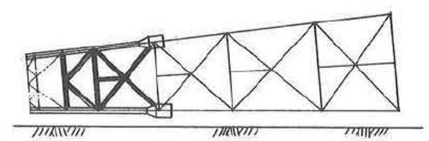
STAGE A2

ASSEMBLE THE JACKET SECTION INDICATED FOLLOWING THE SAME GENERAL ERECTION STEPS USED FOR STAGE A1.



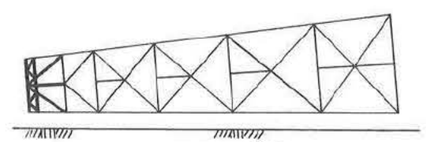
STAGE A3

ASSEMBLE THE JACKET SECTION INDICATED FOLLOWING THE SAME GENERAL ERECTION STEPS USED FOR STAGE A1.



STAGE B1

ASSEMBLE THE JACKET SECTIONS INDICATED FOLLOWING SIMILAR PROCEDURES USED FOR PHASE A.



STAGE B2

ASSEMBLE THE TOP JACKET SECTION AND THE TOP TRUSSES.

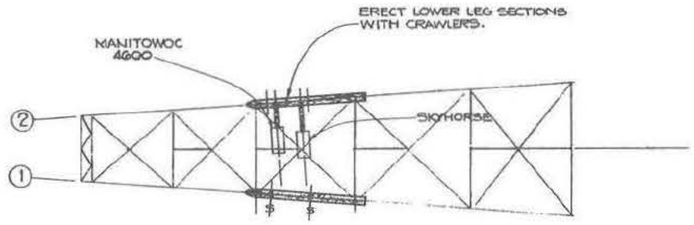
REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	NO. PRINTS	FOR WHOM	DATE	NO. PRINTS	FOR WHOM

BOLTS
HOLES
PAINT

KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

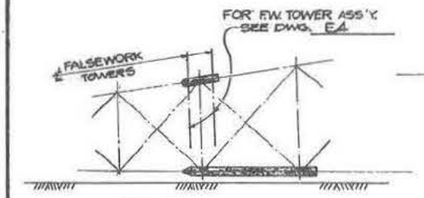
DRAWN	DATE	840' W.D. PLATFORM	JOB NO.
B. Ross	2-5-71		
CHECKED KIP		JACKET CONSTRUCTION	
IN CHARGE E. Lemmers		PHASES & ERECTION SEQUENCE	DR. E1 REV. A



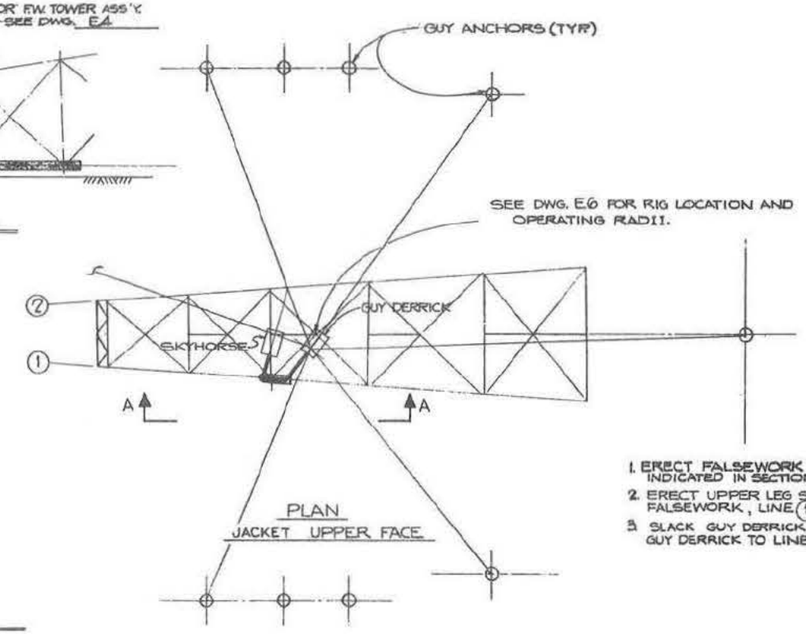
PLAN
JACKET LOWER FACE

LAND LOWER LEG SECTIONS ON SUPPORT SADDLES AND CRIBBING.

STEP ONE



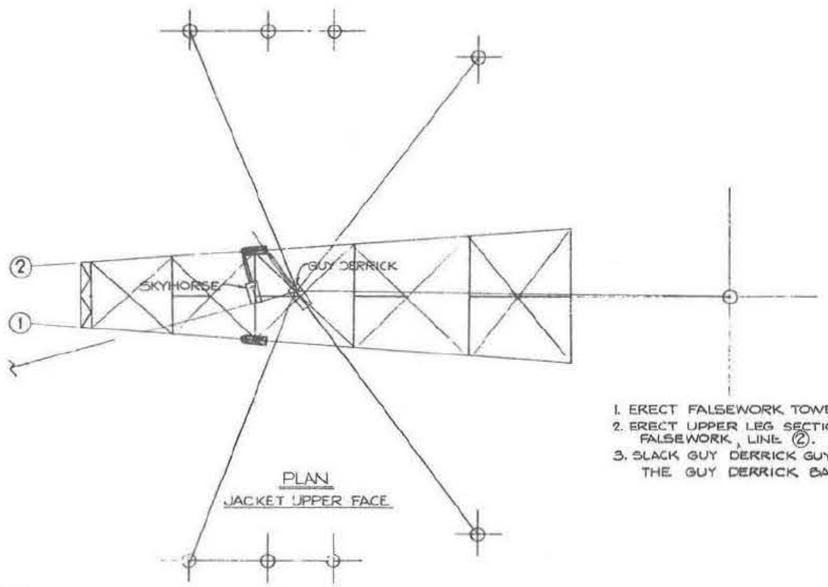
ELEVATION
SECTION A-A



PLAN
JACKET UPPER FACE

1. ERECT FALSEWORK TOWERS AS INDICATED IN SECTION A-A.
2. ERECT UPPER LEG SECTION ON FALSEWORK, LINE ①.
3. SLACK GUY DERRICK GUYS TO MOVE GUY DERRICK TO LINE ②.

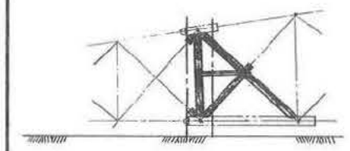
STEP TWO



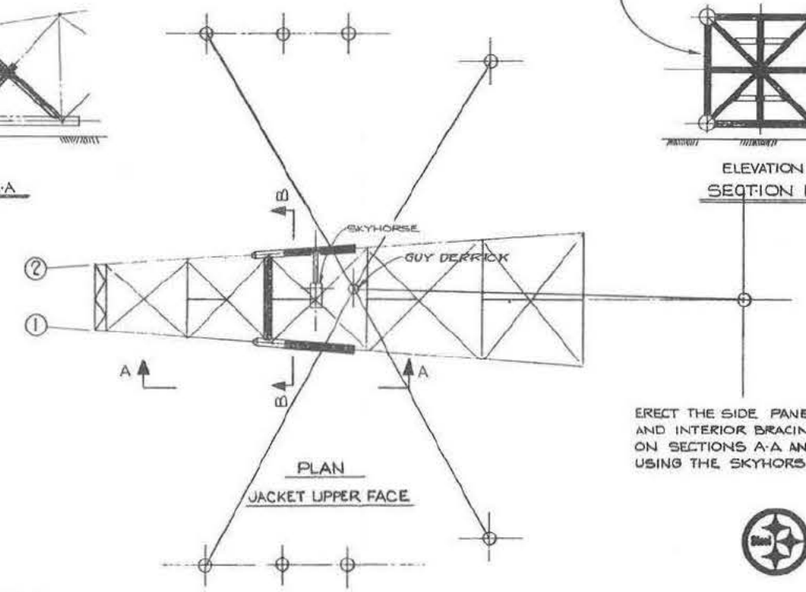
PLAN
JACKET UPPER FACE

1. ERECT FALSEWORK TOWERS.
2. ERECT UPPER LEG SECTION ON FALSEWORK, LINE ②.
3. SLACK GUY DERRICK GUYS TO MOVE THE GUY DERRICK BACK.

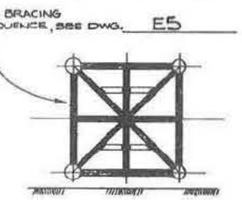
STEP THREE



ELEVATION
SECTION A-A



PLAN
JACKET UPPER FACE



ELEVATION
SECTION B-B

ERECT THE SIDE PANEL AND INTERIOR BRACING, AS SHOWN ON SECTIONS A-A AND B-B, USING THE SKYHORSE.

STEP FOUR

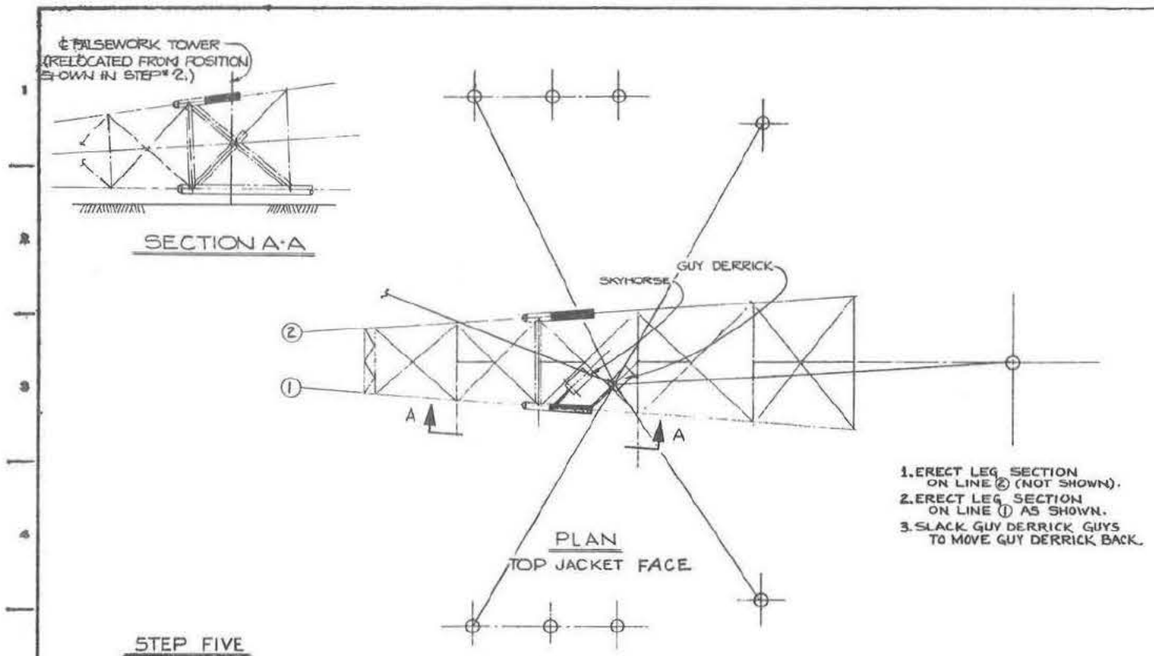
REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	NO. PRINTS	FOR WHOM	DATE	NO. PRINTS	FOR WHOM

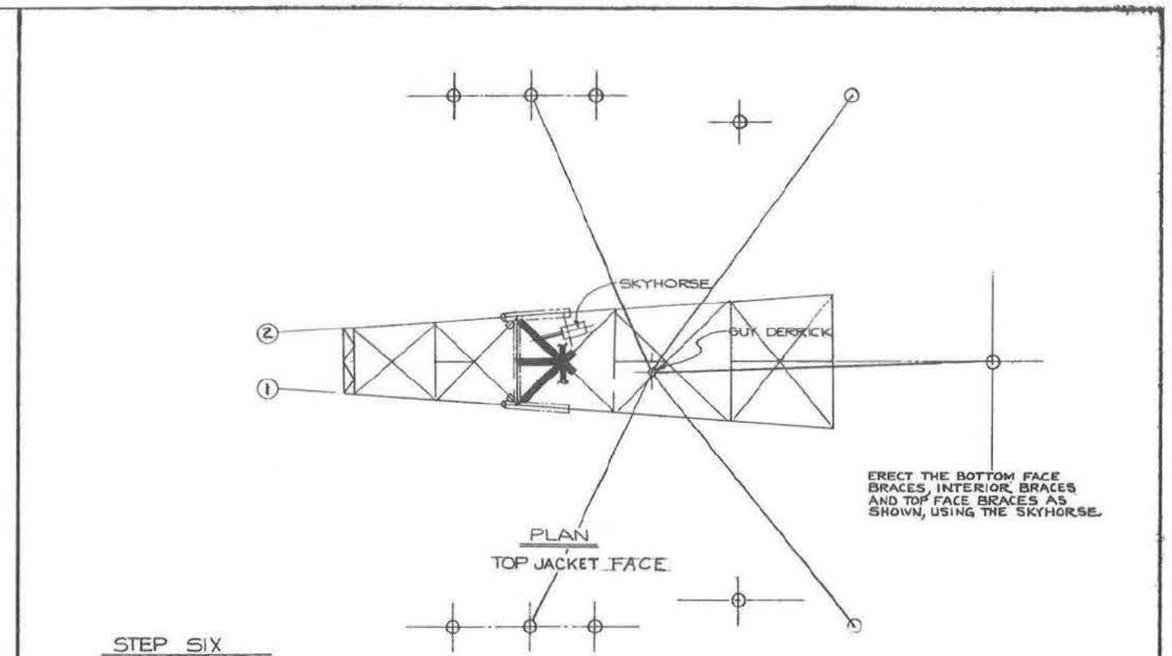
BOLTS
HOLES
PAINT

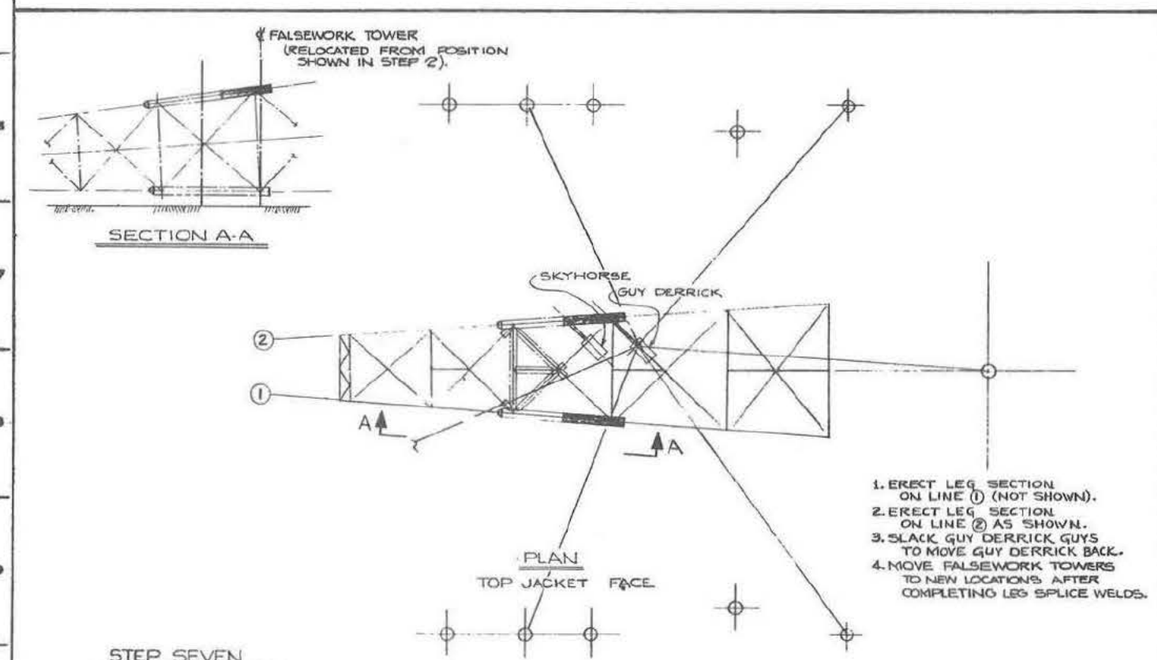
KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

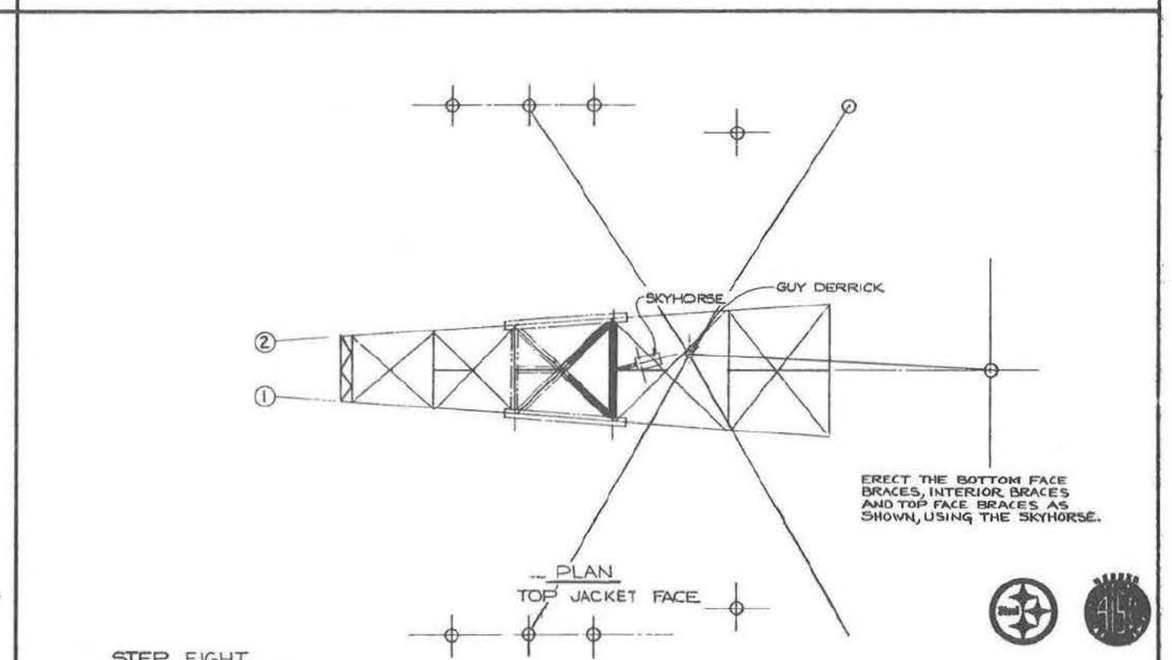
HUMBLE OIL & REFINING COMPANY

DRAWN B. Ross DATE 2-3-71	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	JACKET ASSEMBLY	
DESIGNED, CONSTRUCTED BY	STAGE A1 ERECTION	DWG. E2 REV. A







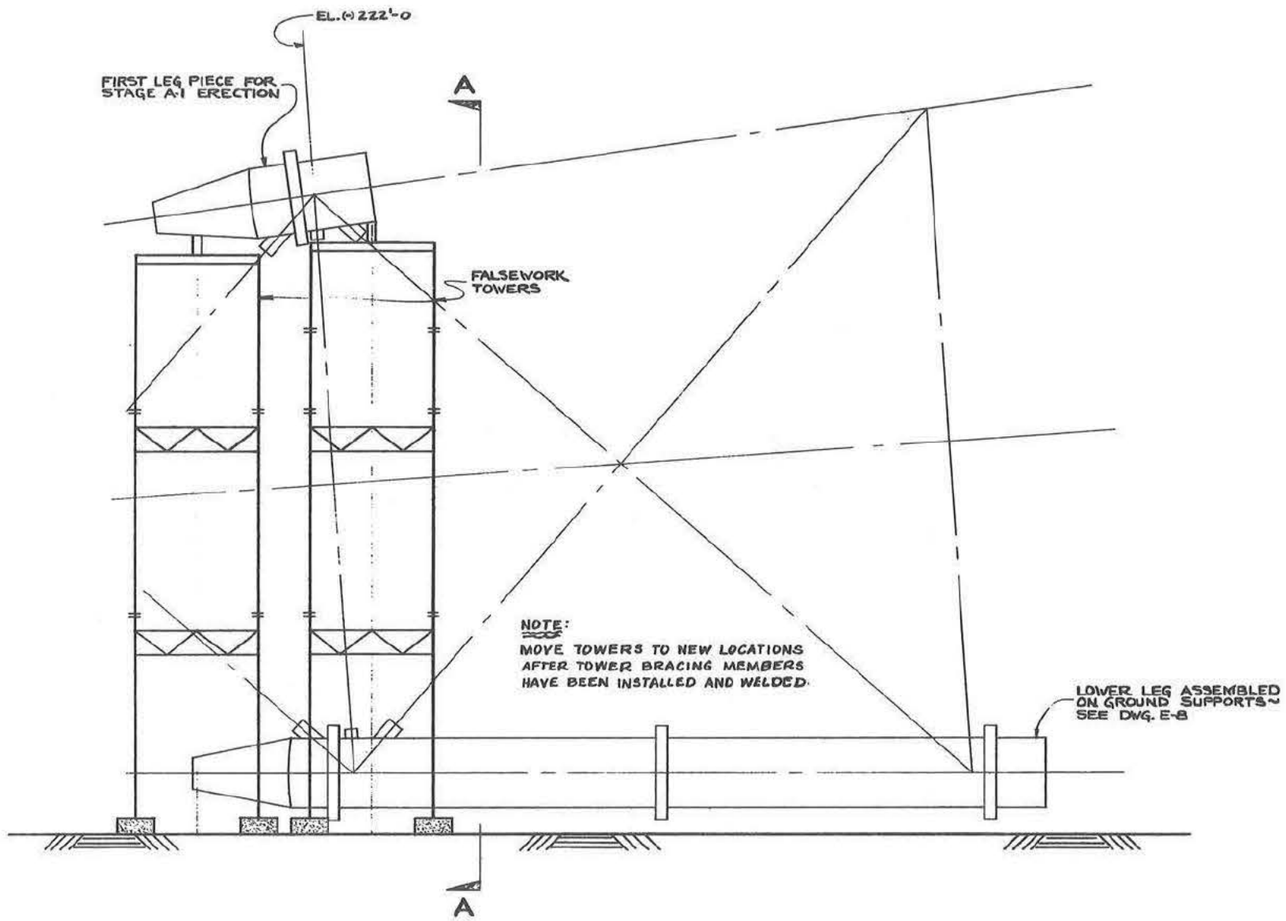


REVISIONS				REVISIONS			BLUE PRINT RECORD			BLUE PRINT RECORD			
DIV. NO.	DATE	DESCRIPTION	DRAWN	DIV. NO.	DATE	DESCRIPTION	DRAWN	DATE	DATE	DATE	DATE	DATE	BOLTS
													HOLES
													PAINT

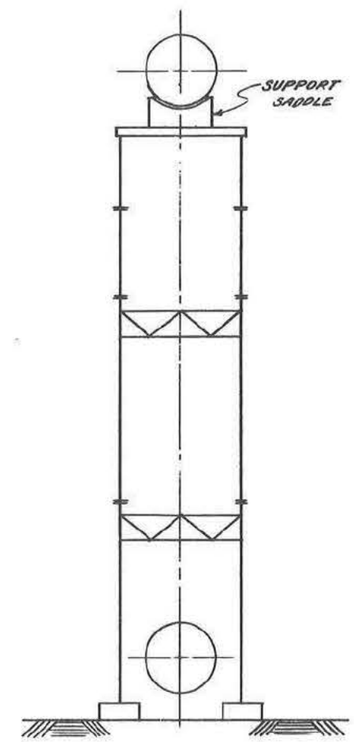
KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN B. Ross DATE 2-5-71	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	JACKET ASSEMBLY	
APPROVED	STAGE A-1 ERECTION	DWG. E3



ELEVATION



SECTION A-A

UPPER LEG PIECE FALSEWORK SUPPORT

REVISIONS			
REV. NO.	DATE	DESCRIPTION	REASON

REVISIONS			
REV. NO.	DATE	DESCRIPTION	REASON

BLUE PRINT RECORD		
DATE	BL. PRINTS	FOR WHOM

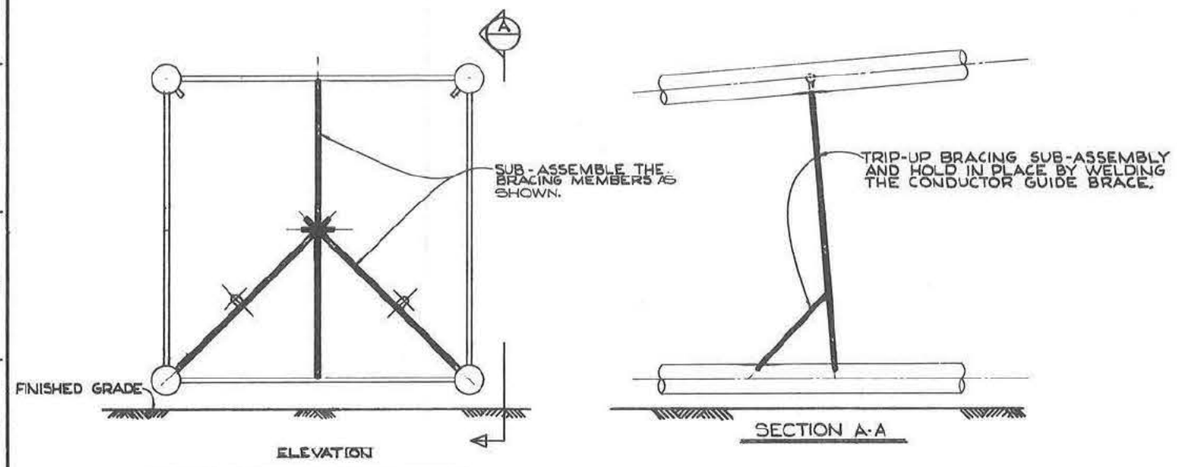
BLUE PRINT RECORD		
DATE	BL. PRINTS	FOR WHOM

BOLTS
HOLES
PAINT
SCALE ~ 1/16" = 1'-0

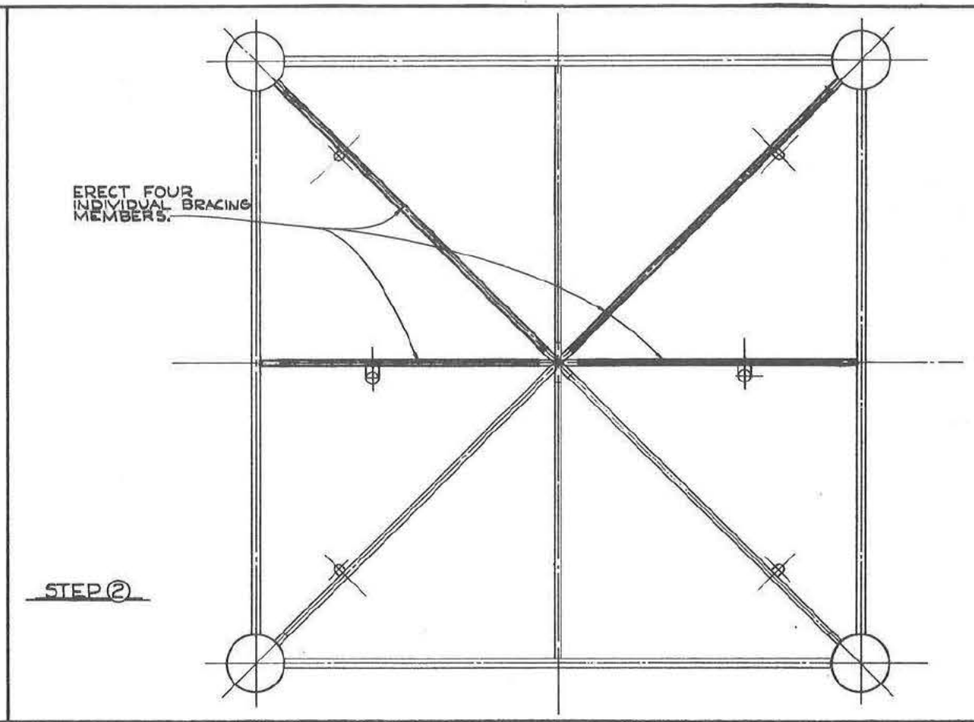
KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND – CALIFORNIA

HUMBLE OIL & REFINING COMPANY

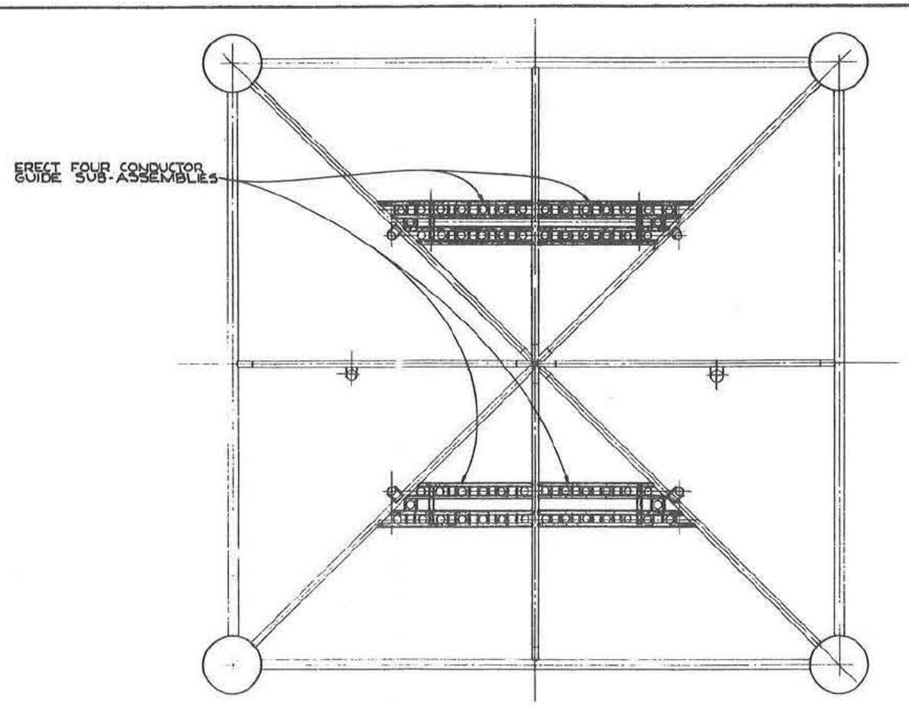
DRAWN B.P.&E.H. DATE 8/8/71	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	JACKET ASSEMBLY	
RE-CHARGE	UPPER LEG ERECTION	DWG. E4 REV. 6



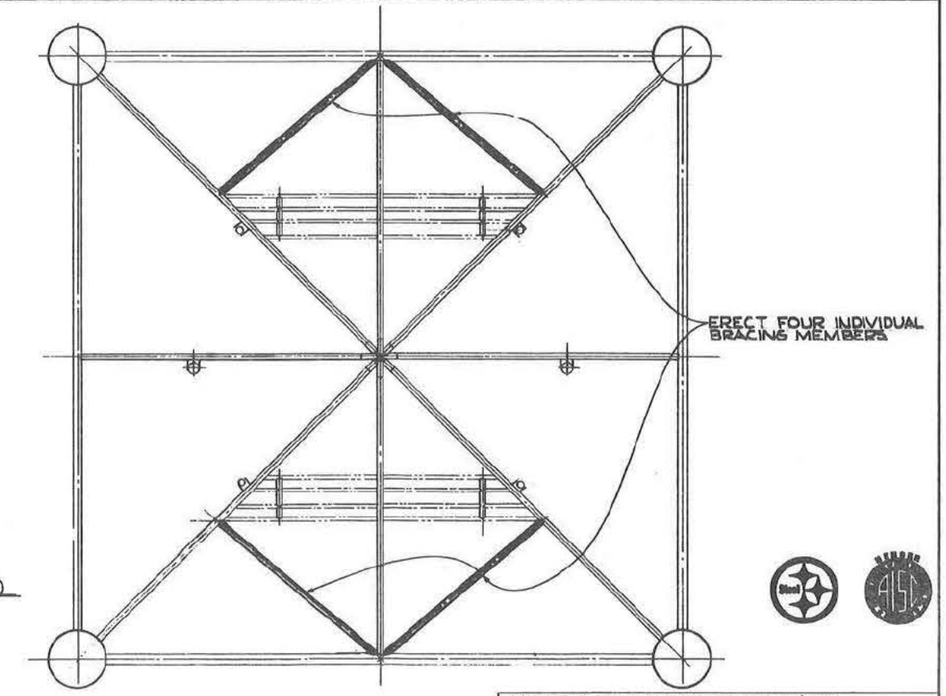
STEP ①



STEP ②



STEP ③



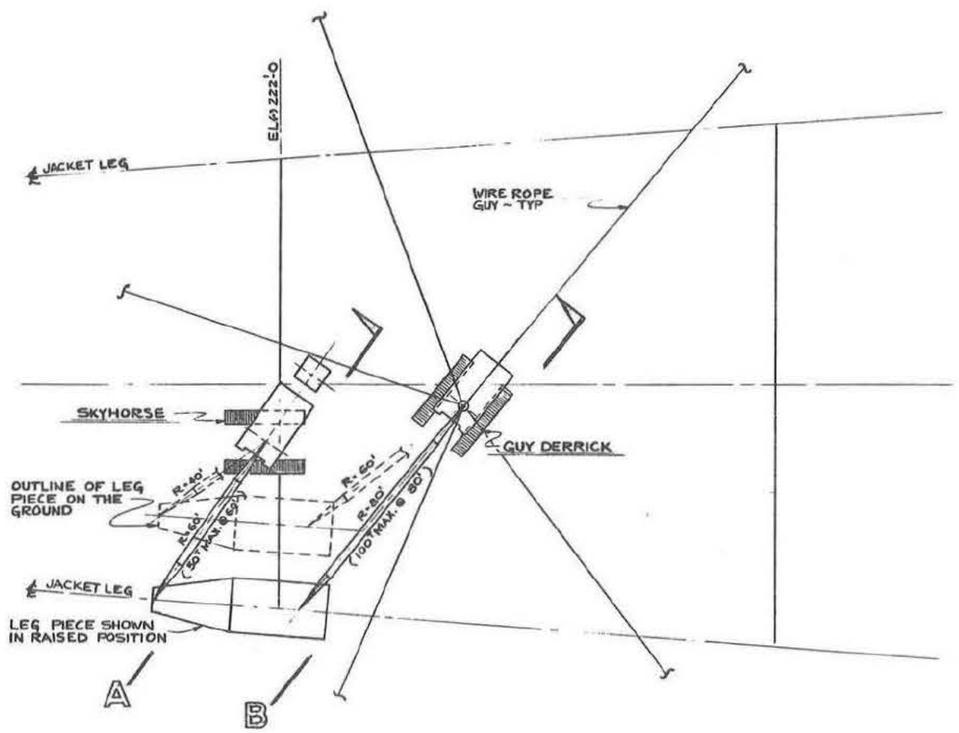
STEP ④

REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD			
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	NO. PRINTS	FOR WHOM	DATE	NO. PRINTS	FOR WHOM	BOLTS
														HOLES
														PAINT

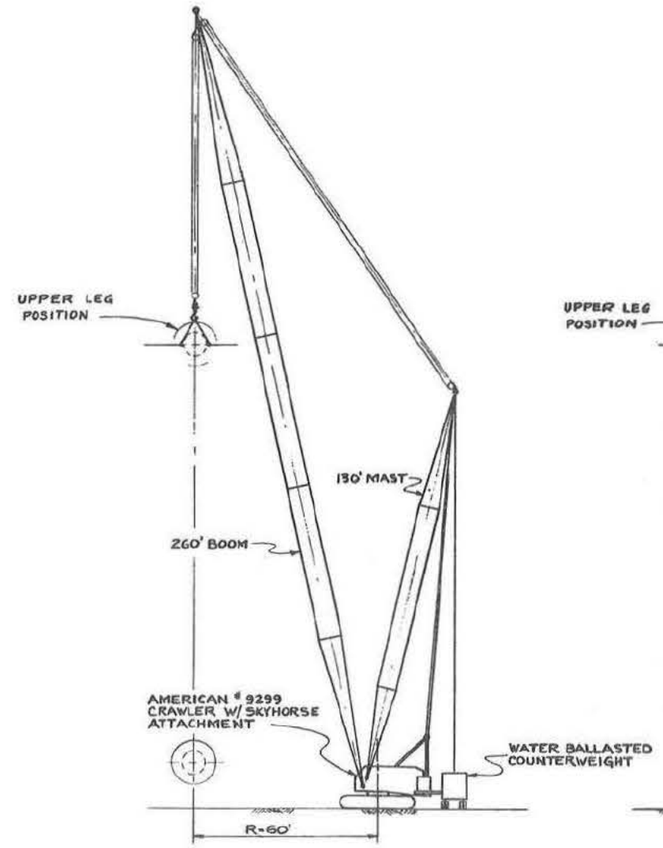
KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

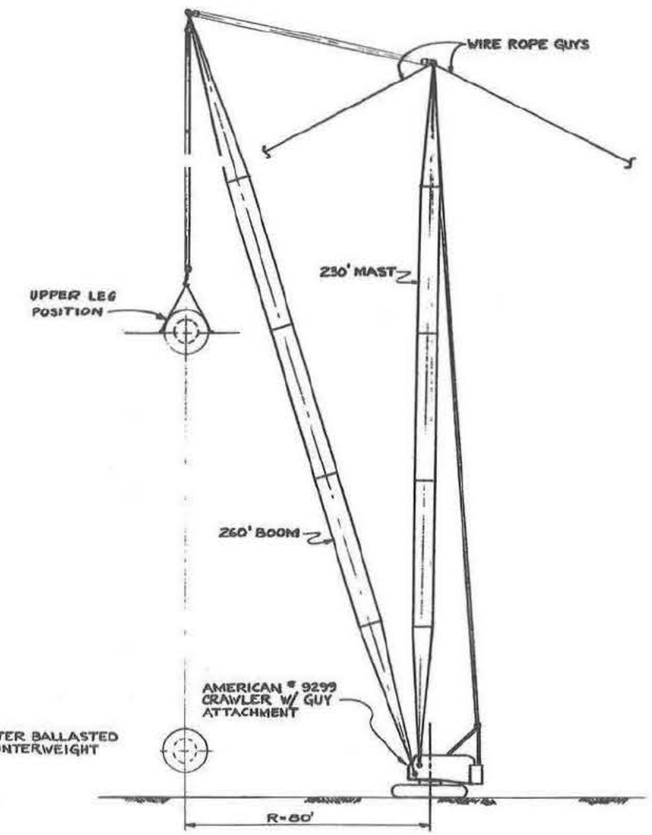
DRAWN B. Ross DATE Jan. 12, 1971	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	JACKET ASSEMBLY	
DESIGNED	INTERIOR BRACING ERECTION	DW. E5 REV. 0



PLAN



SECTION A



SECTION B

RIG LOCATIONS FOR LANDING FIRST PIECE FOR STAGE A-1 ERECTION

NOTE

ORIENTATION OF RIGS FOR SUBSEQUENT OPERATIONS IS SIMILAR TO THE POSITION SHOWN.

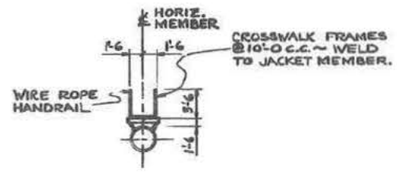
REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REV. NO.	DATE	DESCRIPTION	REASON	DATE	NO. PRINTS	FOR WHOM	DATE	NO. PRINTS	FOR WHOM

BOLTS
HOLES
PAINT

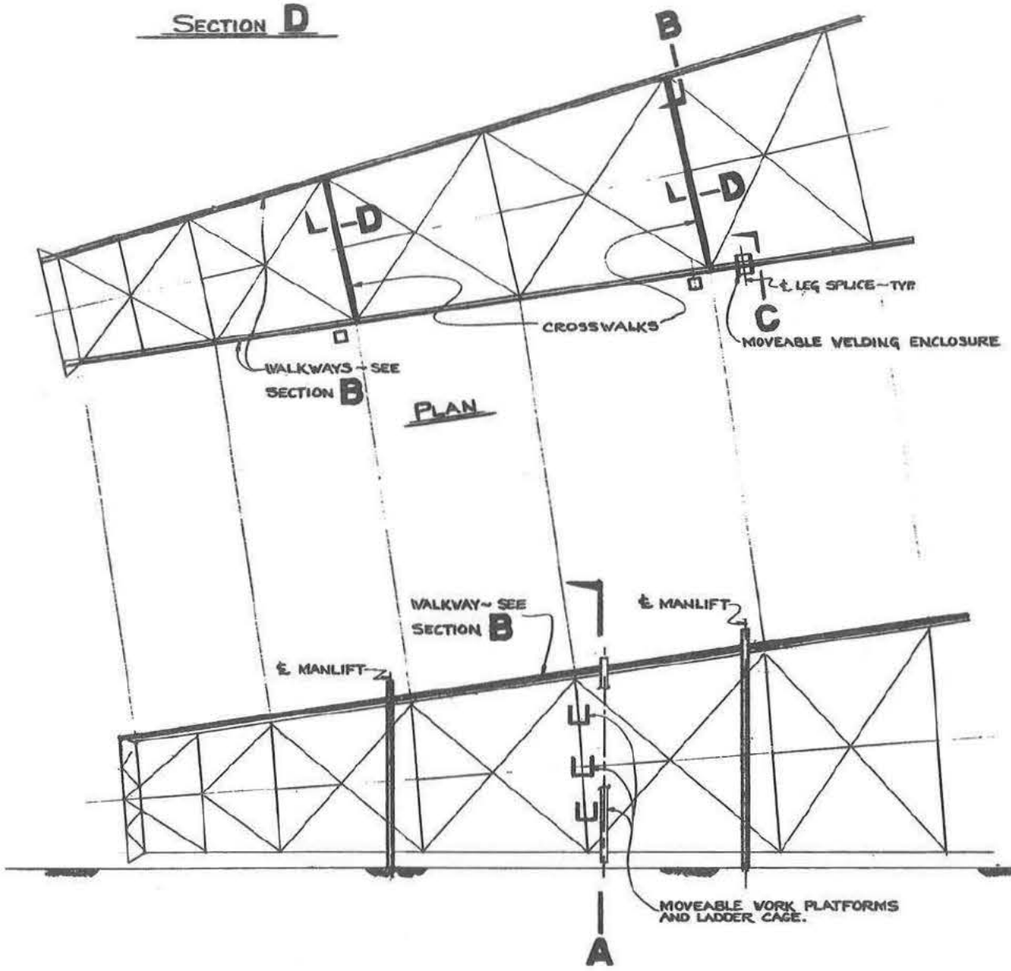
KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN EH DATE 2-6-71	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	JACKET ASSEMBLY	
IN CHARGE	RIG LOCATION, STAGE A-1	DWG. E6 REV. 0

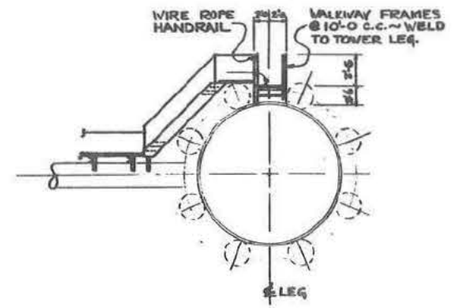


SECTION D



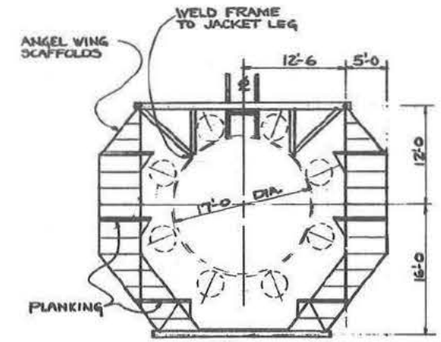
PLAN

ELEVATION
1" = 60'-0

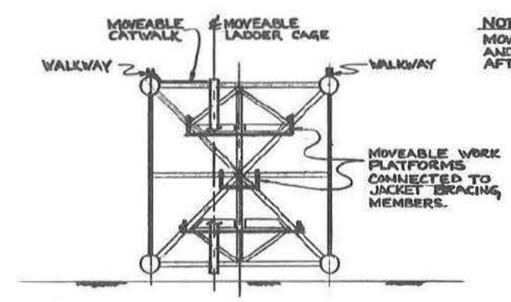


SECTION B
1" = 1'-0

NOTE
MOVE ENTIRE ASSEMBLY TO NEW LOCATION AFTER LEG SPLICE WELD IS COMPLETED.



SECTION C
1" = 1'-0
TYPICAL AT 204" ϕ LEG SPLICE LOCATIONS



NOTE
MOVE WORK PLATFORMS, CATWALKS, AND LADDER CAGE TO NEW LOCATION AFTER WELDING IS COMPLETED.

SECTION A
1" = 60'-0
TYPICAL AT ALL INTERIOR BRACING PANELS

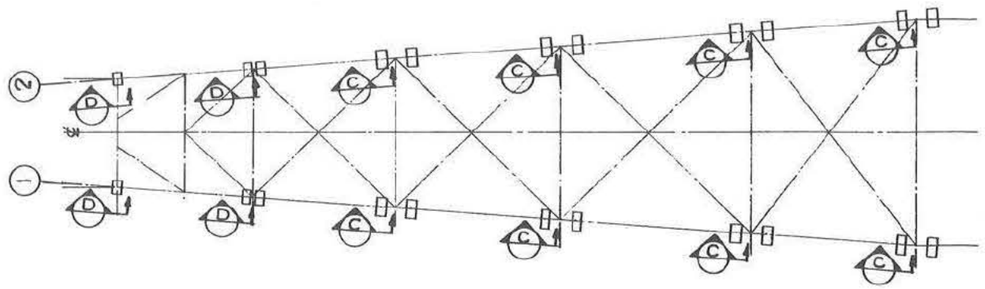
REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
SYM.	DATE	DESCRIPTION	REMARKS	SYM.	DATE	DESCRIPTION	REMARKS	DATE	DR. PRINT	FOR WEIGHT	DATE	DR. PRINT	FOR WEIGHT

BOLTS
HOLES
PAINT

KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN E.H. DATE 2-1-71	840' W.D. PLATFORM	JOB NO.
CHECKED E.H.P.	WALKWAY & SCAFFOLDING	
DR. CHARGE	GENERAL ARRANGEMENT	DR. E7 REV. 0



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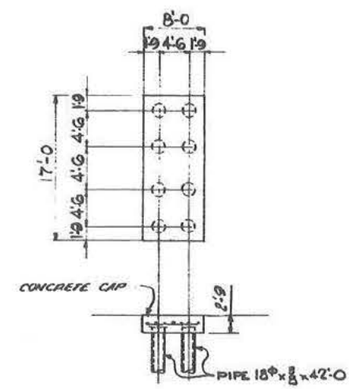
FOUNDATION PLAN



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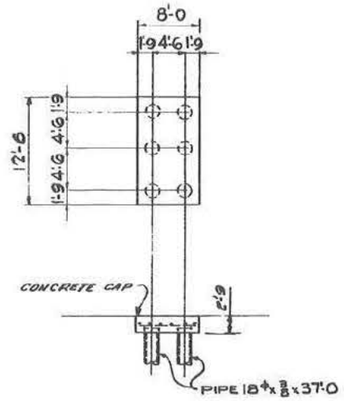

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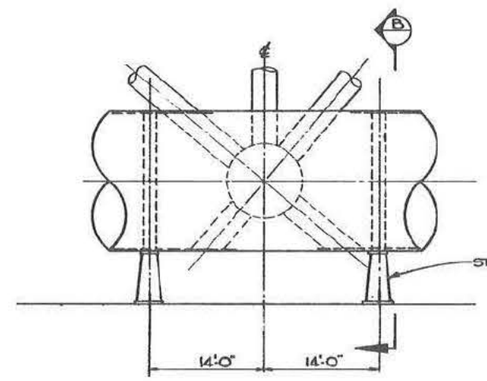

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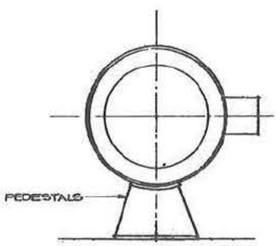

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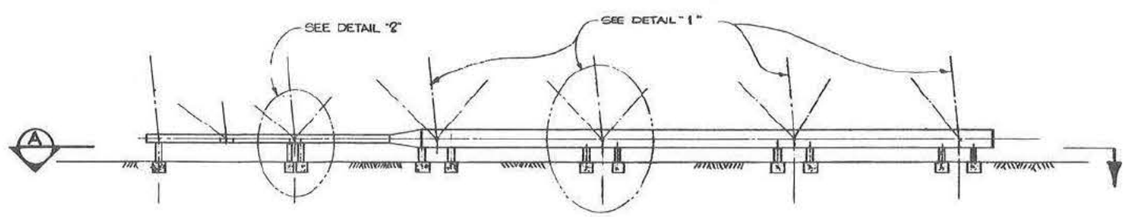
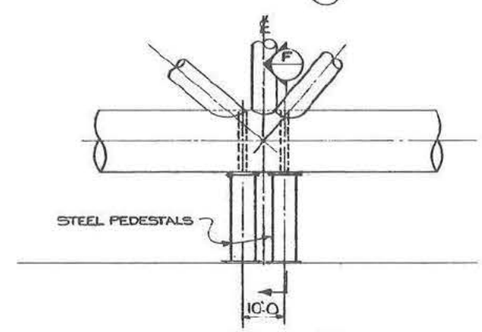


ELEVATION

LOWER LEG SUPPORT LOCATION

SCALE: 1" = 60'-0"



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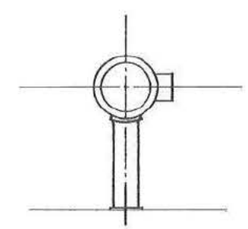

SECTION (F)

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REV. NO.	DATE	DESCRIPTION	DRAWN	REV. NO.	DATE	DESCRIPTION	DRAWN	DATE	BP. POINTS	FOR VENDOR	DATE	BP. POINTS	FOR VENDOR

BOLTS

HOLES

PAINT

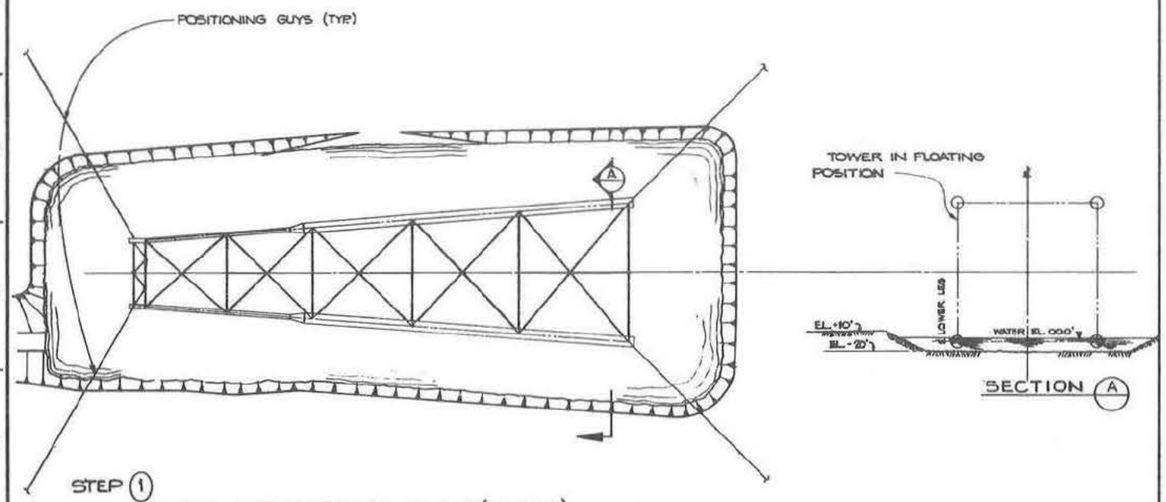
KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN B. Ross DATE 2-6-71 | 840' W.D. PLATFORM | JOB NO.

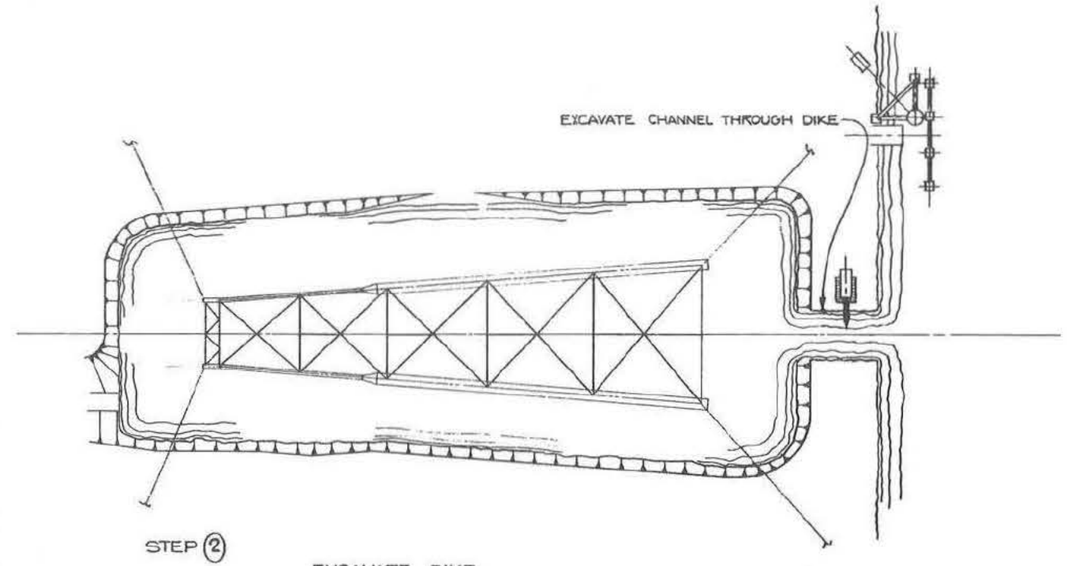
CHECKED KIP | JACKET ASSEMBLY

IN CHARGE | LOWER LEG SUPPORTS & FOUNDATIONS | DWG. E8 REV. A



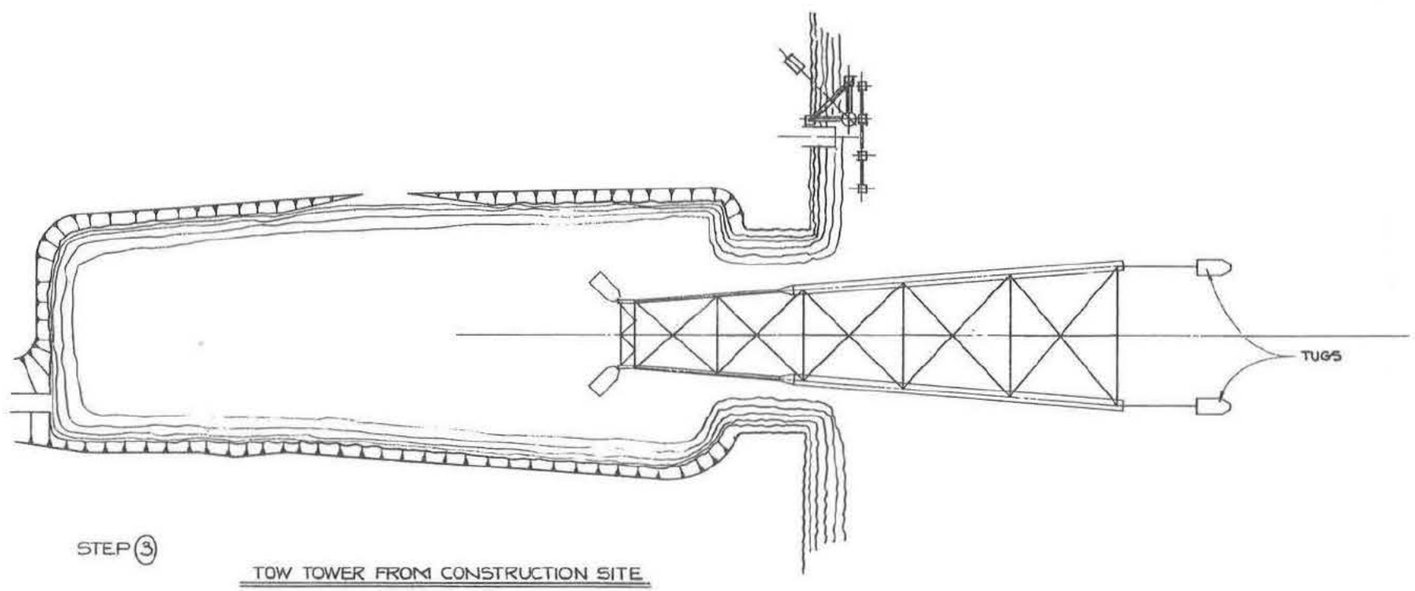
STEP 1

FLOOD EXCAVATION TO EL. 0.0 (M.L.L.W.)



STEP 2

EXCAVATE DIKE



STEP 3

TOW TOWER FROM CONSTRUCTION SITE

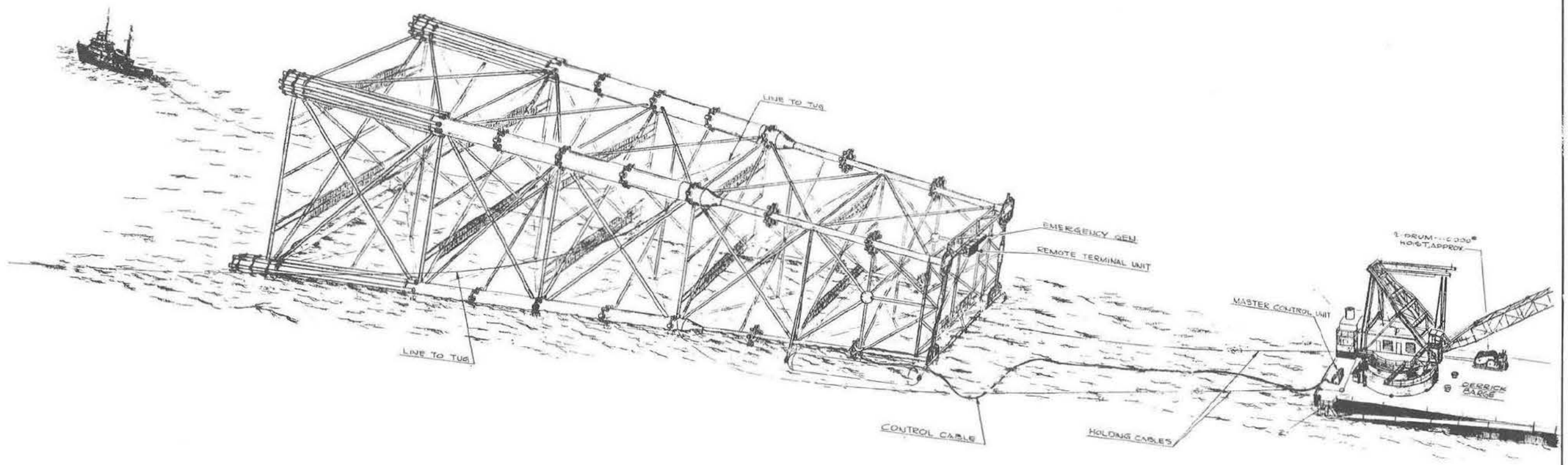
REVISIONS				REVISIONS				BLUE PRINT RECORD			BLUE PRINT RECORD		
REV. NO.	DATE	DESCRIPTION	REASON	REQ. NO.	DATE	DESCRIPTION	REASON	DATE	NO. PRINTS	FOR WHOM	DATE	NO. PRINTS	FOR WHOM

BOLTS
HOLES
PAINT

KAISER STEEL CORPORATION
ERECTION DIVISION
KAISER CENTER
OAKLAND - CALIFORNIA

HUMBLE OIL & REFINING COMPANY

DRAWN B. Ross DATE 2-8-71	840' W.D. PLATFORM	JOB NO.
CHECKED KIP	JACKET LAUNCH	
IN CHARGE Gallmore	PROCEDURE	SH. E9 REV. A



60 WELL SELF CONTAINED
DRILLING & PRODUCTION PLATFORM

SANTA BARBARA CHANNEL, CALIFORNIA 840' W.D.

FOR

HUMBLE OIL & REFINING CO.

J. RAY Mc DERMOTT & CO., INC.
ENGINEERS — NEW ORLEANS, LA. — CONTRACTORS

DRAWN BY	SCALE	DATE	DWG. NO.
S. DELAUNE	NONE	2-17-70	HOR-4189
		ENGRG. JOB NO.	SHEET NO. 001-P

PERSPECTIVE OF JACKET BEFORE UP PUSHING

APPROVED:
A. RAY Mc DERMOTT & CO., INC.
DATE:

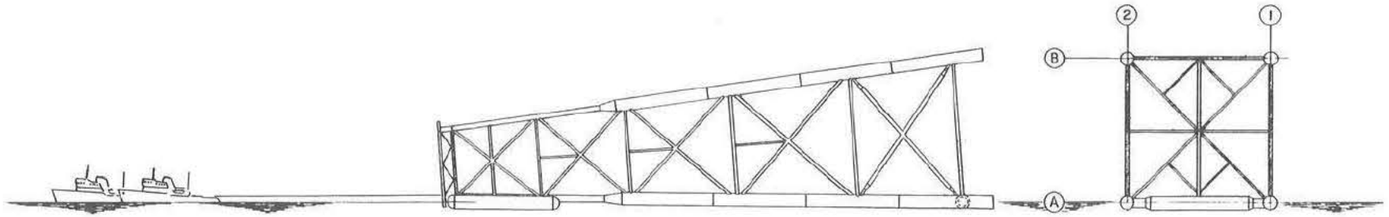
ENGINEERS APPROVAL	BY	DATE
PROJECT		
STRUCTURAL		
PIPING		
MECHANICAL		
ELECTRICAL		
INSTRUMENT.		
FAB. CHECK		
PROJ. CHECK		

FAB. STDS. REQ'D. THIS SHT.

DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.

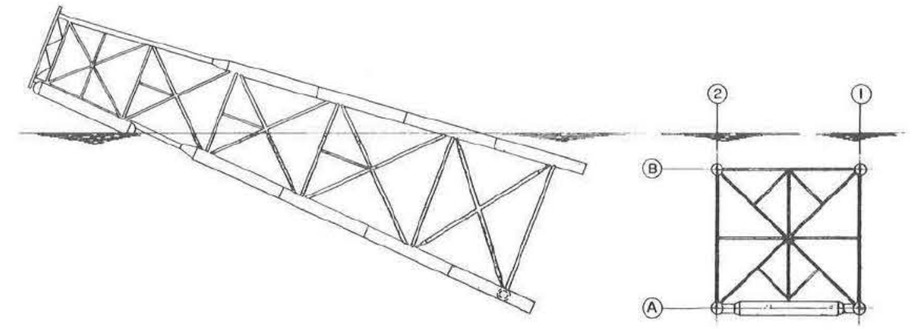
DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.

DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.



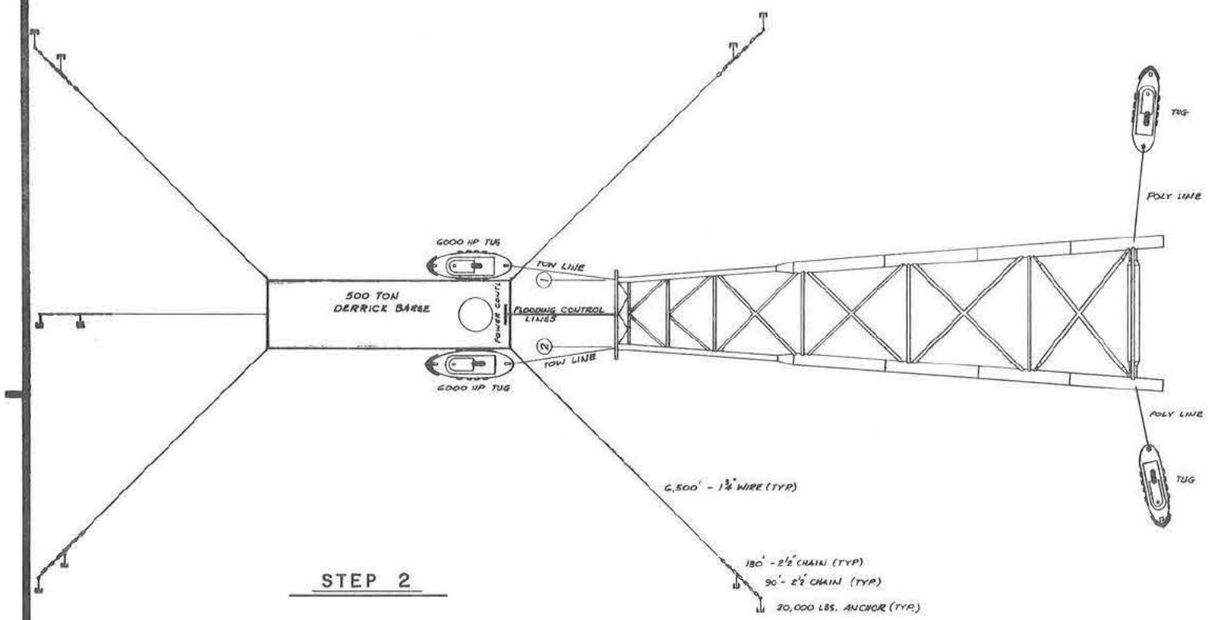
STEP 1

VIEW A



STEP 4

VIEW C



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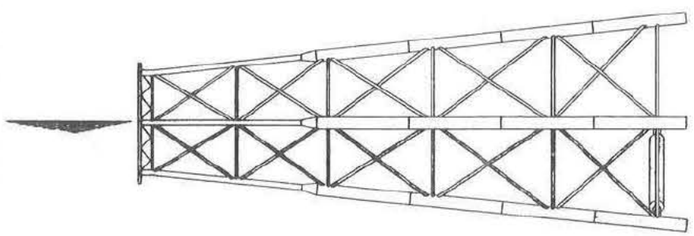

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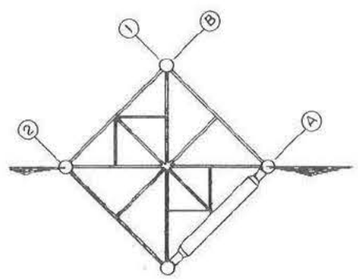
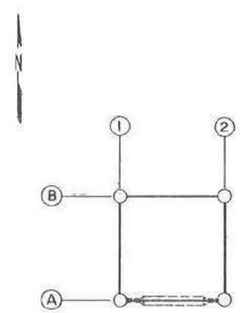
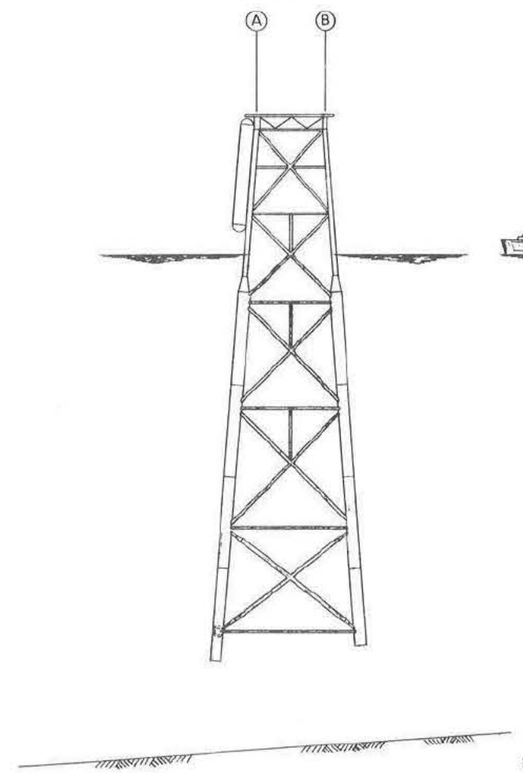


VIEW B



PLAN



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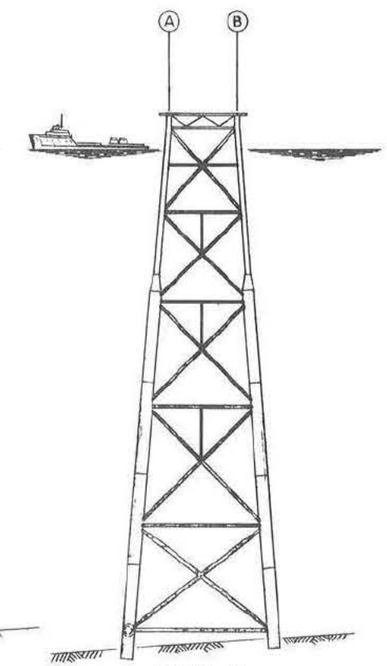

STEP 6

DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.

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DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.

APPROVED:

J. RAY McDERMOTT & CO., INC.

APP.:

ENGINEERS APPROVAL

	BY	DATE
PROJECT		
STRUCTURAL		
PROCESS		
MECHANICAL		
ELECTRICAL		
INSTRUMENT.		
PIP. CHECK		
PROP. CHECK		

60 WELL SELF CONTAINED
DRILLING & PRODUCTION PLATFORM

SANTA BARBARA CHANNEL, CALIFORNIA 840' W.D.

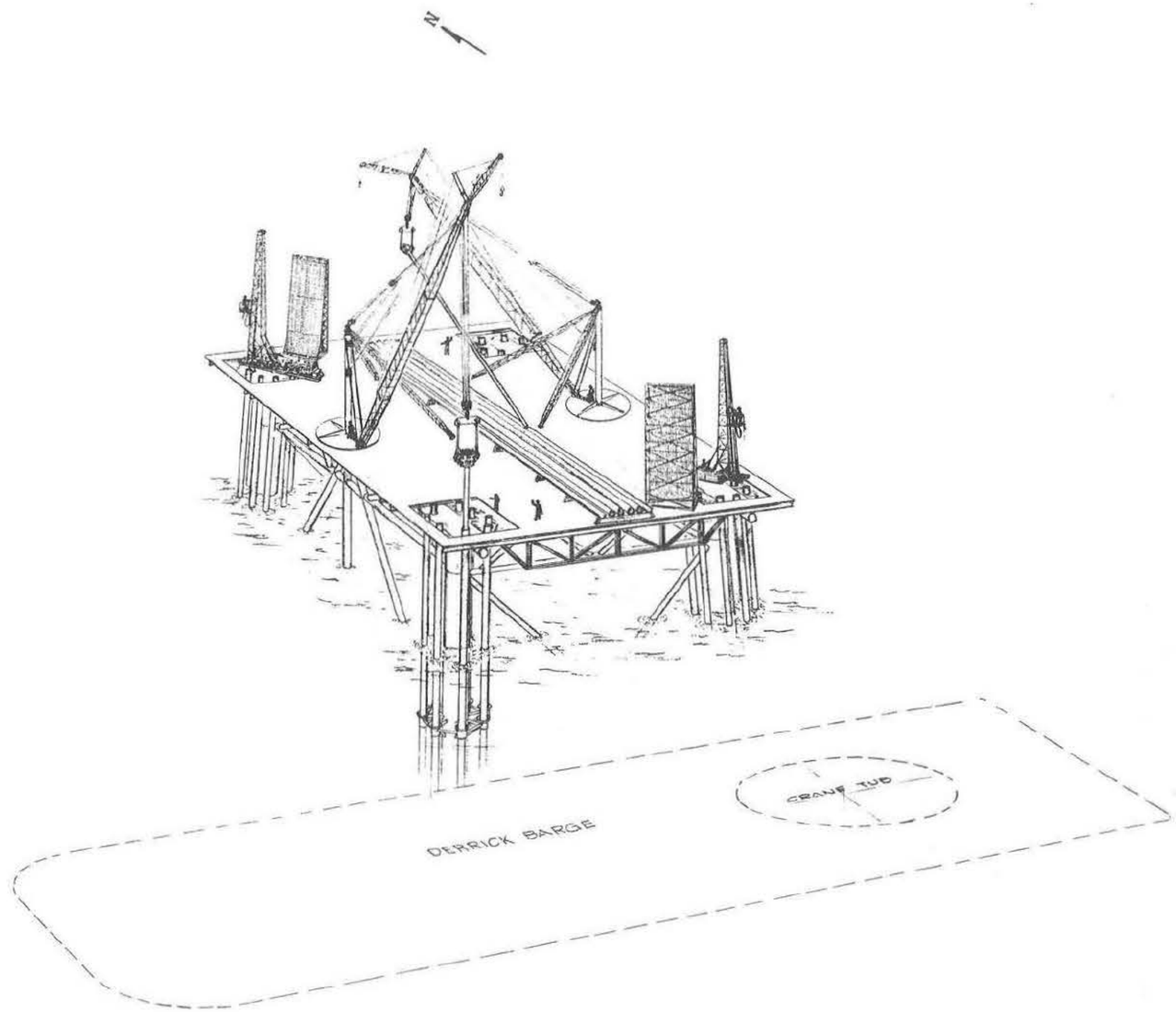
FOR

HUMBLE OIL & REFINING CO.

J. RAY Mc DERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

DRAWN BY	SCALE	DATE	DWG. NO
S. DELALAUZE	NONE	2-18-71	HOR-4489
		ENGRG. JOB NO	SHEET NO
			002-P

UPENDING



60 WELL SELF CONTAINED
DRILLING & PRODUCTION PLATFORM

SANTA BARBARA CHANNEL, CALIFORNIA 840' W.D.

FOR

HUMBLE OIL & REFINING CO.

J. RAY Mc DERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

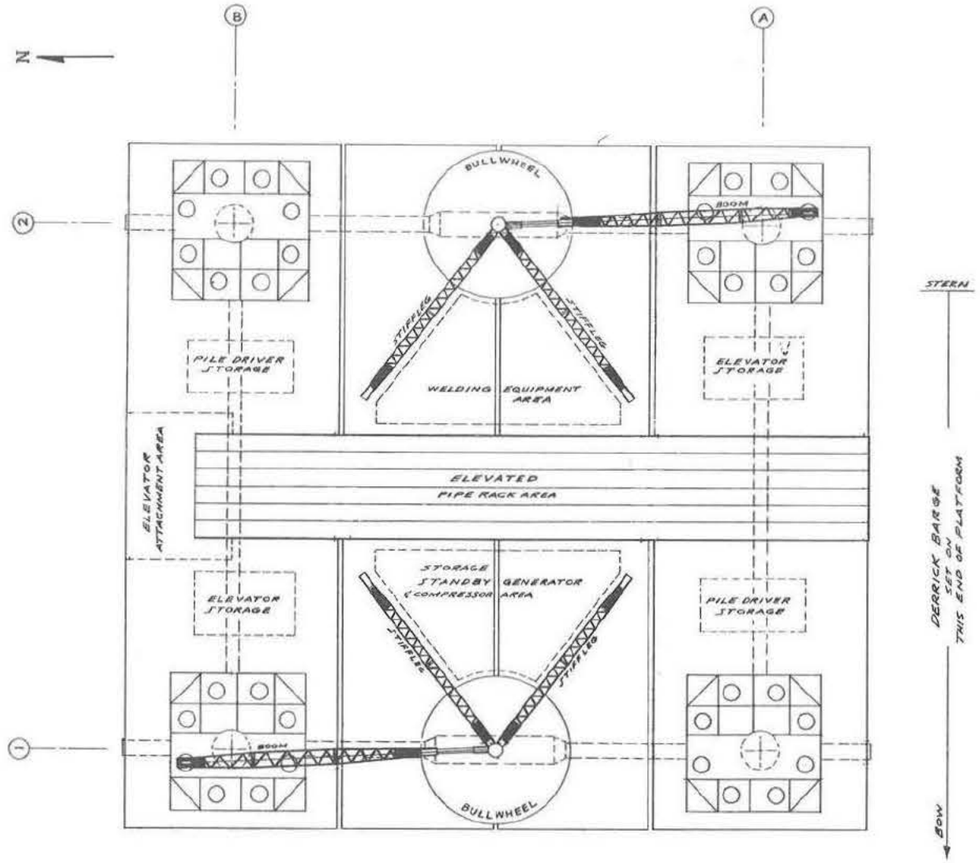
DRAWN BY	SCALE	DATE	DWG. NO.
D. DELAUNE	NONE	2-18-71	HOR-4189
		ENGRG. JOB NO.	SHEET NO. 003-P

PERSPECTIVE OF ERECTION DECK DURING PILE INSTALLATION

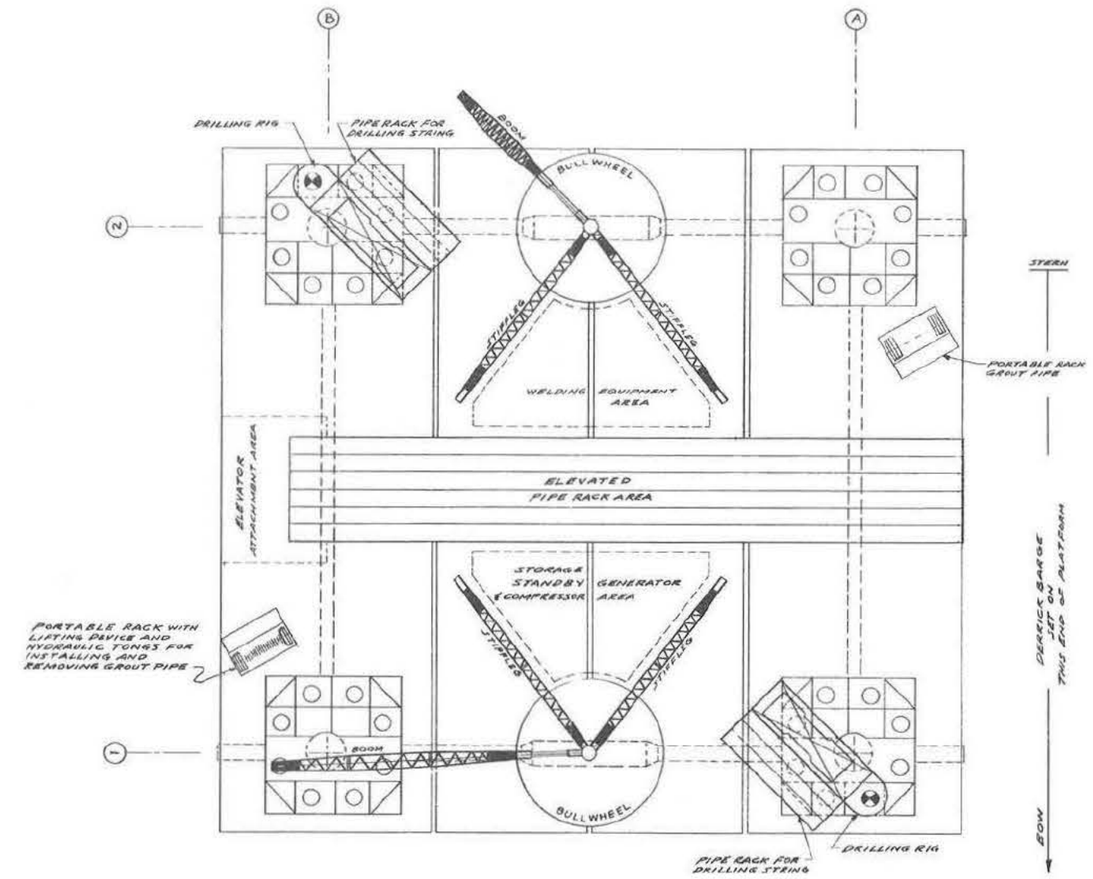
APPROVED:
J. RAY Mc DERMOTT & CO., INC.
DATE:

ENGINEERS APPROVAL	BY	DATE
PROJECT		
STRUCTURAL		
PROCESS		
MECHANICAL		
ELECTRICAL		
INSTRUMENT.		
PAR. CHECK		
PROT. CHECK		

FAB. STDS. REQ'D. THIS SHT.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.



JACKET ERECTION DECK
FOR
36"ϕ SLEEVE PILING INSTALLATION



JACKET ERECTION DECK
DURING
INSTALLATION OF 30"ϕ INSERT PILING

1. WINCHES FOR OPERATION OF STIFFLEG CAN BE PLACED BELOW TEMPORARY DECK AT EL. (+) 33'-0. CONDUCTOR GUIDE FRAMING MAY BE USED FOR DECK AREA.
2. JACKET ERECTION DECKS MAY BE USED FOR SIMILAR STRUCTURES IN THE FUTURE, SO MAY BE SALVAGED. DROP-IN TYPE UNITS SHOULD INSTALL AND REMOVE EASILY.

60 WELL SELF CONTAINED
DRILLING & PRODUCTION PLATFORM

SANTA BARBARA CHANNEL, CALIFORNIA 840' W.D.

FOR

HUMBLE OIL & REFINING CO.

APPROVED:
J. RAY McDERMOTT & CO., INC.
DATE:
ENGINEERS APPROVAL

	BY	DATE
PROJECT		
STRUCTURAL		
PROCESS		
INSTRUMENTATION		
ELECTRICAL		
INSTRUMENT.		
PER. CODES		
PROT. COATS		

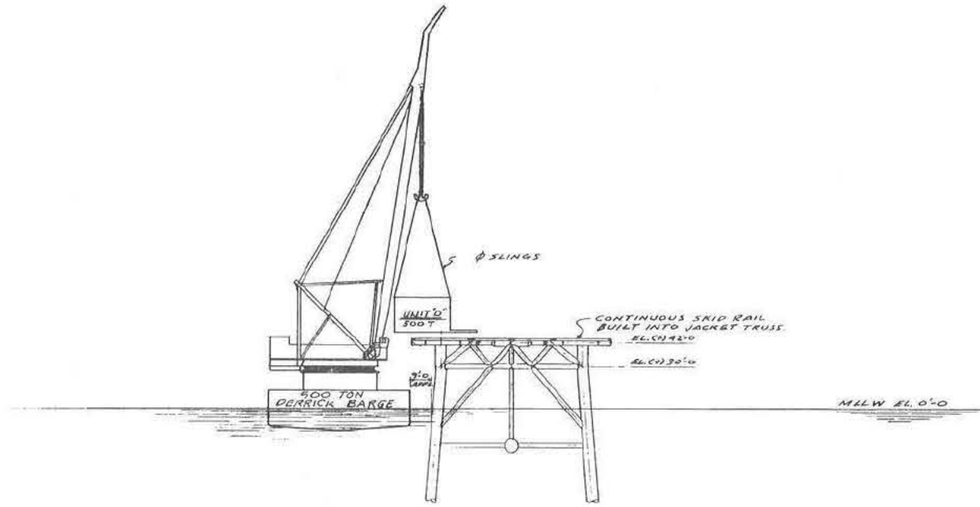
J. RAY McDERMOTT & CO., INC.
ENGINEERS — CONTRACTORS
NEW ORLEANS, LA.

DRAWN BY	SCALE	DATE	DWG. NO.
JDM/	3/32"=1'-0"	2-18-71	HOR-4189
	SHARE JOB NO.		SHEET NO. 004-P

PLAN OF ERECTION DECK
DURING PILE INSTALLATION

FAB. STDS. REQ'D. THIS SHT.

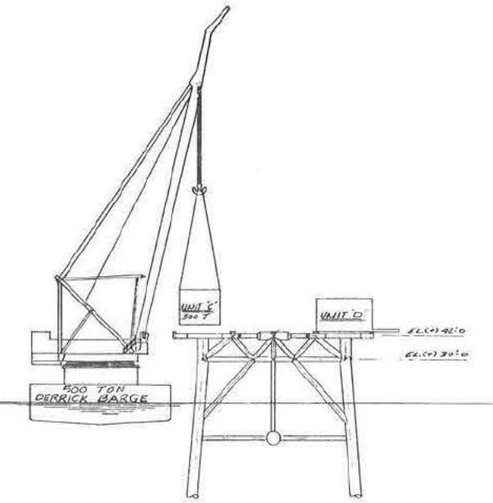
DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.



LIFT Nº 1

DECK UNIT "D" APPROX. 500T

1. DERRICK BARGE WILL TAKE POSITION AT ONE END OF PLATFORM AS SHOWN. ALL LIFTS SHALL BE CARRIED OUT WITH DERRICK IN THIS POSITION.

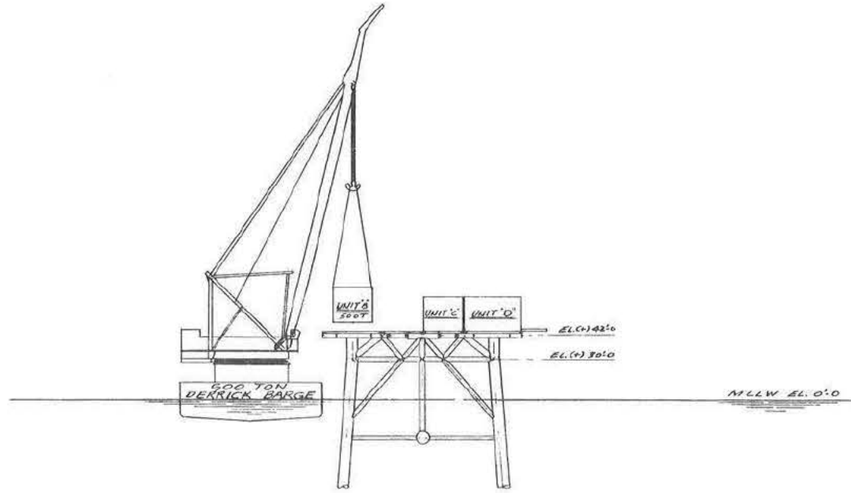


LIFT Nº 2

DECK UNIT "C" APPROX. 500T

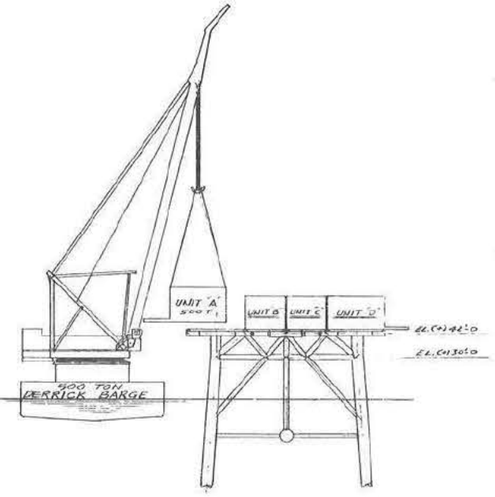
1. BEFORE UNIT "C" IT PLACED, UNIT "D" MUST BE MOVED TO ITS CORRECT POSITION. THIS WILL TAKE PLACE ON THE BUILT-IN SKID RAILS ON THE JACKET TRUSSES USING STANDARD RIG MOVING JACKS.

2. LIFT UNIT "C" ON TO JACKET SKID RAILS AND PROCEED TO SKID INTO POSITION.



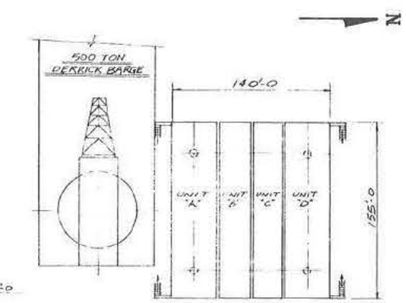
LIFT Nº 3

DECK UNIT "B" APPROX. 500T



LIFT Nº 4

DECK UNIT "A" APPROX. 500T



PLAN

NTS

NOTE
THE ABOVE ARE MAJOR STRUCTURAL LIFTS ONLY. NORMALLY, ADDITIONAL MISCELLANEOUS EQUIPMENT IS LIFTED ON THE PLATFORM EITHER DURING OR SUBSEQUENT TO THE MAJOR LIFTS.

APPROVED:

J. RAY McDERMOTT & CO., INC.

DATE:

ENGINEERS APPROVAL	BY	DATE
PROJECT		
STRUCTURAL		
PIPING		
MECHANICAL		
ELECTRICAL		
INSTRUMENT.		
FAB. CHECK		
PROJ. CHECK		

60 WELL SELF CONTAINED
DRILLING & PRODUCTION PLATFORM

SANTA BARBARA CHANNEL, CALIFORNIA 840' W.D.

FOR

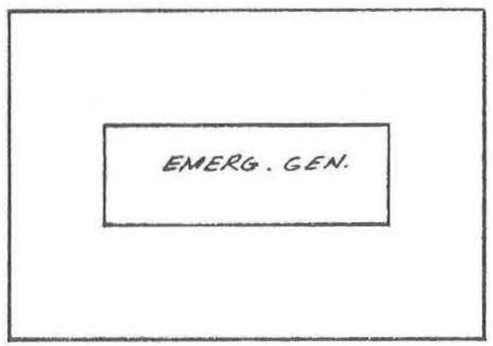
HUMBLE OIL & REFINING CO.

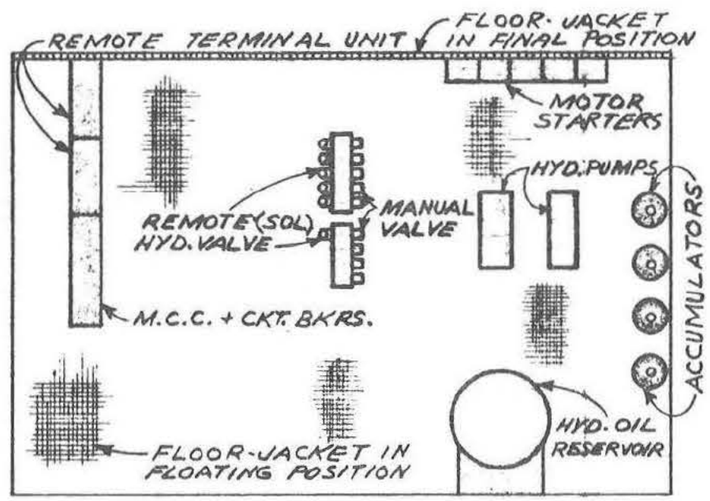
J. RAY Mc DERMOTT & CO., INC.
ENGINEERS — NEW ORLEANS, LA. — CONTRACTORS

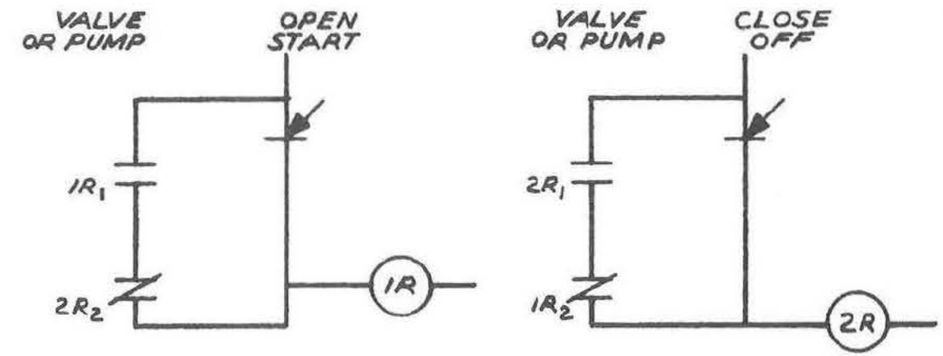
DRAWN BY	SCALE	DATE	DWG. NO.
J. LORINO	1"=40'-0"	2-18-70	HOR-4189
		ENGRG. JOB NO.	SHEET NO.
			005-P

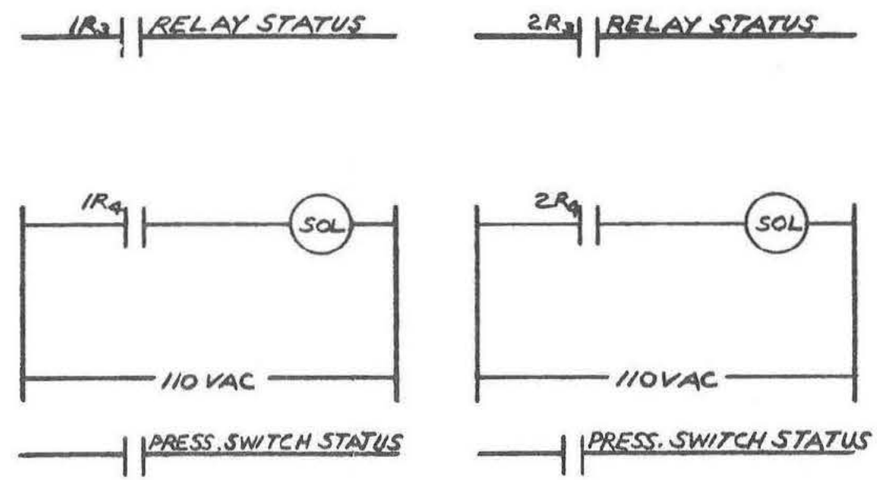
DECK UNIT INSTALLATION SEQUENCE

FAB. STDS. REQ'D. THIS SHT.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.	DESIGN	STRUCT.	PIPING	ELEC.	MK.	BY	REVISIONS	DATE	APP.









NOTE:
RELAYS SHOWN DE-ENERGIZED.
SOLENOID VALVE LOAD-3 AMPS.

NOTE:
RELAYS SHOWN DE-ENERGIZED.
SOLENOID VALVE LOAD-3 AMPS.

NO.	BY	REVISION	DATE	CHK.	APP.

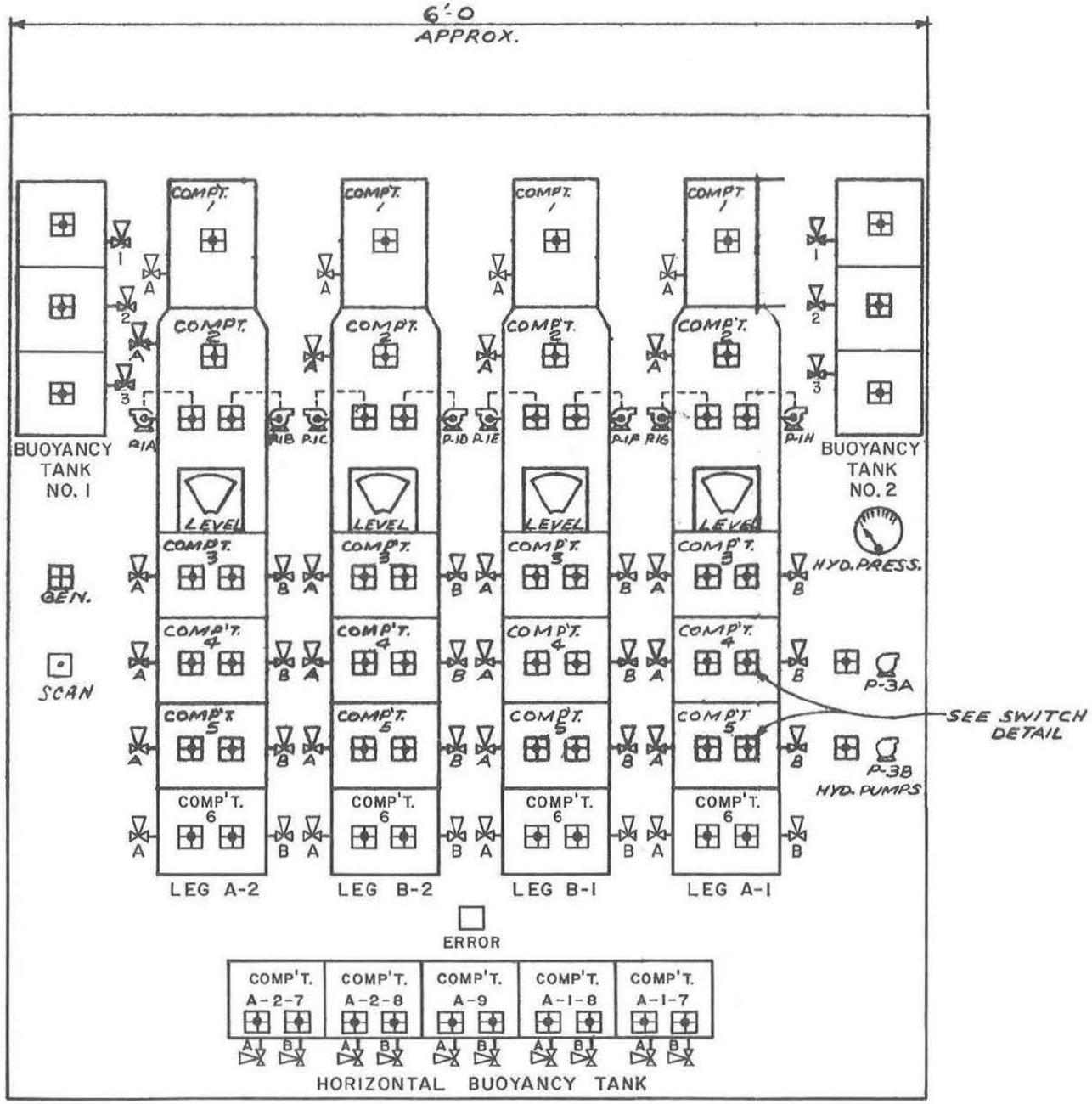
J. RAY McDERMOTT & CO., INC.
ENGINEERS — NEW ORLEANS, LA. — CONTRACTORS

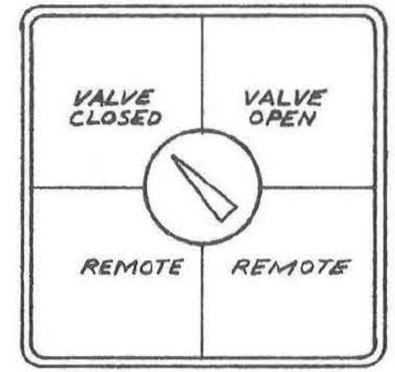
DATE	DRAWN BY	APPROVED:
10-30-70	V.M.	
SCALE NONE	CHECKED BY	APPROVED:

REMOTE CONTROL JACKET FLOODING
REMOTE TERMINAL UNIT & ELECTRICAL & HYDROULIC SYSTEMS.

HUMBLE OIL & REFINING CO.

DWG NO.
SHEET NO. SK-1





ENGRAVING DESCRIPTION

SWITCH DETAIL

A — PRIMARY FLOODING VALVE

B — BACK-UP FLOODING VALVE

NO.	BY	REVISION	DATE	CHK.	APP.

J. RAY McDERMOTT & CO., INC.
ENGINEERS — NEW ORLEANS, LA. — CONTRACTORS

DATE	DRAWN BY	APPROVED:
10-29-70	J.M.	
SCALE NONE	CHECKED BY	APPROVED:

REMOTE CONTROL JACKET FLOODING
MASTER CONTROL UNIT

HUMBLE OIL & REFINING CO.

SHEET NO. SK-2

APPENDIX 1.7

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.7

Platform Design and Analysis
For Towing and Installation

Esso Production Research Company

October, 1971

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PLATFORM DESIGN AND ANALYSIS
FOR TOWING AND INSTALLATION

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5. IMPACT PRESSURES	
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PLATFORM DESIGN AND ANALYSIS FOR TOWING AND INSTALLATION

INTRODUCTION

The proposed platform is designed to have adequate stability and to safely withstand the most severe loads that might occur during transport to location and during preparation for installation. The following paragraphs give the design criteria, methods of analysis, and results of the analyses of the platform during tow and preparation for installation.

1. MOTIONS AND DYNAMIC WAVE LOADS

The platform motions and dynamic wave loads were calculated using a computer program that is based on equations of motions and forces that are developments from the equations used for the "Dynasar" program developed for Project Mohole ("Mohole Platform Equations of Motion for Dynasar Program," J. A. Bain, Project Mohole Report No. 63G2122 by General Electric Company, Aug. 1963). Calculations of inertia (or added mass) and wave damping coefficients were based on Frank's source distribution technique ("Oscillation of Cylinders In or Below the Free Surface of Deep Fluids," W. Frank, Naval Ship Research and Development Center, Report 2357, 1967).

The roll angle computed for beam waves was used in evaluating the platform's stability. The computed dynamic wave forces were used as inputs for the structural analysis

and the computed relative velocities between the platform members and the water surface were used to calculate maximum impact pressures during tow.

2. DESIGN CONDITIONS

Oceanographic studies by Oceanographic Services, Inc. (OSI) indicate that the proposed towing from the Long Beach vicinity to the Santa Barbara Channel might result in exposure to maximum storm conditions of sea state 5 (significant wave height = 12 ft.) with 60-knot winds. These conditions were used for the study of intact stability, for structural analysis due to dynamic wave loads, and for the study of hydrodynamic impact pressures during tow. A copy of the OSI report, "A Study of Wave Conditions Along a Tow Route from Long Beach to a Proposed Platform Location Off Gaviota," is attached as Appendix 6.3.

3. STABILITY

Stability studies were conducted in two phases: (1) intact stability in beam winds and waves, and (2) damaged stability due to flooding; and for two operating conditions: [1] platform under tow in deep water, and [2] preparations complete for tipping and positioning on location.

3.1 Design Criteria

The stability criteria during tow are based on the following references:

(1) T. H. Sarchin and L. L. Goldberg: "Stability

and Buoyancy Criteria for U. S. Naval Surface Ships;" Transactions of the Society of Naval Architects and Marine Engineers, 1962.

(2) "Rules for Building and Classing Offshore Mobile Drilling Units, 1968;" American Bureau of Shipping.

The intact stability criteria are consistent with current practice for sea-going vessels as detailed in references (1) and (2). The damaged stability criteria are at least as stringent as the current practice for sea-going cargo vessels.

3.1.1 Intact Stability

The criteria for intact stability are as follows:

(1) For the design wind and waves, the vessel's dynamical stability reserve must exceed by 40% the energy associated with combined wind heeling moments and synchronous rolling response of amplitude equal to the maximum in 100 waves approaching from the beam of the tow.

(2) For the design wind, the platform's dynamical stability must exceed by 40% the energy associated with the wind heeling moment in heeling the platform to the angle at the second intercept of the righting arm and wind heeling arm curves.

(3) For the design wind, the reserve of dynamical stability must exceed by 40% the energy associated

with combined wind heeling moments and an assumed synchronous rolling response of amplitude equal to twice the static heel angle (angle at first intercept of righting arm and wind heeling arm curves).

(4) The vessel must remain upright after preparations have been completed for erection and prior to the controlled flooding of compartments in erecting the platform.

(5) Repeat seps 1) through 4) assuming the vessel has been tipped to its equilibrium attitude at about 45° from the original towing attitude.

3.1.2 Damage Stability

The platform must meet the following criteria under conditions of internal flooding due to collision:

(1) The platform must not tip over for damage at any location penetrating to one-half of the compartment width and affecting at least one water-tight bulkhead (two-compartment flooding).

(2) Repeat step 1) assuming the platform was previously tipped to the 45° attitude.

3.2 Method of Analysis

The righting arm and moment computations were conducted with a computer program that computes buoyancy and its centroid for individual platform elements under conditions of hydrostatic equilibrium

in displacement and trim for each independent heel angle specified for the platform as a whole. The resulting buoyancy and centroid of buoyance of the floating vessel is used to establish the conditions of equilibrium based on total platform weight and the location of the center of gravity. In computations involving damaged compartments, the "lost buoyance" method has been utilized. This technique is described in textbooks on naval architecture. The program has been mathematically validated, and results have been verified by comparison to a floating scale model.

3.3 Results of Analysis

The stability study indicates that all stability criteria have been satisfied. Table I summarizes the results of the intact stability study. Figures 1, 2, and 3 illustrate the methods of applying intact stability criteria 1, 2, and 3.

A total of 56 individual cases of flooding were studied for the damaged stability study. Two compartments at any location may be simultaneously flooded without causing tipping to the 45° attitude. If the vessel is already tipped at 45°, the vessel will not tip again after damage to any two compartments. After flooding ports have been opened in preparation for platform installation, any one compartment may be flooded without causing tipping, but two-compartment

flooding will tip the vessel. This is consistent with the procedures for controlled flooding of compartments in erecting the platform on the sea floor.

Only one example of damaged stability is included (Figure 4). It was selected to show the worst two compartments. A number of three-compartment cases were studied and were selected by reason of interest and flooding sequence during erection. A length of damage of over 50 feet can be withstood at any location on the auxiliary buoyancy tanks or main platform legs. If the platform is damaged on the athwartship 30 feet diameter member, 37 feet or more of athwartship damage can be sustained.

TABLE I

CASE	CRITERIA	RESULT	REQD	EVALUATION
INTACT STABILITY - UPRIGHT - FLOODING PORTS CLOSED				
1	USN Rolling and Wind Area Ratio	8.49	≥1.4	SAT
	Righting Arm Ratio	0.113	≤0.6	SAT
2	ABS Wind Area Ratio	4.64	≥1.4	SAT
3	Twice Static Heel	*		SAT
INTACT STABILITY - TIPPED - FLOODING PORTS CLOSED				
4	USN Rolling and Wind Area Ratio	5.75	≥1.4	SAT
	Righting Arm Ratio	0.139	≤0.6	SAT
5	ABS Wind Area Ratio	3.97	≥1.4	SAT
6	Twice Static Heel	*		SAT
INTACT STABILITY - UPRIGHT - FLOODING PORTS OPEN				
7	USN Rolling and Wind Area Ratio	1.86		SAT
	Righting Arm Ratio	0.230		SAT
8	ABS Wind Area Ratio	2.61		SAT
9	Twice Static Heel	*		SAT
INTACT STABILITY - TIPPED - FLOODING PORTS OPEN				
10	USN Rolling and Wind Area Ratio	7.39		SAT
	Righting Arm Ratio	0.096		SAT
11	ABS Wind Area Ratio	5.28		SAT
12	Twice Static Heel	*		SAT

* Ratios not measured. Obviously satisfactory.

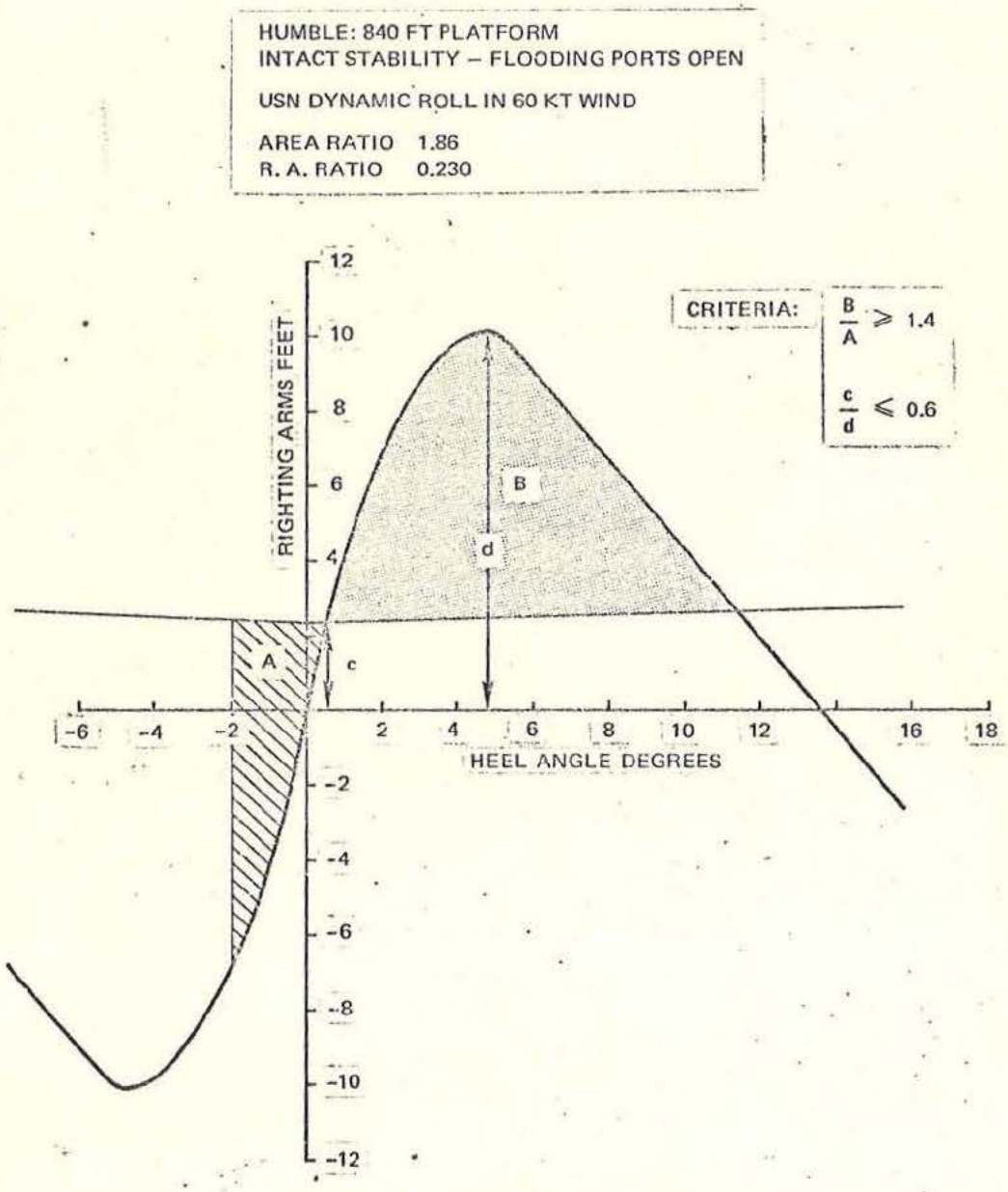

HUMBLE: 840 FT PLATFORM
INTACT STABILITY – FLOODING PORTS OPEN
USN DYNAMIC ROLL IN 60 KT WIND
AREA RATIO 1.86
R. A. RATIO 0.230
CRITERIA:
B/A ≥ 1.4
c/d ≤ 0.6
RIGHTING ARMS FEET
HEEL ANGLE DEGREES
A
B
c
d
12
10
8
6
4
-2
-4
-6
-8
-10
-12
-6
-4
-2
2
4
6
8
10
12
16
18

FIGURE 1.

HUMBLE: 840 FT PLATFORM
INTACT STABILITY – FLOODING PORTS OPEN

ABS – 60 KT WIND

AREA RATIO 2.61

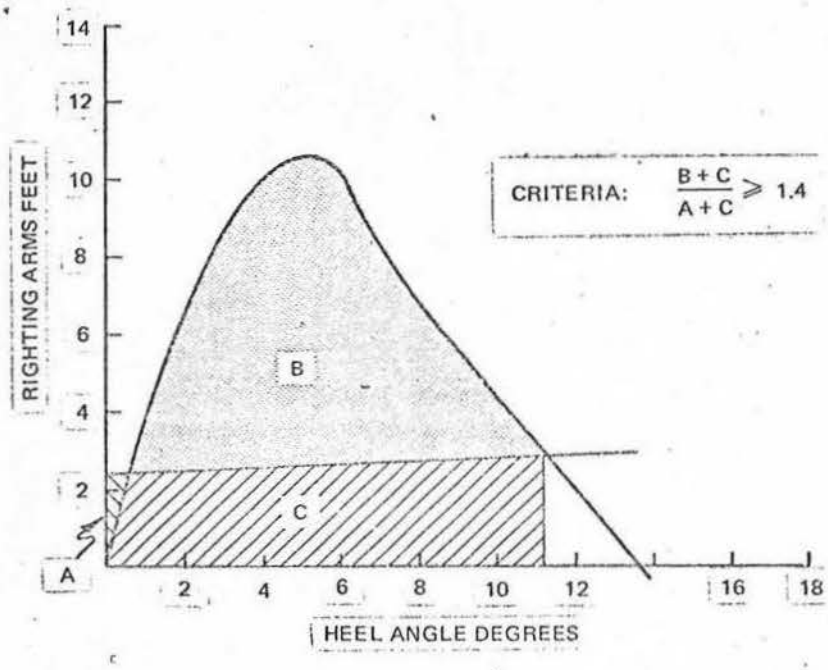


FIGURE 2.

HUMBLE: 840 FT PLATFORM
INTACT STABILITY – FLOODING PORTS OPEN

TWICE STATIC WIND HEEL 60 KT WIND

AREA RATIO SATISFACTORY

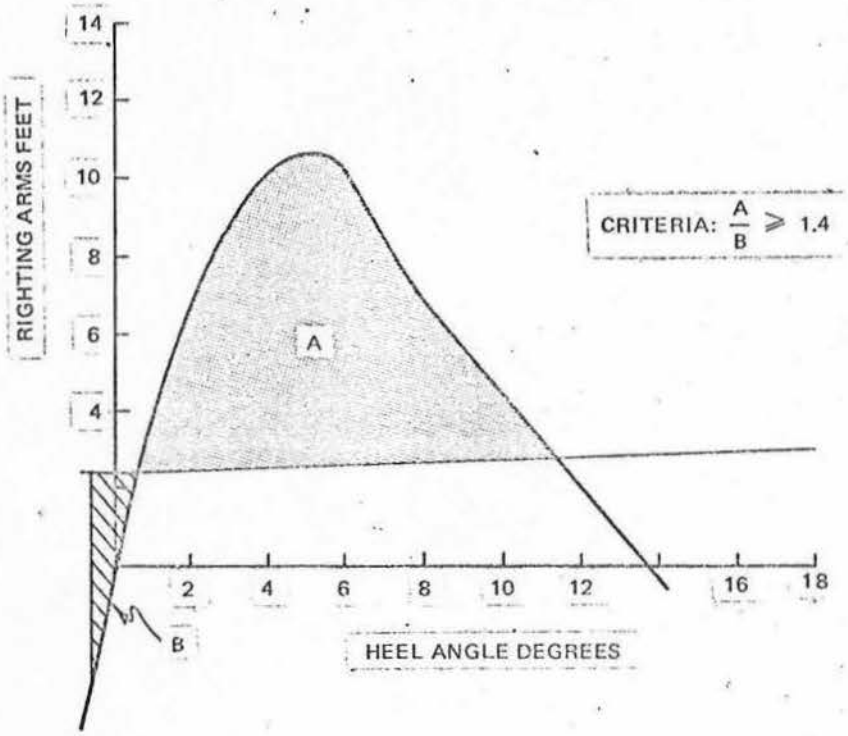


FIGURE 3.

HUMBLE: 840 FT PLATFORM

DAMAGED STABILITY – FLOODING PORTS CLOSED

TWO COMPARTMENT FLOODING – COMPARTMENTS A2.5, A3

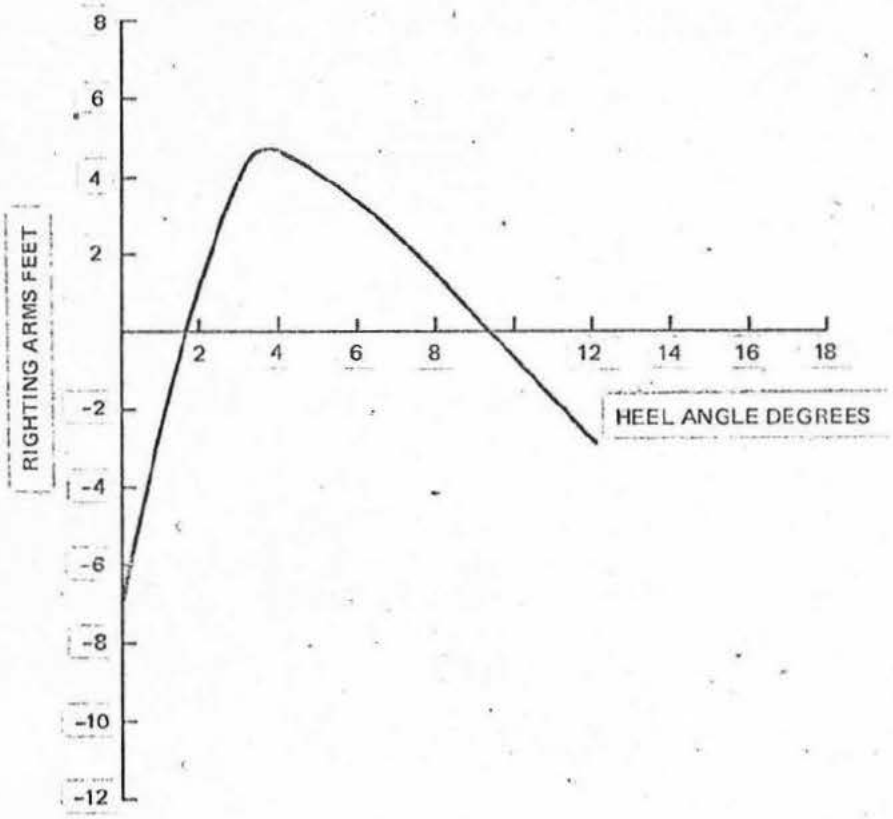


FIGURE 4.

4. STRUCTURAL ANALYSIS

4.1 Design Criterion

The platform must be designed for structural adequacy during towing.

4.2 Design Loads

Dynamic wave loads were calculated using the computer program discussed in Section 1. Three wave headings were considered: head waves, beam waves, and quartering waves. Different wave periods were used to get maximum stresses for each wave direction. The design wave height was the maximum anticipated in one thousand waves of sea state 5 (22.3 feet).

For comparison, loads determined by statically balancing the platform on a standard trochoidal wave were also considered in the design.

Four cases were examined as listed below:

Case	Condition	Platform Integrity	Wave Height
I	hogging	intact	1.1/L
II	sagging	intact	1.1/L
III	hogging	damaged	0.66/L
IV	sagging	damaged	0.66/L

where L is the wave length taken as the platform length.

4.3 Analysis

In the structural analyses of the platform during towing, the platform was idealized as an elastic

three-dimensional framed structure. Weights of the structural members and accessories were considered as distributed and lumped masses. The inertia forces resulting from platform motion were first determined according to the principle of dynamics known as the D'Alembert principle. Then, the wave-induced loads and the corresponding inertia forces at an instant of time were considered as a set of equilibrium forces applied to the platform. Structural analyses were performed to determine the instantaneous relative displacement at the joints and forces and moments in the members. The member forces and moments were converted into stresses. For the loading cases where it was assumed that the platform was poised motionless on a standard wave, only gravity and buoyancy forces were considered. The analytical approach employed for this platform design is essentially the same as that developed in the Mohole project for floating structure analysis. ("Platform Stress Analysis Program," by E. C. Holt, Progress Report of the Mohole Project, May 1964.) The structural analyses are based on the standard matrix displacement method ("Matrix Computer Analysis of Structure" by M. F. Rubinstein, 1966).

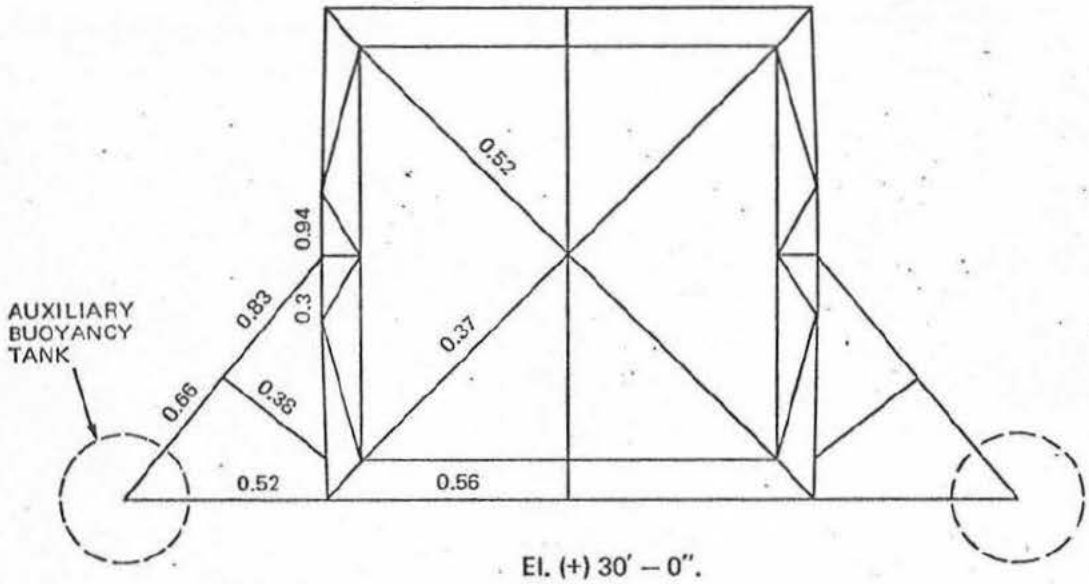
4.4 Results of Analyses

The combined axial and bending stresses were calculated for each member and compared with allow-

able stresses calculated in accordance with the American Institute of Steel Construction "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," Feb. 12, 1969.

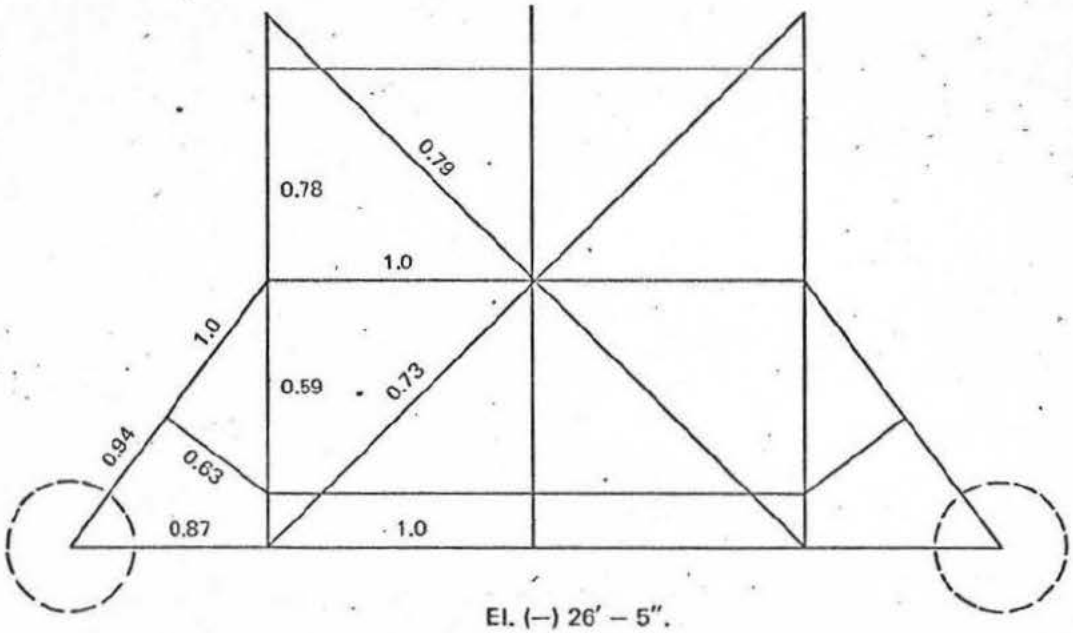
The results of the analyses indicate that the member stresses produced by the design loads satisfy the design criterion.

Among the design loads, the beam wave-induced loads produced the most severe stresses in the members. Figures 5, 6, and 7 show the combined stresses in the buoyancy tank supports and some adjacent members for the beam wave case. The members shown are the most highly stressed. The combined stresses are given as ratios calculated according to a formula in the AISC Specifications. Thus, a member with a ratio of 1.0 has the maximum allowable stress, and any number less than 1.0 indicates less than the allowable stress.



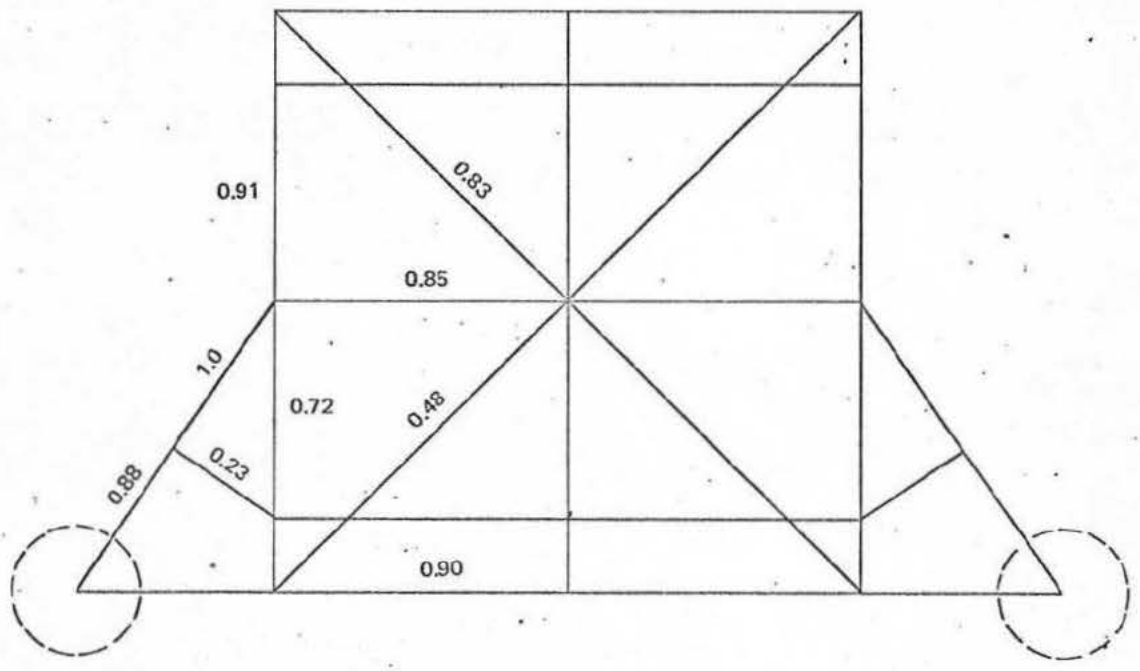
El. (+) 30′ – 0″.

Figure 5



El. (–) 26′ – 5″.

Figure 6



El. (–) 93′ – 0″.

Figure 7

5. IMPACT PRESSURES

Two types of impact pressures were investigated: 1) the impact pressures while the platform is under tow in waves, and 2) the impact pressures on the platform members when the platform flips from the 0°-heel position to the 45°-heel position during the platform installation in calm water.

5.1 Design Criterion

The impact pressures must be less than the design pressure for any member.

5.2 Impact Pressures During Towing

The impact pressures during towing were calculated using methods that are given in the following references:

Ochi, M. K. and Motter, L. E., "Prediction of Extreme Values of Impact Pressure Associated with Ship Slamming," Journal of Ship Research (June 1969).

Ochi, M. K. and Motter, L. E., "A Method to Estimate Slamming Characteristics for Ship Design," presented at the meeting of the New York Metropolitan Section, The Society of Naval Architects and Marine Engineers, 1970.

Response amplitude operators of the velocities and motions of the platform members relative to waves were calculated by the computer program described in Section 1. The computed response amplitude operators were multiplied by a Pierson-Moskowitz wave spectrum

to get the response spectra. The areas under the response spectra gave the variances of the relative velocities and motions. These variances were used to apply the Ochi and Motter method. The members were treated as if each member was a single-hull ship attached to and moved with the platform.

Extreme impact pressures with a small probability (.001) of being exceeded in a sea state 5 (significant wave height = 12 feet) were calculated. The results of the analyses showed that the platform meets the design criterion for impact pressures during towing. Consider a 3-knot towing speed and head seas of sea state 5 and 60-hour duration. For the members with the highest relative velocities and motions, the calculated extreme impact pressure with a .001 probability of being exceeded is 32 psi; 32 psi is well below the 111 psi maximum design pressure of the members.

5.3 Impact Pressure During Installation

According to an analysis of a model platform flipping from the 0°-heel position to the 45°-heel position, the deck support truss members of the platform hit the water first. The vertical velocity measured at impact was 18 feet per second (full-scale). A velocity of 20 feet per second was used for analysis as an upper bound of the vertical velocity.

The impact pressure was calculated using an empirical formula developed by Fabula and Ruggles (Ref: Fabula, A. G. and Ruggles, I. D., "Vertical Broadside Water Impact of Circular Cylinder - Growing Circular Arc Approximation," NAVORD Report, 1947 (1955). The maximum impact pressure calculated for the 20 fps vertical velocity at impact is 23.1 psi and is much lower than the member design pressure of 111 psi.

APPENDIX 1.8

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.8

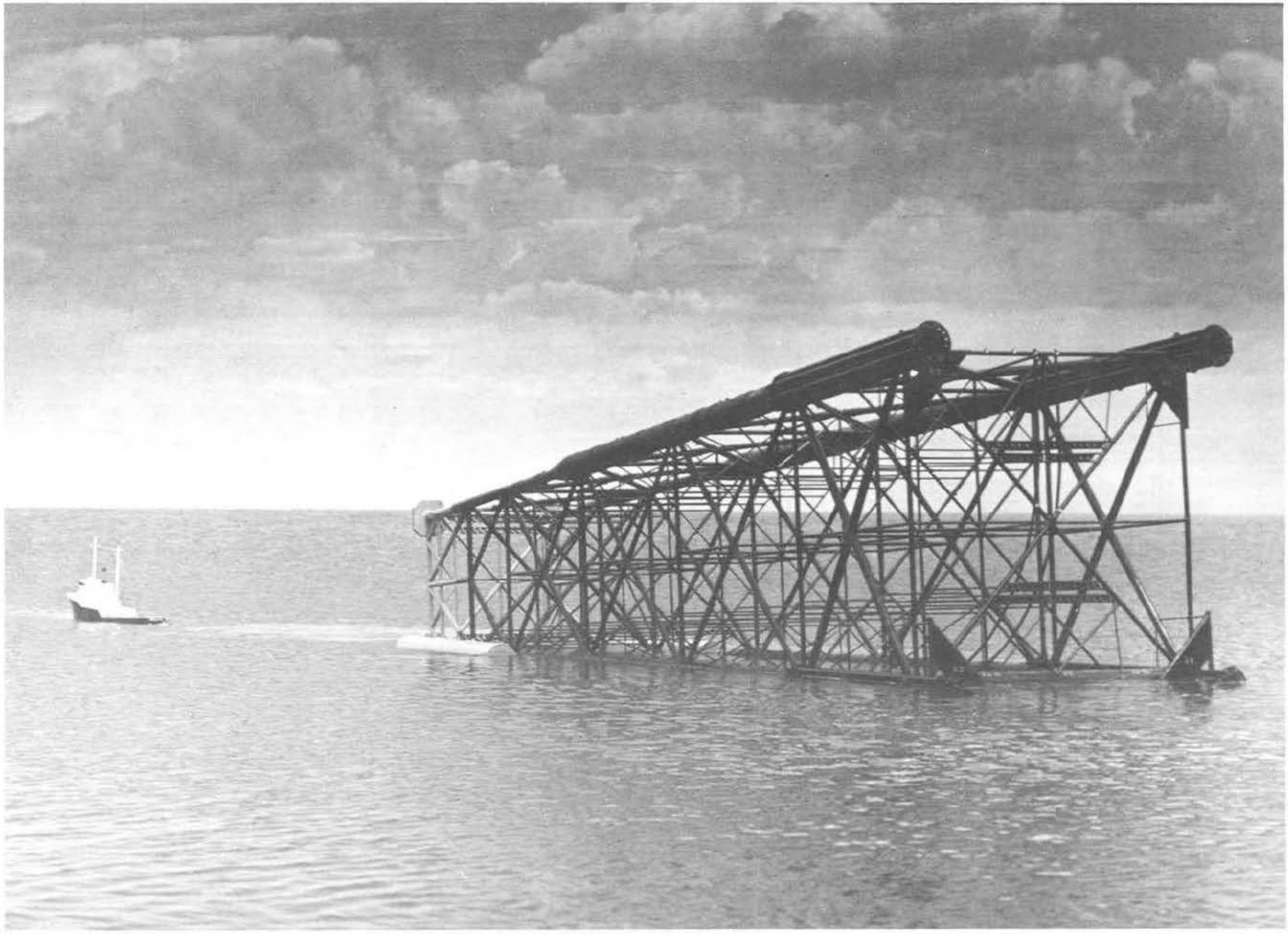
Model Study for Installation of a Self-Contained Platform for Drilling and Producing Operations, Santa Barbara Channel

Esso Production Research Company

September, 1971

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

MODEL STUDY
FOR
INSTALLATION OF A SELF-CONTAINED PLATFORM
FOR
DRILLING AND PRODUCING OPERATIONS
SANTA BARBARA CHANNEL



Model Study For Installation of a Self-Contained Platform
For Drilling and Producing Operations, Santa Barbara Channel

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CONCLUSIONS

The model test has accomplished the goals of confirming the theoretical stability predictions, measuring towing forces, pitch and roll periods, confirming theoretical predictions for platform draft during each stage of upending, establishing upending procedures, and finally proving removal feasibility.

The model test has shown that the stability of the 700-foot platform is either acceptable or can be made so with a minor design change. The maximum draft is 17 feet in the normal towing position. This increases to 147 feet when the jacket is rolled to the 45° position. Nominally, the two buoyancy tanks are positioned 25 feet from the platform leg. Intact stability tests for the nominal case result in a 22.1 foot righting arm. By increasing the spacing to 40 feet and 55 feet, the righting arm increases by 6.7% and 13.6%, respectively. Any two adjacent compartments, except A12 plus A13, can be flooded without causing the platform to roll to the 45° position with the nominal auxiliary tank position. By increasing the spacing to 45 feet, even these adjacent compartments can be flooded without rolling.

The jacket can be towed at a 4½ knot speed with 4,000 HP. In the 45° position, the same horse-power could move the jacket at 3 knots. Finally, 4,000 HP will resist either a 400 Kip transverse wind force or a 3¼ knot transverse current. During upending, the minimum pitch period is 12.1 seconds and the minimum roll period is 28.0 seconds. Just before touching the mudline, the heave period is 36.4 seconds.

The model test confirmed that it is possible to accurately predict the model draft configuration during each stage of the upending. Therefore, it follows that theoretical predictions will forecast the draft configuration of the prototype during each stage of upending.

Normal upending procedures have been established. Contingency procedures, including upending with damaged compartments, have also been tested. We

have concluded that upending can be achieved in any circumstance with any kind of damage to the platform, as long as the platform is floating at the beginning of the operation and the control system is intact.

Platform removal can be achieved by reconnecting the buoyancy tanks and deballasting the legs. The resulting draft is 265 feet. A 240 foot draft is possible if the bottom horizontal is also deballasted but the 25 foot difference is probably not worth the added piping and valves required.

1. INTRODUCTION

This paper reports the results of tests performed on a scaled model of a drilling platform for 700 foot water depth. Several features of the prototype are significant for proper modeling; the most important are weight, buoyancy and geometry. The prototype total weight is 26,300 Kips; the buoyancy in the towing face is 36,000 Kips. Some of the special geometric features worthy of note include the 24 foot diameter bottom horizontal; two 24 foot diameter by 170 foot long auxiliary buoyancy tanks spaced 25 feet from the platform legs; and the platform legs which vary from 90 inch diameter at the top end to a 17 foot diameter member in the middle which is surrounded by eight 40 inch diameter pile sleeves for 200 feet at the bottom end of the platform.

2. SCOPE OF THE TESTS

The tests review the different phases of the platform towing, upending, and salvaging. Table 2.1 lists the tests performed.

TABLE 2.1 Model Test Schedule

I. Tow Stability Tests

A. Intact stability in normal position

B. Intact stability in 45° position

C. Damaged stability when each compartment or when two adjacent compartments are flooded

D. Intact stability for increased spacing between auxiliary tanks and platform legs

1. 40 foot spacing

2. 55 foot spacing

II. Tow Power Test

A. Towing in normal position

1. Towing along longitudinal axis

2. Towing along transverse axis

B. Towing in 45° position along longitudinal axis

C. Towing in normal position with bottom horizontal flooded

1. Towing along longitudinal axis

2. Towing along transverse axis

III. Upending Tests

A. Normal upending procedures

B. Upending with damaged compartments in auxiliary tank.

C. Pitch, roll and heave period during upending.

IV. Removal Tests

A. Check flotation in salvage condition

The results of the model tests are presented in sections 4,5,6,7, and 8 of this report.

3. MODEL DESIGN

3-1 Model Similitude

Reliable model test results require that the laws of similitude are followed. Since gravitational and inertial effects are predominant, the model and prototype similitude is governed by the Froude Law. The model and prototype are related by the constants detailed below.

$$\text{Length:} \quad Lp = \lambda \; Lm$$

$$\text{Time:} \quad Tp = \sqrt{\lambda} \; Tm$$

$$\text{Velocity:} \quad Vp = \sqrt{\lambda} \; Vm$$

$$\text{Force:} \quad Fp = \lambda^3 \; Fm$$

$$\text{Moment:} \quad Mp = \lambda^4 \; Mm$$

3-2 Model Features

The linear scale factor $\lambda = 51$ results in a total model height of 15½ feet. The model is constructed of aluminum tubing. The weight was adjusted by adding lead weight to the platform members. The model weighs 194.3 pounds. This weight is adjusted for fresh water testing. The center of gravity is within 2% of the proper location.

Direct scaling of the prototype pipe sizes would have required model members which either are not available or are too thin to weld. Accordingly, model member thicknesses are only approximately scaled. Adjustments were partially made to account for this variation.

All members larger than ¼" diameter are free flooding except during the stability and towing tests. At this time the diagonals on the towing face are plugged, as they are on the prototype.

Figure 3-2 shows the compartmentation of the platform. The compartment flooding is controlled by air-operated valves. Compartments 2 and 3 have been sub-divided in the model to study the damaged stability more closely. Fabrication convenience placed a bulkhead at ELEV(-)207'-0" in the model instead of ELEV(-)183'-0". Finally, the prototype's ELEV(-)619'-8" bulkhead was placed at ELEV(-)646'-0" to balance compartments 4 and 5.

4. PLATFORM TRIM

4-1 Normal Towing Position

Figure 4-1 presents a comparison between the predicted and measured draft condition of the platform in the normal towing position. Because the tests were performed in an open-air pond, the measurement accuracy is limited to ±1/16" which is 4" prototype scale. With this in mind, one notes that the comparison are excellent. The longitudinal trim

angle is 1.6 minutes with the top end of the platform lower in the water than the bottom end.

4-2 45° Position

Figure 4-2 records the measured draft condition for the 45° position. In this case, one buoyancy tank as well as the bottom end of two of the legs are completely out of the water. The longitudinal trim angle is 1°-41' while the transverse heel angle is 1°-47'.

5. STATIC STABILITY TESTS

5-1 Testing Procedure

The stability tests were carried out by applying a known disturbing moment and measuring the resulting heeling angle. The trace of these results is known as a righting moment curve. The maximum righting moment divided by the total weight is known as the righting arm. The stability tests were performed as shown in Figure 5-1.

To reduce experimental error and thus insure proper load application, the lines attached to the platform legs were carefully leveled before each reading was taken.

5-2 Intact Stability

The intact stability test results are shown in Figures 5-2a and 5-2b. As shown in Figure 5-2a, the maximum righting moment for the normal position is 580,500 kip-feet, or a 22.1 foot righting arm. The angle of maximum righting moment is $4^{\circ}30'$. Figure 5-2b, shows that in the 45° position, the maximum righting moment is 366,000 kip-feet or a 13.9 foot righting arm. The angle of maximum righting is 22°. Stability in the 45° position can be increased by flooding compartments in the bottom horizontal as this brings two legs in contact with the water surface.

5-3 Damage Stability

In the normal towing position, each compartment and every combination of two adjacent compartments have been flooded and the stability tested. In the 45° position, the stability was checked for damage in the upper 90" diameter leg and also for the case of damage in the two lowest compartments of the waterline leg. These two cases are the least stable in the 45° position. Figure 5-3a to 5-3o plot the stability curves for the damage stability cases run. Each case is listed and compared with the intact case in Table 5.1 and 5.2.

The platform is stable enough in the normal towing position to resist damage in any two adjacent compartments, except A12 plus A13, without rolling. Section 5-5 explains one method of increasing the stability so that A12 plus A13 can also be flooded without causing the platform to roll.

The intact stability in the 45° position is only 63% of that in the normal towing position. Damage to a waterline compartment reduces the stability to about 50% of the intact stability.

5-4 Model Test and Calculation Comparison

Figure 5-4a,b, and c are presented to compare the righting moment curves of the test and theoretical predictions. Figure 5-4a shows the intact stability in the normal position. The computed righting arms are 21.5 feet and 22.1 feet for the theoretical and test results, respectively. The comparison for the case in which one 90" diameter leg and compartment BT1-1 are damaged is found in Figure 5-4b. The computed righting arms are 9.4 feet and 10.5 feet for the theoretical and test result, respectively. The comparison for the case in which both compartments BT1-1 and BT1-2 are damaged is found in Figure 5-4c. The computed righting arms are 4.5 feet and 4.8 feet for the theoretical and test result, respectively. Needless to say, the theoretical predictions and model test results are in excellent agreement.

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The platform is stable enough in the normal towing position to resist damage in any two adjacent compartments, except A12 plus A13, without rolling. Section 5-5 explains one method of increasing the stability so that A12 plus A13 can also be flooded without causing the platform to roll.

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TABLE 5.1 STABILITY IN NORMAL POSITION

Upright Position

Flooded Compartments	Maximum righting moment, Mm (kip-feet)	Maximum righting arm (feet)	Mm/Mm (intact) (%)
Intact stability	580500	22.1	100.0
A11	504900	19.2	87.0
A11 + BT1-1	275100	10.5	47.4
BT1-1 + BT1-2	125900	4.8	21.7
A11 + BT1-1 + BT1-2	47200	1.8	8.1
A11 + A12	160400	6.1	27.6
A12 + A13	0	0	—
A13	270200	10.3	46.6
A13 + A14 + 4 pile sleeves	28900	1.1	5.0
A14 + 4 pile sleeves	342100	13.0	58.9
A14 + A15 + 4 pile sleeves	193500	7.4	33.3
A15 + 4 pile sleeves	361700	13.7	62.3
A16 + A15 + 4 pile sleeves	191400	7.3	33.1
A16	418900	15.9	72.1
A16 + A7	219600	8.4	37.8

TABLE 5.2 STABILITY IN NORMAL POSITION

45° Rolled Position

Flooded Compartments	Maximum righting moment, Mm (kip-feet)	Maximum righting arm (feet)	Mm/Mm (intact, 45°) (%)	Mm/Mm (intact, upright) (%)
Intact stability	366000	13.9	100.0	63.0
B11	304400	11.6	83.1	52.3
A14 + A15 + 4 pile sleeves	309100	11.8	84.5	53.2

Several general experimental errors affect the model test results. The model pipe thickness reduces the inside volume of the compartments; this prevents entailment of sufficient ballast water resulting in a slight excess of buoyancy. An attempt was made to account for this in the calculations. Most likely some air was trapped in the compartments during flooding. This also leads to slight excess buoyancy. The test procedure itself including levelness of the load lines, the pulley friction, and environmental effects (wind and waves) influence the results. Each of these errors tend to increase the apparent model stability in relation to the theoretical prediction. The theory therefore should be a lower limit on the real answer. In this light, the agreement between tests and predictions are very encouraging.

5-5 Effect of Increasing the Distance Between Buoyancy Tanks and 90" Diameter Leg.

Additional stability tests were run to determine the effect of increasing the spacing between legs and buoyancy tanks. A comparison of righting moment curves for 25 feet, 40 feet, and 55 feet spacings are presented in Figure 5-5. As shown, the maximum righting moment for the 40 feet spacing is 6.7% larger than the base case of 25 feet and the 55 foot spacing is 13.4% larger than the base case. A spacing of 45 feet would allow damage in compartments A12 plus A13 without rolling to the 45° position.

6. TOWING RESISTANCE

6-1 Testing Procedure

The testing arrangement is illustrated in Figure 5-1. As shown, a line was connected between the platform and a reel. The reel is rotated by a variable speed motor. A dynamometer measures the tension in the pull line as the jacket is reeled in at a constant speed. The jacket was towed both along the transverse and longitudinal axes and in the normal and 45° positions. A small error results in these tests because the pile guides, see HQE-154-1, were not included on the model.

6-2 Towing Resistance Curves for the Model

Figures 6-2a through 6-2e plot the tow force variation with tow velocity. The cases reported in the figures include normal position, longitudinal axis; normal position, transverse axis; 45° position, longitudinal axis; bottom horizontal flooded, normal position, longitudinal axis; bottom horizontal flooded, normal position, transverse axis. This experimental data has been projected to prototype scale in the next section.

6-3 Towing Resistance Curves for the Prototype

The total drag measured on the model is equal to the summation of the wave drag which is related to the Froude number and the friction drag which is related to the Reynolds number. The wave drag can be directly scaled to prototype values. The friction drag cannot be because of the laws of similitude. Tests run on a model and prototype oil retention boom (Reference 1) have shown that if one uses Froude's law to project the total drag from model to prototype, conservative results are obtained. This simplification will be used here. The total model drag is amplified by λ^3 (132,651) to obtain the tow forces for the prototype.

Figures 6-3a through 6-3e present the towing force and towing power for each case tested. For example, Figure 6-3a shows that 4000 HP is required to provide the 275 kips necessary to tow the platform at 4½ knots. The curves do not include a factor of safety.

7. UPENDING

7-1 Normal Procedure

During the installation of the prototype, a certain sequence of events are necessary to assure proper upending and precise setting of the platform. This procedure is listed below.

1. Open all plugged members in water plane.
2. Flood bottom horizontal.

Reference 1 "Some Design Aspects of an Oil Retention Boom" by J. S. Chung, Esso Production Research Corporation, September 1971.

3. Flood compartment A15.
4. Platform rolls to 45° position and pile sleeve caps on submerged leg burst.
5. Flood compartments A14, A25, and A24; the platform returns to a symmetrical position.
6. Flood compartments B15 and B25.
7. Flood compartments B14 and B24.
8. Flood 40' of compartments A12, A22, B12 and B22 to prime deballast pumps.
9. Flood 60' of compartments A13, A23, B13, and B23 which brings the structure about 20 feet from mud-line.
10. Position with tugs.
11. Set platform by simultaneously slowly flooding compartments A13, A23, B13 and B23.
12. Level structure by operating deballast pumps located in compartment 2.

This procedure was duplicated, as much as possible, during the model upending tests. Several modeling problems prevent exact duplication of the procedures. Since the model pipe thickness is larger than necessary, the model buoyancy during upending is larger than it should be. To account for this problem, lead weights were added during each stage of the upending. The predictions assume that the pile sleeves are flooded from the beginning of the test, when in fact the sleeves were flooded only after a simulated 120 foot draft supposedly burst the sleeve plugs.

The model test results and theoretical predictions are compared in Figure 7-1. The differences between predictions and test results are small and mainly result from the pile sleeve assumption in the calculation. As shown, in the upright position, after flooding compartment 3 with 100 feet of water, the draft difference between measurements and prediction is only 13 feet; small enough to confirm the theoretical procedure.

7-2 Stability During Upending

An additional stability test was performed at upending Stage 5 (Section 7-1). Because of the position of the platform, only a partial curve is possible. These results are given in Figure 7-2.

7-3 Upending with Damaged Compartments in the Buoyancy Tanks

Two upending tests were made to check the feasibility of upending the platform with damaged buoyancy tanks. In the first test, compartments BT1-2 and BT1-3 were flooded and upending attempted. In the other test, compartments BT1-1, BT1-2, and BT1-3 were flooded. In both cases, upending is possible using the normal sequence up to and including Step 7 (Section 7-1). Beyond this phase, the structure must be lowered by selectively flooding individual legs.

7-4 Upending with a 40 foot Distance Between Buoyancy Tanks and 90" Diameter Legs.

The model test showed that with a 40 foot spacing between buoyancy tanks and legs that upending is possible without the step of rolling the structure to the 45° position. Upending proceeds by symmetrically flooding the compartments in the A1 and A2 legs. Upending in this manner is very smooth. A 55 foot spacing of buoyancy tank would probably allow symmetrical upending with damaged compartments.

7-5 Heave, Pitch and Roll Periods.

Heave, pitch and roll periods were measured at various stages during the upending. The results are reported in prototype magnitudes and the upending stages refer to those outlined in Section 7-1. At Stage 5, the pitch and roll periods are 12.1 seconds and 28.0 seconds, respectively. At Stage 6, the pitch and roll periods are 13.2 seconds and 41.0 seconds, respectively. At Stage 7, the pitch and roll periods are 15.3 seconds and 55.0 seconds, respectively. At Stage 9, the heave period is 36.4 seconds. After Stage 7 with 100 feet of water in A13 and A23, the heave period is 28.6 seconds.

Periods were also measured for the case by which the buoyancy tank is 40 feet from the legs. When the water line is just above the tow face legs, the pitch and roll periods are 36.0 seconds and 17.0 seconds, respectively. When the water line is centered between the upper and lower legs, the roll period is 27.0 seconds. Finally, when the water line is immediately below the upper legs, the roll period is 50.0 seconds.

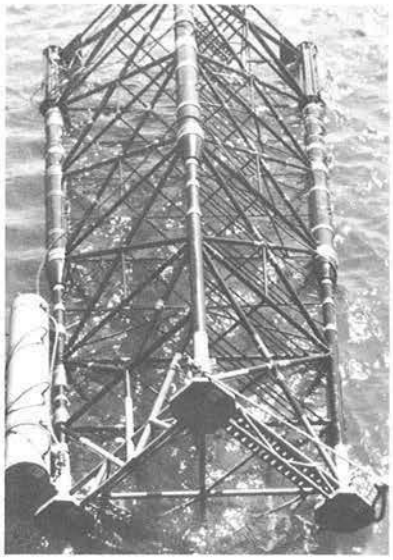
8. REMOVAL

Once the platform has been installed, the oil wells drilled, and the reservoir depleted, the platform will be removed. Tests to simulate the removal were performed during the model testing.

Additional weight amounting to 4400 kips was added to the platform to simulate the piles and cement which are added inside the pile sleeves. This is equivalent to 34 pounds on the model. Figure 8 depicts the removal sequence. It is possible to refloat the prototype by attaching the buoyancy tanks and deballasting the 4 legs. The maximum draft in this condition is 265 feet. The draft can be reduced to 240 feet if the bottom horizontal is also deballasted, but the 25 foot difference is probably not worth the added piping and valves required.

UPENDING SEQUENCE

1



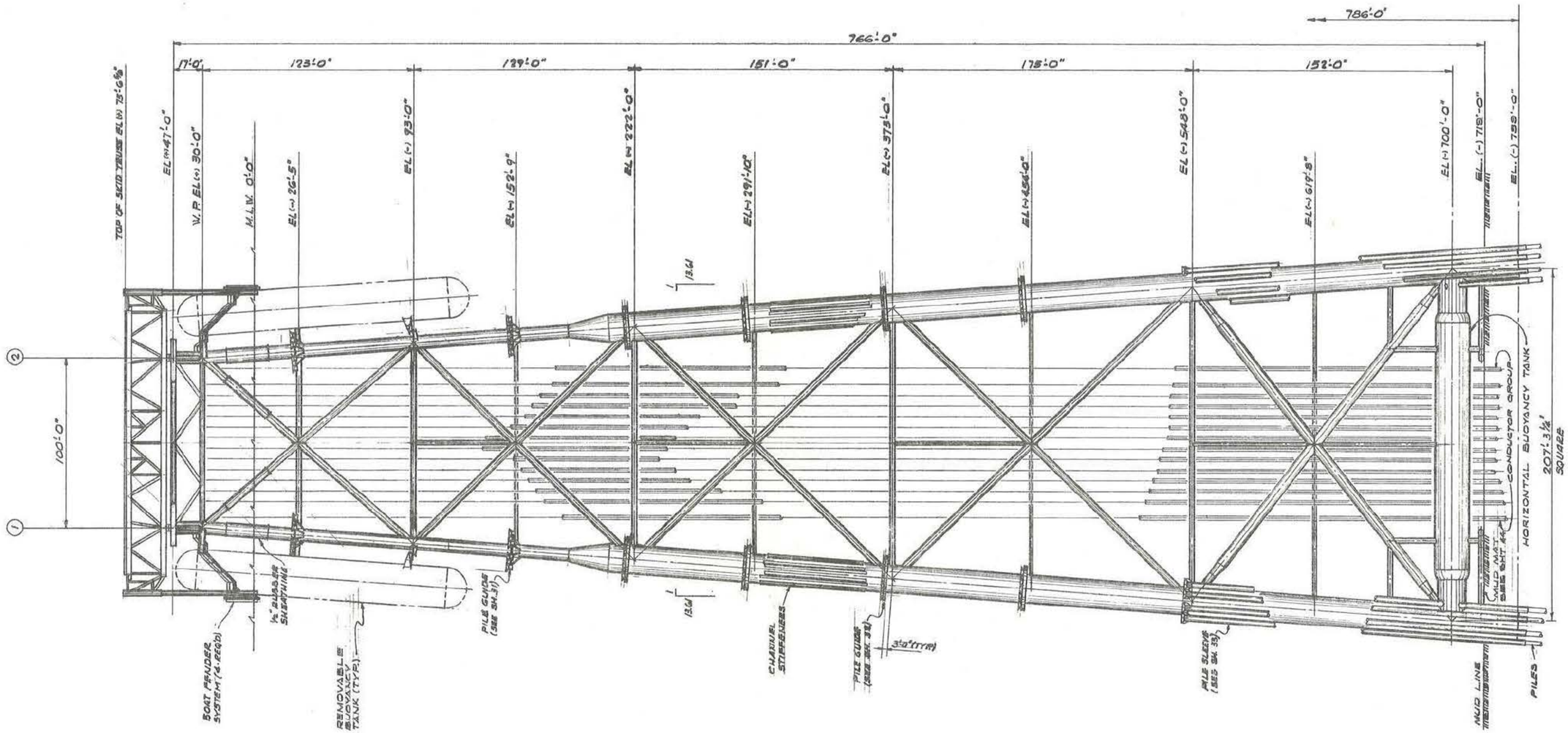
2

3

4

5

6



SOUTH ELEVATION

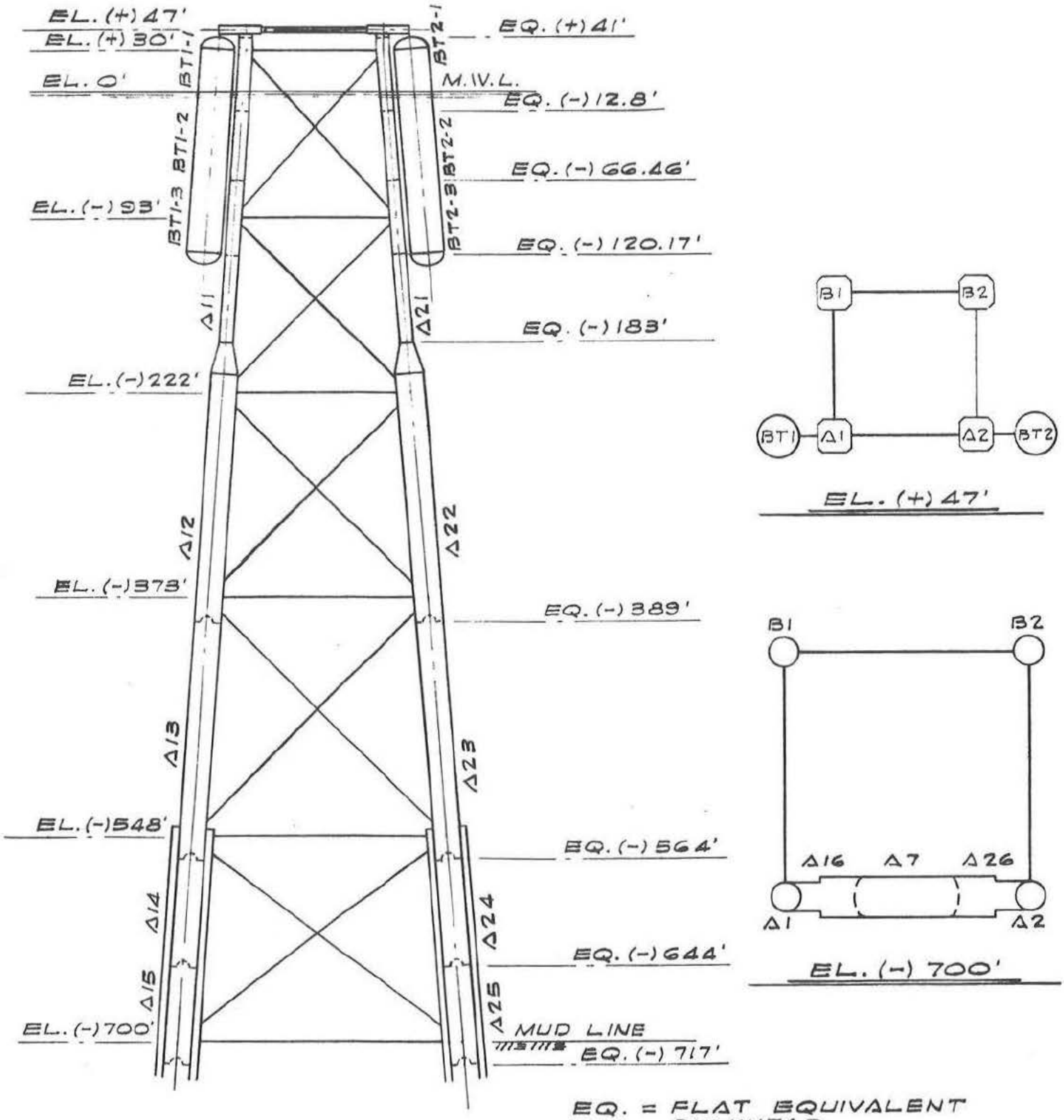
NO.	DATE	REVISIONS	BY	CHK.	APPD.	NO.	DATE	REVISIONS	BY	CHK.	APPD.

JACKET UNIT
60-WELL OFFSHORE DRILLING PLATFORM
700' WATER
HUMBLE PLATFORM RUBY

DRAWN R.E. DAVIES
CHECKED
ENGR. SECTION
APPROVED
SCALE 1" = 30'
DATE
JOB NO.
FILE NO. MQE-164-1

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

Fig 3-2

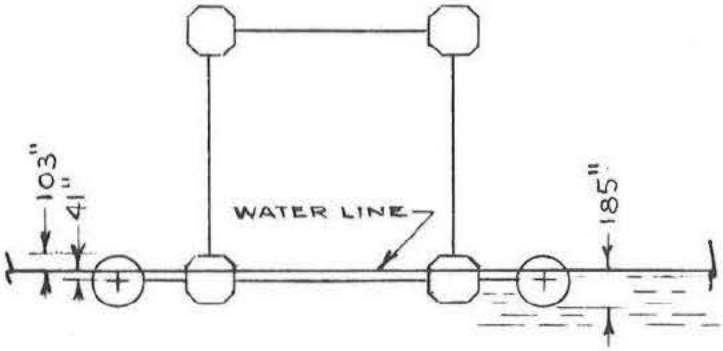

EL. (+) 47'
EL. (+) 30'
EL. 0'
EL. (-) 93'
EL. (-) 222'
EL. (-) 378'
EL. (-) 548'
EL. (-) 700'
EQ. (+) 41'
M.W.L.
EQ. (-) 12.8'
EQ. (-) 66.46'
EQ. (-) 120.17'
EQ. (-) 183'
EQ. (-) 389'
EQ. (-) 564'
EQ. (-) 644'
MUD LINE
EQ. (-) 717'
BT1-1
BT1-2
BT1-3
BT2-1
BT2-2
BT2-3
Δ11
Δ12
Δ13
Δ14
Δ15
Δ21
Δ22
Δ23
Δ24
Δ25
B1
B2
BT1
BT2
Δ1
Δ2
EL. (+) 47'
B1
B2
Δ16
Δ7
Δ26
Δ1
Δ2
EL. (-) 700'
EQ. = FLAT EQUIVALENT BULKHEAD

TRIM COMPARISON

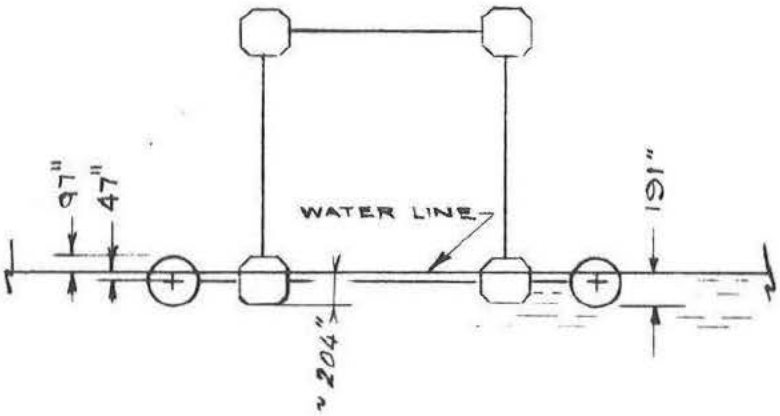
Fig. 4-1

ANTICIPATED FROM CALCULATIONS	MEASURED FROM THE MODEL

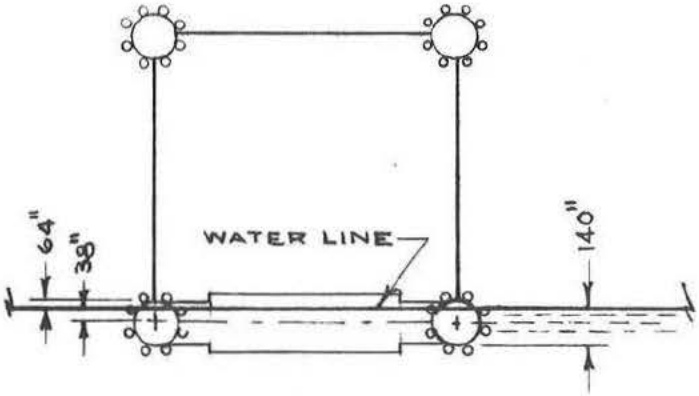
ELEV. (+) 30'



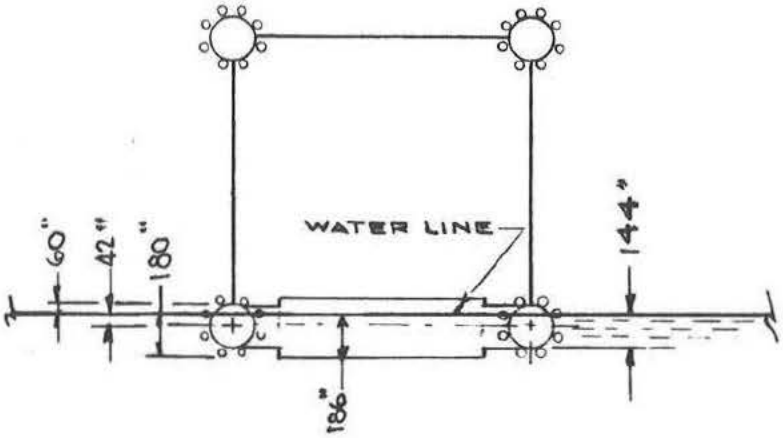
ELEV. (+) 30'



ELEV. (-) 739'



ELEV. (-) 739'



TRIM WHEN PLATFORM IS ROLLED ON 45°

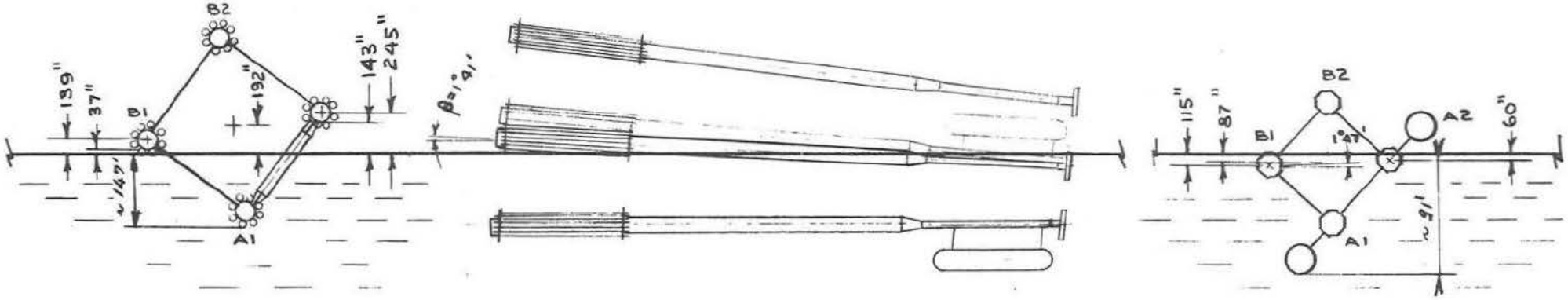
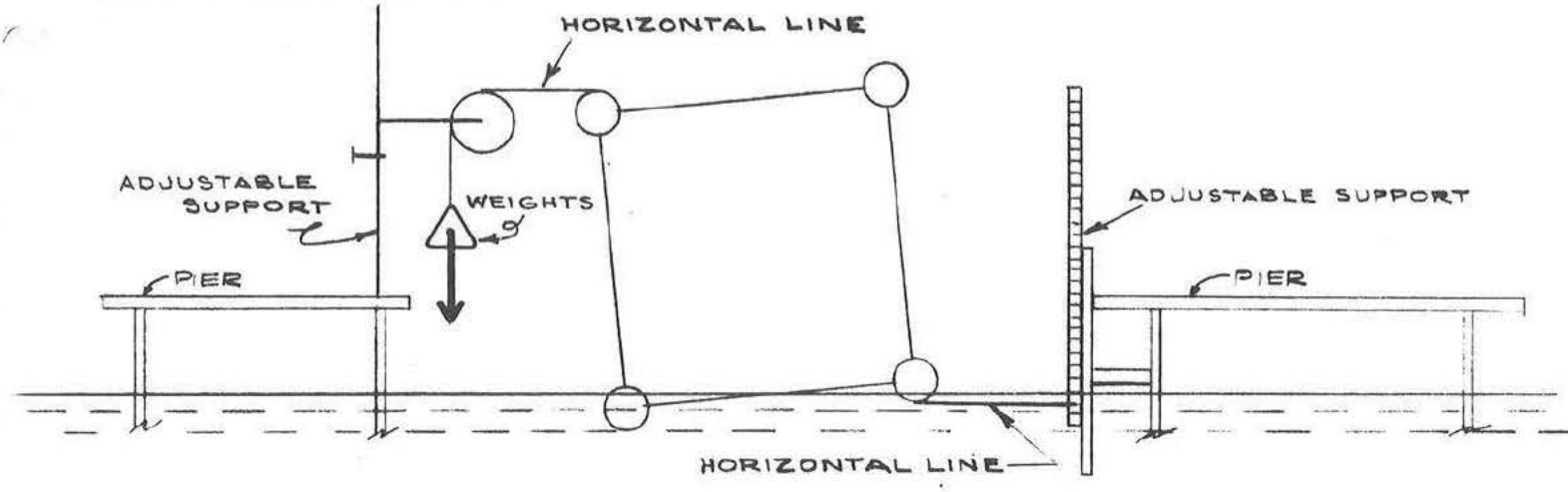


Fig 4-2

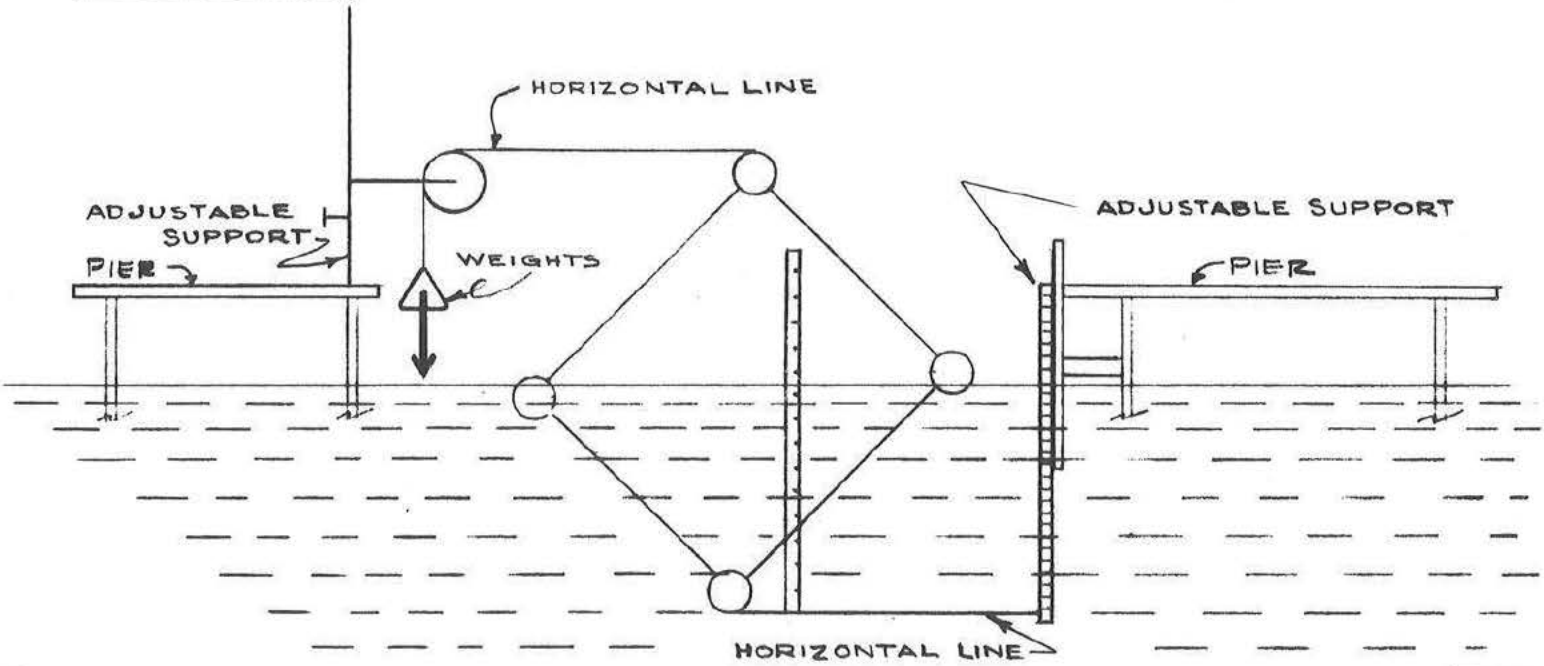
STABILITY TEST ARRANGEMENT

Fig. 5-1

UPRIGHT POSITION



45° POSITION



TOWING TEST ARRANGEMENT

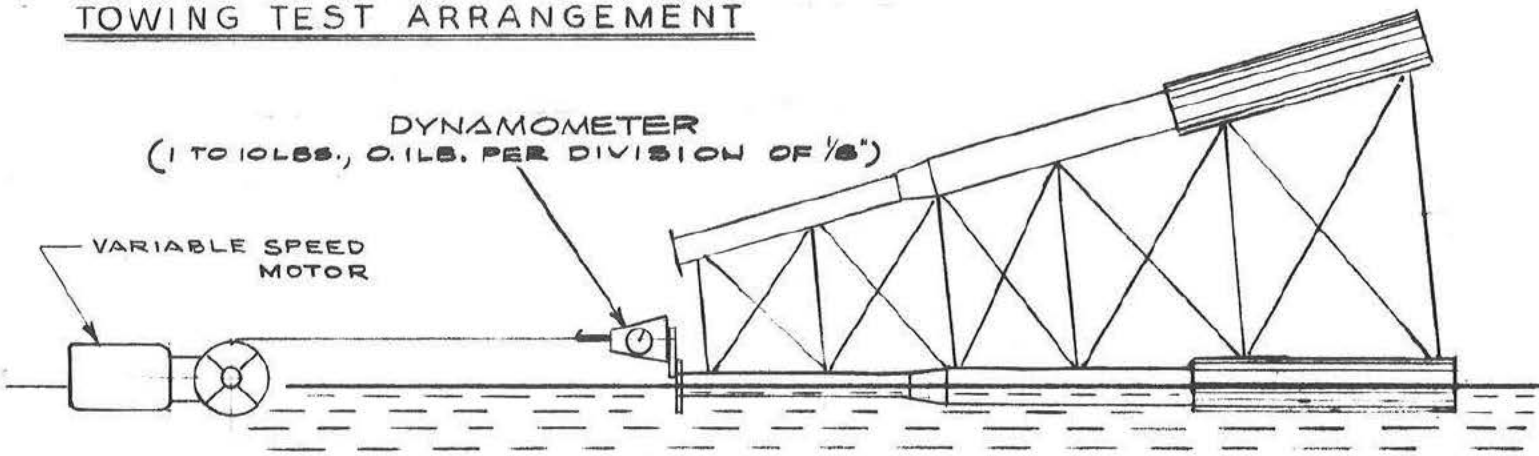


Fig 5-2a

RIGHTING MOMENT CURVE

all members bouyant

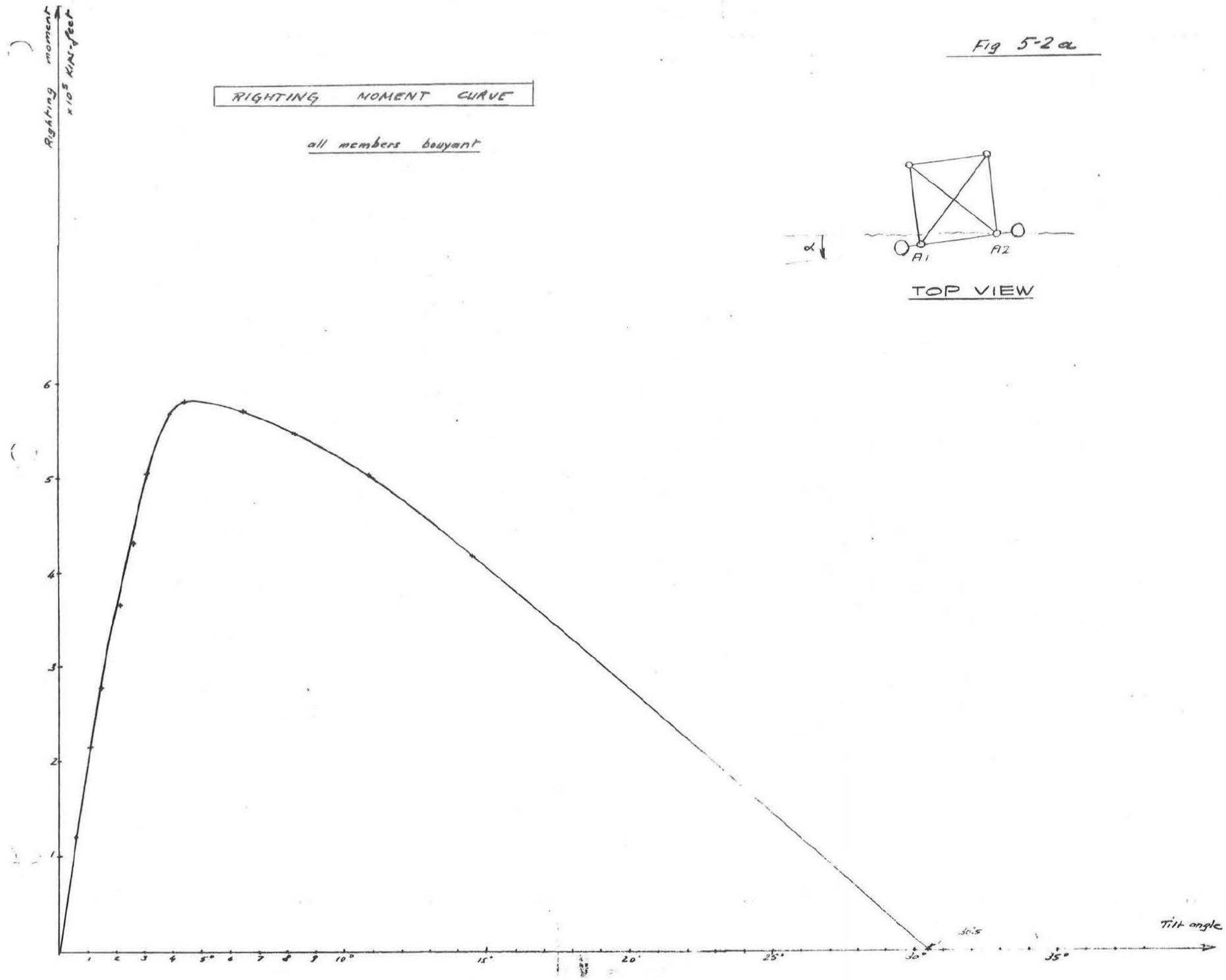


Fig 5-2b

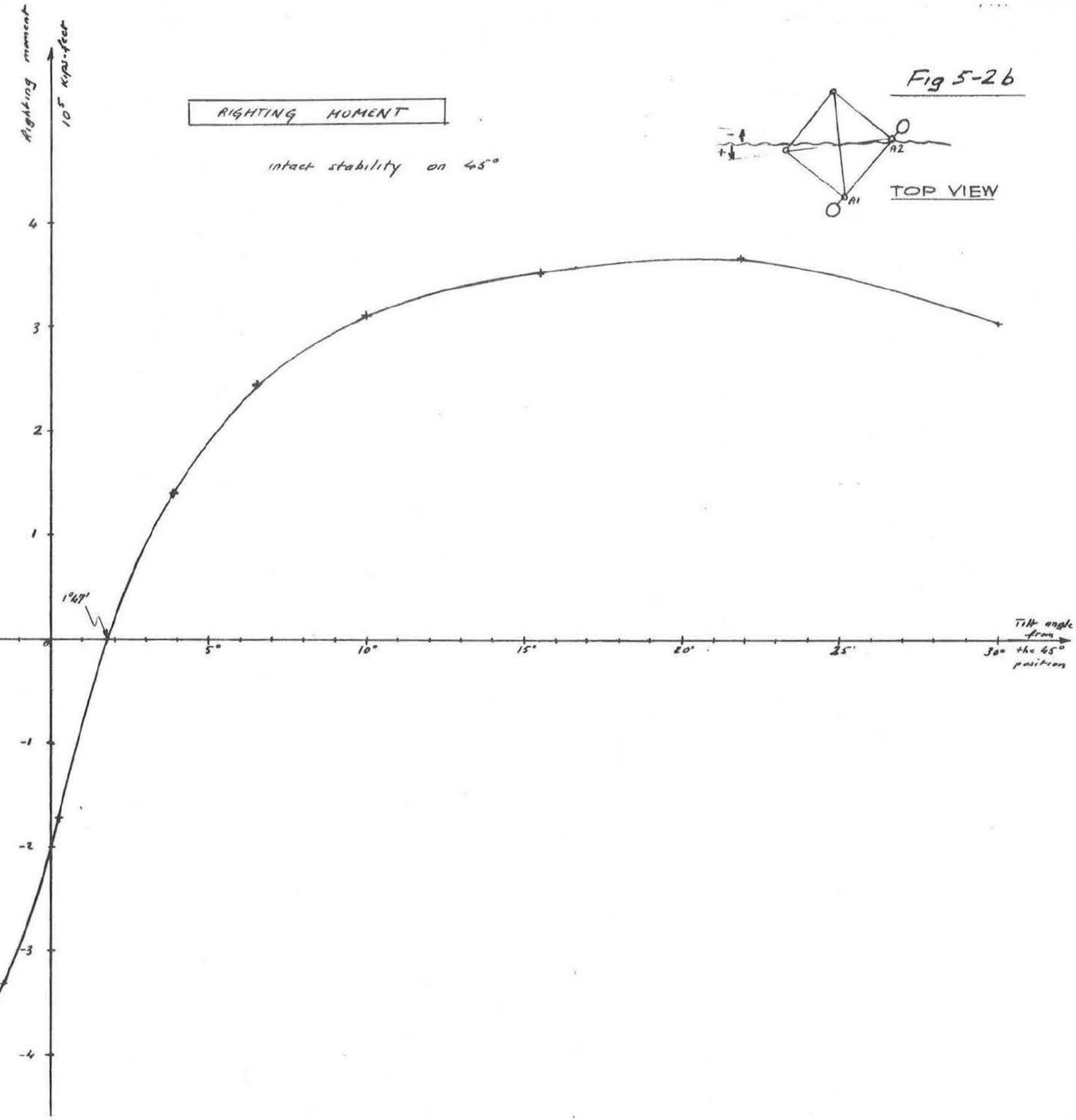

RIGHTING MOMENT
intact stability on 45°
Righting moment
10^5 kips-feet
4
3
2
1
-1
-2
-3
-4
1°47'
-5°
0
5°
10°
15°
20°
25°
30°
Tilt angle from the 45° position
TOP VIEW
A1
A2

Fig 53 a

RIGHTING MOMENT CURVE

90" leg flooded

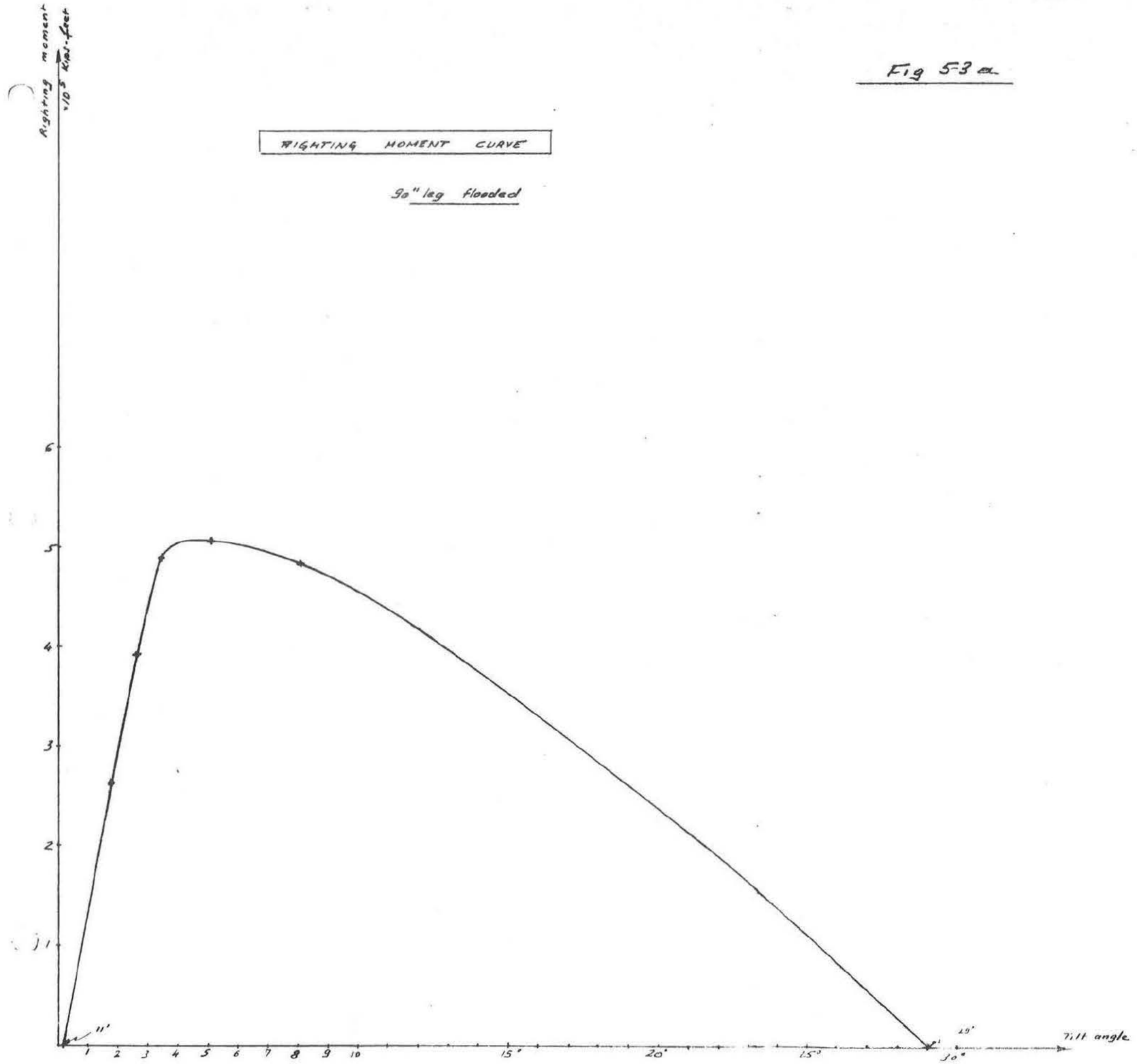


Fig 5-3 b

RIGHTING MOMENT CURVE

90" leg flooded
BT1-1 flooded

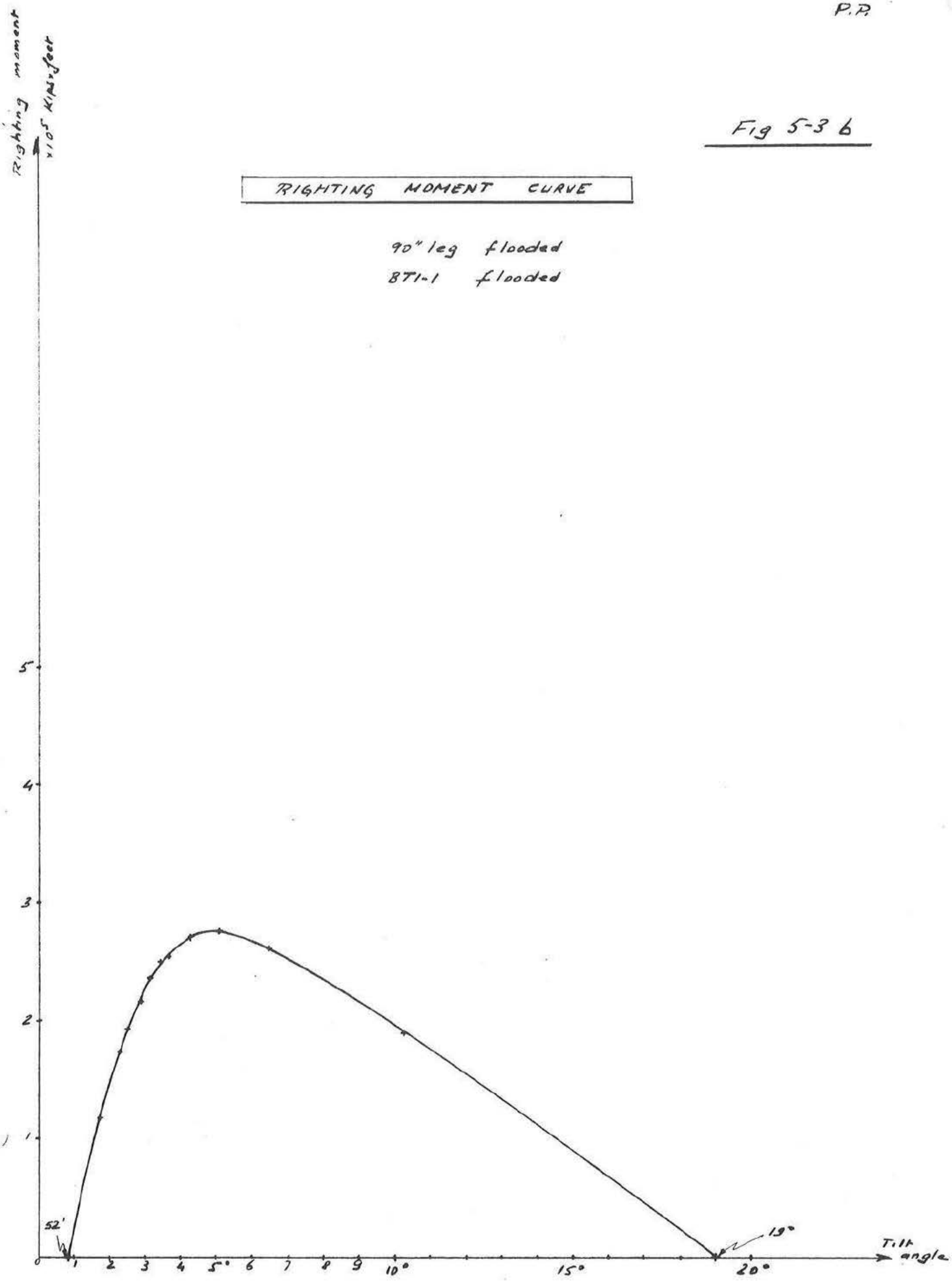
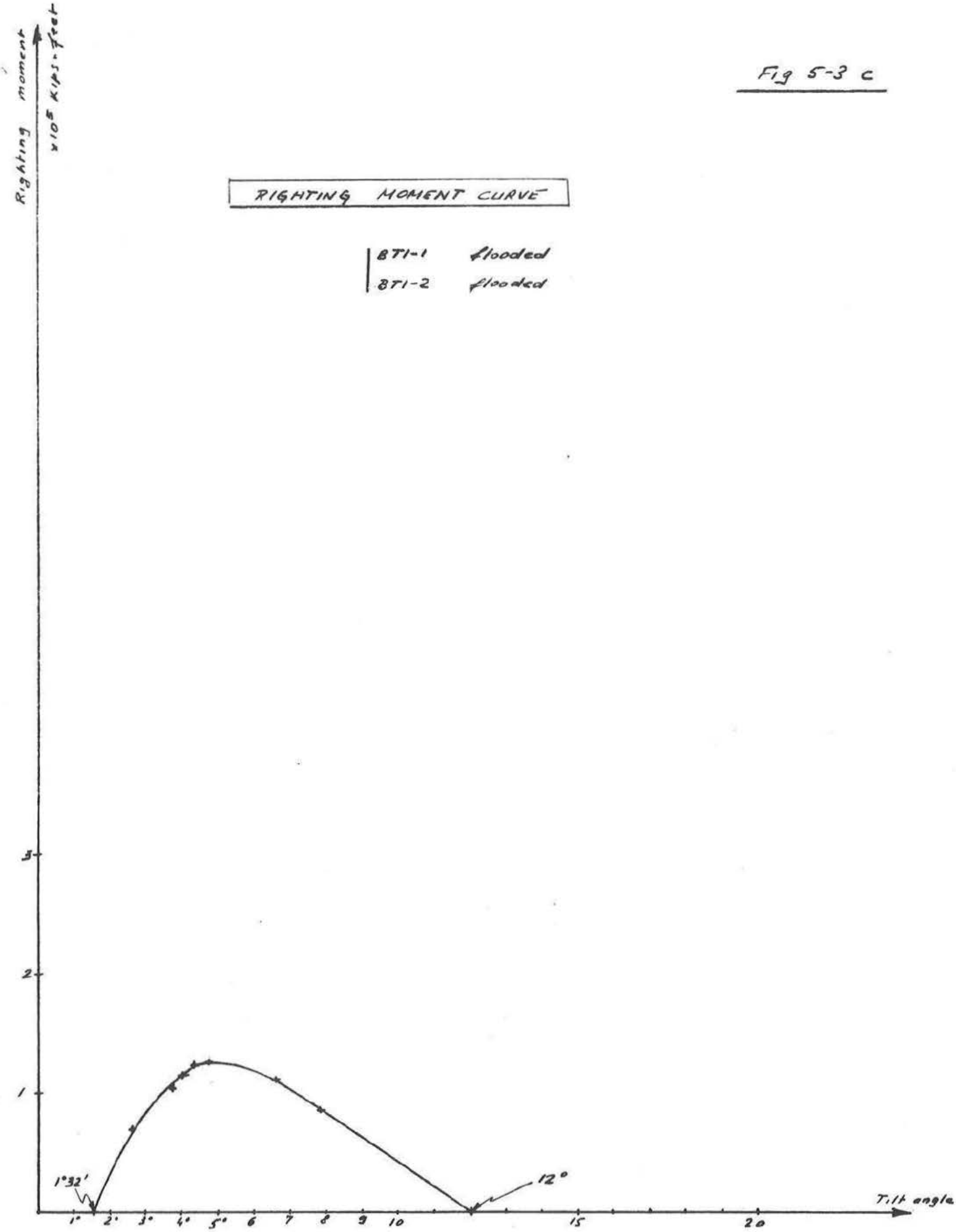


Fig 5-3 c


Righting moment
x10^5 Kips-feet
RIGHTING MOMENT CURVE
BT1-1 flooded
BT1-2 flooded
3
2
1
1°32'
12°
Tilt angle
1°
2°
3°
4°
5°
6
7
8
9
10
15
20

P.P.

Fig 5-3 d

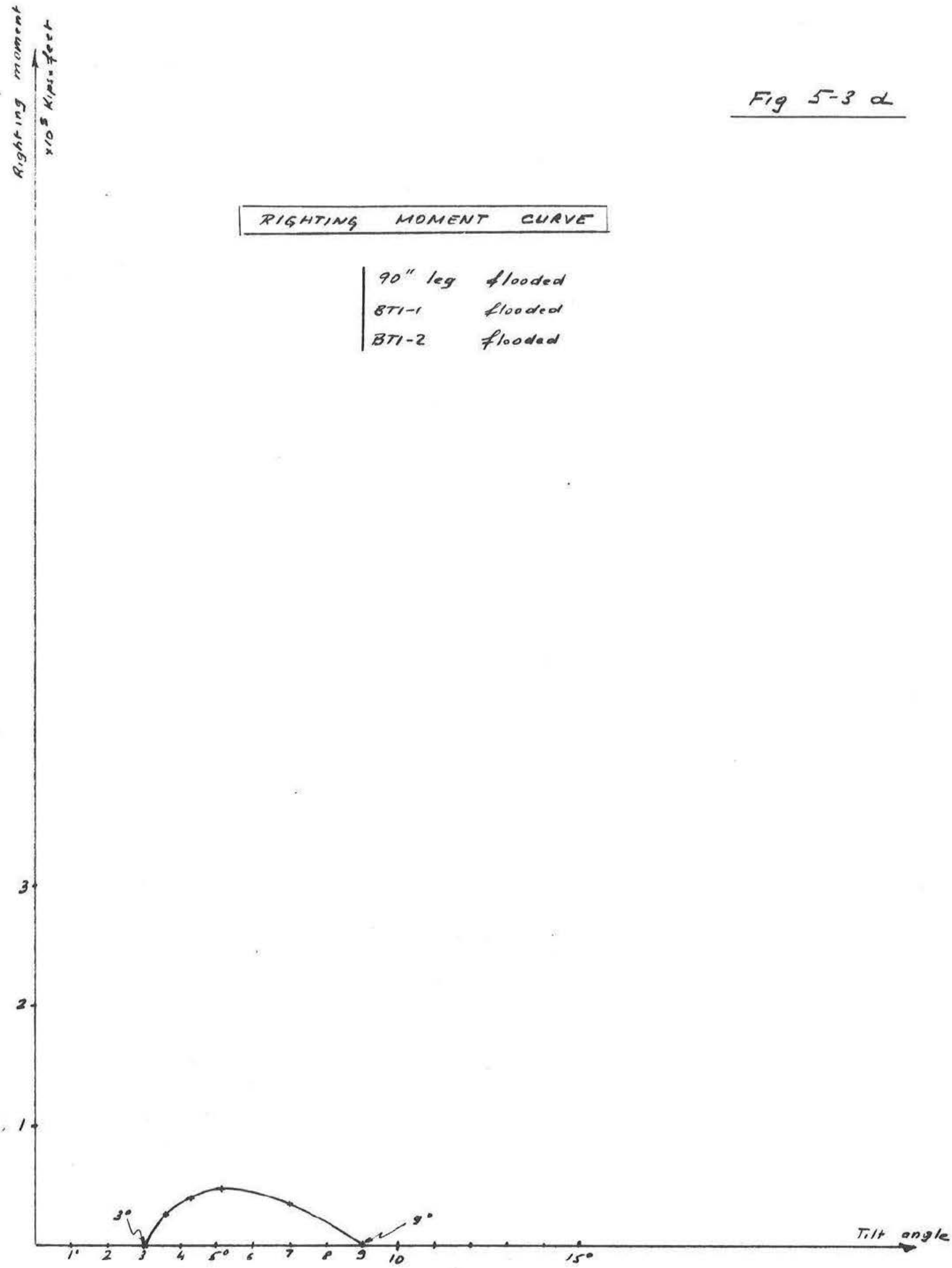
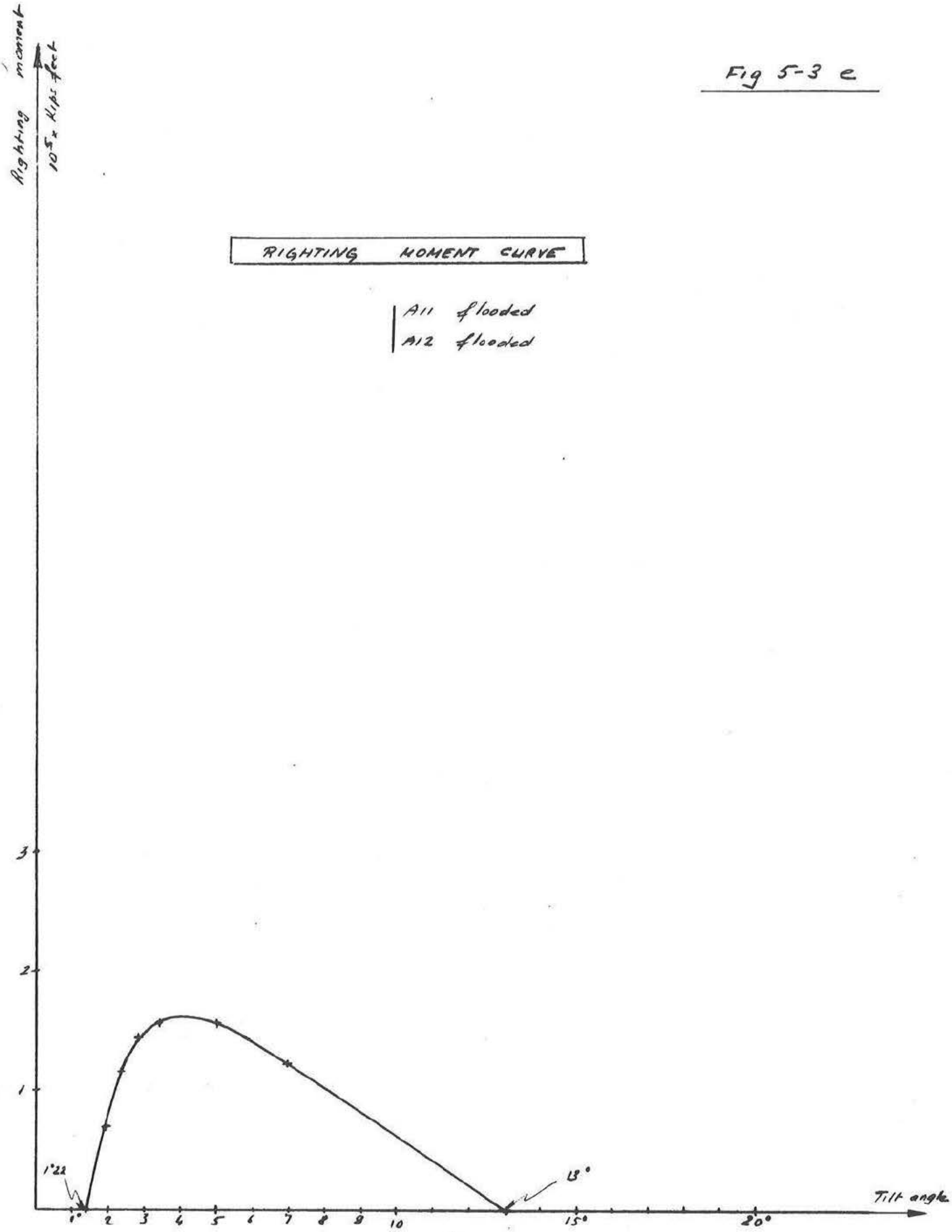
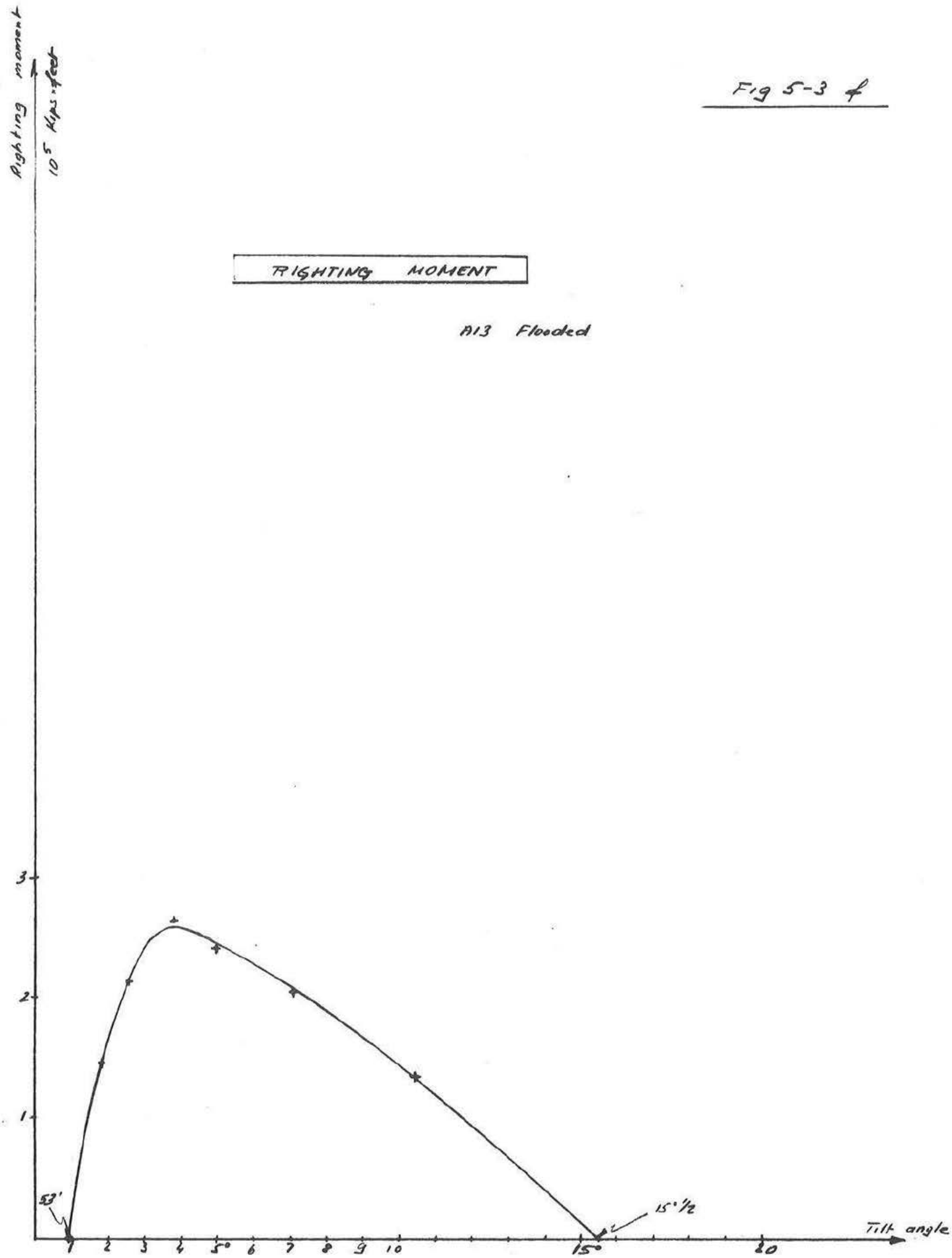

RIGHTING MOMENT CURVE
90" leg flooded
BT1-1 flooded
BT1-2 flooded
Righting moment
x10^5 Kips-feet
3
2
1
3°
9°
1°
2
3
4
5°
6
7
8
9
10
15°
Tilt angle

Fig 5-3 e


Righting moment
$10^5 \times$ Kips-feet
RIGHTING MOMENT CURVE
A11 flooded
A12 flooded
3
2
1
1°22
13°
Tilt angle
1°
2
3
4
5
6
7
8
9
10
15°
20°

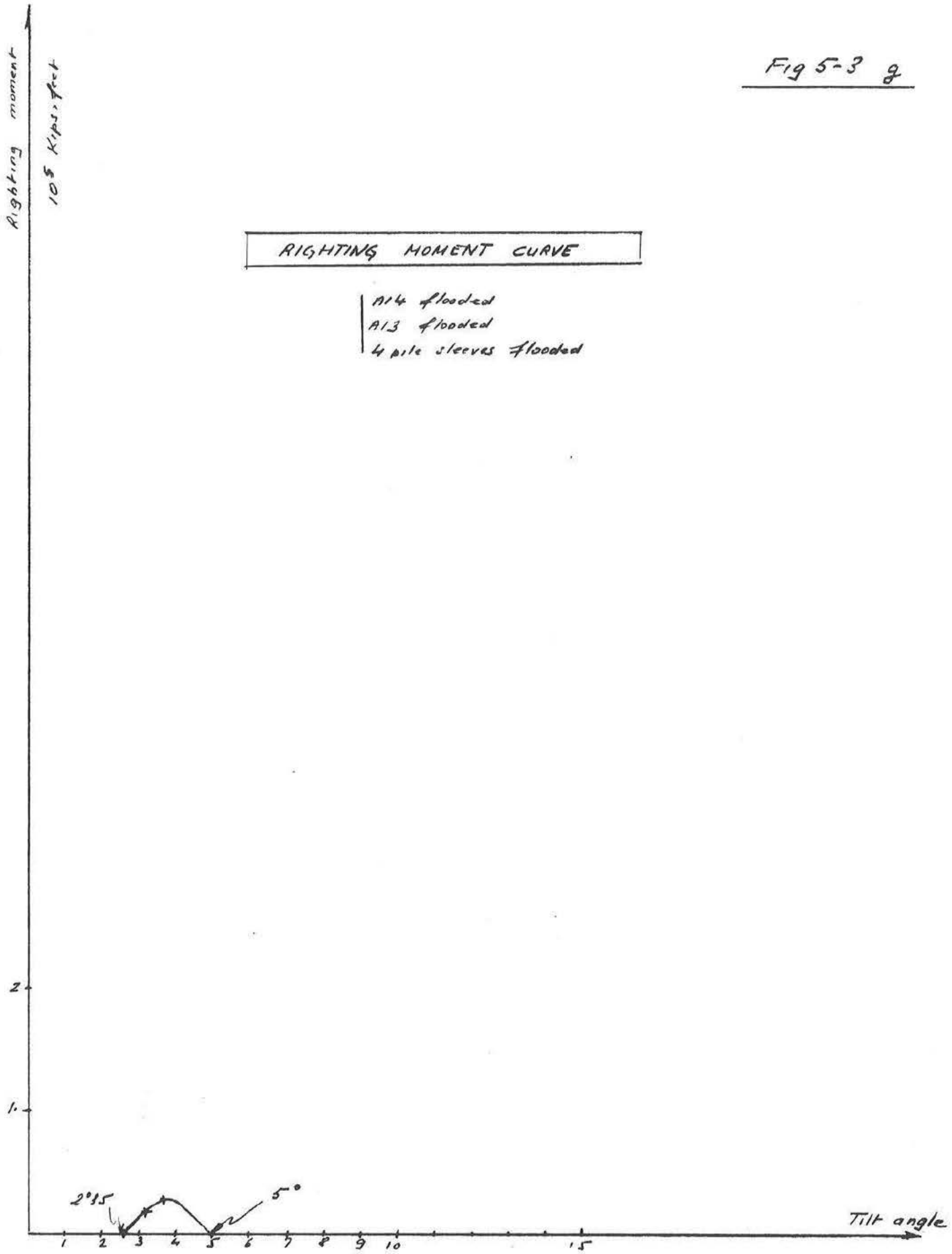
P.P.

Fig 5-3 f


Righting moment
10^5 Kips·feet
RIGHTING MOMENT
A13 Flooded
3
2
1
53'
15°½
Tilt angle
1
2
3
4
5°
6
7
8
9
10
15°
20

P.P.

Fig 5-3 g


Righting moment
10^5 Kips·feet
RIGHTING MOMENT CURVE
A14 flooded
A13 flooded
4 pile sleeves flooded
2
1.
2°35
5°
Tilt angle
1
2
3
4
5
6
7
8
9
10
15

P.P.

Fig 5-3 h

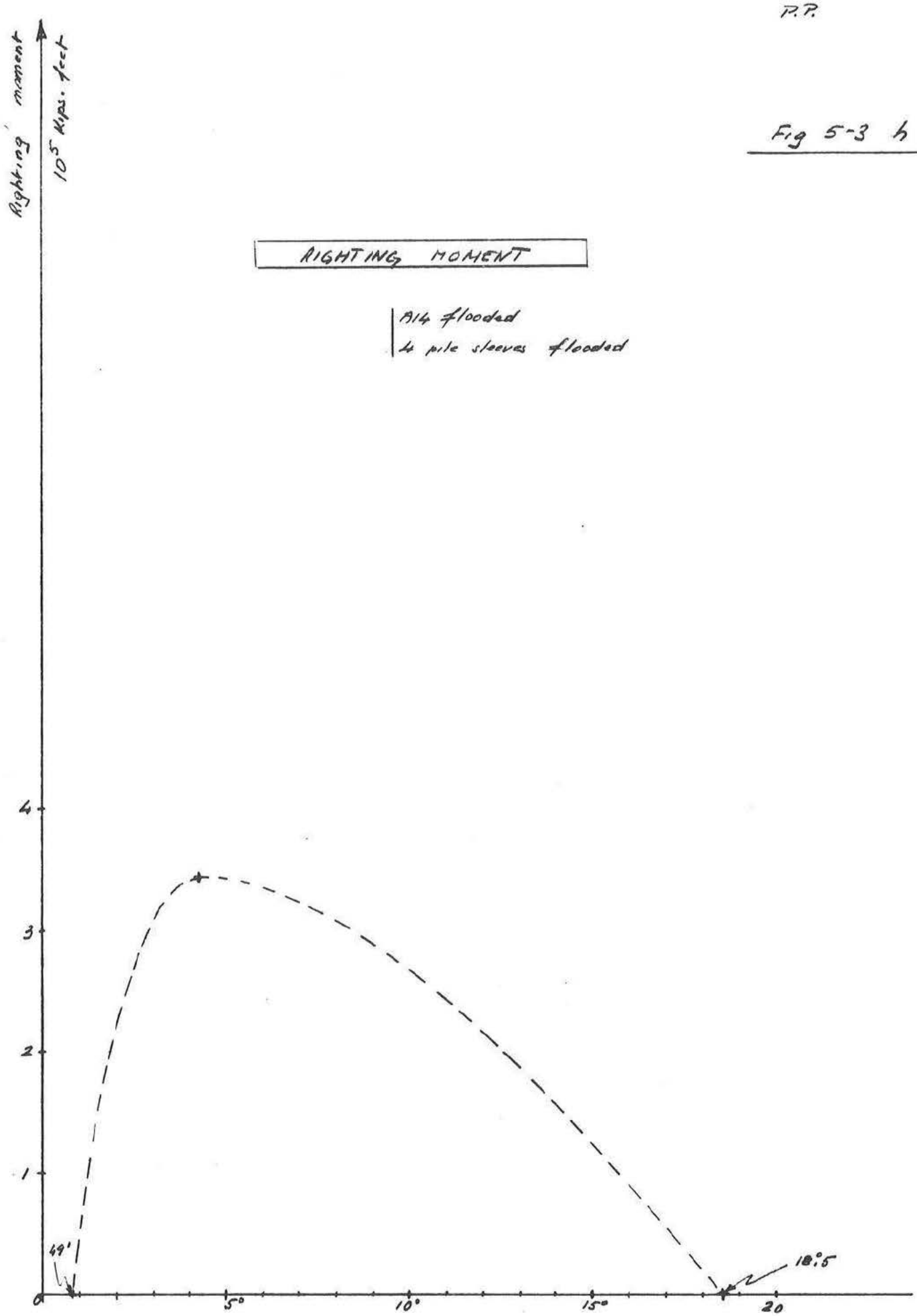

Righting moment
10^5 kips · feet
RIGHTING MOMENT
B14 flooded
4 pile sleeves flooded
4
3
2
1
0
49'
18°.5
5°
10°
15°
20

Fig 5-3 L

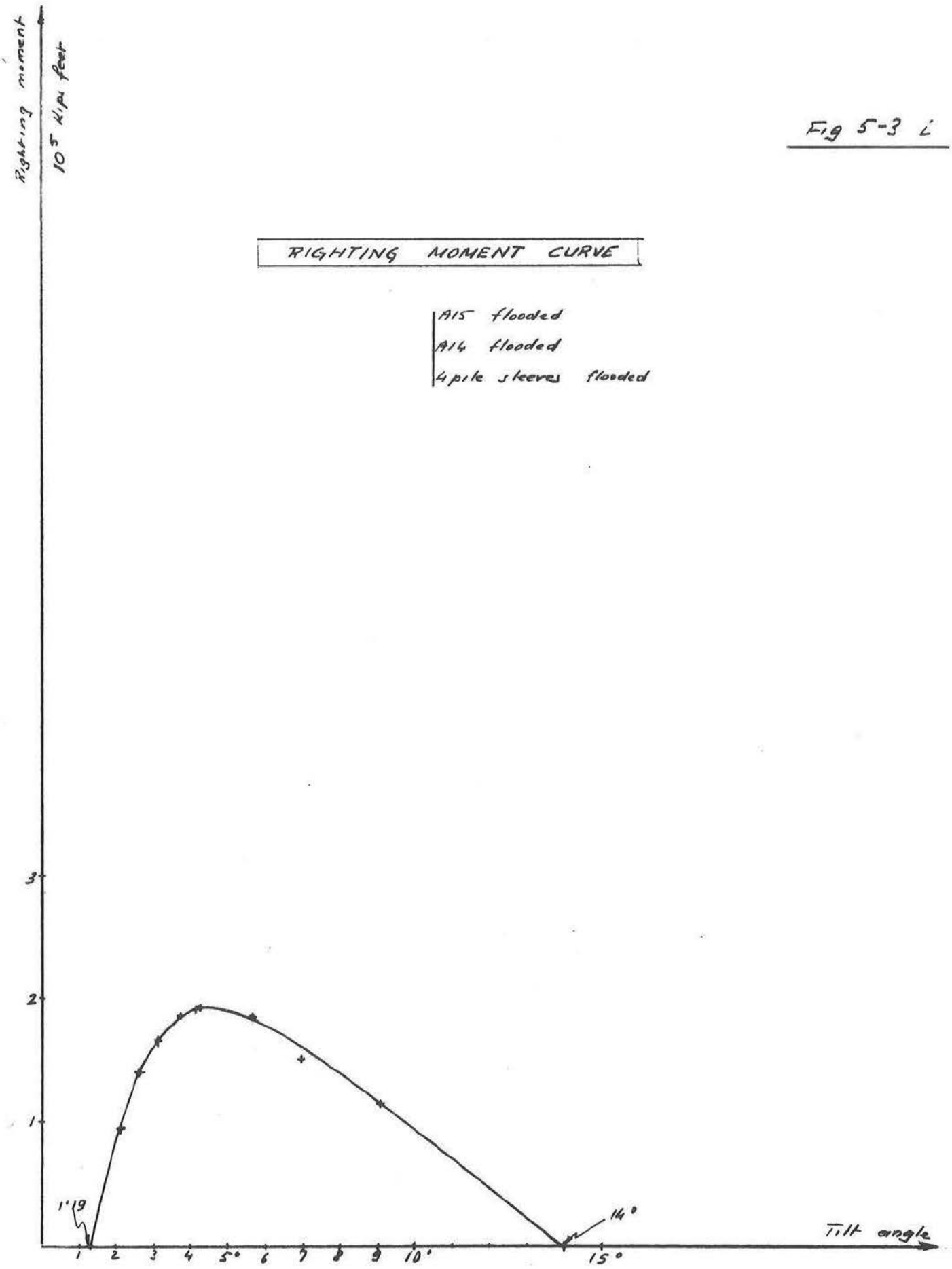
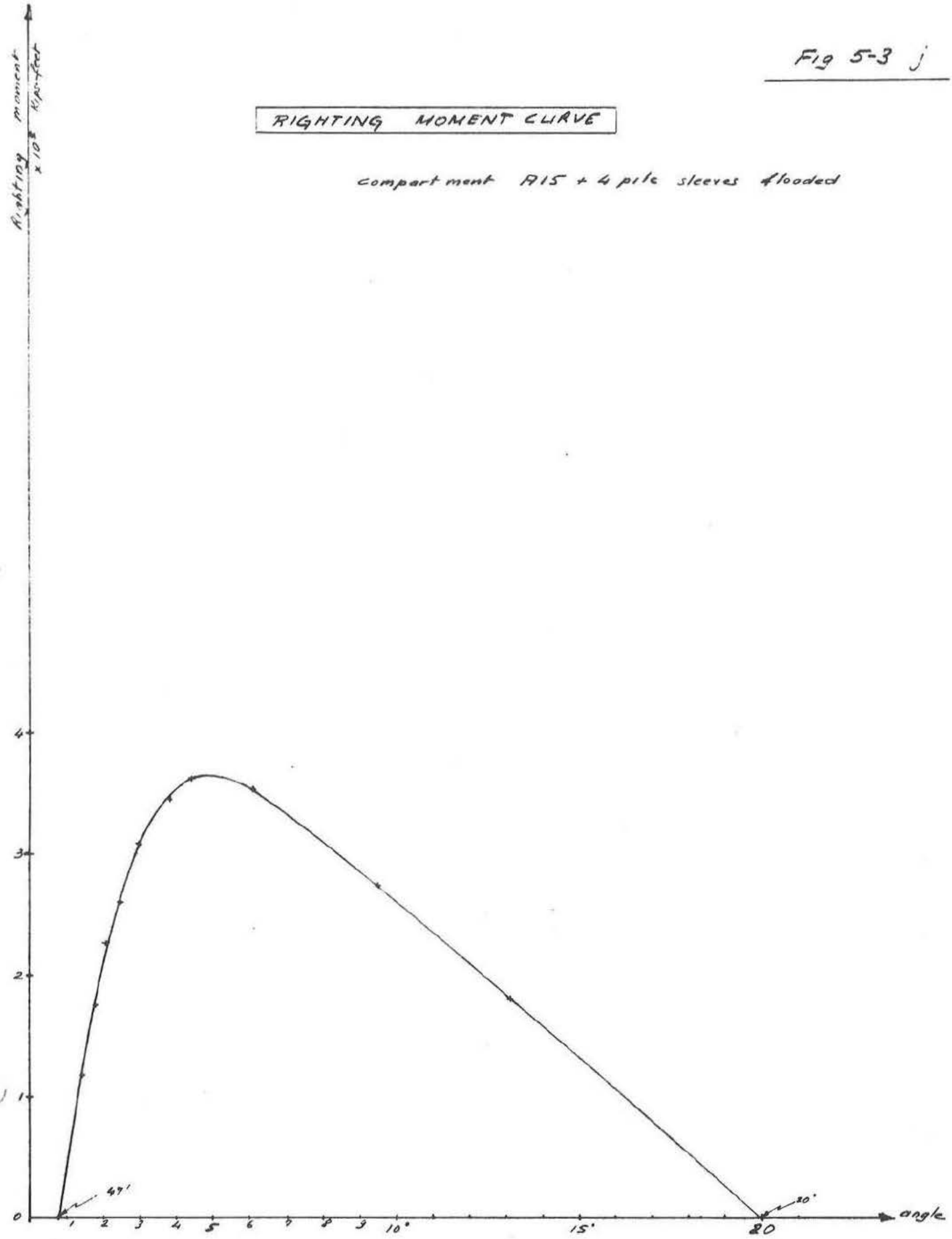

Righting moment
10^5 kip feet
RIGHTING MOMENT CURVE
A15 flooded
A14 flooded
4 pile sleeves flooded
3
2
1
1°19
14°
Tilt angle
1
2
3
4
5°
6
7
8
9
10°
15°

Fig 5-3 j

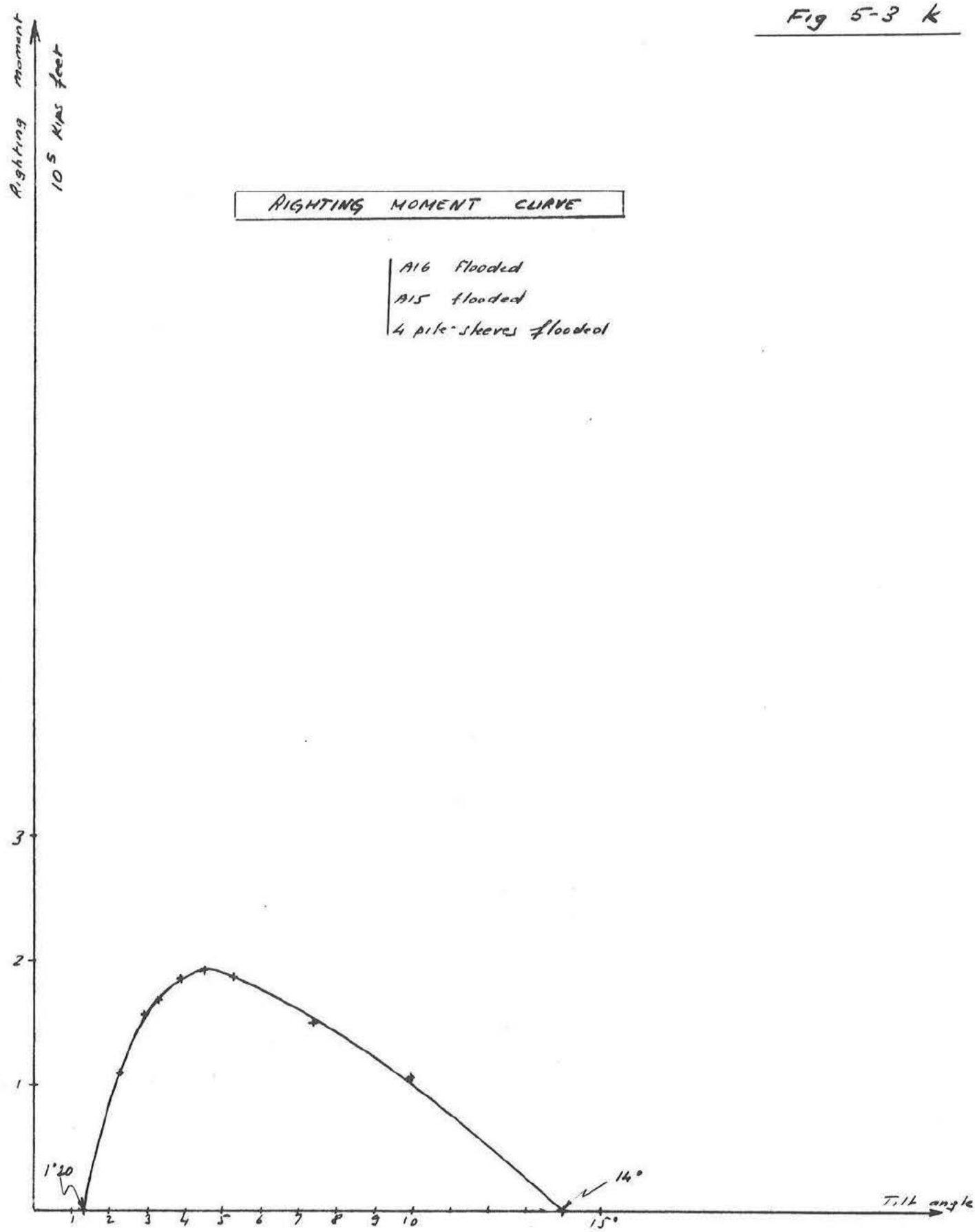
RIGHTING MOMENT CURVE

compartment A15 + 4 pile sleeves flooded



P.P.

Fig 5-3 k


Righting moment
10 5 kips feet
RIGHTING MOMENT CURVE
A16 flooded
A15 flooded
4 pile-sleeves flooded
3
2
1
1°20
14°
Tilt angle
1
2
3
4
5
6
7
8
9
10
15°

P. P.

Fig 5-3 L

TRIGHTING MOMENT CURVE

A16 flooded

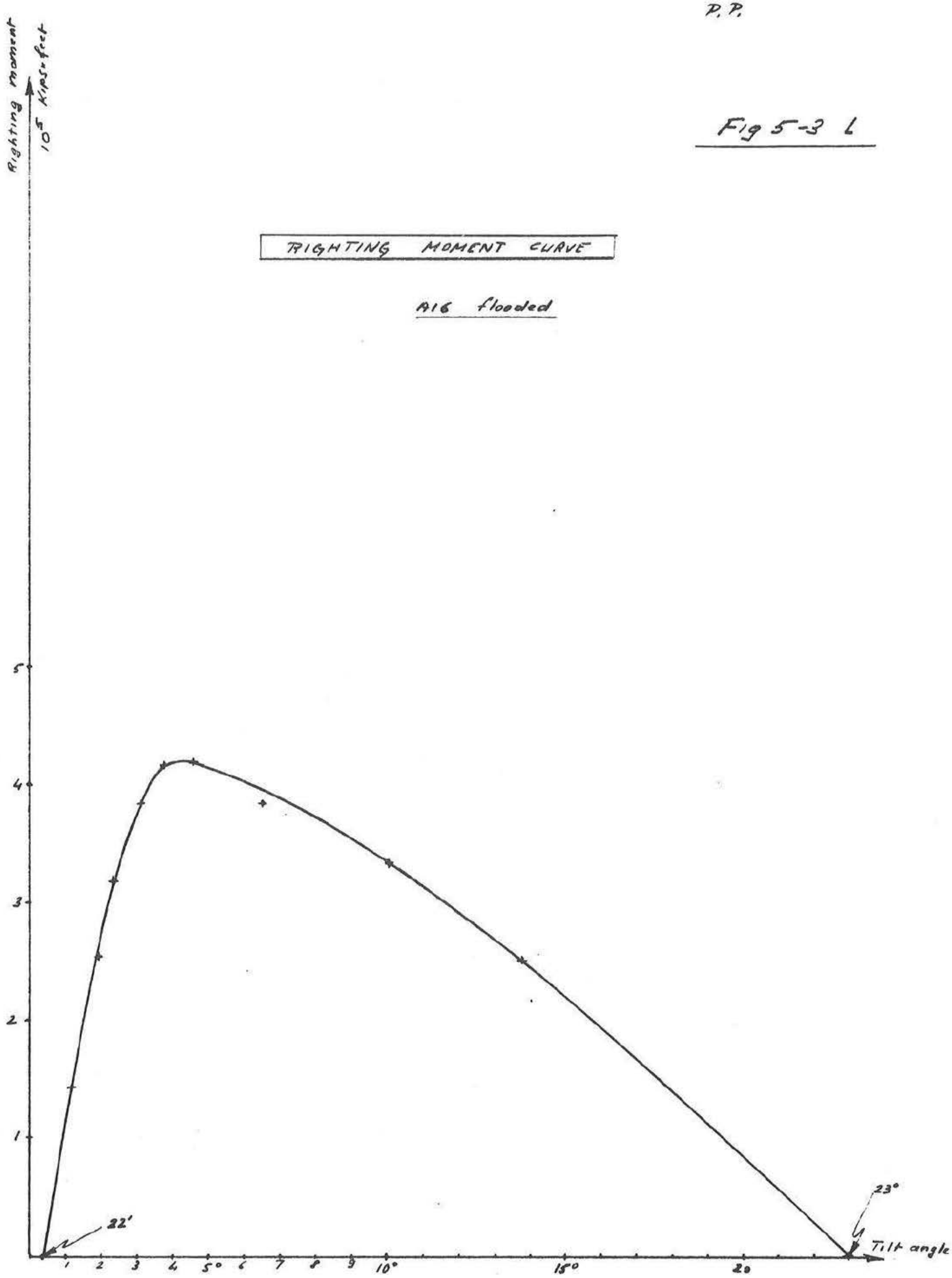
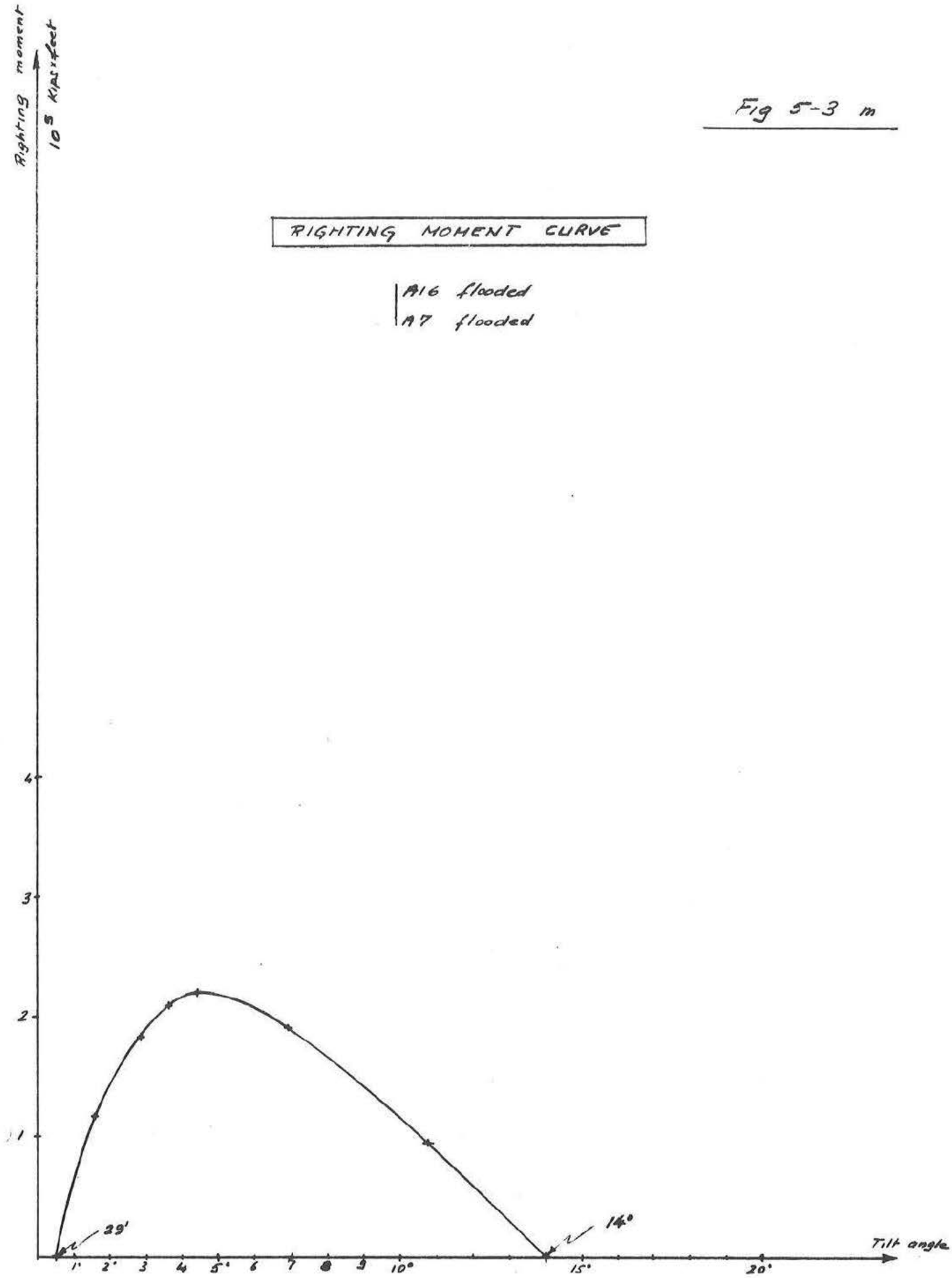


Fig 5-3 m


RIGHTING MOMENT CURVE
A16 flooded
A7 flooded
Righting moment
10^5 Kips×feet
4
3
2
1
29'
14°
Tilt angle
1°
2°
3
4
5°
6
7
8
9
10°
15°
20°

P.P.

Fig 5-3

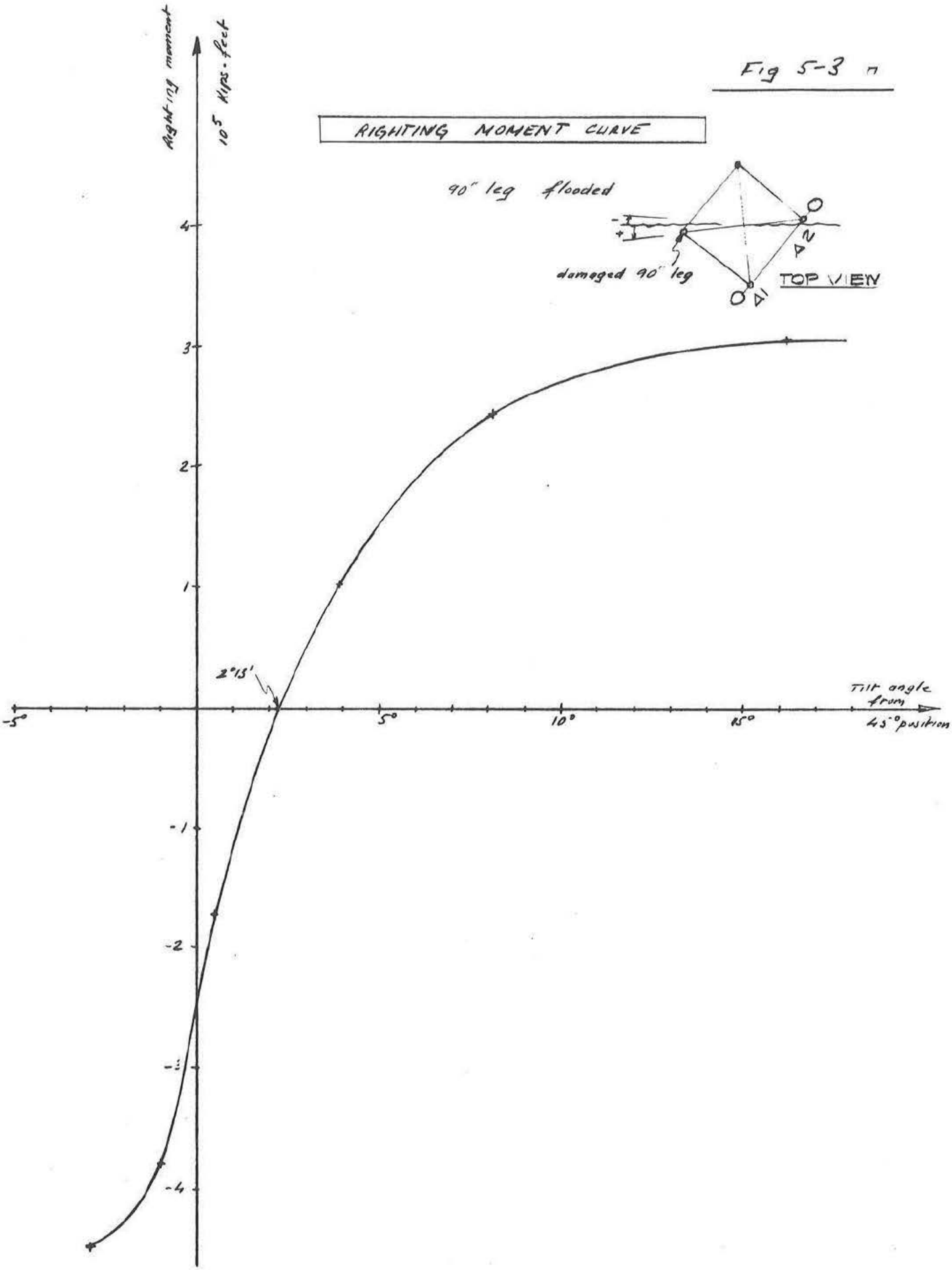
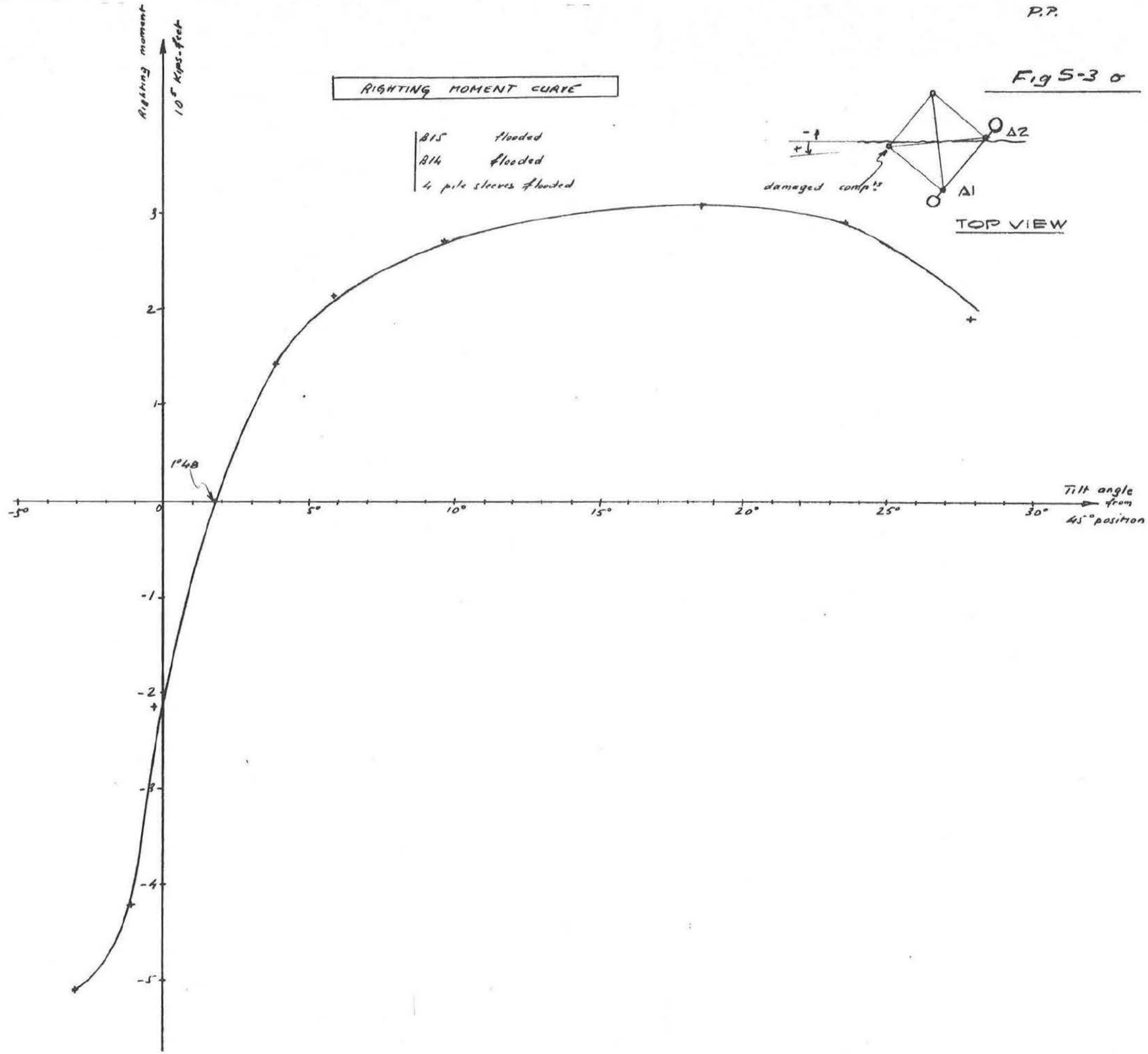

RIGHTING MOMENT CURVE
Righting moment
10^5 Kips-feet
90" leg flooded
damaged 90" leg
TOP VIEW
N
A
A1
2°15'
Tilt angle from 45° position
-5°
5°
10°
15°
4
3
2
1
-1
-2
-3
-4

Fig 5-3 a


RIGHTING MOMENT CURVE
B15 flooded
B14 flooded
4 pile sleeves flooded
Righting moment
10^5 Kips-feet
3
2
1
-1
-2
-3
-4
-5
1°48
-5°
0
5°
10°
15°
20°
25°
30°
Tilt angle from 45° position
-
+
damaged compt's
Δ2
Δ1
TOP VIEW

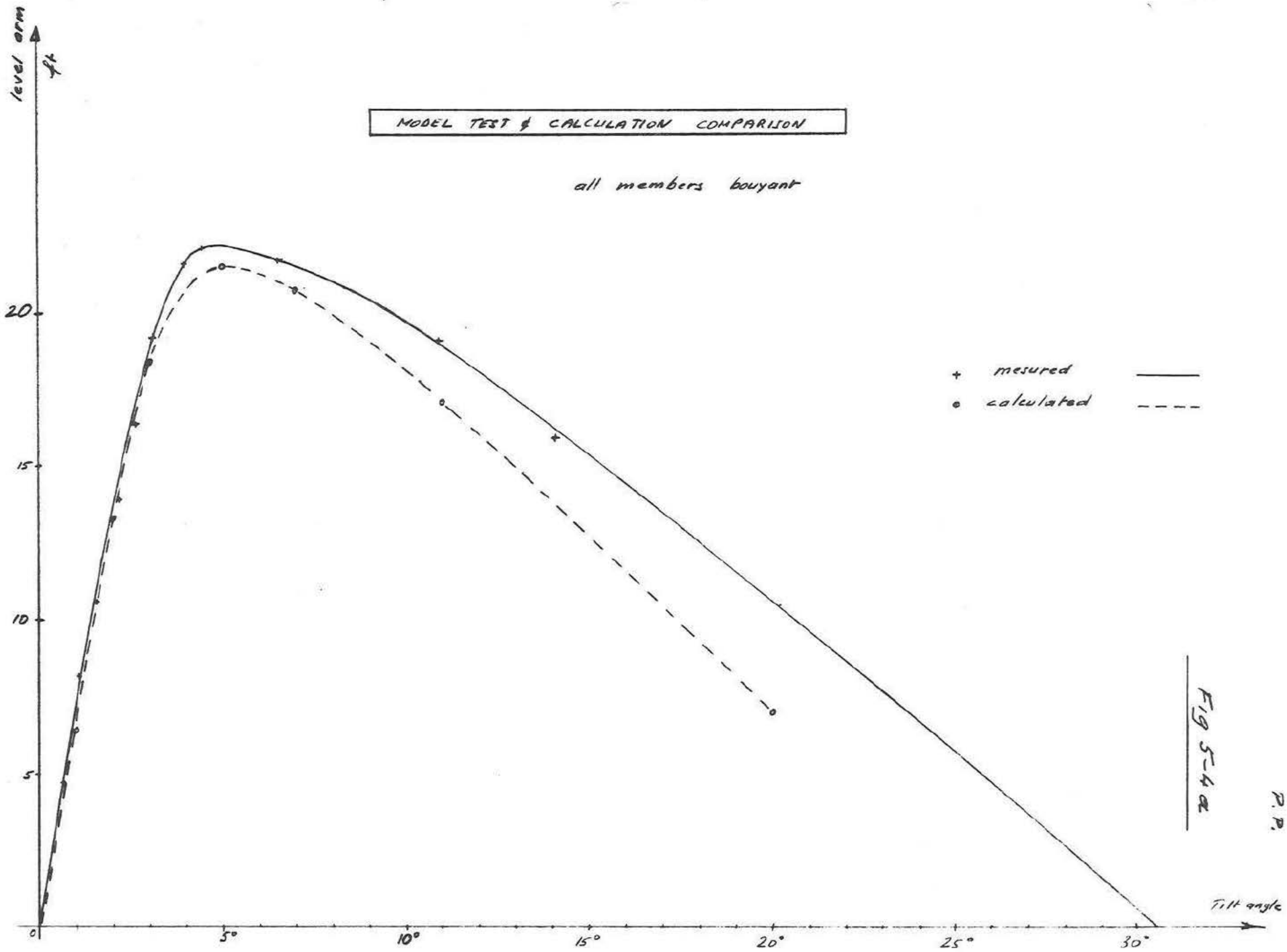

MODEL TEST & CALCULATION COMPARISON
all members bouyant
level arm
ft
20
15
10
5
0
5°
10°
15°
20°
25°
30°
Tilt angle
+ mesured
o calculated

Fig 5-4a

P.P.

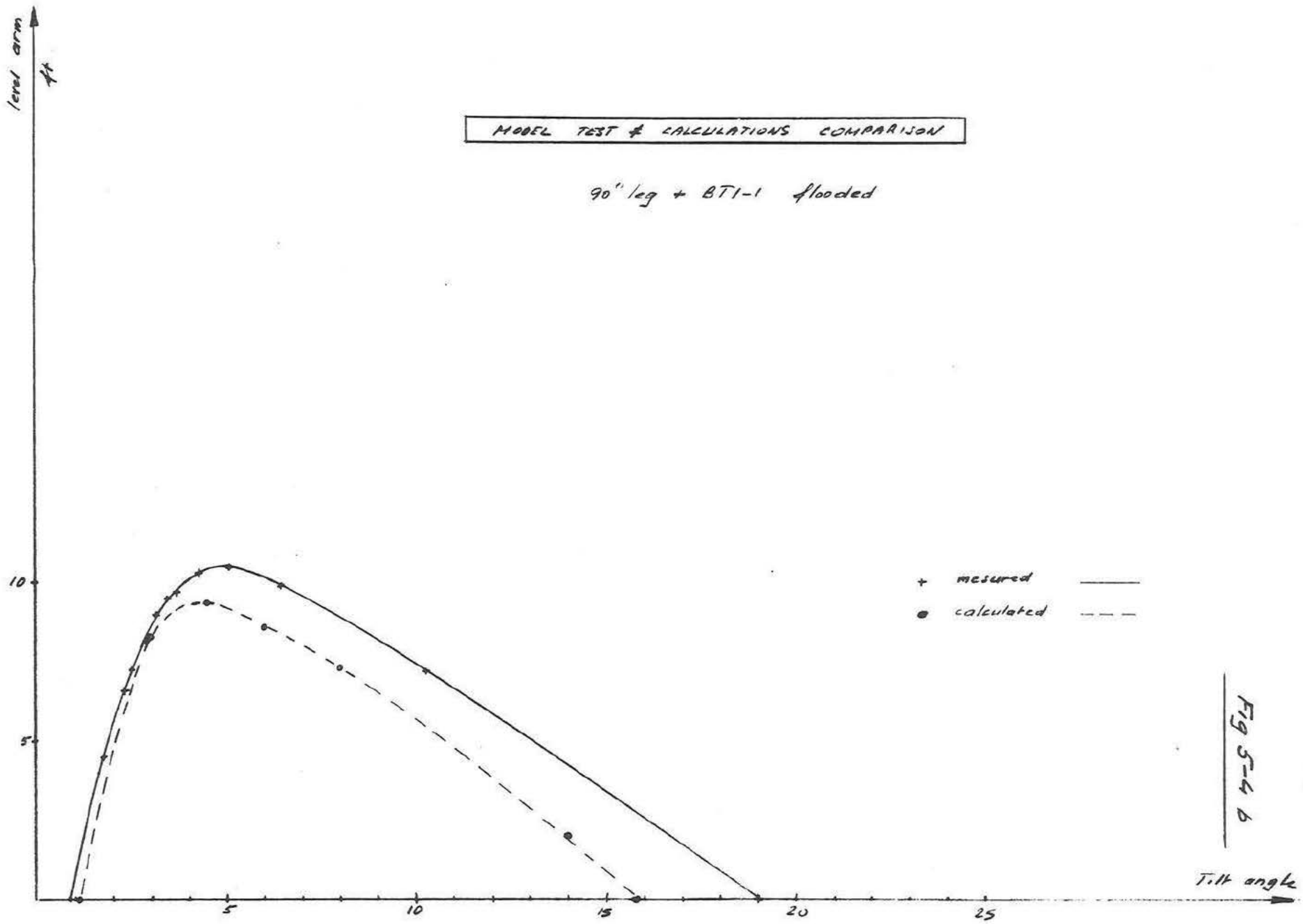

MODEL TEST & CALCULATIONS COMPARISON
90" leg + BT1-1 flooded
level arm
ft
10
5
5
10
15
20
25
Tilt angle
+ mesured
● calculated

Fig 5-4 b

p.2

MODEL TESTS - CALCULATIONS COMPARISON

BTI-1 + BTI-2 flooded

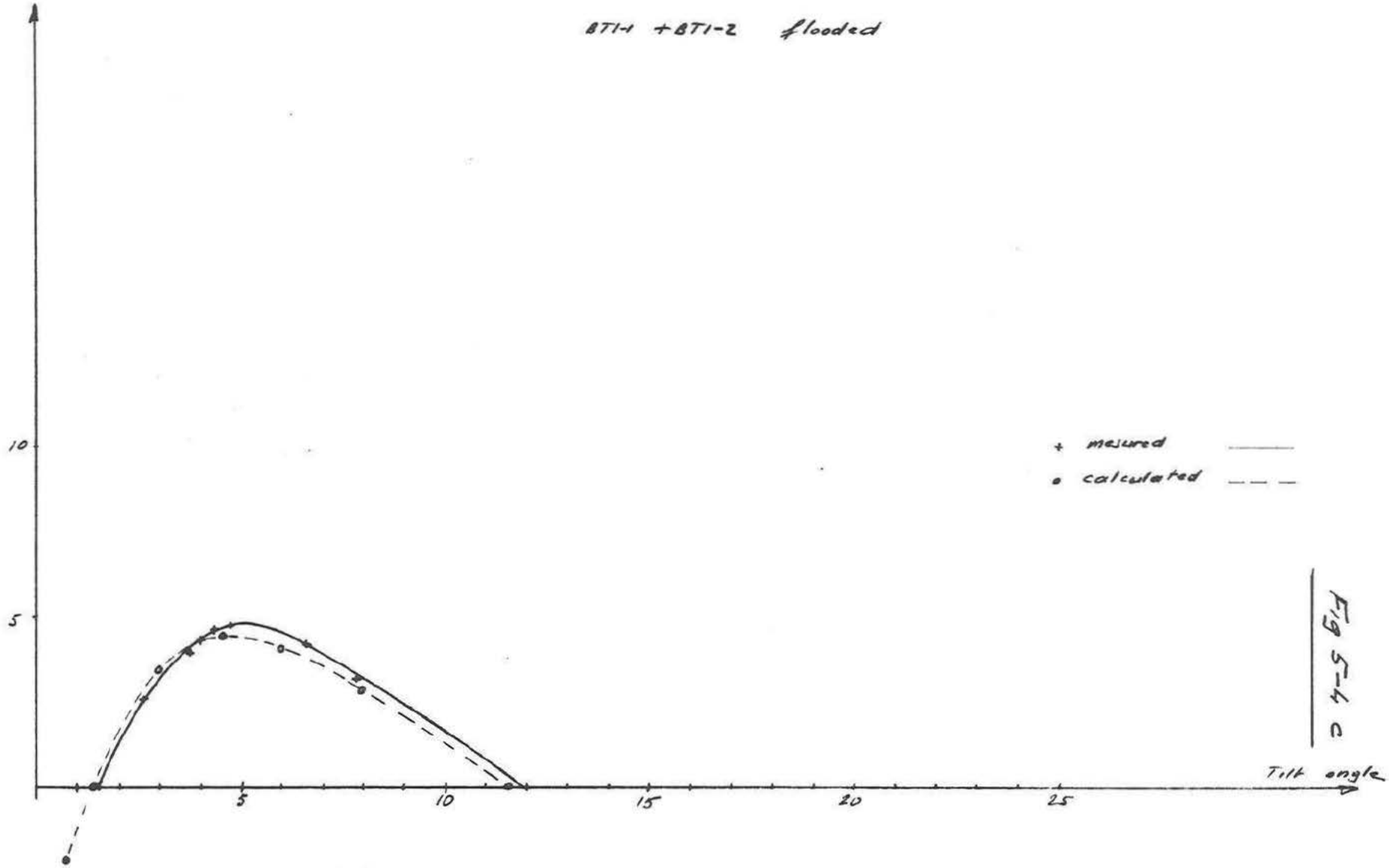


Fig 5-4 c

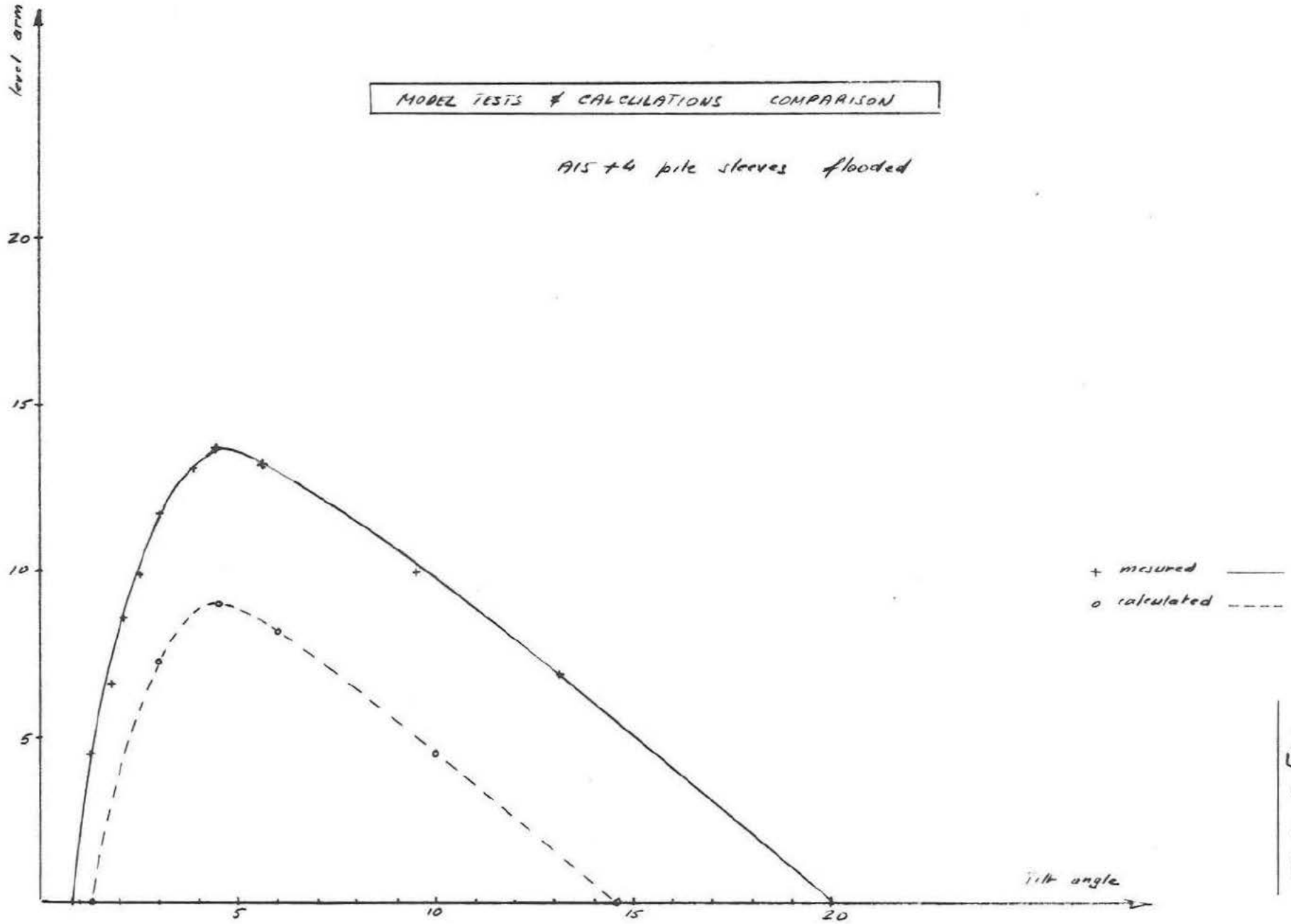

MODEL TESTS & CALCULATIONS COMPARISON
A15 + 4 pile sleeves flooded
level arm
20
15
10
5
5
10
15
20
tilt angle
+ measured
o calculated

Fig 5-4 a

P.2

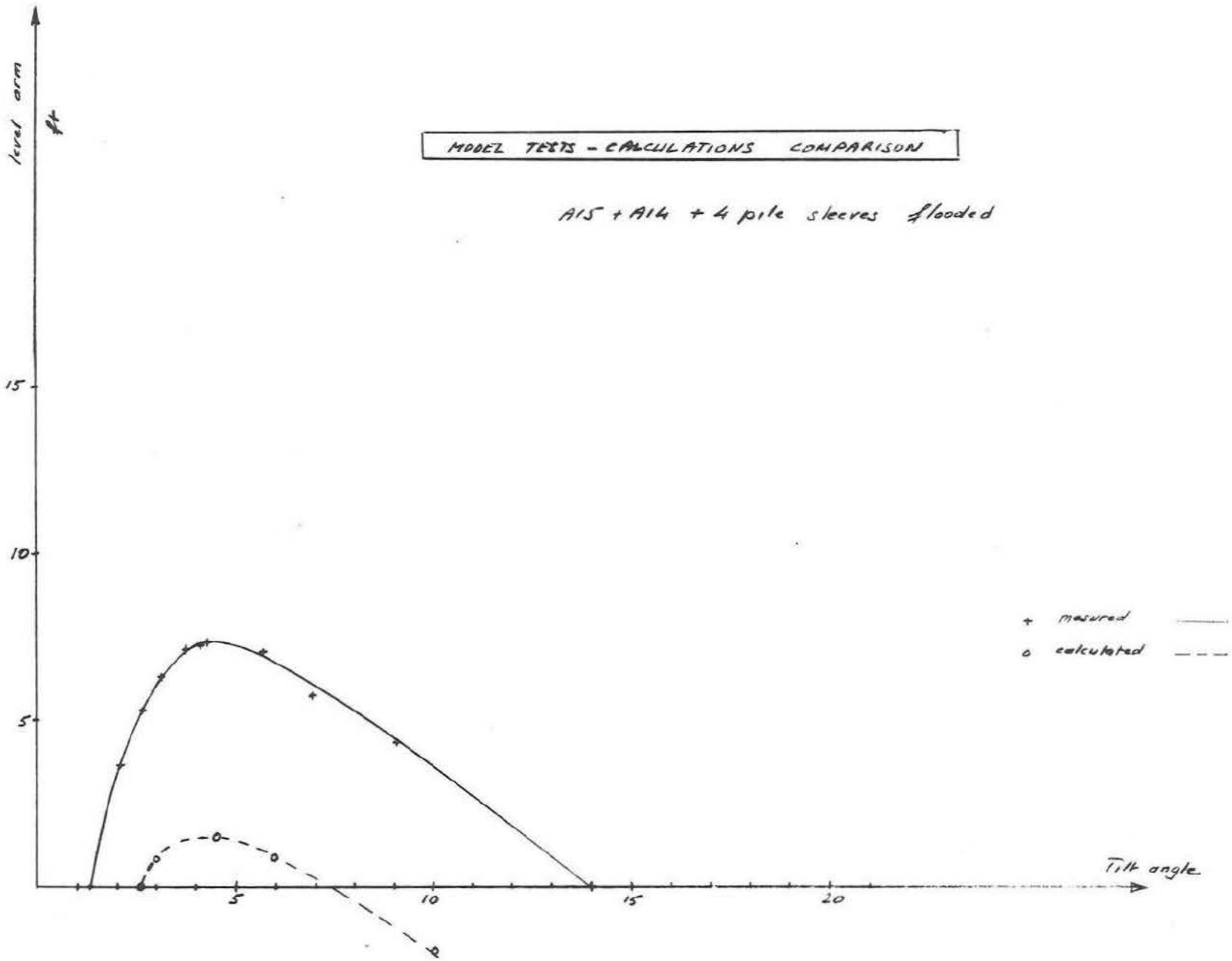

MODEL TESTS - CALCULATIONS COMPARISON
A15 + A14 + 4 pile sleeves flooded
level arm
ft
15
10
5
5
10
15
20
Tilt angle
+ measured
o calculated

Fig 5-4 e

MODEL TESTS & CALCULATIONS COMPARISON

A16 flooded

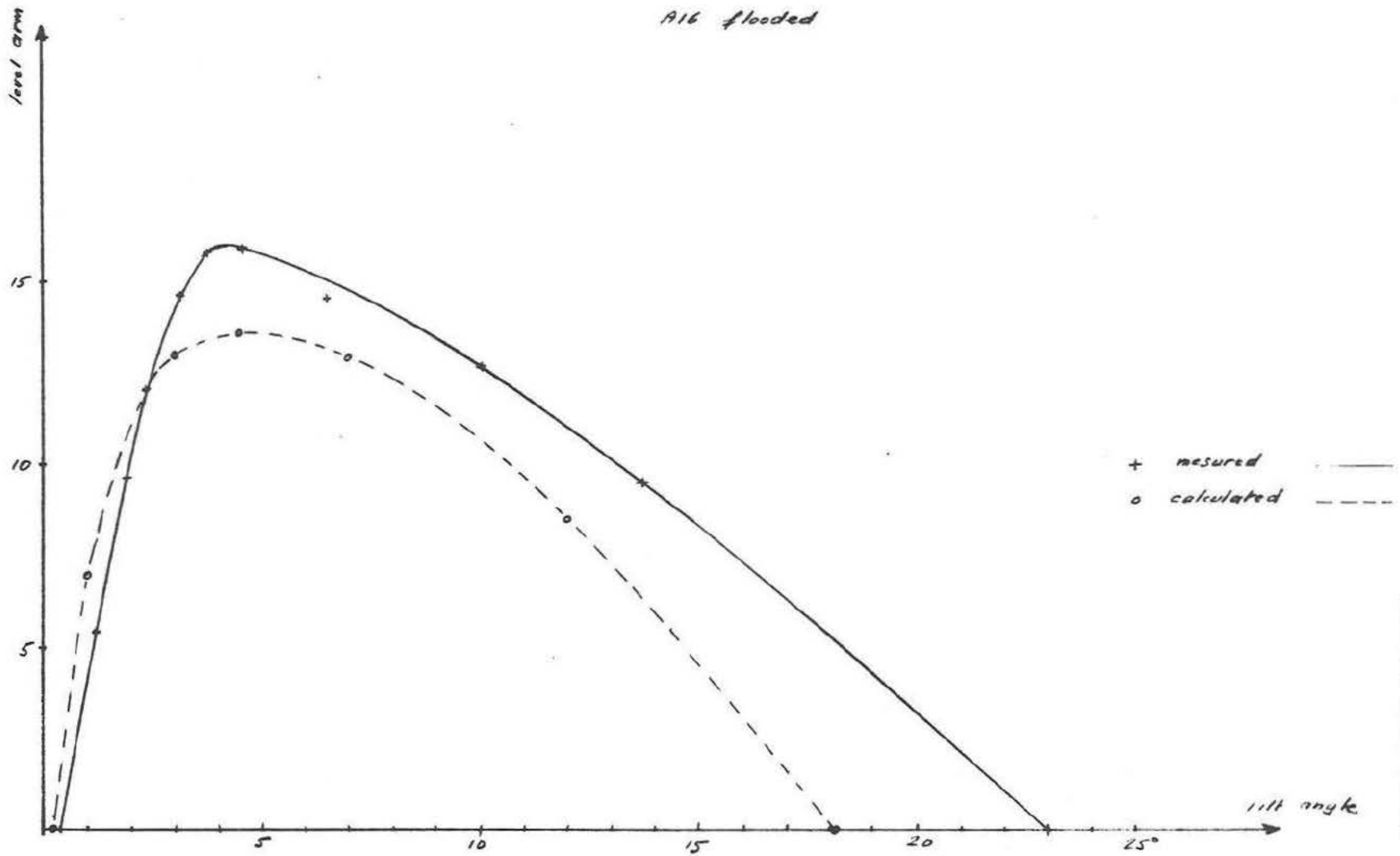


Fig 5-4 b

MODEL TESTS & CALCULATIONS COMPARISON

A16 + A7 flooded

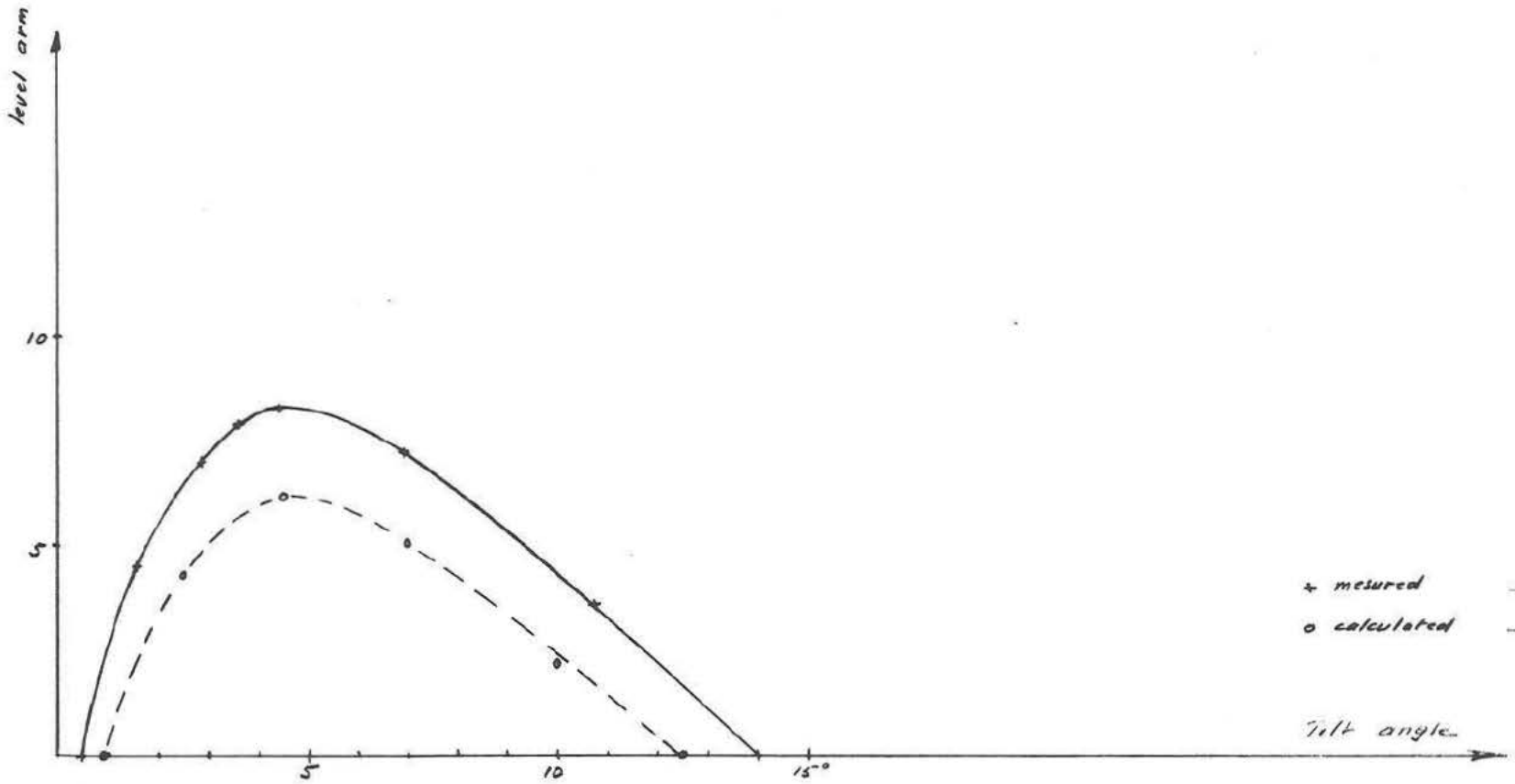


Fig 5-4 B

F.F.

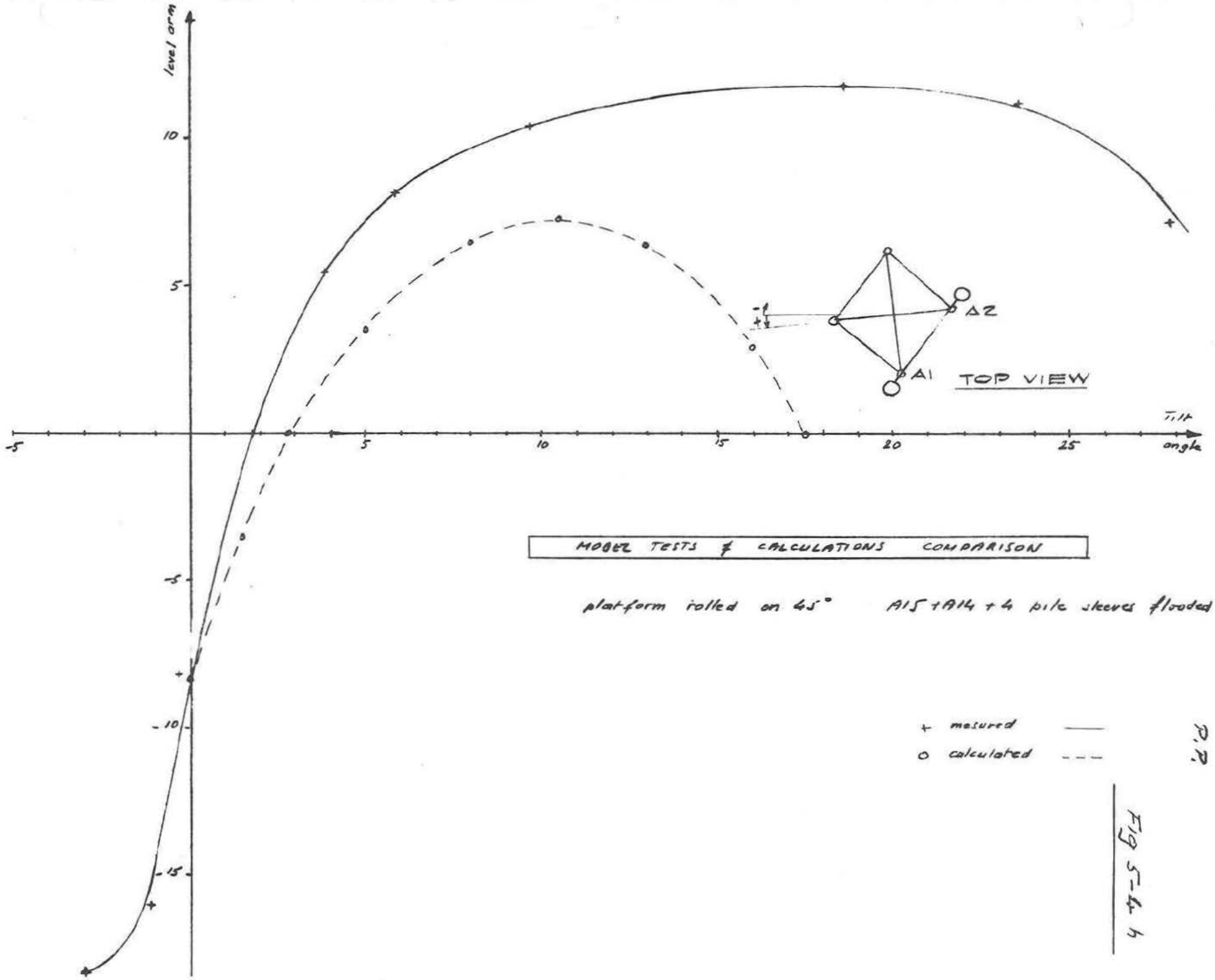

level arm
10
5
-5
-10
-15
-5
5
10
15
20
25
Tilt angle
A2
A1
TOP VIEW
MODEL TESTS & CALCULATIONS COMPARISON
platform rolled on 45°
A15 + A14 + 4 pile sleeves flooded
+ measured
o calculated

Fig 5-4 4

P.2.

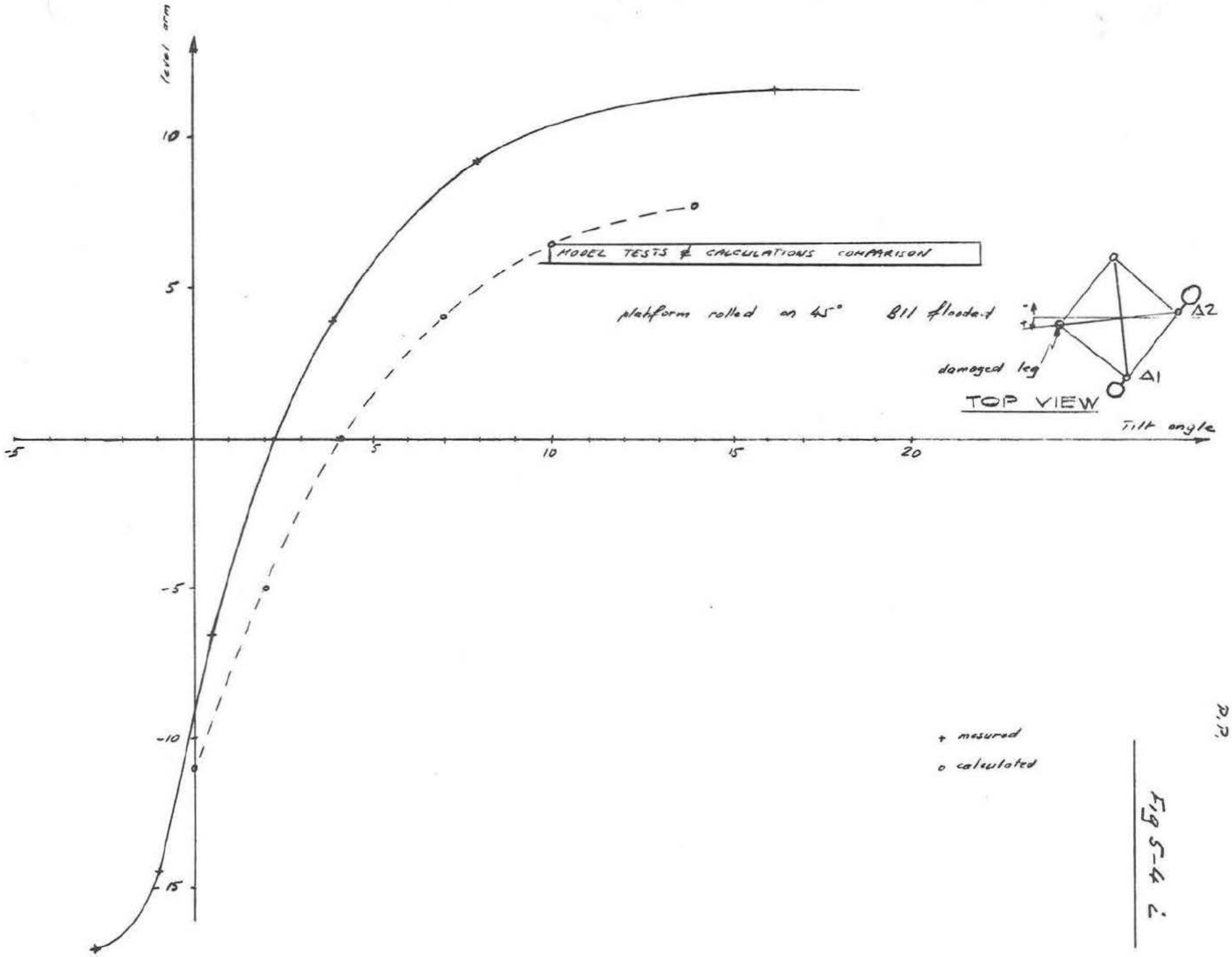

level arm
10
5
-5
-10
-15
-5
5
10
15
20
Tilt angle
MODEL TESTS & CALCULATIONS COMPARISON
platform rolled on 45°
B11 flooded
damaged leg
Δ1
Δ2
TOP VIEW
+ mesured
o calculated

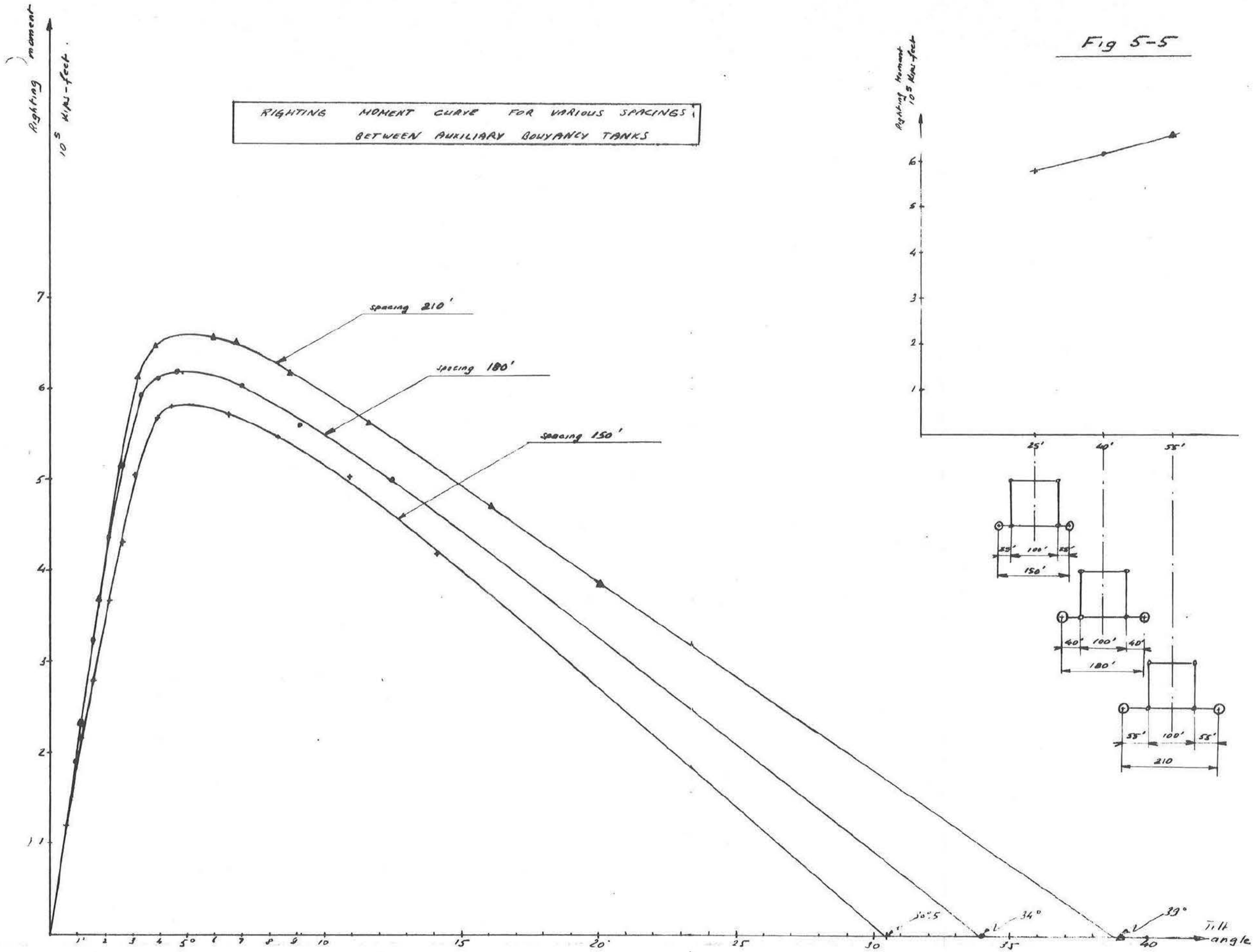
Fig 5-4 c

p.12

P.P.

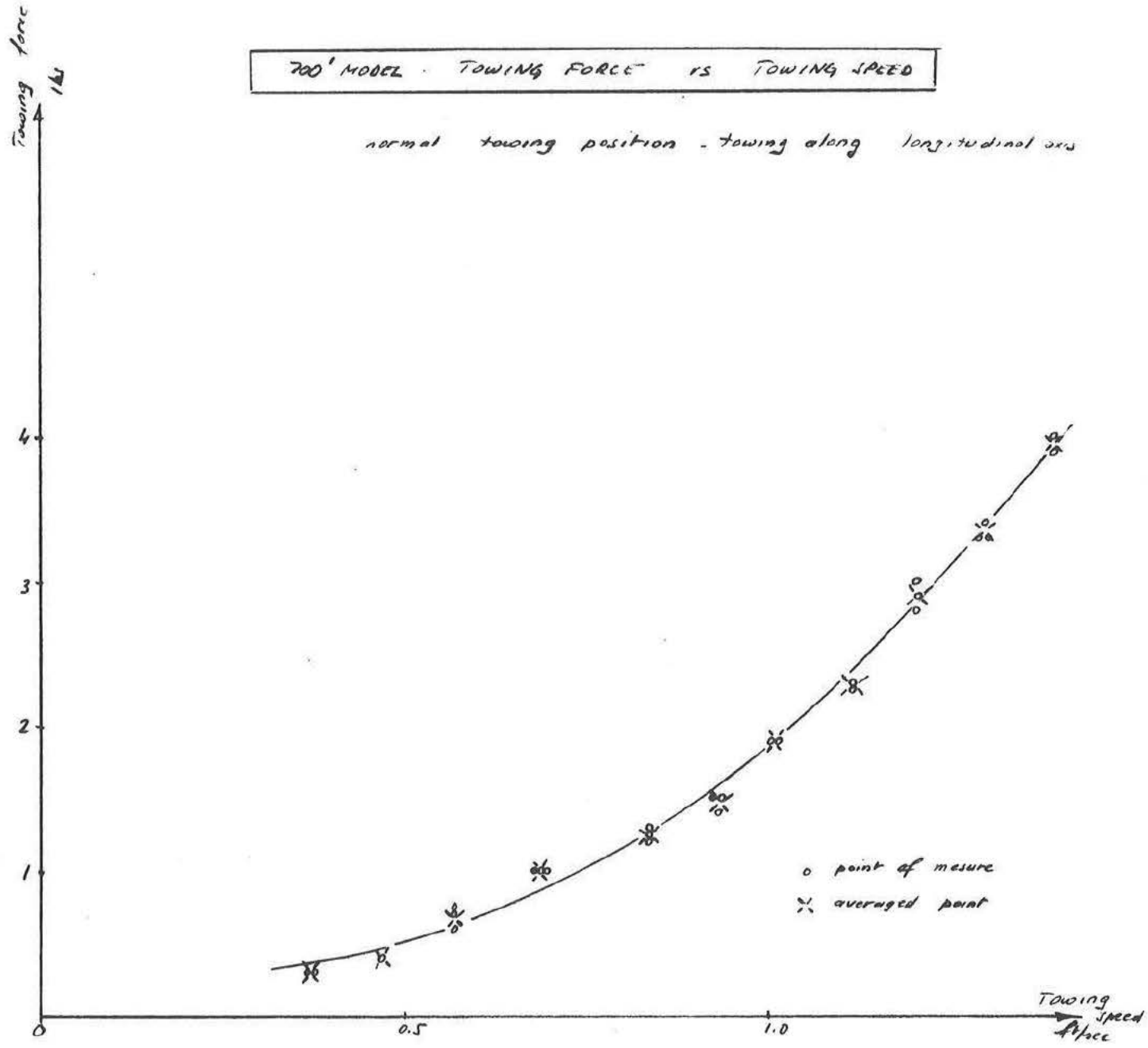
Fig 5-5

RIGHTING MOMENT CURVE FOR VARIOUS SPACINGS BETWEEN AUXILIARY BOUYANCY TANKS



P.P.

Fig 6-2 a

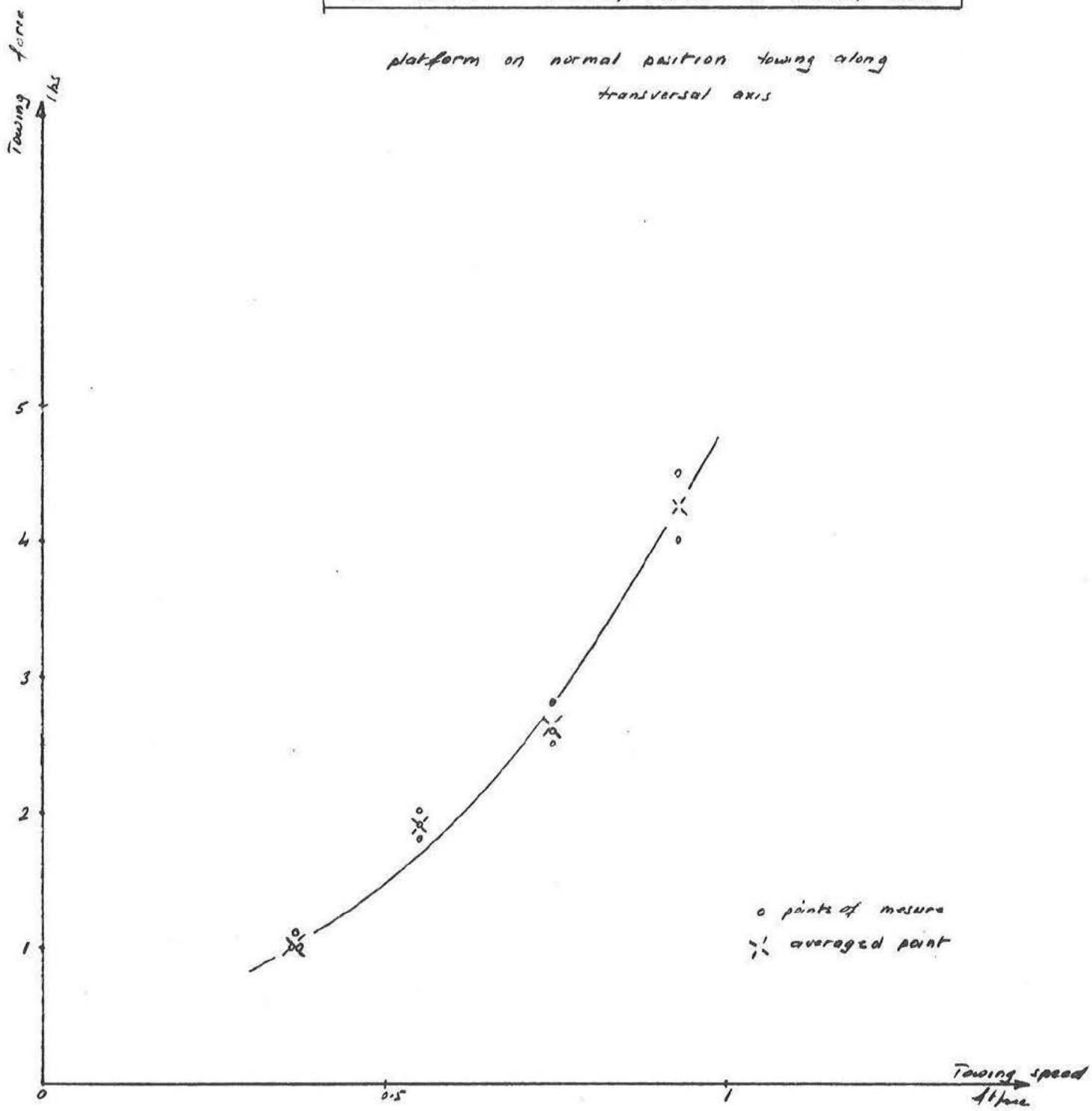

700' MODEL . TOWING FORCE vs TOWING SPEED
normal towing position - towing along longitudinal axis
Towing force lbs
4
3
2
1
0
0.5
1.0
Towing speed ft/sec
o point of mesure
x averaged point

P.P.

Fig 6-2 b

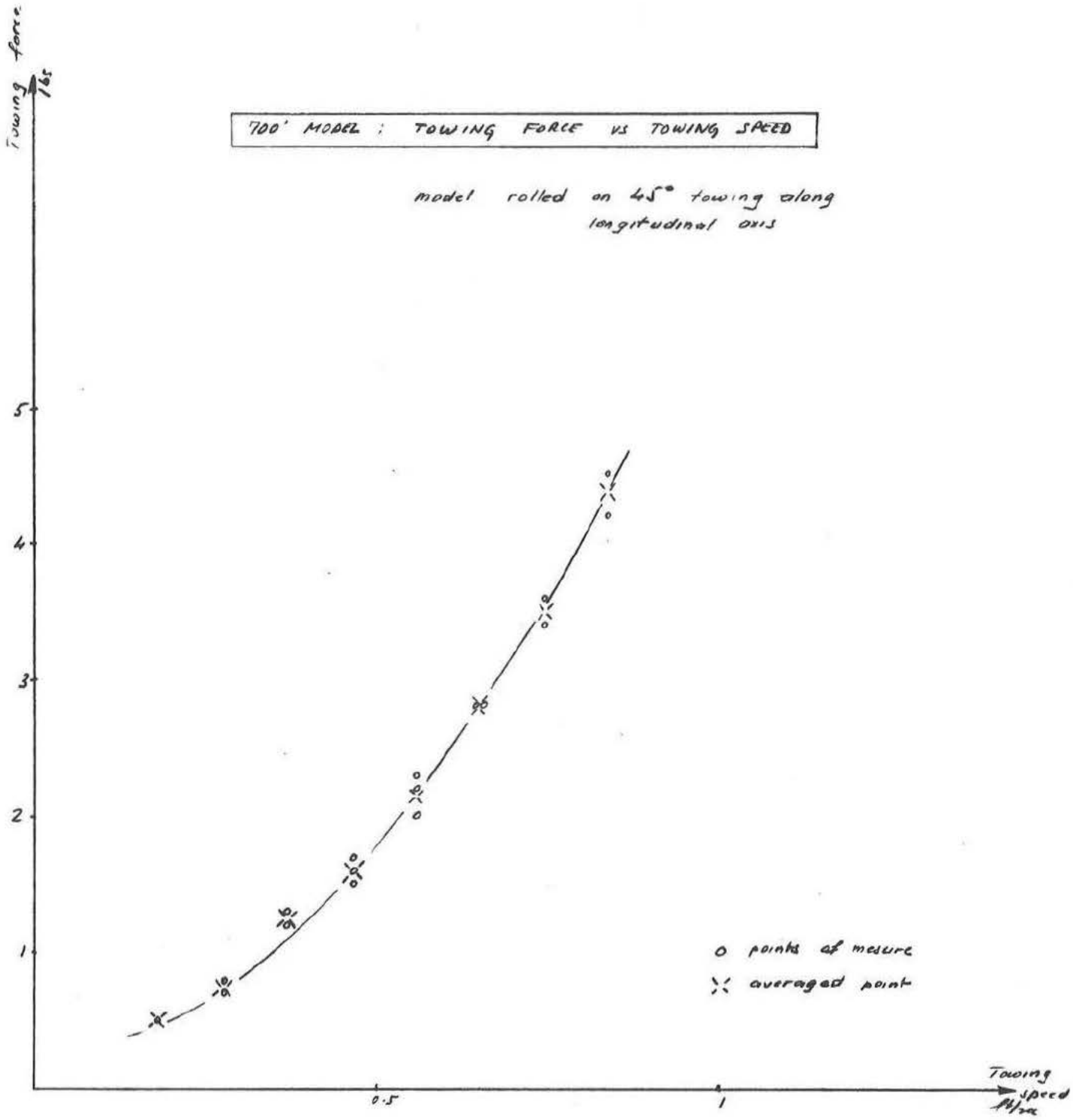
700' MODEL TOWING FORCE vs TOWING SPEED

platform on normal position towing along transversal axis



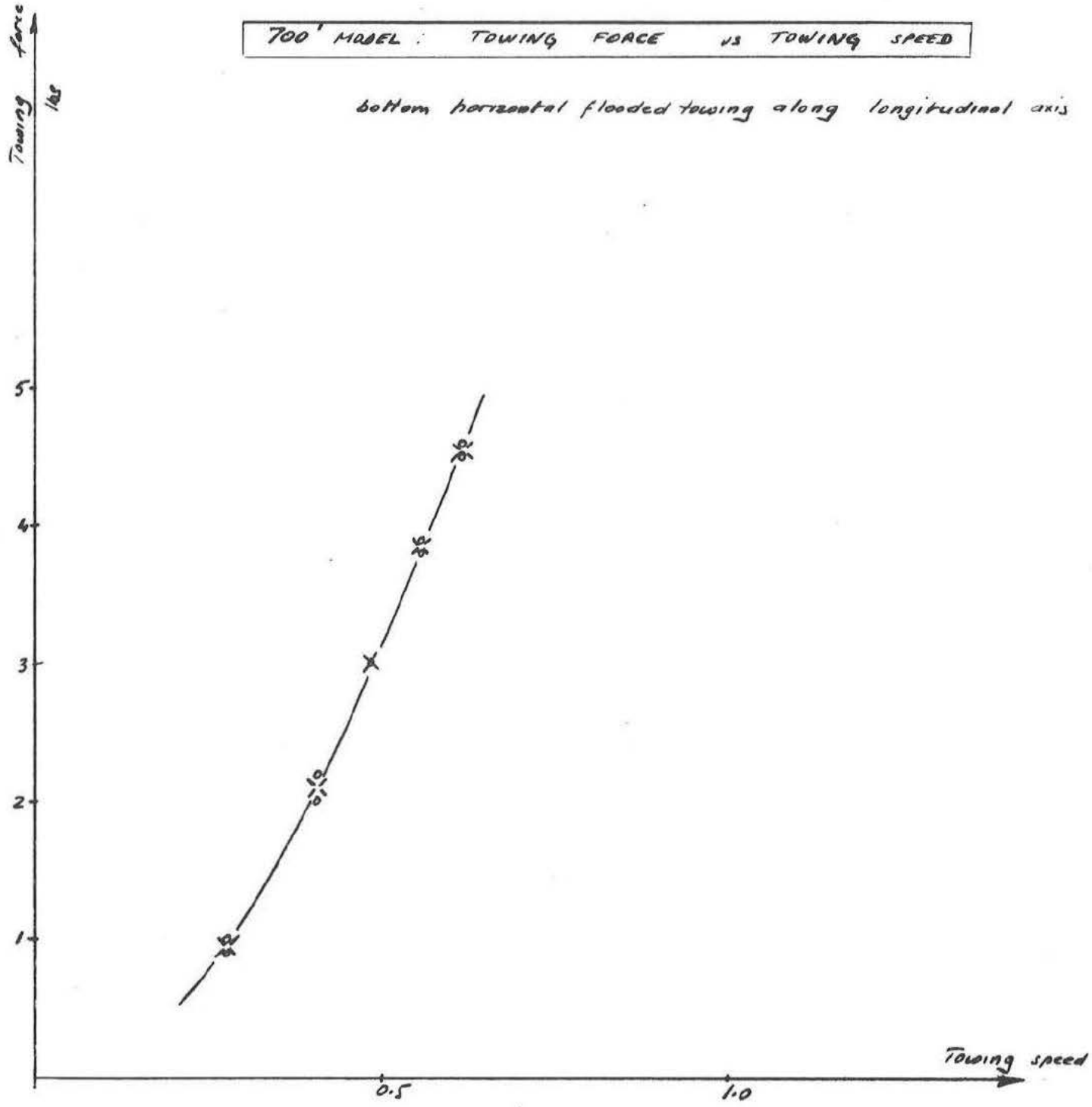
P.P.

Fig 6-2 c


700' MODEL : TOWING FORCE VS TOWING SPEED
model rolled on 45° towing along longitudinal axis
Towing force lbs
5
4
3
2
1
0.5
1
Towing speed ft/sec
o points of mesure
averaged point

P. P.

Fig 6-2 d

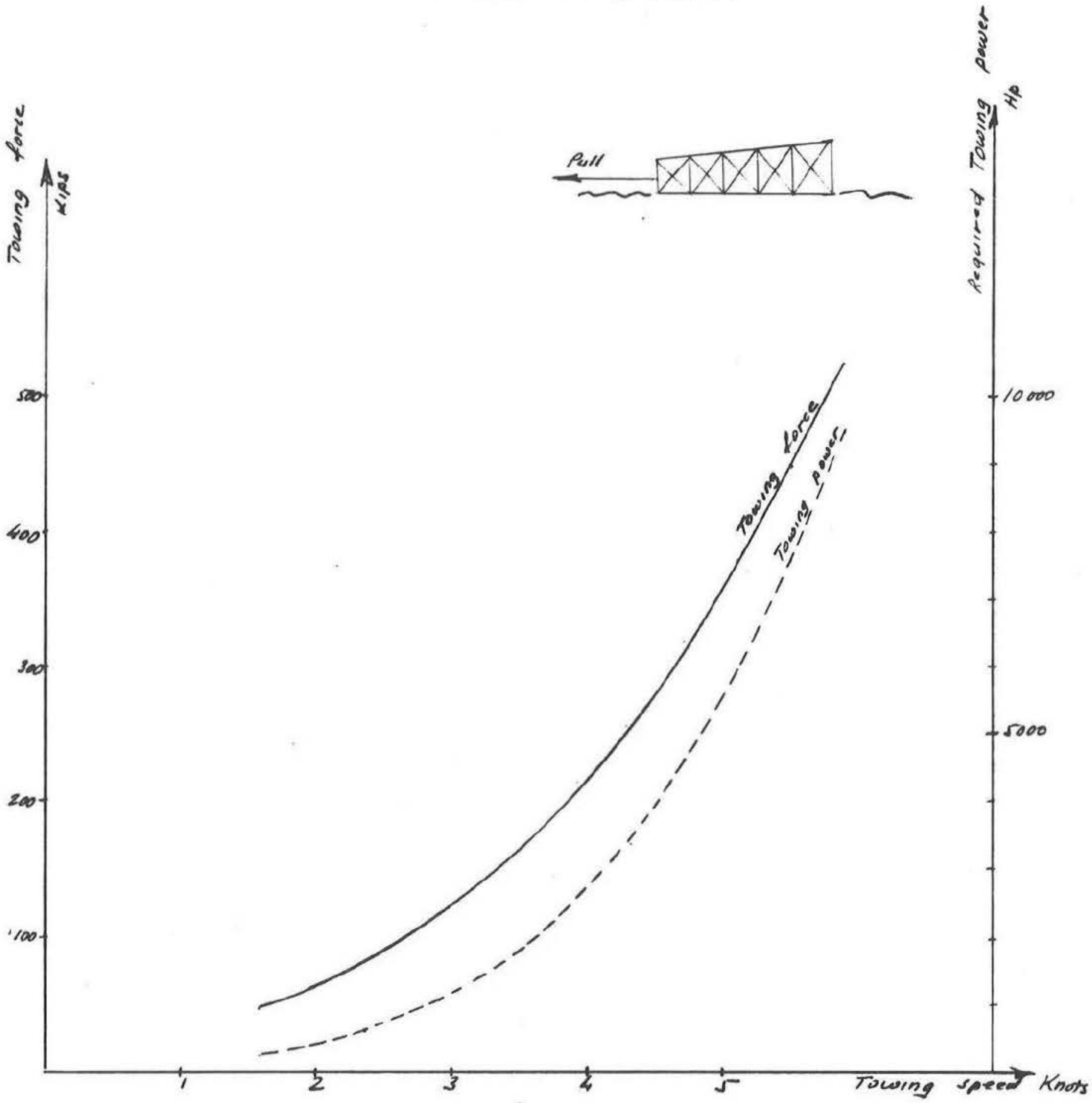

700' MODEL : TOWING FORCE vs TOWING SPEED
bottom horizontal flooded towing along longitudinal axis
Towing force
lbs
5
4
3
2
1
0.5
1.0
Towing speed

P.P.

Fig 6-3 a

700' PLATFORM . TOWING RESISTANCE

normal towing position

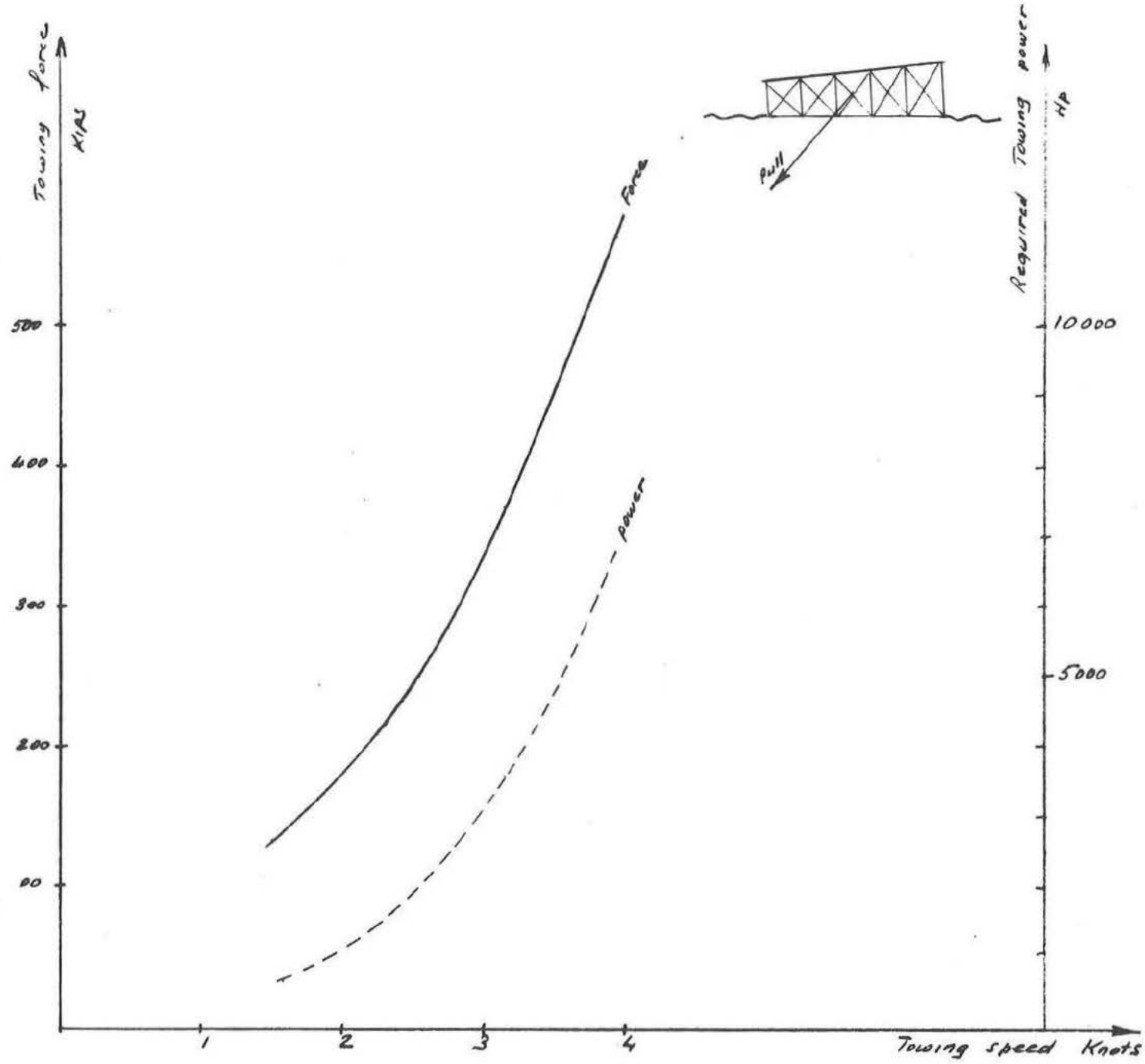


P.P.

Fig 6-3 b

700' PLATFORM - TOWING RESISTANCE

normal towing position towing along transversal axis



P.P.

Fig 6-3 c

700' PLATFORM TOWING RESISTANCE

platform rolled on 45°

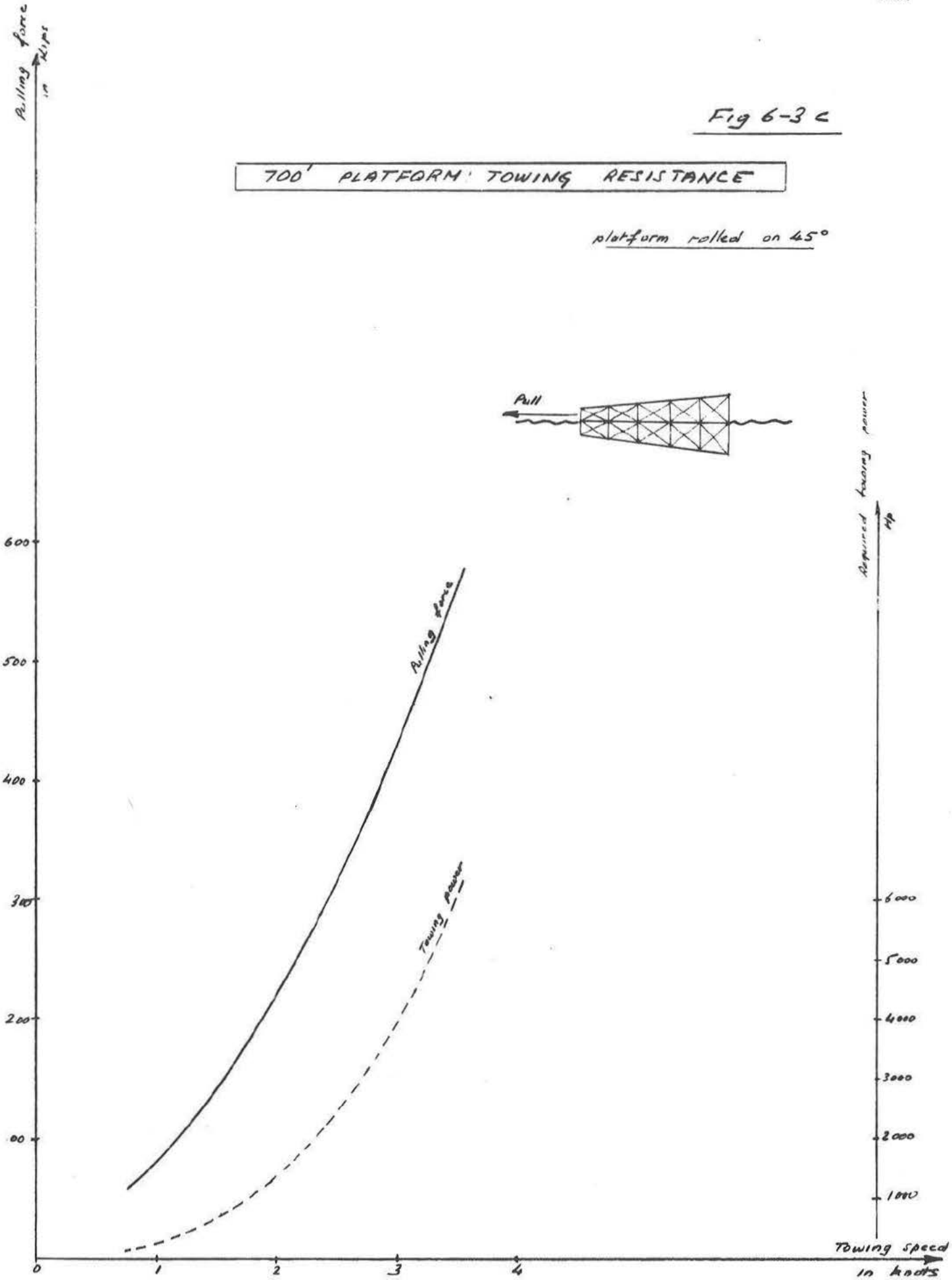


Fig 6-3 d

700' PLATFORM: TOWING RESISTANCE

bottom horizontal flooded
towing along longitudinal axis

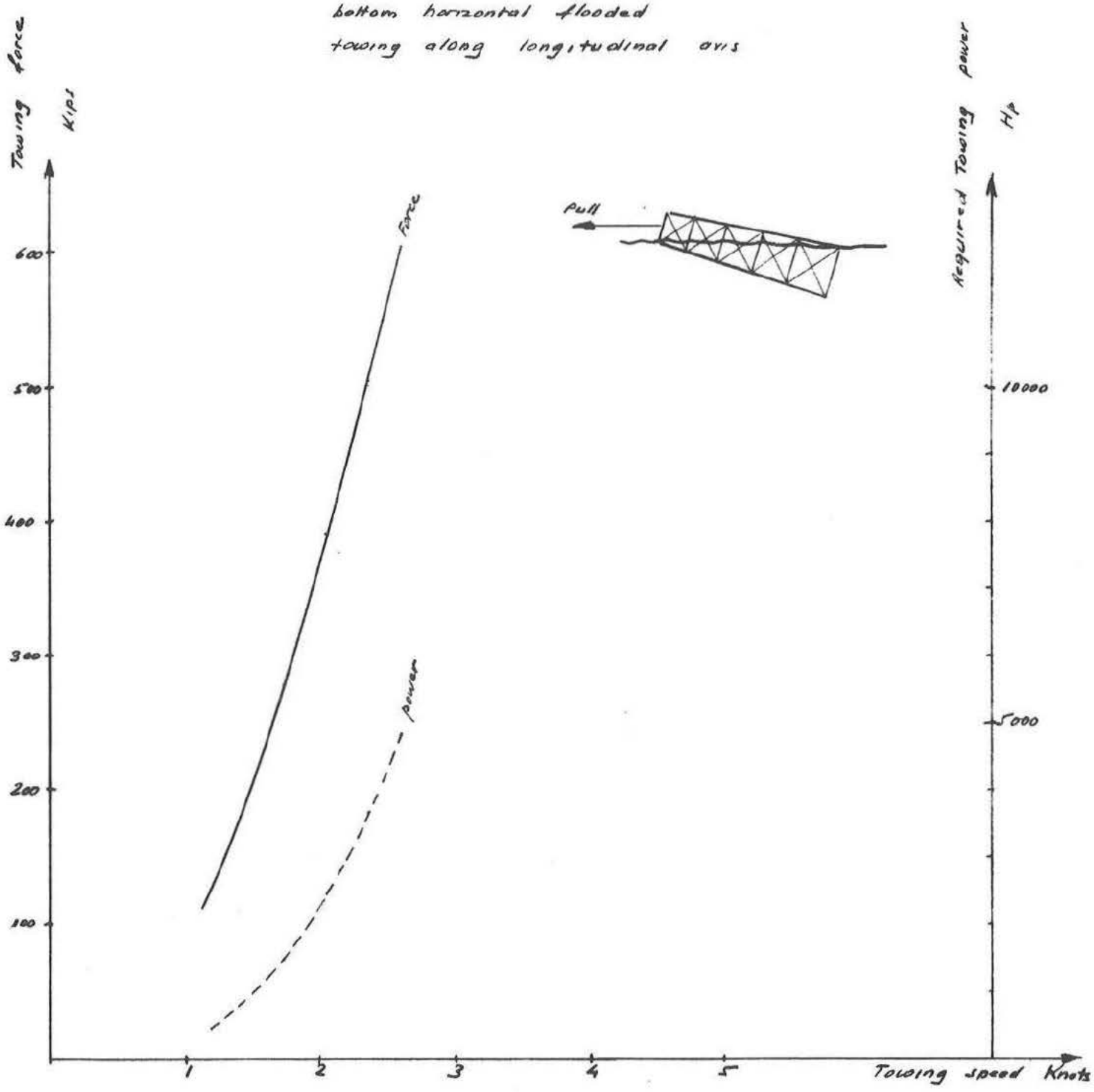
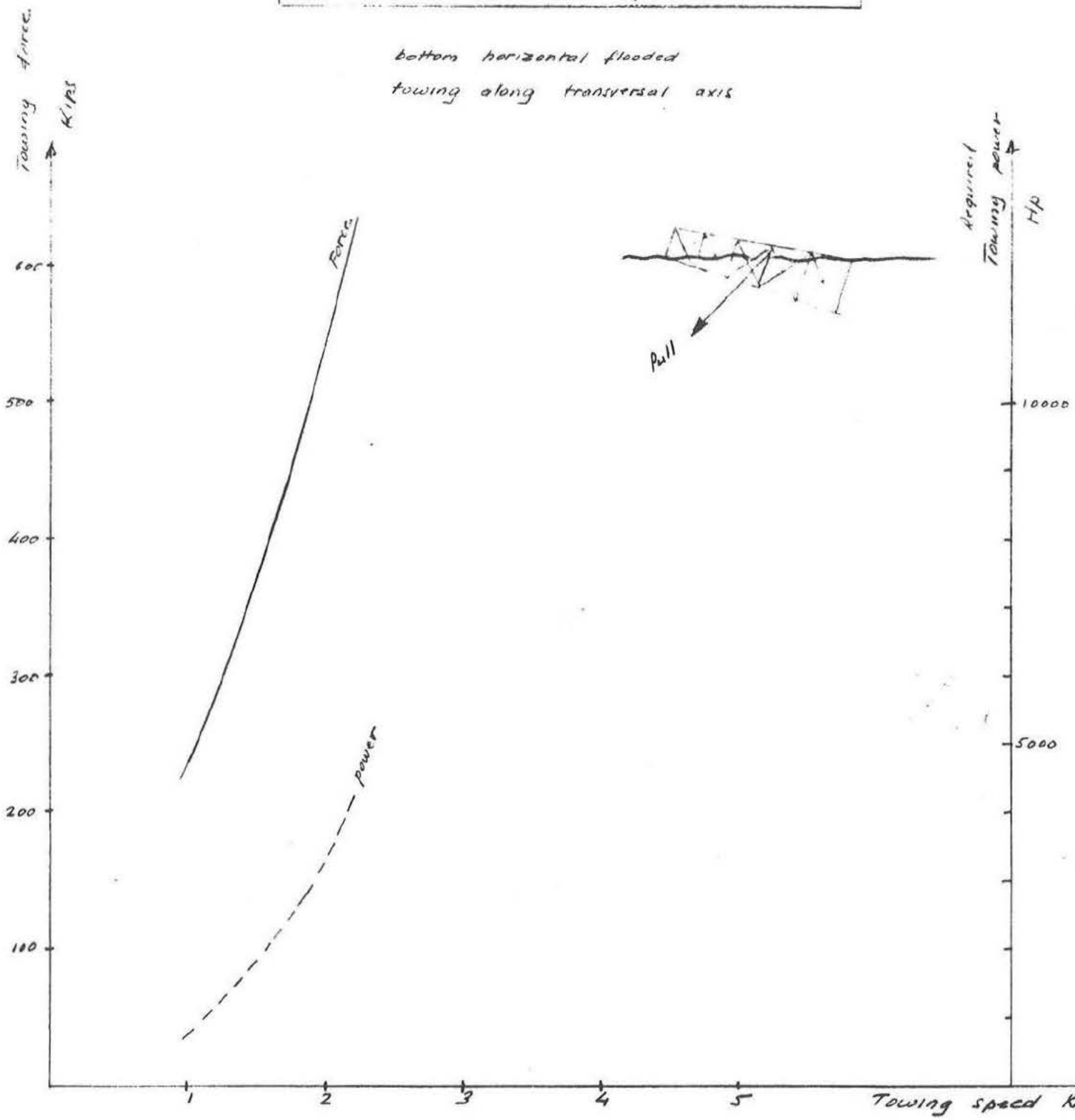


Fig 6-3 e

700' PLATFORM: TOWING RESISTANCE

bottom horizontal flooded

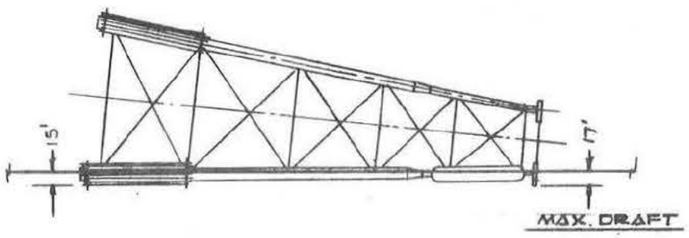
towing along transversal axis



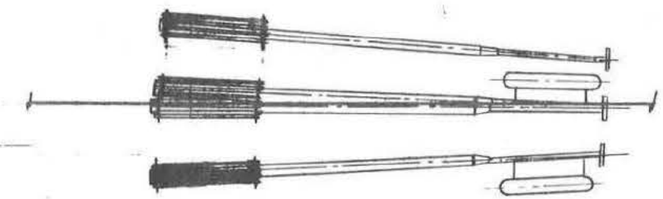
UPENDING

Fig. 7-1

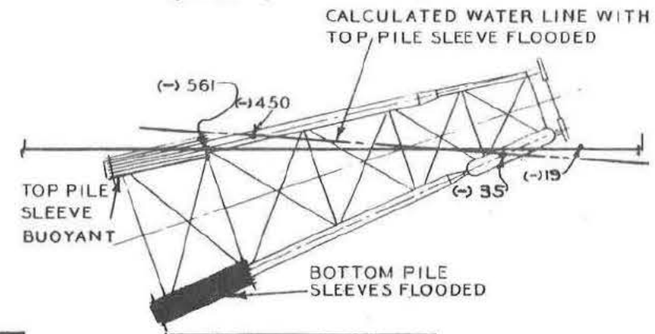
TOWING TRIM
ALL MEMBERS BUOYANT



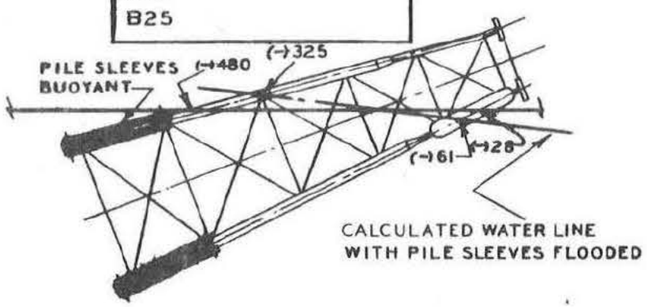
A26 - A7 - A16 - A15 FLOODED



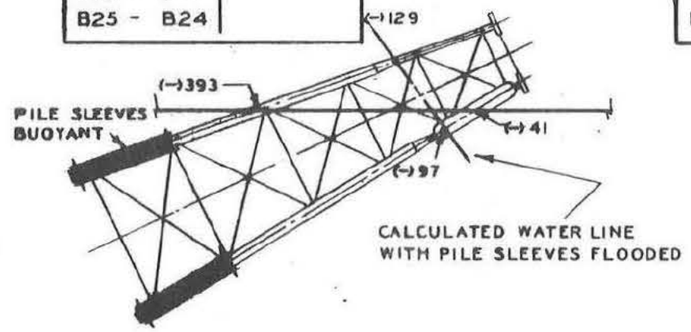
A15 - A14
A25 - A24 | FLOODED



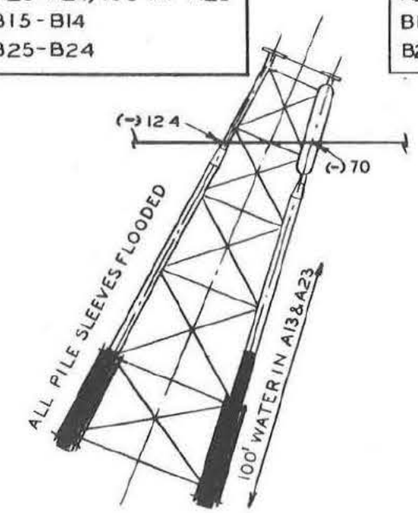
A15 - A14
A25 - A24 | FLOODED
B15
B25



A15 - A14
A25 - A24
B15 - B14
B25 - B24 | FLOODED

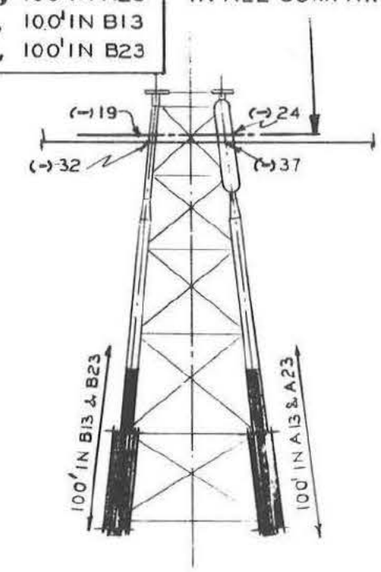


A15 - A14, 100' IN A13
A25-A24, 100' IN A23
B15 - B14
B25-B24



A15-A14, 100' IN A13
A25-A24, 100' IN A23
B15-B16, 100' IN B13
B25-B26, 100' IN B23

CALCULATED WITH 100' IN ALL COMPARTMENTS



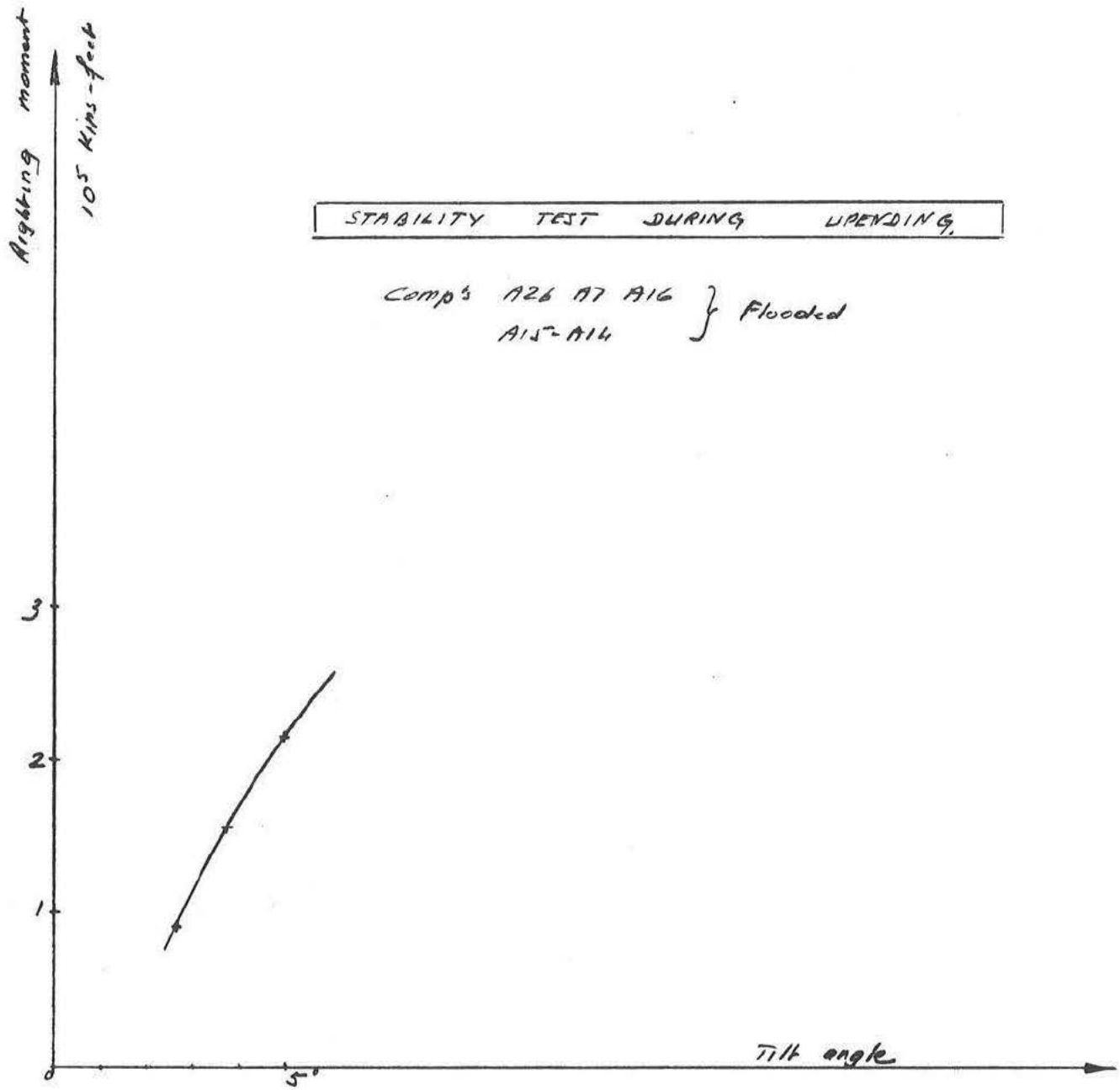
LEGEND

— - — CALCULATED FOR THE 700' PROTOTYPE

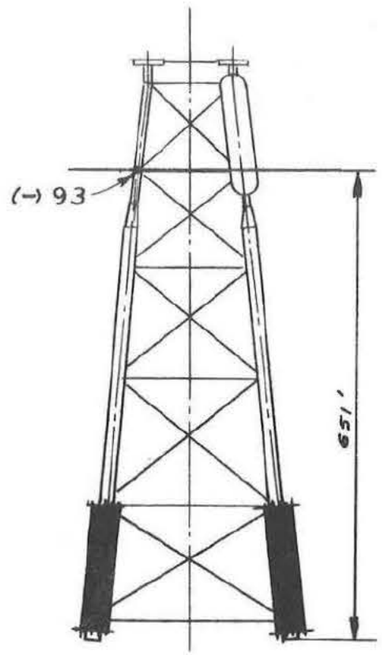
——— MODEL TEST RESULTS

P. P.

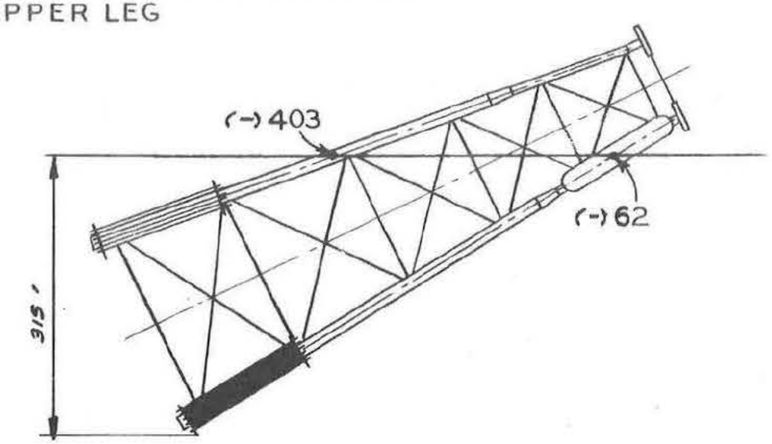
Fig 7-2


Righting moment
10^5 Kips-feet
STABILITY TEST DURING UPENDING
Comp's A26 A7 A16
A15-A14
Flooded
3
2
1
0
5°
Tilt angle

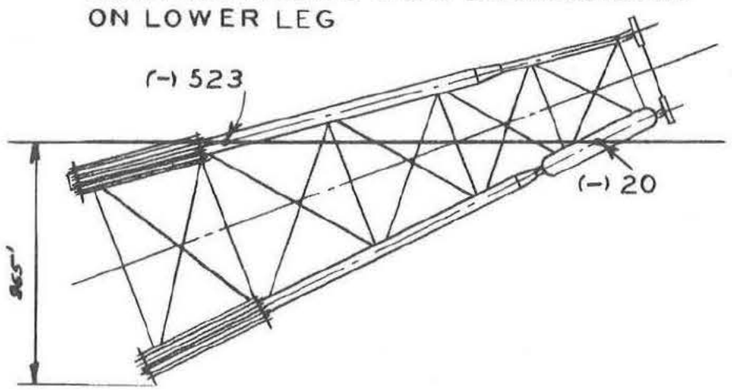
COMPARTMENTS 3 DEBALLASTED



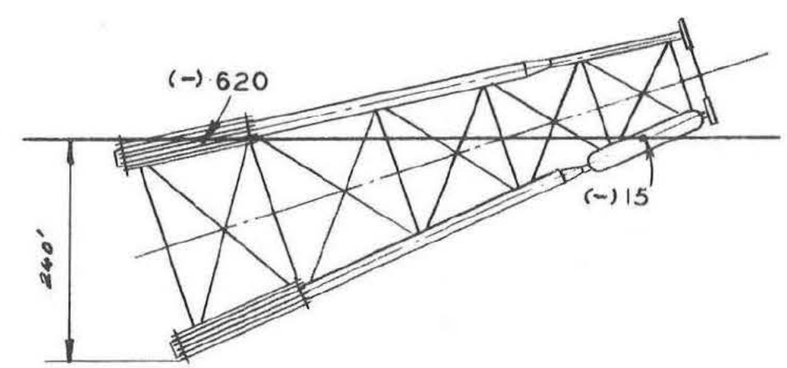
COMPARTMENTS 4 & 5 DEBALLASTED
ON UPPER LEG



COMPARTMENTS 4 & 5 DEBALLASTED
ON LOWER LEG



BOTTOM HORIZONTAL DEBALLASTED



APPENDIX 1.9

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

APPENDIX 1.9

Removal of a Self-Contained Platform for
Drilling and Producing Operations, Santa Barbara Channel

J. Ray McDermott & Co., Inc.

September, 1971

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

REMOVAL OF A SELF-CONTAINED PLATFORM FOR DRILLING AND PRODUCING OPERATIONS SANTA BARBARA CHANNEL

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
WESTERN DIVISION

REMOVAL OF A SELF-CONTAINED PLATFORM
FOR
DRILLING AND PRODUCING OPERATIONS
SANTA BARBARA CHANNEL

By

J. RAY McDERMOTT & CO., INC.
NEW ORLEANS, LOUISIANA

SEPTEMBER 1, 1971

J. RAY McDERMOTT & CO., INC. ENGINEERS AND GENERAL CONTRACTORS

1010 COMMON STREET P. O. BOX 60035, NEW ORLEANS, LOUISIANA 70160

September 1, 1971

Humble Oil & Refining Company
Research Center
Post Office Box 2189
Houston, Texas 77001

Attention: Mr. A. L. Guy

Re: Engineering Study for the Removal
of a Self-Contained Platform
841' Water Depth
Project No. 4679

Gentlemen:

Submitted herewith is our report covering the subject study. It is our opinion that removal of the platform using the procedures outlined is entirely feasible and will not require methods or equipment beyond present-day state of the art.

Detailed procedures presented in the report are summarized as follows:

1. Remove the deck packages and appurtenances (boat-landings, risers, etc.) with a derrick barge and transport them to shore.

2. Install two (2) auxiliary buoyancy tanks at the top of the jacket.

3. Cut the piling below the mudline using explosive or mechanical cutting devices operated from above the water surface.

4. Using compressed air, deballast the jacket buoyancy compartments to float the jacket in a horizontal attitude.

5. Due to the additional weight of the cut piles, grout, etc. at the bottom of the jacket, the maximum horizontal attitude obtainable with all compartments deballasted, the jacket will have a draft of approximately 250 feet. In this condition it may be towed to very deep water on the high seas and scuttled.

6. Should it be desired to take the jacket to shore for disposal this may be accomplished by partially dismantling it at sea to reduce its weight until it floats with a draft of about 20 feet. In this condition it may be towed to a suitable shore site and there completely dismantled.

The procedures presented in the report to accomplish the above, i.e., controlled deballasting and refloating are essentially the reverse of installation by controlled flooding. We have designed and installed numerous platforms using this method and are therefore intimately familiar with the techniques employed.

Although we did investigate alternate means of removal, some of which appeared feasible, we feel the method recommended to be the most practical and economic means for accomplishing the task.

We express our sincere appreciation for the assistance and guidance given by your office during the course of the study.

We trust you will find this report in order and that we may have the privilege of again serving you in the future.

Very truly yours,

J. RAY McDERMOTT & CO., INC.
Engineering Department

Giff C. Lee

G. C. Lee
Chief Engineer

GCL:CEY:bas

TABLE OF CONTENTS

Removal of a Self-Contained Platform
Drilling and Producing Operations
Santa Barbara Channel
For
Humble Oil & Refining Company

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	HOR-4679, Sheets 001-P thru 009-P	

SECTION I

I. SCOPE

The structure herein investigated is an outgrowth of a concept developed jointly by Humble Oil & Refining Company and J. Ray McDermott & Co., Inc. as our Project No. 4095. During development a continuous check was maintained on the weight and displacement of the jacket then under consideration. The purpose of this check was to insure that at least partial refloatation of the jacket could be effected taking into account the additional weight of the piles which must be removed as a part of the jacket. However, a detailed study of a removal procedure was not performed during the design.

The purpose of this study is to develop a procedure to remove the platform from its installation site and transport it to a suitable location for dismantling. In addition, it is the intent of the study to recommend any modifications or additions which should be incorporated into the present design to facilitate the removal procedures.

SECTION II

II. JACKET WEIGHT SUMMARY

The design of the jacket investigated in this study is that shown on Humble Oil & Refining Company drawing series HQE-182, along with additional details and requirements furnished by Humble.

The weight of the jacket to be removed is summarized as follows:

Calculated Jacket Weight	30,472
26' O.D. Auxiliary Buoyancy Tanks . . .	1,728
	32,200
Plus 5% Overage on Plate Thickness . .	1,610
	33,810
Additional Weight of Piles and Grout to be Removed with Jacket	4,400
Total Salvage Weight	38,210^{k}
REFLOATATION WEIGHT	19,100 Tons

SECTION III

III. REFLOATATION PROCEDURES

The following steps in the refloatation procedure along with the drawings showing the position of the jacket relative to the water surface during various stages of deballasting have been determined by use of an IBM 360 computer. The program used was developed by ourselves for use in determining controlled flooding procedures for erecting tilt-up type jackets and rotating launched jackets to a vertical position. The refloatation is essentially the reverse of the erection procedure.

Refer to Sheet No. 001-P

1. Remove the deck packages (shown dotted) from the jacket trusses and transport to shore on cargo barges for dismantling.

2. Install the original (or similar) 26' O.D. auxiliary buoyancy tanks on the top of the jacket by seating the bottom pin in the socket at Elevation (-) 93' and welding the top supports at Elevation (+) 30'. The tanks are partially ballasted in order to control their weight by buoyancy.

Refer to Sheet No. 002-P

3. Using compressed air connected to the vent lines, blow out all water ballast through the open flooding valve ports in the auxiliary buoyancy tanks. Close the vent valves to maintain the tanks dry.

4. Similarly, deballast all four (4) legs to the approximate depth shown to give the jacket some positive buoyancy and thus remove its weight from the piles.

5. Cut the piles at the bottom of their sleeves approximately 20 feet below the mudline using mechanical cutters, explosive shape charges or other means lowered through conduits inserted through the pile guides to the tops of the piles.

Refer to Sheet No. 003-P

6. Continue deballasting jacket legs to the approximate elevation shown until the intermediate auxiliary buoyancy tank supports at Elevation (-) 26'-5" can be welded above water. Install watertight cover plates on auxiliary tank flooding valve ports.

Refer to Sheet No. 004-P

7. Deballast the remainder of two (2) legs bringing the jacket to the position shown.

Refer to Sheet No. 005-P

8. Deballast the remainder of the other two (2) legs bringing the jacket to the position shown.

Refer to Sheet No. 006-P

9. Completely deballast 30' O.D. horizontal buoyancy tank bringing the jacket to the position shown. As a safety measure, install watertight cover plates on all flooding valve ports on upper two (2) legs.

SECTION IV

IV. REMOVAL FROM SITE

ALTERNATE "A"

The jacket floating (as shown on Sheet 006-P) is in a highly stable attitude and may be safely towed from the site in this position.

It is doubtful that it will be desirable to salvage the jacket for reuse or even scrap. If this is in fact the case, the most expeditious and economical solution for disposing of it will be to tow it to a selected location on the high seas, in several thousands of feet of water, and simply scuttle it.

However, if this is not desirable or possible due to restrictions, it may be partially dismantled and towed to shore site for complete dismantling as will be explained in the following section, ALTERNATE "B".

ALTERNATE "B"

With the addition of the weight due to the cut-off piles grouted in the sleeves, it is not possible to raise the jacket past the position shown on Sheet 006-P. However, with the jacket in this position, it may be towed to shallow water, partially dismantled, and then made to float on the lower two (2) legs. In this condition it

ALTERNATE "B" - Continued

may be towed to a suitable shore site for complete dismantling. This may be accomplished as follows:

Refer to Sheet No. 007-P

10. Tow to a water depth of approximately 250 feet until the lower legs ground. Deballast the 6' O.D. diagonals in the bottom bay along with the 3' O.D. bracing at Elevation (-) 822'. This operation will bring the upper legs out of the water as shown.

Refer to Sheet No. 008-P

11. Tow the jacket into water approximately 210' deep until the lower legs again ground as shown. This grounding will assure positive stability during the partial dismantling.

12. Partially flood the 30' O.D. horizontal buoyancy tank by releasing the air pressure to anchor the jacket to bottom and to keep it from rising as weight is removed during partial dismantling.

13. Remove the lower portions of the two (2) upper legs, piles and bracing as shown by the dotted lines. This will lighten the jacket by approximately 3000 tons.

Refer to Sheet No. 009-P

14. Deballast the 30' O.D. horizontal buoyancy tank which will cause the jacket to float on its lower two (2) legs as shown.

15. As a safety precaution, install watertight cover plates on all flooding valve ports on the lower legs and horizontal buoyancy tank.

16. The jacket may now be safely towed to a dock for complete dismantling.

SECTION V

V. MODIFICATIONS AND RECOMMENDATIONS

In order to perform the foregoing removal procedures outlined in this report, a few minor modifications to the jacket design will be necessary. These, along with other conditions and recommendations are as follows:

A. The two (2) 26' O.D. auxiliary buoyancy tanks at the top of the jacket should be located 60' off the column centerlines rather than 40' as shown on the present drawings.

B. All flooding valves should be located as near to the bottom of their respective compartments as possible and oriented so as to be always below water during the refloating operations.

C. All flooding valve ports should be fitted with flanges or some means whereby watertight cover plates may be installed during refloatation.

D. Since most certainly the flooding valve hydraulic system will be inoperative after many years immersion in sea water, the valve should be left in the OPEN position on completion of installation. In this way, ballast water can be forced out the open valves by introducing compressed air through the vent lines at the top of the compartments.

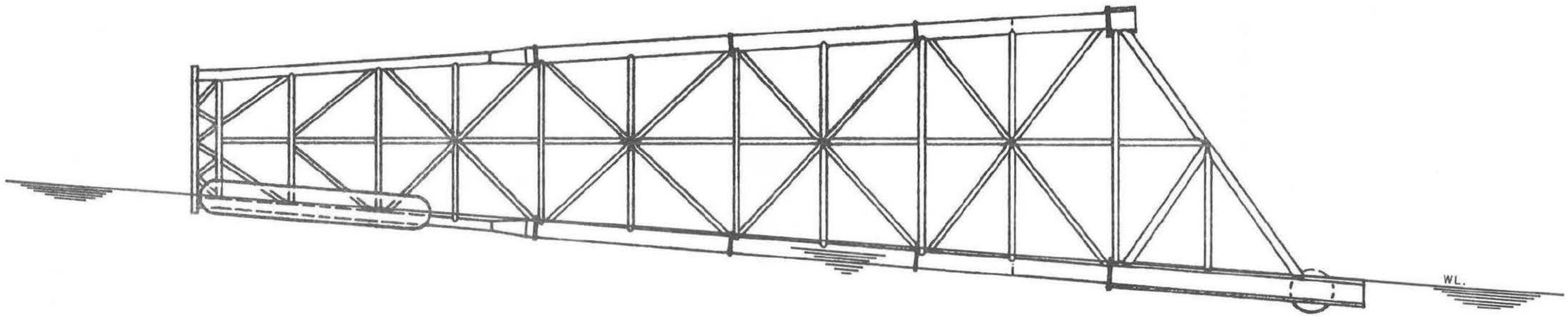
E. It is recommended that padeyes designed for 600 tons be installed on two (2) of the jacket legs. These would be utilized should additional lifting force from the surface equipment be necessary to raise the jacket due to some damage, etc.

F. It would be helpful during re-installation of the 26' O.D. auxiliary buoyancy tanks to have underwater sheaves mounted on the jacket legs through which "pulldown" lines attached to the bottoms of the tanks would lead back to hoists on the surface. By controlling the buoyancy of the sinking tank and tension on the pulldown line, the bottom pin could more easily be led into its socket.

G. In order to raise the upper legs clear of the water (see Sheet 007-P), it will be necessary to provide a vent line and flooding ports for the bracing members (indicated on the drawing) rather than have them free flood, as in the present design. The members should be interconnected so that only one (1) or two (2) vent lines will serve to deballast them all.

H. It has been assumed that all conductors, wellheads and associated items have been removed prior to the start of refloatation.

APPENDIX



MEMBERS FLOODED
" EVACUATED

HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

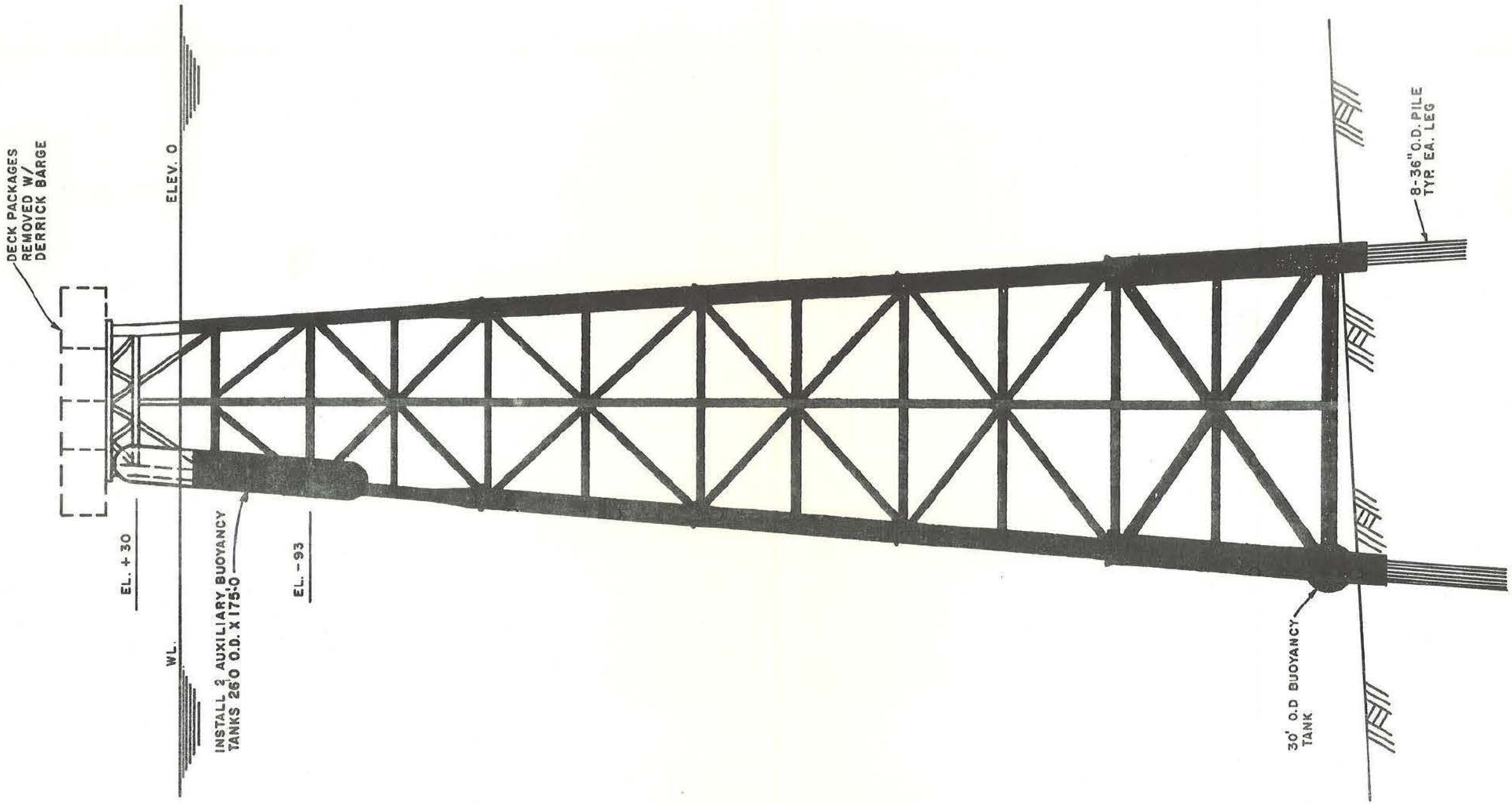
J. RAY McDERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

DATE	DRAWN BY	APPROVED:
8/27/71		
SCALE NONE	CHECKED BY	APPROVED:

60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 009-P



HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

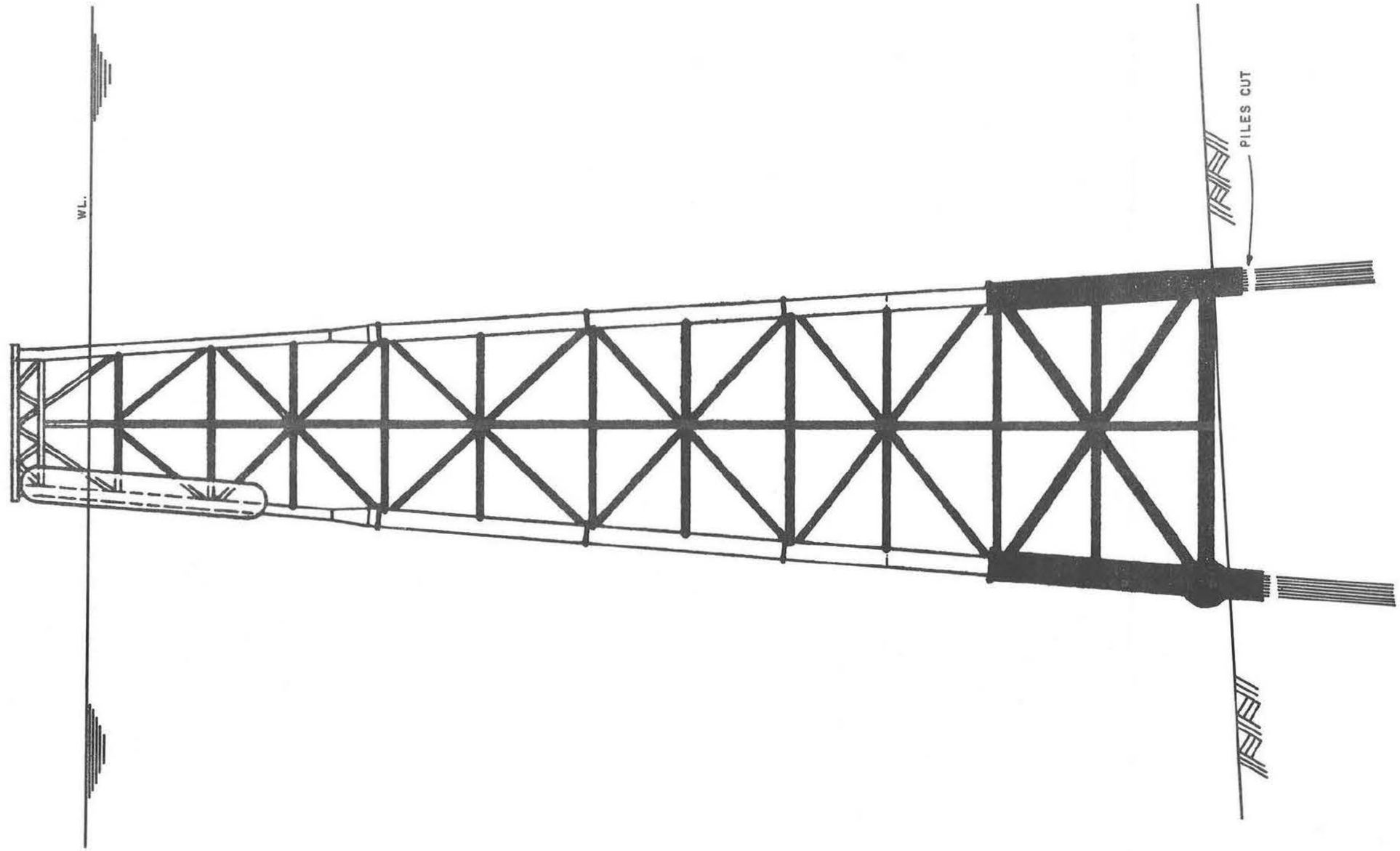
J. RAY McDERMOTT & CO., INC.
ENGINEERS — NEW ORLEANS, LA. — CONTRACTORS

60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

DATE 8/27/71	DRAWN BY	APPROVED:
SCALE NONE	CHECKED BY	APPROVED:

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 001-P



HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

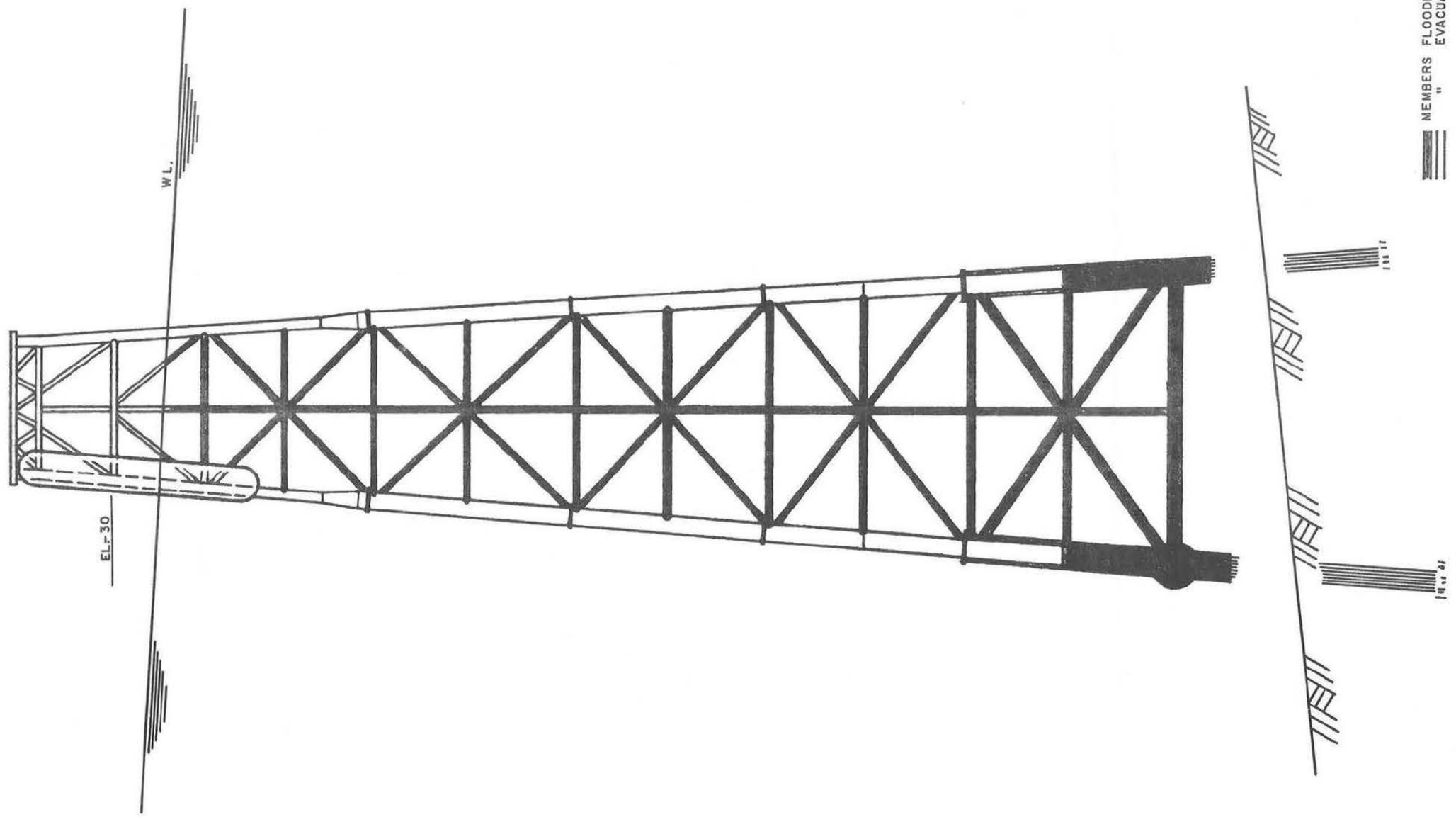
J. RAY McDERMOTT & CO., INC.
ENGINEERS NEW ORLEANS, LA. CONTRACTORS

60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

DATE 8/27/71	DRAWN BY	APPROVED:
SCALE NONE	CHECKED BY	APPROVED:

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 002-P



HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

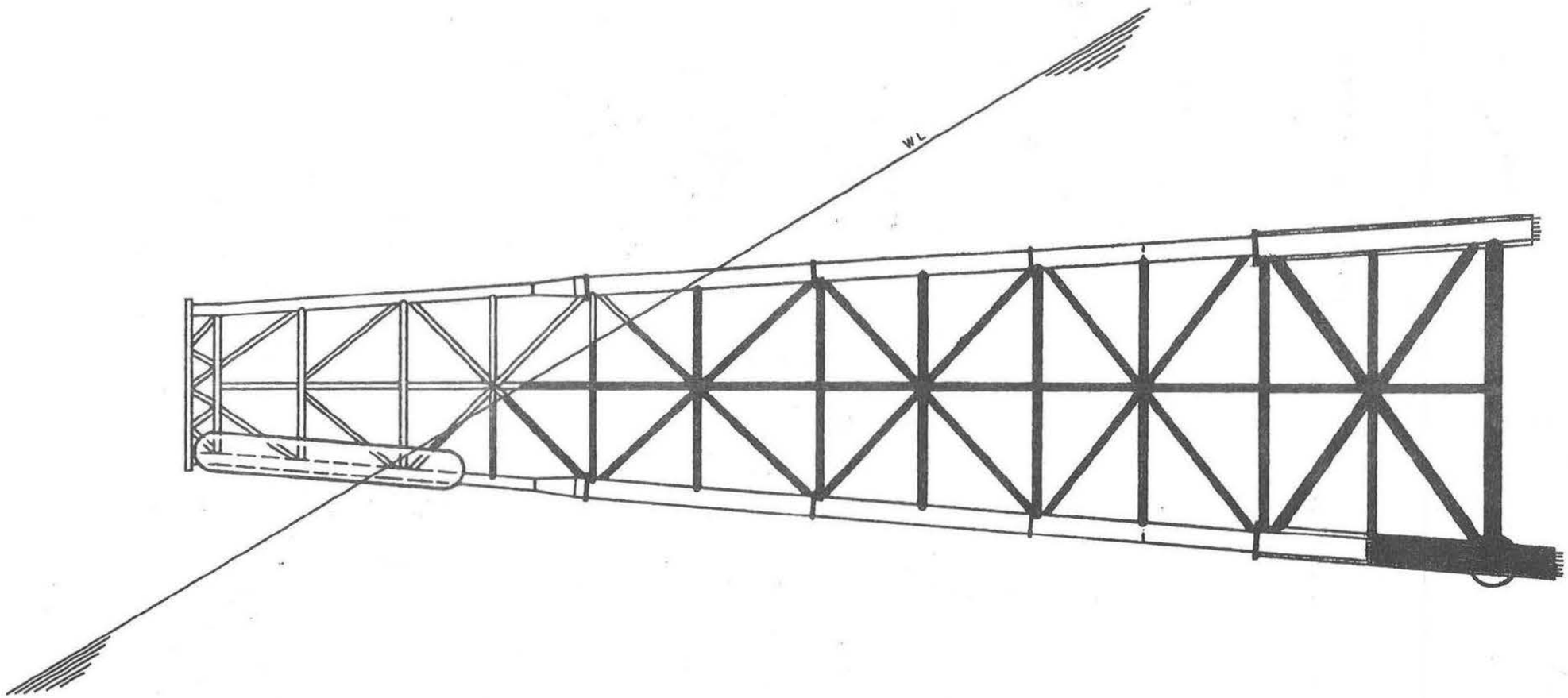
J. RAY McDERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

DATE 8/27/71	DRAWN BY	APPROVED:
SCALE NONE	CHECKED BY	APPROVED:

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 003-P



MEMBERS FLOODED
" EVACUATED

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NO.	BY	REVISION	DATE	CHK.	APP.

J. RAY McDERMOTT & CO., INC.
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NEW ORLEANS, LA.

DATE 8/27/71	DRAWN BY	APPROVED:
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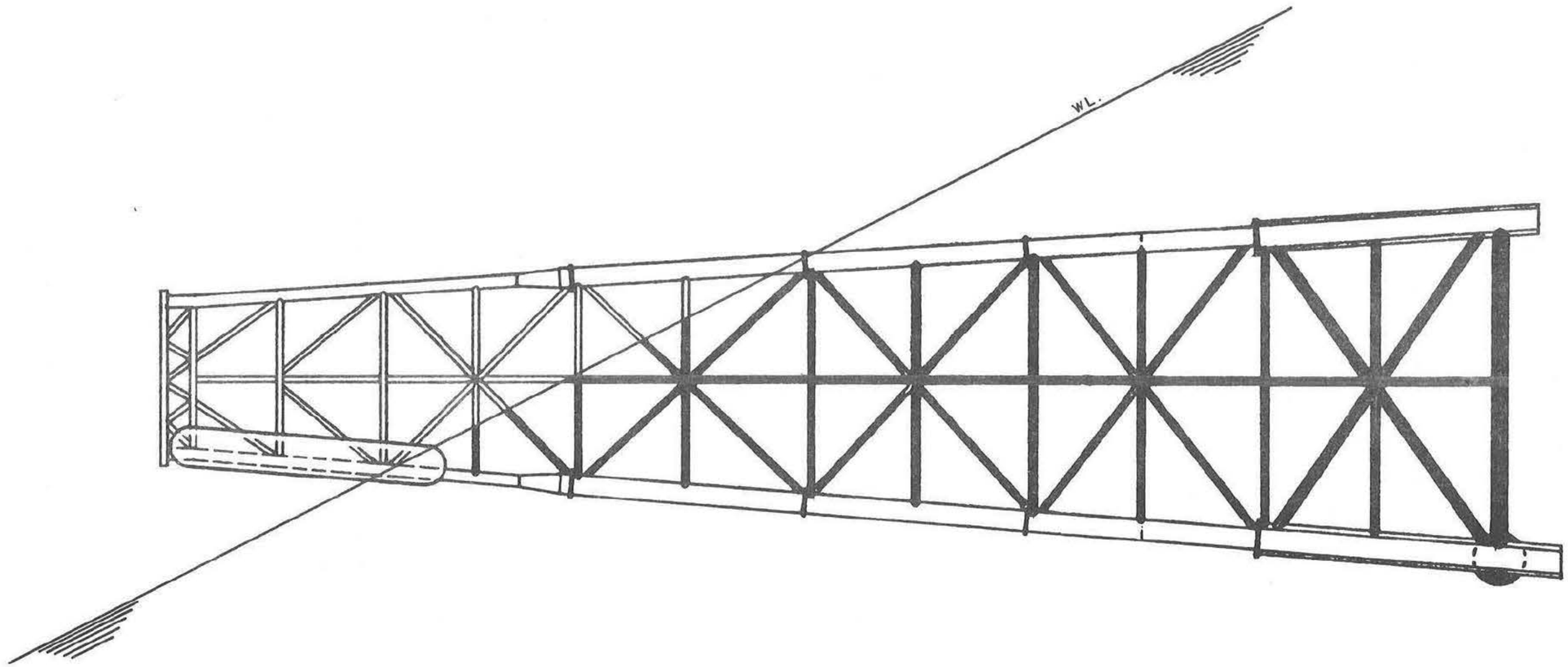
60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 004-P



MEMBERS FLOODED
" EVACUATED

HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

J. RAY McDERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

60 WELL DRILLING & PRODUCTION PLATFORM
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DATE 8/27/71	DRAWN BY	APPROVED:
SCALE NONE	CHECKED BY	APPROVED:

REMOVAL OF PLATFORM FROM SITE

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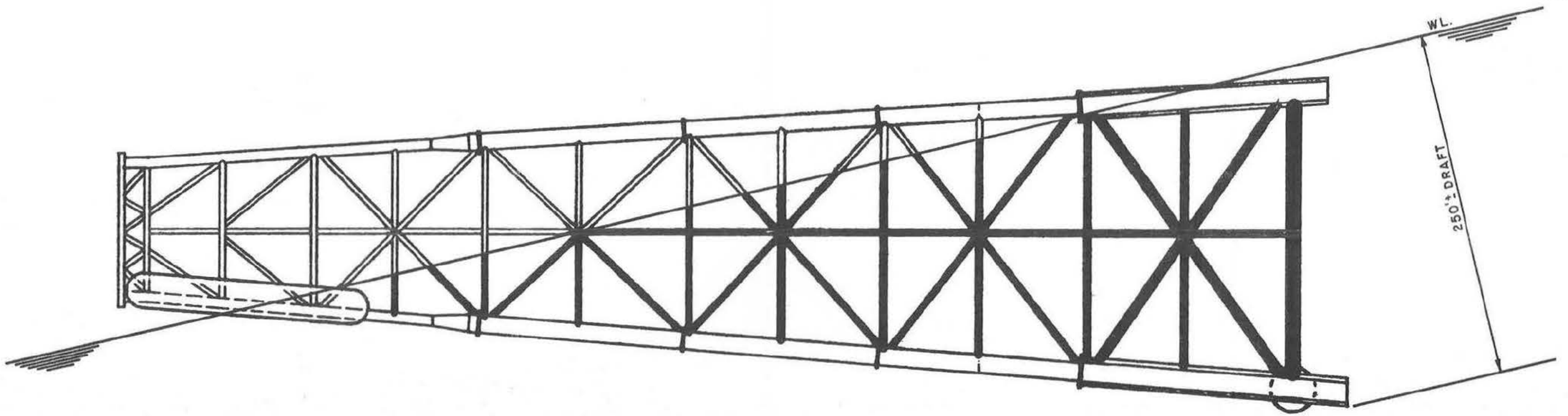
SHEET NO. 005-P



HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

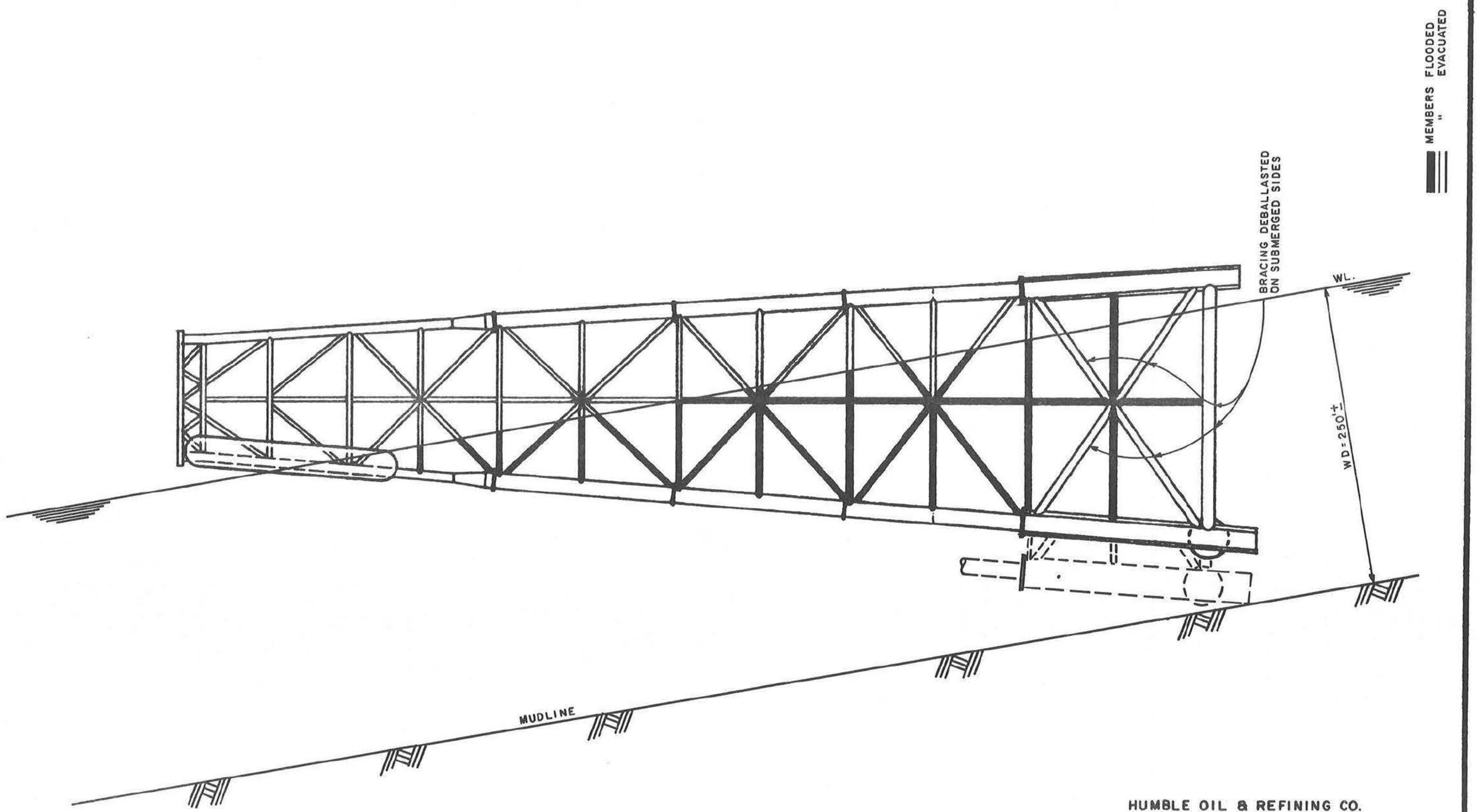
J. RAY McDERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

DATE 8/27/71	DRAWN BY	APPROVED:
SCALE NONE	CHECKED BY	APPROVED:

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 006-P



HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

J. RAY McDERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

DATE 8/27/71	DRAWN BY	APPROVED:
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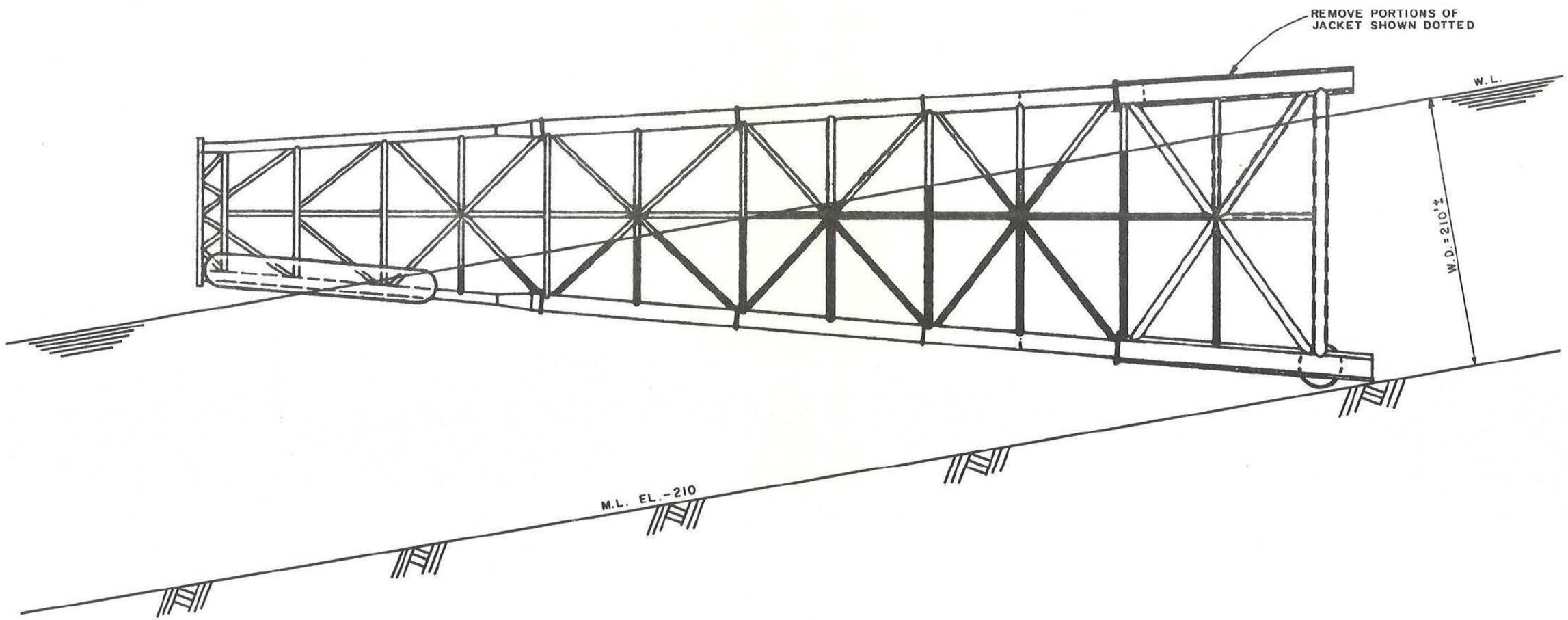
60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 007-P



HUMBLE OIL & REFINING CO.

NO.	BY	REVISION	DATE	CHK.	APP.

J. RAY McDERMOTT & CO., INC.
ENGINEERS CONTRACTORS
NEW ORLEANS, LA.

DATE 8/27/71	DRAWN BY	APPROVED:
SCALE NONE	CHECKED BY	APPROVED:

60 WELL DRILLING & PRODUCTION PLATFORM
SANTA BARBARA CHANNEL, CALIFORNIA 841' W.D.

REMOVAL OF PLATFORM FROM SITE

DWG. NO. HOR-4679
SHEET NO. 008-P

SUPPLEMENTAL PLAN OF OPERATIONS

SANTA YNEZ UNIT

HUMBLE OIL & REFINING COMPANY

UNIT OPERATOR

APPENDIX VOL. 2

0004

INDEX

GEOLOGICAL SURVEY
RECEIVED
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LOS ANGELES

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MAJOR EQUIPMENT LIST

PRODUCTION PLATFORM

SECTION NO.	SPECIFICATION NO.	EQUIPMENT ITEM
3.1	10-084-PSU1	Production Separators
3.1	-PSU2	Sandstone Production Separator
3.1	-PSU3	Main Gas Scrubber
3.2	-WTUS1	Test Separators
3.3	-WCS	Well Clean Separator
3.3	-V6	Well Clean Tank
4.1	-PST	Production Surge Tanks
4.2	-P4A	Crude Oil Booster Pumps
4.2	-P4B	Crude Oil Shipping Pumps
4.4	-MP1	Meter Prover
5.1	-T20	Therminol Expansion Tank
5.1	-P20	Therminol Circulation Pumps
5.2	-CHE	Crude Oil Heat Exchangers
7.1	-PSGU	Sweet Gas Scrubber
7.1	-FGHE	Fuel Gas Heater
7.1	-F1	Fuel Gas Filters
7.21	-GCSIP	Sales Injection Compressor & Dehydration
7.22	-GCSTV	Vapor Compressor
8.1	PTG	Turbine Generators
8.2	-WHE	Gas Turbine Exhaust-Waste Heat Exchangers
9.1	-FLOU	Flotation Unit
9.1	-T2	Produced Water Surge Tank
9.1	-T2A	Clean Water Surge Tank
9.1	-P21A	Produced Water Pumps

SECTION NO.	SPECIFICATION NO.	EQUIPMENT ITEM
9.2	10-084-V6	Water Sump
9.2	V6	Oil Sump
9.2	-P1A	Water Sump Pumps
9.2	-P5A	Oil Sump Pumps
9.3	-P2	Oil Disposal Tube Pump
11.0	V6	Vent Surge Tank
11.0	VENS	Vent Stack Seal
12.1	-EWDP	Washdown & Firewater Protection Pump
12.1	-EDFP	Firewater Protection Pump (engine driven)
12.1	-EFP	Firewater Protection Pumps
13.1	-AC1	Utility Air Compressor
13.1	-AC1	Instrument Air Compressor
14.0	P-101	Diesel Fuel Transfer Pumps
14.0	T-20	Diesel Fuel Day Tank
15.0	P-22	Potable Water Pump
15.0	T-2	Potable Water Tank
15.0	-PWPT	Potable Water Supply Pressure Tank
16.1	-STU	Sewage Treatment Unit
16.3	T-2	Emergency Surge Tank
17.2	-CRANE	Platform Cranes

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET	OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	1	7
LOCATION SANTA BARBARA CHANNEL		REVISION DATE	PROJECT ENGINEER	ACCT. NO.	

EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
V1A	10-084-PSU1	Production Separator	84"O.D. X 30'-0" s/s 275 psig D.P. @ 100°F	3.1	
V1B	10-084-PSU1	Production Separator	84"O.D. X 30'-0" s/s 275 psig D.P. @ 100°F	3.1	
V1C	10-084-PSU2	Sandstone Production Separator	48"O.D. X 15'-0" s/s 500 psig D.P. @ 100°F	3.1	
V3	10-084-PSU3	Main Gas Scrubber	48"O.D. X 15'-0" s/s 275 psig D.P. @ 100°F	3.1	
V2A	10-084-WTUS1	Test Separator	48"O.D. X 15'-0" s/s 275 psig D.P. @ 100°F	3.2	
V2B	10-084-WTUS1	Test Separator	48"O.D. X 15'-0" s/s 500 psig D.P. @ 100°F	3.2	
V1D	10-084-WCS	Well Clean Separator	30"O.D. X 10'-0" s/s 1440 psig D.P. @ 100°F	3.3	
V6	10-084-V6	Vent Surge Tank	8'-0"O.D. X 15'-0" s/s 25 psig D.P. @ 100°F	11.0	
V7	10-084-V6	Water Sump	60" O.D. X 15'-0" s/s 25 psig D.P. @ 100°F	9.2	
V8	10-084-V6	Oil Sump	60"O.D. X 8'-0" s/s 25 psig D.P. @ 100°F	9.2	

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	2 | 7
LOCATION SANTA BARBARA SHANNEL		REVISION DATE	PROJECT ENGINEER	ACCT. NO.

EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
V10	10-084-V6	Well Clean Tank	10'-0" O.D. X 7'-6" s/s 50 psig D.P. @ 100°F	3.3	
V4A	10-084-PST	Production Surge Tank	12'-0" O.D. X 9'-0" s/s 50 psig D.P. @ 150°F	4.1	
V4B	10-084-PST	Production Surge Tank	12'-0" O.D. X 9'-0" s/s 50 psig D.P. @ 150°F	4.1	
V4C	10-084-PST	Production Surge Tank	12'-0" O.D. X 9'-0" s/s 50 psig D.P. @ 150°F	4.1	
P4A	10-084-P4A	Crude Oil Booster Pump	625 gpm @ 75 psi P - 100HP	4.2	
P4C	10-084-P4A	Crude Oil Booster Pump	625 gpm @ 75 psi P - 100HP	4.2	
P4E	10-084-P4A	Crude Oil Booster Pump	625 gpm @ 75 psi P - 100HP	4.2	
P4B	10-084-P4B	Crude Oil Shipping Pump	590 gpm @ 1000psig - 500HP	4.2	
P4D	10-084-P4B	Crude Oil Shipping Pump	590 gpm @ 1000psig - 500HP	4.2	
P4F	10-084-P4B	Crude Oil Shipping Pump	590 gpm @ 1000psig - 500HP	4.2	

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET	OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	3	7
LOCATION		**REVISION DATE**	**PROJECT ENGINEER**	**ACCT. NO.**	
SANTA BARBARA CHANNEL					

EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
	10-084 MP1	Meter Prover	450 gpm @ 500 psig - 150°F	4.4	
T20	10-084-T20	Therminol Expansion Tank	36"O.D. X 8'-0" s/s 30 psig D.P.	5.1	
T23	10-084-T-20	Diesel Fuel Day Tank	24"O.D. X 20'-0" s/s 30 psig D.P.	14.0	
P20A	10-084-P20	Therminol Circulation Pump	350 gpm @80 ft. diff. head - 10HP	5.1	
P20B	10-084-P20	Therminol Circulation Pump	350 gpm @ 80 ft. diff. head - 10HP	5.1	
E1A	10-084 CHE	Crude Oil Heat Exchanger	24"O.D. X 20'-0" Max. 240 psig D.P. @ 200°F	5.2	
E1B	10-084 CHE	Crude Oil Heat Exchanger	24"O.D. X20'-0" Max 240 psig D.P. @ 200°F	5.2	
E2A	10-084 CHE	Crude Oil Heat Exchanger	18"o.D. X 20'-0" Max. 1434 psig D.P. @ 110°F	5.2	
V5	10-084 PSGU	Sweet Gas Scrubber	24" O.D. X 6'-0" S/S 500 psig D.P. @ 100°F	7.1	
E3	10-084 FGHE	Fuel Gas Heater	Hairpin 12'-0" Lg. Max. 200 psig D.P. @ 300°F	7.1	

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	4 | 7
LOCATION		REVISION DATE	PROJECT ENGINEER	ACCT. NO.
Santa Barbara Channel				

EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
F1A	10-084 F1	Fuel Gas Filter	8-5/8" O.D. X 85-3/4" s/s 200 psig D.P. @ 220°F	7.1	
F1B	10-084 F1	Fuel Gas Filter	8-5/8" O.D. X 85-3/4" s/s 200 psig D.P. @ 220°F	7.1	
-	10-084 PTG	Turbine Generator No. 1	750 KW	8.1	
-	10-084 PTG	Turbine Generator No. 2	750 KW	8.1	
-	10-084 PTG	Turbine Generator No. 3	750 KW	8.1	
E5A	10-084 WHE	Gas Turbine Exhaust Waste Heat Exchanger	10'-2" X 10'-0" X 2'-9" 1.0 psig D.P. @ 900°F	8.2	
E5B	10-084 WHE	Gas Turbine Exhaust Waste Heat Exchanger	10'-2" X 10'-0" X 2'-9" 1.0 psig D.P. @ 900°F	8.2	
E5C	10-084 WHE	Gas Turbine Exhaust Waste Heat Exchanger	10'-2" X 10'-0" X 2'-9" 1.0 psig D.P. @ 900°F	8.2	
-	0-084 FLOU	Flotation Unit	8'-0" X 30'-0" 25,725 b/d	9.1	
T21	0-084-T2	Potable Water Tank	10'-0" X 35'-0" X 8'-0" High API 650 welded	15.0	

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	5 / 7
LOCATION		REVISION DATE	PROJECT ENGINEER	ACCT. NO.
Santa Barbara				

EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
T22	10-084-T2	Diesel Storage and Emergency Surge Tank	10'-0" X 35'-0" X 8'-0" high API 650 welded	16.3	
T2	10-084-T2	Produced Water Surge Tank	9'-2-3/4" O.D. X 16'-0" high API 650 - welded	9.1	
T2A	10-084-T2	Clean Water Surge Tank	9'-2-3/4" O.D. X 16'-0" high API 650 - welded	9.1	
P21A	10-084-P21A	Produced Water Pump	750 gpm @ 65 ft. diff. head 25 HP	9.1	
P21B	10-084-P21A	Produced Water Pump	750 gpm @ 65 ft. diff. head. 25 HP	9.1	
P1A	10-084 P1A	Water Sump Pump	250 gpm @ 100ft. diff. head - 15HP	9.2	
P1B	10-084 P1A	Water Sump Pump	250 gpm @ 100 ft. diff. head - 150 HP	9.2	
P5A	10-084-P5A	Oil Sump Pump	15 gpm @ 100 psi ΔP - 5 HP	9.2	
P5B	10-084-P5A	Oil Sump Pump	15 gpm @ 100 psi ΔP - 5 HP	9.2	
P2	10-084-P2	Oil Disposal Tube Pump	30 gpm @ 100 psi ΔP - 10HP	9.3	

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	6 / 7
LOCATION Santa Barbara Channel		REVISION DATE	PROJECT ENGINEER	ACCT. NO.

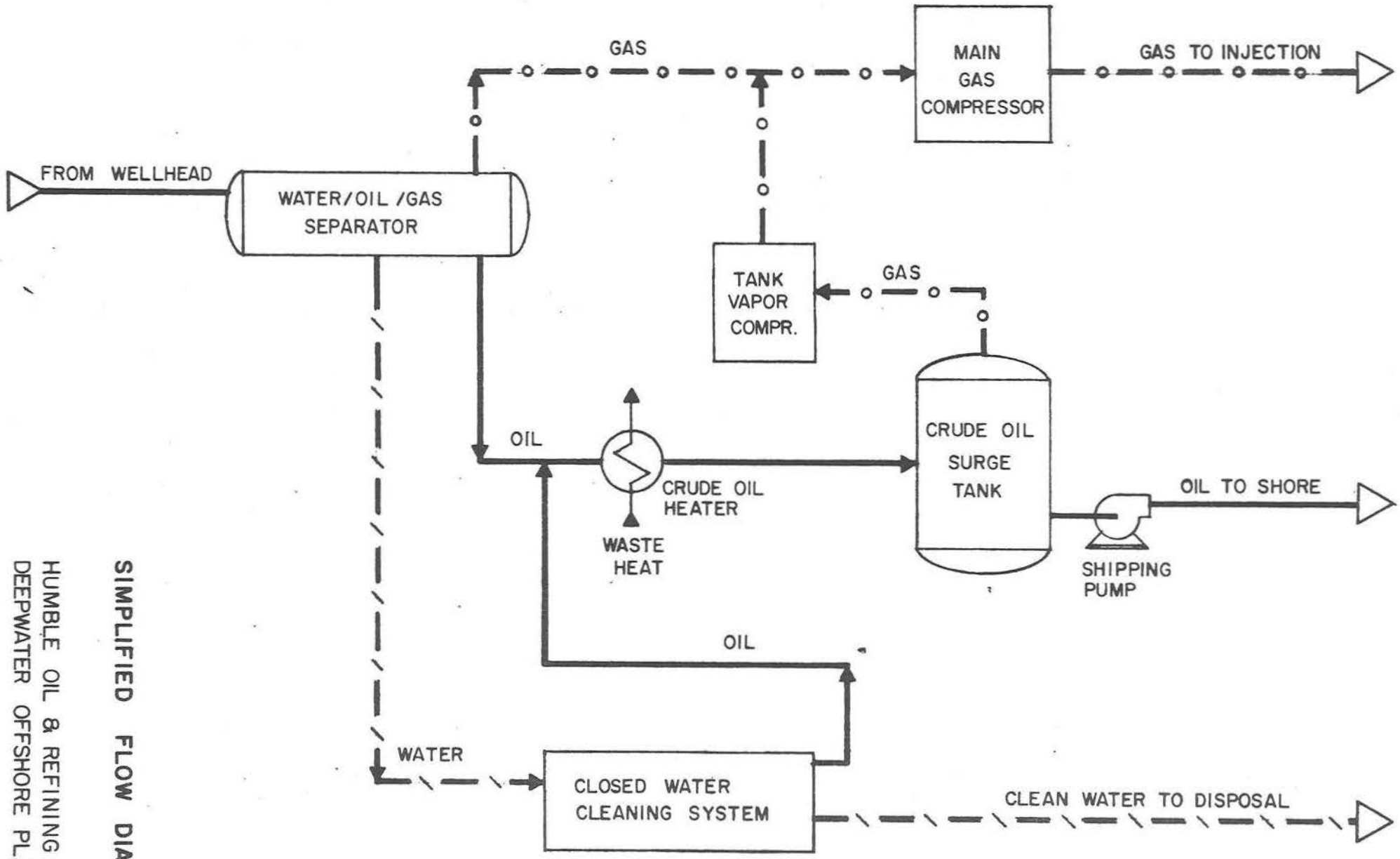
EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
P9	10-084 EWDP	Washdown & Firewater Protection Pump	300 gpm @ 150 psi 40 HP	12.1	
P8	10-084 EDFP	Firewater Protection Pump	800 gpm @ 150 psi	12.1	
P7A	10-084 EFP	Firewater Protection Pump	800 gpm @ 150 psi 100HP	12.1	
P7B	10-084 EFP	Firewater Protection Pump	800 gpm @ 150 psi 100HP	12.1	
-	10-084-AC1	Utility Air Compressor	120 SCFM @ 150 psig	13.1	
-	10-084-AC1	Instrument Air Compressor	35 SCFM @ 125 psig	13.1	
P101A	10-084 P101	Diesel Fuel Transfer Pump	20 gpm @ 40 psig	14.0	
P101B	10-084 P101	Diesel Fuel Transfer Pump	30 gpm @ 40 psig	14.0	
P22	10-084 P22	Potable Water Pump	40 gpm @ 50 psig	15.0	
-	10-084-PWPT	Potable Water Supply Pressure Tank	36" X 120" 75 psig W.P.	15.0	

CUSTOMER	PROJECT NO.	REVISION NO.	DATE	SHEET	OF
HUMBLE OIL & REFINING COMPANY	10-084		July 13, 1971	7	7
LOCATION: Santa Barbara Channel		REVISION DATE	PROJECT ENGINEER	ACCT. NO.	

EQUIPMENT NO.	SPEC. NO.	DESCRIPTION	REMARKS	SECT. NO.	VENDOR
-	10-084-STU	Sewage Treatment Unit	5'-0" X 10'-0"	16.1	
-	10-084-CRANE	Platform Cranes	(2) 50 ton each	17.2	
	0-084-VENS	Vent Stack Seal		11.0	
	10-084-GCSIP	Sales Injection Compressor		7.21	
	10-084-GCSTV	Vapor Compressor		7.22	

1.0 GENERAL DESCRIPTION OF SYSTEM

1.1 PRODUCTION FACILITIES



SIMPLIFIED FLOW DIAGRAM

HUMBLE OIL & REFINING CO.
DEEPWATER OFFSHORE PLATFORM

GENERAL DESCRIPTION OF PRODUCTION FACILITIES

HUMBLE OIL & REFINING CO. DEEP WATER PLATFORM

SANTA BARBARA CHANNEL

1.0 GENERAL

This description applies to production and support equipment on the platform including gas compression and treating. Platform structure, drilling equipment and pipelines are not covered by this report.

2.0 PRODUCTION FACILITIES

The overall scheme of the production program is shown on the Process Flow Diagram Drawing 084-180.

2.1 The platform production facilities are designed for completions into the Monterey Chert sands and into the Sandstone formation. All wells are to be provided with conventional well head equipment including automatic pneumatic fail-safe well head shut-in valves. In addition, all wells are to be equipped with hydraulically operated fail-safe sub-surface tubing safety shut-in valves. The maximum anticipated well head pressures for the Monterey Chert wells is below 1440 psig. The same pressure for the Sandstone wells is 2160 psig. All equipment from well heads to separators including the inlet block valve on the separators is designed for the anticipated maximum well head pressure.

Provisions are to be made for installation of future electrically driven submersible pumps on all wells. The wells however will initially be flowing and will not be pumped.

2.2 The Monterey Chert and Sandstone production will be handled separately through separate manifolds and oil and gas separators. Each group has a test separator. The sandstone gas is to be used as a source for fuel gas. The Monterey Chert gas with the excess Sandstone gas is scrubbed, metered and delivered to the gas compression and treating facilities for processing and injection into the Monterey Chert formation. The gas handling facilities are covered by another part of this report.

2.3 Oil from the two zones are co-mingled after passing through three phase separators. Two production separators are provided for the Monterey Chert stream and one for the Sandstone. Two test separators are provided, one for each formation. The Monterey Chert test separator inlet stream may optionally be heated prior to entering the unit. This heating is accomplished by a 500°F heating fluid system discussed in other parts of this report. The heat is provided for the low gravity crude wells where low flow rates will result in low temperatures and high viscosities that may be troublesome in the test separator.

The co-mingled oil stream is then heated in heat exchangers by means of a circulating hot oil stream. The produced oil is then weathered at atmospheric pressure in three surge tanks at 110°F. The oil is then boosted to metering pressure and then pumped by the shipping pumps to the submarine oil pipeline. An emergency overflow surge tank is provided to take the oil from the filled crude tanks in the event a faulty well head valve leaks after a platform shutdown. The emergency surge provides adequate time to manually shut in the well head wing or master valves.

2.4 A well clean separator and a well clean surge tank are provided for removal of mud from the completed wells. The oil and gas are returned to the platform systems and provisions are made to barge load the mud for removal from the platform.

2.5 Produced water and sand (if any) from the separators are collected in a water surge tank. Vessel drains and deck drains on the platform are piped to a water sump tank where they are pumped to the above water surge tank. Oil is skimmed from the water surge tank and sand is removed by use of sand pans. The oil is piped to the oil sump tank. The sand is piped to either the water disposal tube or the water sump depending whether it is completely clean. Valves provide the option as to which way the sand goes. Water from the surge tank is fed to the four stage flotation unit to remove oil. The anticipated performance of this unit is to reduce oil to about 25 ppm average which is about one-half of that specified by OCS Order No. 8. Layout provisions are made for future addition if necessary of a final sand filter if water cleaning approaches being a problem.

2.6 Water from the flotation tank is piped to a 24" diameter x 250 feet deep disposal tube. This disposal tube acts as the final separator and trap for any oil not otherwise removed. Oil trapped is collected and pumped to the oil surge tank. Water leaves the disposal tube at the bottom and into the ocean.

2.7 Oil from skimmers and drains is piped to the oil sump. This oil is pumped to the oil surge tank. Overflow from this sump goes to the water sump.

2.8 Vapors from all atmospheric pressure tanks and equipment are collected in a vapor recovery system and piped to the vapor compressors which are part of the gas compression system. A repressuring system is provided to prevent air being admitted to these tanks during pumpout.

2.9 All relief valves from pressure vessels are piped to a main vent scrubber. The liquid from this scrubber is piped to the oil sump tank.

3.0 FLOW CAPACITIES

The maximum anticipated production rates for oil, gas and water are shown on the attached Process Flow. Each well manifold is capable of producing up to 5000 BFPD without unreasonable pressure drops. The two Monterey production separators are each designed for 30,000 BOPD, 14MMSCFPD and 12,000 BWPD at 85 psig. The Sandstone productor separator and the two test separators are designed for 5000 BOPD, 5MMSCFPD of gas, and 2000 BWPD. The normal operating pressure of the Monterey test separator is 85 psig and the Sandstone production and test separators are designed for a normal pressure of 350 psig.

1.2 SAFETY SHUT-IN FACILITIES

SAFETY FACILITIES

1.0 GENERAL

This description covers the safety provisions for the Humble Oil and Refining Company Deepwater Platform offshore near Santa Barbara, California. These facilities include both the Platform Shut-in System and the Production Shut-in System.

The safety system is combination electrical-pneumatic operation. Electrically-operated solenoid valves shown tie in the electrical system to the pneumatic circuit. The final valve operation circuit is pneumatic as shown on Drawing 084-148. This system includes subsurface safety valves in each well, surface safety valves on each well and pipeline shut-in valves. These can be operated by individual well head high-low pressure shut-in pilots, manual shut-in stations, central control shut-ins. The well head safety valves are used for all remote control and automatic shut-ins.

Electrical schematic for the production shut-in is shown on Drawing 084-303. The drawings 084-148 and 084-303 indicate the complete safety shut-in system.

A 24 volt DC battery-operated system is provided for critical electrical circuits where power dips or outage may upset the operation.

2.0 PLATFORM SHUT-IN SYSTEM (refer to Drawing 084-148)

The platform shut-in system consists of the operation of the sub-surface safety valves, the surface safety valves and the pipeline shut-in valves. The sub-surface safety valves on each well are hydraulically operated by a pneumatic control system. The surface safety valves are air operated spring closed valves at each wellhead. The pipeline valves are held open pneumatically and spring closed. The platform shut-in system is operated by only those functions that may endanger the platform as opposed by the production shut-in which are operated by upset operational functions.

The following functions close the platform shut-in system:

(1) Instrument air failure.
(2) Manual emergency control at the main control panel and other manual stations.
(3) Fire detectors.
(4) Gas detectors at high level setting.
(5) Control line breaks.
(6) Fire exposure of fusible links in pneumatic control lines.

3.0 DESCRIPTION OF THE PRODUCTION SHUT-IN SYSTEM (Refer to Drawing 084-303)

3.1 Each separator is equipped with high and low pressure and level electrical sensing devices. The Monterey Chert production separator controls shut-in all Monterey Chert wells under abnormal conditions. Similarly the sandstone separator controls shut in all sandstone wells. The well clean separator controls shut-in all producing wells. The test separator controls switch the well from the test separator to the production separator in which it is assigned.

3.2 Surge Tanks

The Well Clean Tank high level and the Crude Oil Surge Tanks high level, high pressure and low level controls shut-in all wells.

3.3 Shipping Pumps and Oil Pipeline

High and low pressure on the discharge of all shipping pumps and on the oil pipeline shuts in the pumps, all wells, and all pipeline block valves at the platform.

3.4 Fire and Gas Detectors

Fire and gas detector locations are shown on Drawing 084-147. In addition to automatically operating the fire pumps, sprinklers and shutting down running equipment, these systems shut-in all wells.

3.5 Emergency Surge Tank'

A high oil level in the emergency surge tank shuts in all wells.

3.6 Alarms and Annunciators

All abnormal functions above will actuate an annunciator and visually indicate to the operator the equipment and upset condition.

3.7 Test Provisions

Test switches are provided to allow the complete testing of all electrical circuits without disrupting the platform operation. These switches individually by-pass the safety shutdown on the electrical side for (1) the Monterey Chert Wells (2) the Sandstone Wells and (3) the pipeline valves.

3.8 Fusible plugs as well as the use of plastic pneumatic tubing in most runs make the system sensitive to fires and cause shut-in of the wells upon such exposure. This is in addition to the fire detection system.

3.9 All electrical and pneumatic circuits are fail-safe design excepting the fire and gas detectors. The fire and gas detector units are self monitoring and ring an alarm in the event of a circuit failure.

DRAWING LIST

Drawing No.	Description
084-148	Platform Shut-In Pneumatic System
084-303	Production Shut-In Electrical System

PRODUCTION SHUT-IN SYSTEM

A. WELLHEAD EQUIPMENT. All wellheads will have pneumatic, fail-closed, automatic shut-in valves, actuated by flowline high-low pressure pilots, as required by Federal OCS Order No. 8, paragraph 2A(2). See drawing 084-148. The wellhead valve on any well will close if the pressure in the flowline of that well is above or below the high or low pilot set pressures. The wellhead valves on all wells will close when upset operating conditions occur on the platform, as described in sections B-D below. Such conditions will cause one or both of the wellhead shutdown solenoids (EOV-A, EOV-B) to be deenergized, closing the associated wellhead valves.

B. PRESSURE AND LEVEL SHUTDOWNS. All pressure vessels and tanks will have high-low pressure sensors and high and low level shut-in controls, as required by Federal OCS Order No. 8, paragraph 2A(1). Shutdown devices on equipment serving only Monterey Chert wells or only Sandstone wells will shut in only the associated well group, while shutdown devices on equipment common to both groups will shut in all wells. The entire electrical shut-in system is shown schematically on drawing 084-303. Specific sections of the shut-in system are described below:

1. Monterey Chert Wells (only) Shut-ins

   a. Production Separator V-1A (see drawing 084-107):
      (1) High Pressure Shut-in (PSH-307) set at 200 psig.
      (2) Low Pressure Shut-in (PSL-307) set at 50 psig.
      (3) High Level Shut-in (LSH-113)
      (4) Low Level Shut-in (LSL-114)

   b. Production Separator V-1B (see drawing 084-108):
      (1) High Pressure Shut-in (PSH-308) set at 200 psig.
      (2) Low Pressure Shut-in (PSL-308) set at 50 psig.
      (3) High Level Shut-in (LSH-115)
      (4) Low Level Shut-in (LSL-116)

2. Sandstone Wells (only) Shut-ins

   a. Production Separator (V-1C) (see drawing 084-108):
      (1) High Pressure Shut-in (PSH-311) set at 400 psig.
      (2) Low Pressure Shut-in (PSL-311) set at 225 psig.
      (3) High Level Shut-in (LSH-120).
      (4) Low Level Shut-in (LSL-121).

   b. Sweet Gas Scrubber (V-5) (see drawing 084-121):
      (1) High Pressure Shut-in (PSH-346) set at 420 psig.
      (2) Low Pressure Shut-in (PSL-346) set at 225 psig.
      (3) High Level Shut-in (LSH-145).

3. Common (all wells) Shut-ins

a. Well Clean Separator (V-1D) (see drawing 084-126):
(1) High Pressure Shut-in (PSH-316) set at 1100 psig.
(2) Low Pressure Shut-in (PSL-316) set at 50 psig.
(3) High Level Shut-in (LSH-125).
(4) Low Level Shut-in (LSL-164).

b. Well Clean Surge Tank (V-10) (see drawing 084-126):
(1) High Level Shut-in (LSH-155).

c. Main Gas Scrubber (V-3) (see drawing 084-107):
(1) High Pressure Shut-in (PSH-313) set at 200 psig.
(2) Low Pressure Shut-in (PSL-313) set at 50 psig.
(3) High Level Shut-in (LSH-123).

d. Production Surge Tanks (V-4A, V-4B, V-4C) (see drawing 084-123):
(1) High Pressure Shut-ins (PSH-355, -356, -357) set at 30 psig.
(2) High Level Shut-ins (LSH-136, -137).
(3) Low Level Shut-ins (LSL-140, -141).

C. PIPELINE SHUT-INS. Oil and gas pipelines leaving the platform will be equipped with high-low pressure sensors, in accordance with Federal OCS Order No. 9, paragraph 1A(1). All pipeline pumps will be equipped with high-low pressure shut-in devices in accordance with the same Order, paragraph 1A(2). All pipelines leaving the platform will be equipped with automatic shut-in valves. In addition, the pipelines will be equipped with a leak detection system in accordance with the same Order, paragraph 1A(6). If pressures or pipeline leakage exceed the set-points of the above devices, the pipeline shut-in valves will close, pipeline pumps will shut down, and all wellhead valves will close. Drawing 084-303 shows the electrical shut-in system.

Initially there will be three pipeline pumps (P-4B, -4D, -4F) and one oil pipeline, with shutin valve FCV-17. See drawing 084-127. Specific parts of this system are described below:

1. Pipeline High-Low Pressure Shut-ins

a. PSH-362 set at 1300 psig.
b. PSL-363 set at 100 psig.

2. Pipeline Pump High-Low Pressure Shut-ins

a. PSH-364, -366 and -368 set at 1300 psig.
b. PSL-365, -367 and -369 set at 100 psig.

PLATFORM SHUT IN SYSTEM

1.0 GENERAL

This system is part of the Safety Facilities. It operates the surface safety valves, the sub-surface safety valves and the pipeline shut-in valves. The functions that operate this system are major emergency items rather than operational items.

2.0 DESCRIPTION OF THE SYSTEM

2.1 Sub-Surface Safety Valves

The system to operate these valves is schematically shown on Drawing 084-148. It is an air controlled hydraulic power system that generates and uses 3,000 psig thru a piping system to and in annulus of the tubing and casing of each well. The tubing valve is held open by the hydraulic pressure acting to balance the well pressure. Releasing the hydraulic pressure causes the well pressure to close the valve. A leak or break in the hydraulic system will cause the valves to close.

The pneumatic control pressure system is used to release the hydraulic pressure by a required shut-in function listed in Par. 4.0.

2.2 Surface Safety Valves

These valves are air operated spring closed well head valves at each well. They are controlled by the pneumatic control system as shown on Drawing 084-148. Shut-in functions listed in Par. 4.0 cause these valves to be depressured and are then closed by springs.

2.3 Pipeline Shut-In Valves

These shut-in valves are also air operated spring closed and are used to isolate the platform from oil and gas pipelines. Shut-in functions listed in Par. 4.0 cause the valves to close by depressuring the pneumatic control lines to the valves.

3.0 SYSTEM INTERLOCK

The pneumatic control system is set up for operation of emergency manual valves at 11 stations plus the main control panel. Operating these manual valves depressures the pneumatic system. Depressuring the pneumatic system causes the hydraulic system to be despressured thru interlocking valves thus causing all of the platform shut-in valves to close.

4.0 SHUT-IN FUNCTIONS

The following functions cause a platform shut-in resulting in closing of the surface valves, the sub-surface valves and the pipeline shut-in valves:

(1) Instrument Air Failure. Loss of air pressure causes the air operated valves to close and the hydraulically operated system to depressure by the interlocking valves thus closing all platform shut-in valves.

(2) Emergancy Manual Valves, at 11 stations plus the main control panel. The operation of any of these valves depressures the system and closes all platform shut-in valves as described in (1).

(3) Fusable Plugs when exposed to fire cause the pneumatic control circuit to depressure and all valves are closed similar to (2).

(4) Control Air and Hydraulic Line Breaks cause the system to depressure and close all shut-in valves.

(5) Fire and Gas Detector Shutdowns

1. A fire fighting system will be installed in accordance with Federal OCS Order No. 8, paragraph 2A(6). This system will close all subsurface safety valves, all wellhead valves and pipeline shut-in valves, and will automatically energize the fire extinguishing system, upon the detection of flame in wellhead rooms or production equipment spaces. See drawings 084-124 and 084-147. The electrical controls and shut-ins are shown by drawings 084-303 and 084-306.

2. A gas detection system will be installed in accordance with Federal OCS Order No. 8, paragraph 2A(7). This system will close all sub-surface safety valves, all wellhead valves and pipeline shut-in valves upon detection of combustible gas, exceeding the upper level of a two level gas detector setting. The lower level setting alarms only. The gas detectors are located in wellhead areas and production equipment spaces. See drawings 084-147, 084-303 and 084-306.

1.3 SHIPPING PUMPS CONTROL SYSTEM

SHIPPING PUMP CONTROL SYSTEM

1.0 GENERAL

This description applies to the operation of the controls for shipping oil thru the oil surge tanks, the booster pumps and the shipping pump to the oil pipeline.

Three shipping surge tanks, three booster pumps and three shipping pumps are involved. Provisions are made for the fourth pump line up. Refer to Piping and Instrument Drawing 084-123 and 084-127 for the general piping and instrument arrangement. Refer to Drawing 084-304 for the control schematic.

2.0 DESCRIPTION OF CONTROLS

2.1 Crude Surge Tanks V4A, V4B and V4C are designed so that any tank may be removed from service without disrupting the shipping program from all pumps. Two of these tanks are fitted with level controls. All tanks can be equalized so that controls from any one tank can control the shipping of oil.

2.2 Each control tank has two sets of level controls, one for low range and the other for high range. Each has a pneumatic level control that operates the by-pass valve from discharge to suction of each shipping pump. This pneumatic controller will normally control the level in the tank (or tanks) at a constant level. The level switches will start and stop pumps as necessary (if they are lined up for automatic operation) when the levels reach the range of the level switches.

The control schematic provides for four shipping pumps (one future). Each pump control has two selector switches: (1) to assign the pump to one or the other of the control oil surge tanks and (2) to select whether the pump is operated off the high or the low level range. The first selector switch provides for an off position to take the pump out of service.

2.3 Relay matrices assure that all start, run and sequence failure signals to the pumps are coordinated to prevent starting two pumps at the same time. Each pump matrix coordinates the run signal of the other pumps, the actual running of the other pumps, booster pump fail to start, shipping pump fail to start and hi-lo discharge shutdown.

2.4 A start sequence failure circuit is provided for proper coordination of start signal, booster pump start, shipping pump start and shut-down signals for each pumping string. The circuit with time delays prevents each booster pump and shipping pump running without its mate.

Hand mode on the HAND-OFF-AUTO switch of each pump will permit the use of a booster pump of one string with the shipping pump of another string. The pumps are also piped to operate in this manner.

2.5 Shutdown and lock-out circuits are provided for the following on each pumping string:

(1) Booster Pump start failure.
(2) Shipping Pump start failure
(3) Shipping Pump low suction pressure
(4) Shipping Pump high discharge pressure
(5) Pipeline high discharge pressure
(6) Pipeline low discharge pressure
(7) Shipping pump high motor winding temperature
(8) Shipping pump high oil temperature

These lock-out circuits are reset for each string by pressing a spring-loaded reset switch on the pump panel.

2.6 A shutdown annunciator is provided in the main control panel to indicate booster or shipping pump shutdown.

2.7 A pipeline pressure pneumatic control system overrides the tank level pneumatic controls when the pipeline pressure approaches the high pressure shutdown settings of the pipeline or shipping pumps. The purpose of this system is to continue shipping oil at near pipeline capacity limit by controling the input rate to the pipeline. A pneumatic pressure controller on the pipeline thru pneumatic signal selector relays takes over the control of the shipping pump by-pass valves (See Drawings084-123 and 084-127). Sustained operation of this control may result in a crude surge tank high level alarm and possible high level shutdown. The operators can prevent this by limiting well production to the shipping capacity.

1.4 FIRE PROTECTION WATER SYSTEM

FIRE PROTECTION WATER SYSTEM

1.0 GENERAL

This description applies to the facilities for fire protection on the Humble Oil & Refining Company offshore platform near Santa Barbara, California. The system is designed to meet or exceed the requirements of O.C.S Order No. 8. Salt water from the ocean is used as the source of supply.

2.0 SYSTEM DESCRIPTION

2.1 The overall system is indicated on Drawing 084-124. The water source is ocean water. Two electrically-driven and one diesel-driven engine pumps designed to supply 800 GPM of water at 150 psig discharge pressure are provided. In addition, a washdown capable of 300 GPM at the same pressure is available to be cross connected to the fire protection system. This gives a total of 2700 GPM with all pumps working.

2.2 The basic platform power supply is primarily from the Southern California Edison Company through a sub-marine cable. The platform has three 750KW gas turbine engine driven generators to supply power and act as standby emergency power. Any one or all of the generator power can be utilized to drive any of the platform equipment in an emergency including the fire protection water pumps.

2.3 The diesel engine is provided with remote starting equipment so that it may be started at any fire hose outlet or at any fire monitor.

2.4 Fixed water spray systems are provided for all well heads and for the main oil-containing production equipment such as separators, surge tanks, heat exchangers, shipping pumps and vapor compressors. These systems comply with NPFA 15. The fire detectors automatically energize the electrically driven pumps and activate the sprinklers of that zone. (See Drawing 084-124)

2.5 Fire monitors are provided at 3 locations. Two 500 GPM monitors are positioned above the drilling deck on the crane pedestals so they are above most of the equipment and are in an excellent position to fully cover the drill deck and its equipment. The nozzles are combination fog and full stream. The third monitor is located on the sub-deck to protect the oil sump and fire protection water pumps. This monitor delivers 170 GPM and is also combination fog and full stream. All monitors are manually operated.

2.6 One inch hose reel stations with combination nozzles and 100 feet of hose are provided at strategic locations on the drilling deck and on the production deck. These stations are backed up by washdown stations of identical equipment operating on another system supplied by the washdown pump. See Drawing 084-124 for specific locations.

2.7 All piping in the fire protection water and washdown systems is protectively coated internally to prevent rusting and scaling that could possibly plug the spray nozzles. The pipes remain dry in the spray systems from the automatic valves to the spray heads. The monitor and hose cabinets are full and under pressure up to the block valve at the item. Provisions are made to drain, flush and fill the wet piping system with fresh water.

3.0 CARBON DIOXIDE AND DRY CHEMICAL EXTINGUISHERS

3.1 A 100# CO_2 extinguisher cart as described in Section 12.1 Specification 10-084 FPEX is located in the main switchgear room to use on electrical fires.

3.2 Dry 150# chemical carts are provided on the production deck as shown on Drawing 084-147 and described in Specification 10-084 FPEX.

3.3 Dry 20# chemical extinguishers are located on the production deck as shown on Drawing 084-147 and described in Specification 10-084 FPEX.

FIRE AND GAS DETECTORS

1.0 GENERAL This description applies to the provisions on Humble Oil and Refining Company offshore platform near Santa Barbara for Fire and Gas Detectors.

2.0 DESCRIPTION OF SYSTEMS

2.1 The locations of fire and gas detectors are shown on Drawing 084-147. The fire protection water system is shown on Drawing 084-124 and described in 10-084-4. The gas detectors are described in Specification 10-084-GDU and the fire detector units are described in 10-084-FDU.

The gas detectors are basically hot wire type units with wheatstone bridge circuit. The elements are protected from sulfur deposits due to high H_2S by use of catalyst in the element. The fire detectors are ultra violet light sensitive type. Both units are specified to meet all requirements of OCS Order No. 8.

3.0 GAS DETECTORS Gas detectors are at approximate twenty-five foot spacing in the well head areas, in the main production equipment areas and in the compressor room. The gas detectors alarm at 20% of the lower explosive limit and the platform wells are shut-in at 50%LEL. Provisions have been made for periodic check of the detectors with a "test" gas of which the % LEL is known.

Gas detectors are not provided in the control rooms, switchgear rooms and living quarters. The location and spacing of the detectors is believed to be adequate to prevent the presence of gas in these locations.

4.0 Detectors are distributed throughout the following areas:

1. Well Head Area
2. Compressor Room
3. Production Equipment Area
4. Turbine Generator and Sweet Gas Scrubber Area

Energization of the detectors in the compressor area cause the compressors to shut-down and to be depressured in addition to shutting in wells and pipeline block valves. In the turbine generator area detectors alarm only and shut-in the platform wells and pipeline block valves. Energization of detectors in other areas causes the energization of automatic sprinklers in that zone.

The fire detector system has an automatic and continuous test and circuit malfunction alarm.

5.0 All fire and gas detectors will cause the platform wells to shut-in and the pipeline block valves to close upon their detection of conditions set to trip these items.

Humble Job 10240
H-B Job 10-084

CODE REFERENCES

The following is a list of codes that are referenced in this report:

1: United States, Department of Interior Geological Survey, Conservation Division, Branch of Oil and Gas Operations, Pacific Region Outer Continental Shelf Orders No. 1, thru and including No. 10

2: California Administrative Code, Title 8, General Industrial Safety Orders, Petroleum Safety Orders for Drilling and Production, Fired and Unfired Pressure Vessels.

3: California Administrative Code Title 24, Part 3, Basic Electrical Regulations, State Building Standards Electrical Code.

4: International Conference of Building Officials, Uniform Building Code and Uniform Plumbing Code and Uniform Mechanical Code, latest editions. Uniform Building Code - Standards (latest edition).

5: American Institute of Steel Construction, Manual of Steel Construction and codes referenced therein.

6: American Society of Testing Materials Standards, Part One - Ferrous Metals and Part Two - Non-Ferrous Metals latest edition.

7: National Electrical Code - latest edition.

8: United States Government Department of Labor, Occupational Safety and Health Administration, Title 29, Part 1910 (standards for sound levels).

9: American Society of Mechanical Engineers ASME Code for Unfired Pressure Vessels Section VIII.

10: American Petroleum Institute Standard 650 (latest edition) for Welded Steel Tanks for Oil Storage.

11: American National Standards Institute ANSI (formerly American Standards Association ASA) Code for Pressure Piping ANSI (ASA or USAS) B31.3 Petroleum Refinery Piping (latest edition).

12: Manufacturers Standardization Society for Valve and Fitting Industry.

13: Standards of the National Electrical Manufacturers Association.

14: Standards of the Institute of Electrical and Electronic Engineers.

15: Standards of Insulated Power Cable Engineers Association.

16: American Petroleum Institute
Reciprocating Compressors for General Refinery Service
API Standard 618.

DISCUSSION OF COMPLIANCE WITH OUTER CONTINENTAL SHELF ORDERS PACIFIC REGION (No. 1 thru 9)

The purpose of this discussion is to briefly review the orders or portions of orders that are applicable to the production facilities on the platforms. Pipelines, drilling facilities, and structural portion of the platform are not described in this report

Order No. and Date	
OCS #1 6/1/71	Applies to structural - not covered in this report.
OCS #2 7/1/71	Applies to drilling - not covered in this report.
OCS-#3 6/1/71	Applies to well abandonment - not applicable to this report
OCS-#4 6/1/71	Applies to operations - not pertinent in this report
OCS-#5 6/1/71	Installation of Subsurface Safety Device - This order applies to the work in this report. Provisions have been made for the full compliance. The wells will be capable of flowing as required in Paragraph 1. Subsurface safety valves will be installed at or below 100 feet beneath the ocean floor. The valves will be Otis Type H ball type. The surface hydraulic unit will be by Otis. See Drawing 084-148 for diagram of the control system. The sub-surface safety valves are fail safe, operated by well pressure. The valves are closed by manual operation thru a pneumatic and hydraulic system at 14 stations including those at two boat docks, one helipot, one in main control panel and 10 at various fire protection water stations. The operation of these manual stations shuts-in all well head safety valves in addition to the sub-surface valves. The energization of the platform fire detection system also closes the sub-surface valves. Fusable plugs and the use of plastic pneumatic tubing in strategic locations also provides for shut-in upon fire exposure.
OCS #6 6/1/71	Applies to completion of oil wells not covered in this report.
OCS #7 6/1/71	Pollution and Waste Water Disposal - Paragraph 1A applies. See OCS-8 for details. Paragraph 2B applies. Standby equipment is continuously available in the Santa Barbara Channel thru Clean Seas, Inc.

Order No.
and Date

OCS-8
6/1/71

Approval Procedure for Platform Installation and Operation

(1) Paragraphs 1A and 1B(1) are not covered in this report

(2) Paragraph 1B(2) applies.
1B(2)(a) The platform is both a drilling platform and a production platform producing oil and gas.

1B(2)(b) The transfer facilities and boat landings are covered in a separate part of this report. The heliport is described in the Crew's Quarters Section 17.1 of this report. The Heliport is on top of the crew's quarters and is an integral part of that package.

(3) 1B(2)(c) All decks of the platform are steel sheeting protectively coated with Humble Rust-Ban which is an inorganic zinc primer proven excellent in salt water and salt air atmosphere exposure.

(4) 1B(2)(d) Sub-surface areas of the platform are protected with the above coating in addition to the Cathodic protection system. The Cathodic protection system provides for 340KW output. Details of the anodes are not covered in this report. Sacrificial anodes may be installed in lieu of the electrically powered system.

(5) 1B(2)(e) Production Facilities are described in Section 1 thru 19 of this report. This report includes equipment specifications and details, layout, piping, electrical work, instruments and controls and safety devices. The main portion of this part of the report deals with this in detail.

(6) 1B(2)(f) Safety and Pollution Control Equipment and Features - The production facilities are designed in accordance with all known applicable codes and regulations of good practice. Codes and Regulations are listed in Section 1.6.

The platform is designed to prevent operational venting of any gas. A vapor recovery system collects vapors from all tanks and vessels containing hydrocarbons. All sumps and water tanks are covered and connected to the vapor recovery system. All sumps, oil tanks and water tanks containing oil are gas blanketed to prevent the occurance of an explosive atmosphere. All equipment handling flammable material is constructed of steel,

stainless steel, ductile iron or other fire safe materials. Most areas of the platform production facilities are classified as Class 1, Group D, Division 1, for electrical equipment and electrical work. The exceptions to this are: (1) Switchgear room and welding room which are air purged with purge failure alarms, (2) the gas compressor room is classified as Class 1, Division 2, to allow the use of synchronous motors, and (3) the crew's quarters which are classified as non-hazardous due to the location. The use of Class 1, Division 1, represents a very conservative design since all the hazardous areas on the platform would normally be classified as Division 2.

Fire detectors, gas detectors and a fire protection water system are provided as described in Sections 1.4, 1.5, 12.1, 12.2, 12.3 and as shown on Drawings 084-124 and 084-147. Reference is also made to the layout and detail drawings of this report in Section 21.

All relief valves and vents from pressure equipment are piped to a vent scrubber and then to a flare which is located on Cantilever structure to obtain a minimum of 100 feet clearance from the nearest platform corner. The flare stack provides continuous pilots to ignite any vented gas. A flow detector alarm is provided in the vent stack. A molecular seal is provided to prevent flash back from the flare to the vent system. Reference is made to Section 11.0 of the report, to Drawings 084-138, 084-400, 084-402 and 084-143 and all other drawings in Section 21.

Provisions are made to clean all produced water in facilities shown on Drawing 084-120 and equipment described in Section 9.0. The produced water is collected, skimmed and fed to a four-stage flotation unit for oil removal. The clean water stored and is recycled through the flotation unit which has excess capacity for this. Water from the clean water surge tank is directed to a disposal tube which projects 250 feet below the surface. Traces of oil if any are trapped in this tube and pumped back to the oil system. A turbidity meter is provided to alarm any upset condition of water output from the flotation unit. As production proceeds close monitoring of water quality will be practiced. Any necessary additional equipment will be anticipated and installed as required. A graded media filter may be provided if the need arises.

(7) 2A(1) (a thru g) are provided for in the design as shown on Drawings in Section 19 and described in detail in Sections 3, 4, 5, 7 and 11.

(8) 2A(2) (a thru e) equipment is described in Section 2.0. Compliance with the requirements is shown on Drawings 084-129. The flow lines to the separators are adequate for the full well head pressures as described in Section 1.1, 10-081-1, Par. 2.1. Drawings 084-184 shows the fusible link and remote shut-in stations. A plan locating these stations is shown on Drawing 084-147.

(9) 2A(f) thru (i) are operational items not covered in this report.

(10) 2A(3) curbs, gutters and drains are provided on both the drilling and production decks (upper and lower decks respectively). These drains divert the fluids to the drain sump. This system is shown on Drawing 084-120.

(11) 2A(4) Three 750KW gas turbine electric generators are provided to furnish emergency power. These units are more than adequate to furnish all necessary power to maintain safe operation in the event of the failure of the shore side power. This equipment is described in Section 8 and the electrical single line diagram is is shown on Drawing 084-302.

(12) 2A(5) (a & b) This has been covered in the discussion under Item (6) above. Operational requirements are not covered in this report.

(13) 2A(5) (a thru d) Fire protection system is described in Section 1.4 and shown on Drawing 084-124. Equipment is described in Section 12.2. 2A(5)(e) is operational and will not be covered in this report.

(14) 2A(7) (a thru f) The automatic gas detector system is described in Section 1.5. The locations are shown on Drawing 084-147 and equipment is described in Section 12.3.

(15) 2A(8) (athru c) The only engines used in the production facilities are gas turbine engines. They meet the requirements of (a). All electrical work complys with State of California Title 24 Electrical Safety Orders, The National Electric Code, and API-RP-500.

(16) 2A(9) A sewerage disposal unit meeting the requirements is provided as described in Section 16.1.

Order No.
and Date

(17) 2B Welding Practices. An enclosed and fresh air purged welding room is provided complete with its purge air supply and purge failure alarm. This room meets the requirements of 2B(2)(a). Other items in this paragraph are operational and are not covered in this report.

OCS #9
6/1/71

Approval Procedure for Pipelines - This deals with pipelines which are not covered in this report. The pipeline automatic shutin valves are described in Section 6.0 Specification 10-084 FCV-17 and shown on Dwg. 084-127.

The pipeline leak detector is part of the on-shore equipment not covered in this report. The platform crude oil meters are provided with a signal output to coordinate with the detectors as described in Section 4.3 of this report.

OCS #10
6/1/71

Drilling of Twin Core Holes - This does not apply to this work.

1.7 POLLUTION CONTROL EQUIPMENT

POLLUTION CONTROLS

1.0 GENERAL

This data sheet is to summarize and reference pollution control features and facilities provided in this project.

2.0 OIL CONTROL

The oil system is a closed system. All vessels and equipment used in the system are equipped as required by OCS Order #8. Pressure and level shut-in controls prevent relief valves from being popped. All relief emissions are piped to a vent scrubber tank prior to being directed to the vent flare. Additional emergency surge is provided and utilized if the vent surge tank becomes full. Thus the primary shut-in system is backed up with two surge systems making the possibility of oil spills, due to over pressure or high level in vessels, very unlikely. Even in the event of failure of the shut-in controls the surge would give adequate time to manually control the oil before spills would occur. The platform decks are designed to contain oil or water spills from the equipment. Piped drains direct the liquid to the oil or water sumps or to the disposal tube. The disposal tube traps the oil and returns it to the production equipment. The oil or water sumps are closed and are equipped with pumps to return the liquids to the process systems on the platform. These facilities are described in the plans and specifications referenced in Sections 2,3, 4,5,6,9,11,14 and 16 of this report.

3.0 GAS AND VAPOR CONTROL

The facilities are designed to prevent the emission of gases or vapors or the flaring of same during the normal operation of the facilities. The gases from the crude oil production are collected at 85 psig and compressed for sales or reinjection.

All low pressure and atmospheric tanks or vessels containing any oil or vapors are equipped with a vapor recovery system. This system collects all vapors and feeds them into the main gas compressors and are disposed of as mentioned above.

The relief valve system and pressure and level controls described in Par. 2.0 also applies to the gas and vapor system. A flare boom and flare is provided to burn any gas emission during the emergency condition.

A gas detector system senses gas leaks and shuts-in the wells upon energization of the detectors. The facilities for handling the gas and vapors are described in specifications and shown on drawings referenced in Sections 3,4,7,11, 12.3 and 16.

4.0 WATER CLEANING

Produced water is cleaned by gravity separation in a dirty water surge tank and then passed through a 4 stage mechanical flotation unit. It is then sent through a clean water surge tank for further gravity separation. The water is recycled to the flotation unit from the clean water tank. A turbidity meter and alarm continuously monitors the outlet from the flotation unit. Clean water is disposed of to the sea through the disposal tube. The disposal tube traps any residual oil and a pump returns the oil to the production equipment on the platform.

Surface water from rain or platforms washdown can be diverted to the produced water treating facilities or to the disposal tube directly.

The water cleaning system is described and shown on specifications and drawings referenced in Sections 3, 4 & 9 of this report.

5.0 SEWERAGE

All sewerage is collected and piped to a sewerage treatment unit digested and sterilized by chlorination prior to disposal as described in Section 16.1.

6.0 WELL MUD

A well clean tank and piping is provided to collect, decant the oil and pipe the used mud to a disposal barge. This equipment is shown on Drawing 084-126 and described in specifications referenced in Section 3.3.

7.0 SOLIDS WASTES

Waste containers for solids are provided on the platform as shown on Drawing 084-149. These materials are to be transported by barge ashore for disposal.

2.0 WELLHEADS & FLOW MANIFOLDS

Humble Job 10240
H-B Job 10-084

Specification 10-084-WHSU-

WELL HEADS-MONTEREY CHERT
SAFETY SHUT-IN VALVES
MARK FCV-A1-1 thru FCV-A1-30
(Order as required as wells are completed)

These valves are for use for the main automatic well head shut-in system. They are to be 600 RTJ ANSI flanged end steel body valves. The valves shall be 3" McEvoy Model C thru conduit gate valves with U S Industries Manumatic Actuator. Actuator to be furnished with Class 1, Group D, explosion proof limit switches SPDT to indicate when valve is fully open or fully closed.

WELL HEADS-SANDSTONE
SAFETY SHUT-IN VALVES
MARK FCV-A2-1 thru FCV-A2-30
(Order as required as wells are completed)

These valves are for use for the main automatic well head shut-in system. They are to be 900 RTJ ANSI flanged end steel body valves. The valves shall be 3" McEvoy Model C thru conduit gate valves with U S Industries Manumatic Actuator. Actuator to be furnished with Class 1, Group D, explosion proof limit switches SPDT to indicate when valve is fully open or fully closed.

WELL HEADS-MONTEREY CHERT
FLOW BEAN
(FCV-B1-1 thru FCV-B1-30)
(Order as needed as wells are completed)

These valves are to be 3" - 600#RTJ ANSI flanged steel body Willis MOV-M3 with provisions for up to 2 - 1-3/16" orifices with CV equal to 56. Orifices are to be specified on each order as well data are developed.

WELL HEADS-SANDSTONE
FLOW BEAN
(FAC-B2-1 thru FCV-B2-9)
(Order as needed as wells are completed)

Same as above except 900# RTJ ANSI flanged.

Humble Job 10240
H-B Job 10-084

Specification 10-084-FCV-C1

WELL TEST SWITCHING VALVES-MONTEREY CHERT

FCV-C1A,B & C thru FCV-C35A,B & C

(90 req'd. as wells are completed)

Each of these valve units consist of an assembly of one ball valve with a pneumatic operator. The valves are to be Cameron Ball Valves, 3" 600# ANSI buttwelded steel body with 3" bore and with 20B corrosion resistant trim (or approved equal).* The pneumatic operators shall be Bettis Model CB525 with adapter and mounting bracket. The operator is for use with 100 psig air. The operator shall be mounted on the valve. The adapter shall be arranged with the cylinder of the operator parallel with the valve bore.

Mount and pipe two 3-way solenoid valves to pilot the pneumatic operator. One solenoid to be normally closed and the other normally open. Solenoid valves to be Asco 832068 and Asco 832064 respectively. The solenoid valves are 115V, 60 hertz, stainless steel bodies, 1/4" FPT, 1/16" orifice, explosion proof and water tight enclosure adequate to operate at 125 psi differential pressure.

The pilots are to be piped to one single 1/4" FPT air connection. Piping shall be 1/4" standard type 304 stainless steel pipe with 150# stainless steel screwed fittings (ASTM 182 GR F304 by Laddish or equal). Unions to be 150# stainless steel of same material as fittings. Unions shall be placed at each cylinder connection to allow removal of pneumatic operator without dismantling the pilot piping. The solenoid valves

to be connected so that pneumatic operator piston is at the top of its stroke (with assembly in position described above) with both solenoid valves de-energized.

Bidders to submit a drawing or sketch showing arrangement and dimensions with the quotes. Drawing to call out and identify all items on the assembly.

* Orbit 600# RTJ No. 1433 with 80625 actuator is acceptable

Humble Job 10240
H-B Job 10-084

Specification 10-084-FCV-C2

WELL TEST SWITCHING VALVES-SANDSTONE

FCV-D1A & B thru FCV-D6A & B

(18 req'd. as wells are completed)

Each of these valve units consist of an assembly of one ball valve with a pneumatic operator. The valves are to be Cameron Ball Valves, 3" 900# ANSI **buttwelded** steel body with 3" bore and with 20B corrosion resistant trim (or approved equal).* The pneumatic operators shall be Bettis Model CB525 with adapter and mounting bracket. The operator is for use with 100 psig air. The operator shall be mounted on the valve. The adapters shall be arranged with the cylinder of the operator parallel with the valve bore.

Mount and pipe two 3-way solenoid valves to pilot the pneumatic operator. One solenoid to be normally closed and the other normally open. Solenoid valves to be Asco 832068 and Asco 832064 respectively. The solenoid valves are 115V, 60 hertz, stainless steel bodies, 1/4" FPT, 1/16" orifice, explosion proof and water tight enclosure adequate to operate at 125 psi differential pressure.

The pilots are to be piped to one single 1/4" FPT air connection. Piping shall be 1/4" standard type 304 stainless steel pipe with 150# stainless steel screwed fittings (ASTM 182 GR F304 by Laddish or equal). Unions to be 150# stainless steel of **same** material as fittings. Unions shall be placed at each cylinder connection to allow removal of pneumatic operator without dismantling the pilot piping. The solenoid valves to be connected so that pneumatic operator piston is at the top of its stroke

(with assembly in position described above) with both solenoid valves de-energized.

Bidders to submit a drawing or sketch showing arrangement and dimensions with the quotes. Drawing to call out and identify all items on the assembly.

* Orbit 900# RTJ No. 1533 with 160100 actuator is acceptable

Humble Job 10240
H-B Job 10-084

Specification 10-084-PSHL-1

WELL HEAD-MONTEREY CHERT
HI-LO PRESSURE PILOTS
MARK PSHL A1-1 THRU PSHL A1-30
(Order as needed when wells are completed)

These pilots are to be used as high or low pressure shutdown pilots for each well flow line. The units shall be U S Industries YH-P controller as shown on USI drawing No. RP 21639 complete with one YH-5 and one YL Pilot. The YH-5 shall have adjustable range of 900-1600 PSIG and shall be set at 1440 psig on increasing pressure. The YL pilot shall have a range of 10-150 psig. Set at 50 psig on decreasing pressure. All materials to be corrosion resistant, type 304SS, or better.

Humble Job 10240
H-B Job 10-084

Specification 10-084-PSHL-

WELL HEADS - SANDSTONE
HI-LO PILOTS
MARK PSHL-A1-1 thru PSHL-A1-9
(REQUIRED ORDER AS NEEDED WHEN WELLS ARE COMPLETED)

A2

These pilots to be used as high or low pressure shutdown pilots for each well flow line. The units shall be U S Industries YH-P Controller as shown on USI Drawing No. RP-21639 complete with one YH-5 and one YL Pilots. The YH-5 shall have an adjustable range of 1700-3000 psig and shall be set at 2160 psig. The YL pilots shall have an adjustable range of 100-450 psig and shall be set at 250 psig. All materials to be corrosion resistant, type 304 SS or better.

3.0 OIL & GAS SEPARATION

3.1 PRODUCTION SEPARATORS & GAS SCRUBBER

SPECIFICATION FOR PACKAGED PRODUCTION SEPARATORS AND GAS SCRUBBER UNIT

1.0 GENERAL:

This specification and the plans and specifications referenced herein describe the work and material by the Contractor. The work includes furnishing all equipment and material except those specifically stated as furnished by others in the request for quotation by Humble Oil and Refining Company. The packaged units includes: (1) three three-phase oil, gas and water separators; (2) one main gas scrubber, complete with base, piping, instruments and controls, electrical wiring and protective coatings. Two skid mounted units contain all the equipment. The units are to be completely assembled and tested prior to shipment. Delivery of the units shall be made f.o.b. trucks at jobsite location stated in Humble's request for quotation.

The equipment is to be installed by Humble on an off-shore oil drilling and production platform. The unit will be continuously exposed to a wet salt air atmosphere. The electrical work shall be for Class 1 Division 1 hazardous location.

2.0 SCOPE OF WORK:

All equipment, material and work shall be as described in this Specification 10-084-PSU and drawings and specifications listed in Par. 6. Codes and standards referenced herein are a part of these Specifications.

3.0 EQUIPMENT, MATERIALS AND CONSTRUCTION

3.1 Oil, Gas and Water Separators & Main Gas Scrubber

Specification 10-084-PSU1 and Drawings 084-113 and 084-115 describe the main production separators V1A and V1B. Specification 10-084-PSU2 and Drawing 084-116 describe the Sandstone Production Separator V1C. Specification 10-084-PSU3 and Drawing 10-084-114 describe the Main Gas Scrubber V3.

3.2 Instruments, Meters and Control Valves

Instruments and control valves are described on data sheets in Specification 10-084-PSU-J1. The main gas meter including transducers and digital readout items are described in 10-084-MGS1.

Read-out items and other items not to be installed in the packaged assembly shall be delivered to a site specified by Humble for incorporation into the platforms master control panel.

3.3 Skid Base Supports and Access Ladders

The skid bases, supports and structural steel shall comply with the applicable parts of the AISC Manual of Steel Construction. All joints shall be solidly welded and continuously sealed so that the protective coatings will be effective. The skid base shall be fabricated as shown on Dwg. 084-117. The contractor shall be responsible to see that all structural items including miscellaneous supports are adequate for marine handling and will withstand a 20% seismic force.

Piping supports are not detailed on the drawings. The Contractor shall be responsible to install these wherever necessary as part of his contract. These supports shall be welded or bolted steel and shall be square plumb and first class in appearance and workmanship. All steel edges and corners shall be ground to 1/8" minimum radius. Steel access ladders and platforms for instruments and controls shall be furnished and installed These shall be located after final assembly of piping and are subject to approval by Humble prior to installation. Ladders shall conform to State of California Safety Orders.

3.4 Piping Valves and Fittings

3.41 Piping valves and fittings shall be installed as shown on drawings 084-107, 108, 109, 110, 111, 112, and 117. The Contractor shall be responsible for field checking the dimensions of all items prior to starting the assembly to assure proper fit up.

All piping work shall conform to American Standard Code for Pressure Piping, Petroleum Refinery Piping USAS B31.3 latest edition, Chapters V & VI. All welds shall be subject to radiographic inspection at Humble's request. Initial cost of the inspection is for Humble's account. Repairs due to defects and reinspection costs are for the Contractor's account. The acceptability of welds to be in accordance with ASME Code, Section VIII Par. UW52.

3.42 Valves shall be as shown on Drawings 084-107 and 084-108 (or approved equal). Bidders to quote manufacturer's and catalog numbers on base bid plus alternate makes with a pricing schedule.

3.43 Piping materials shall conform to the Piping Specification for the class shown on Drawings 084-107 and 084-108.

3.44 Instrument tubing materials shall conform to those shown on Drawing 084-118. All instrument tubing shall be run square and plumb. All tubing bends shall be neatly made with tubing benders. All tubing runs shall be supported in steel channels or firmly attached to piping runs. Tubing and support work shall be first class in appearance and workmanship.

3.5 Protective Coatings

3.51 Internal Protective Coatings for all oil, gas and water piping, valves and fittings shall be Tube-Kote TK21 (12-15 mils) heat cured epoxy (or approved equal). All welds to be ground smooth prior to application of coating. Surface preparation shall be same as in Specification 10-084-C2. Instrument items shall be coated with this system where specified on data sheets of Specification 10-084-J1.

3.52 External Protective Coatings shall be applied to all metal surfaces except stainless steel and aluminum. Instrument cases, glass and name plates are not to be coated. The coating shall conform to Specification 10-084-C2.

3.53 Separator Internal Coatings - The separator shells, heads, nozzles and internals shall be protectively coated in accordance with Specification 10-084-C1. All shell and head welds shall be ground smooth on the interior prior to coating.

3.6 Electrical work shall comply with Specification 10-084-PSU-E1.

3.7 Testing - After assembly of all piping the oil water and gas piping shall be hydrotested as follows: V1A, V1B and V-3 systems at 412 psig and V-1C system at 750 psig. All instruments shall be disconnected prior to testing. Test pressure shall be held for a minimum of one hour and equipment carefully inspected for leaks. Humble to be notified of test schedule so they may witness them at their option. Equipment shall be thoroughly dried and cleaned inside. Control systems shall be tested to prove they operate properly. Humble shall be notified prior to check out so they may have the option to witness the tests.

3.8 Drying and Sealing for Shipment - Vessel and piping shall be sealed for shipment with dry air inside and adequate desiccant to maintain dryness in the units. Instruments shall be removed and packaged separately in crates for shipping.

4.0 QUOTATIONS shall be for a lump sum firm price to furnish the completed units f.o.b. trucks at the jobsite designated on the Humble request for quotation. Bidders shall summarize and list any exceptions from these Specifications. The quotation shall essentially comply with these specifications. Exceptions will be allowed only on the basis of equal or better units with essentially no change in the arrangement.

5.0 GUARANTEE - The Contractor and the manufacturer shall guarantee all items and the assembly to comply with these Specifications and to be free of defects in material and workmanship for a period of 12 months from first service date.

6.0 SPECIFICATIONS AND DRAWING LIST

Specifications

10-084-PSU	Specification for packaged production separator units with main gas scrubber
10-084-PSU1	Specification for Production Separators V1A & V1B.
10-084-PSU2	Specification for Sandstone Production Separator V1C
10-084-PSU3	Specification for Main Gas Scrubber V3
10-084-PSUE1	Electrical Specification for Packaged Units
10-084-MGS1	Specification for Main Production Digital Gas Measurement Equipment
10-084-PSU-J1	Specification Instruments & Controls
Class A	Specification Class A Piping
Class AA	Specification Class AA Piping
Class B	Specification Class B Piping
10-084-C1	Specification Protective Coatings, Epoxy-mastic for Internal Surfaces
10-084-C2	Specification for Application of Protective Coatings to External Surfaces

Drawings

084-107	Production Separator V1B and Main Gas Scrubber P & I Diagram
084-108	Production Separator V1B and Sandstone Separator V1C P & I Diagram
084-109	Gas Scrubber V3 and Separator V1A Piping Plan
084-110	Gas Scrubber V3 and V1A Piping Elevation
084-111	Sandstone Separator V1C and Separator V1B Piping Plan
084-112	Separators V1B & V1C Piping Elevation
084-113	Production Separator V1A
084-114	Gas Scrubber V3
084-115	Production Separator V1B
084-116	Sandstone Separator V1C
084-117	Skid Bases & Piping Elevations
084-118	Electrical and Instrumentation Connections

7.0 TECHNICAL DATA

Supplier shall furnish 6 copies of all parts lists, operating and maintenance instructions, sectional drawings, wiring schematics, connection diagrams and certified dimensional outline drawings at time of shipment of unit.

SPECIFICATION FOR

PRODUCTION SEPARATORS V1A & V1B
(2 required)

1.0 GENERAL

This specification applies to the purchase of two oil production separators. The separators are to be used in a packaged unit for an off-shore platform. The separators are three phase. Drawings referenced herein show the size, arrangement and construction locations. These shall not be changed. Internals equal to or better than those shown may be supplied if the details are approved by the Humble Engineer.

2.0 DESIGN CONDITIONS

The manufacturer shall be responsible for the design and construction of the separator to meet the design conditions as follows:

V1A & V1B Separators

Design Pressure	275 psig @ 100°F
Normal Pressure	85 psig @ 100°F
Oil Rate	30,000 B/D
Gas Rate	14.0 MMSCFD
Water Rate (max.)	12,000 B/D
Oil Gravity	16-23°API
Gas Specific Gravity	0.85
Oil Viscosity	7000 SSU (max.)
Temperature	100°F - 110°F

3.0 SEPARATOR INTERNALS AND ACCESSORIES

3.1 Scrubber Plates. Each separator shall be equipped with anti-foam scrubber plates, Dixon or approved equal. Bidders to specify the total plate area in their proposals. Demister mesh shall not be used.

The scrubber section shall be designed for a maximum of 1 gallon liquid carryover per million SCF of gas.

3.2 The primary scrubber shall be designed by the manufacturer.

3.3 The remainder of the internals shall be essentially as shown on the drawings.

3.4 Separator manufacturer shall check and be responsible to see that all instruments specified in the attached specification sheets will properly fit the separators and clear as necessary all internals.

3.5 All separator internals except the scrubber plates shall be protectively coated in accordance with the attached specifications for protective coatings of vessel internals. Bidders to quote an alternate proposal to coat the scrubber plates.

4.0 CONTROLS AND INSTRUMENTS

These items are to be as specified on the attached data sheets and specifications. The purchaser will specify on the purchase order if these are to be furnished with the separator.

The gage glasses and cocks will be furnished and installed by the separator manufacturer.

5.0 VESSEL SHELL AND CONNECTIONS

5.1 The manufacturer shall design, construct, test and certify the shells in accordance with the ASME Code Section VIII, Latest Edition. A corrosion allowance of 1/16" shall be provided throughout. The vessel shall be coated internally with protective coating as specified in the attached specifications.

5.2 All welds for nozzles and connections penetrating the vessel shell shall be full penetration.

5.3 Humble shall have access to inspection of vessels during fabrication. Purchaser reserves the right to radiograph any or all vessel welds before or after delivery of the vessel. Defects detected by this inspection shall be repaired at the expense of the manufacturer.

5.4 Manhole davits shall be provided at each manhole to properly handle the cover.

5.5 Shell supports to be adequate to support vessels full of liquid with 20% seismic force when vessels are stacked. The minimum metal thickness for supports is 1/4".

6.0 TECHNICAL DATA

6.1 Bidders shall furnish proposed scrubber plate area, spacing, length and metal thickness.

6.2 Bidders shall furnish details of any deviation proposed from these specifications and drawings.

6.3 Supplier shall furnish Humble with 3 copies of shop drawings for approval prior to starting fabrication.

6.4 Supplier shall furnish Humble 6 copies of certified dimensional drawings and final shop drawings. Six copies of final as-built drawings shall be furnished if any changes are made during fabrication of the vessel.

6.5 Guarantee

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date.

SPECIFICATION FOR

SANDSTONE PRODUCTION SEPARATOR V-1C

1.0 GENERAL

This specification applies to the purchase of an oil production separator. The separator is to be used in a packaged unit for an off-shore platform. The separator is three phase. Drawings referenced herein show the size, arrangement and construction locations. These shall not be changed. Internals equal to or better than those shown may be supplied if the details are approved by the Humble Engineer.

2.0 DESIGN CONDITIONS

The manufacturer shall be responsible for the design and construction of the separator to meet the design conditions as follows:

V1C Separator

Design Pressure	500 psig @ 100°F
Normal Pressure	350 psig @ 110°F
Oil Rate	5000 B/D
Gas Rate	5.0 MMSCFD
Water Rate (max.)	2000 B/D
Oil Gravity	32° API
Gas Specific Gravity	0.70
Oil Viscosity	100 SSU
Temperature	100°F

3.0 SEPARATOR INTERNALS AND ACCESSORIES

3.1 Scrubber Plates. Each separator shall be equipped with anti-foam scrubber plates, Dixon or approved equal. Bidders to specify the total plate area in their proposals. Demister mesh shall not be used.

The scrubber section shall be designed for a maximum of 1 gallon liquid carryover per million SCF of gas.

3.2 The primary scrubber shall be designed by the manufacturer.

3.3 The remainder of the internals shall be essentially as shown on the drawings.

3.4 Separator manufacturer shall check and be responsible to see that all instruments specified in the attached specification sheets will properly fit the separators and clear as necessary all internals.

3.5 All separator internals except the scrubber plates shall be protectively coated in accordance with the attached specifications for protective coatings of vessel internals. Bidders to quote an alternate proposal to coat the scrubber plates.

4.0 CONTROLS AND INSTRUMENTS

These items are to be as specified on the attached data sheets and specifications. The purchaser will specify on the purchase order if these are to be furnished with the separator.

The gage glasses and cocks will be furnished and installed by the separator manufacturer.

5.0 VESSEL SHELL AND CONNECTIONS

5.1 The manufacturer shall design, construct, test and certify the shells in accordance with the ASME Code Section VIII, Latest Edition. A corrosion allowance of 1/16" shall be provided throughout. The vessel shall be coated internally with protective coating as specified in the attached specifications.

5.2 All welds for nozzles and connections penetrating the vessel shell shall be full penetration.

5.3 Humble shall have access to inspection of vessels during fabrication. Purchaser reserves the right to radiograph any or all vessel welds before or after delivery of the vessel. Defects detected by this inspection shall be repaired at the expense of the manufacturer.

5.4 Manhole davits shall be provided at each manhole to properly handle the cover.

5.5 Shell supports to be adequate to support vessels full of liquid with 20% seismic force when vessels are stacked. The minimum metal thickness for supports is 1/4".

6.0 TECHNICAL DATA

6.1 Bidders shall furnish proposed scrubber plate area, spacing, length and metal thickness.

6.2 Bidders shall furnish details of any deviation proposed from these specifications and drawings.

6.3 Supplier shall furnish Humble with 3 copies of shop drawings for approval prior to starting fabrication.

6.4 Supplier shall furnish Humble 6 copies of certified dimensional drawings and final shop drawings. Six copies of final as-built drawings shall be furnished if any changes are made during fabrication of the vessel.

6.5 Guarantee

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date.

SPECIFICATION FOR

MAIN GAS SCRUBBER SEPARATOR V3
(One Req'd.)

1.0 GENERAL

This specification applies to the purchase of a production gas scrubber. The scrubber is to be used in a packaged unit for an off-shore platform. Drawings referenced herein show the size, arrangement and construction locations. These shall not be changed. Internals equal to or better than those shown may be supplied if the details are approved by the Humble Engineer.

2.0 DESIGN CONDITIONS

The manufacturer shall be responsible for the design and construction of the separator to meet the design conditions as follows:

V3 Separator

Design Pressure	275 psig @ 100°F
Normal Pressure	80 psig @ 100°F
Liquid	2000 B/D (max)
Gas Rate	28.0 MMSCFD
Liquid sp. gr.	0.60 to 0.93
Gas Specific Gravity	0.85
Liquid Viscosity	7000 SSU (max.)
Temperature	100°F

3.0 SCRUBBER INTERNALS AND ACCESSORIES

3.1 Demister. Each separator shall be equipped with a type 304 or 316 ss mesh type demister, 6" thick, York (or approved equal). The demister and its supports shall be adequate to withstand a differential pressure of 2 psi in either direction. The demister shall be removable and replaceable without welding through the vessel manway.

The demister section shall be designed for a maximum of 1 gallon liquid carryover per million SCF of gas.

3.2 The remainder of the internals shall be essentially as shown on the drawings.

3.3 Separator manufacturer shall check and be responsible to see that all instruments specified in the attached specification sheets will properly fit the separators and clear as necessary all internals.

3.4 All separator internals except the demister mesh shall be protectively coated in accordance with the attached specifications for protective coatings of vessel internals.

4.0 CONTROLS AND INSTRUMENTS

These items are to be as specified on the attached data sheets and specifications. The purchaser will specify on the purchase order if these are to be furnished with the separator.

The gage glasses and cocks will be furnished and installed by the separator manufacturer.

5.0 VESSEL SHELL AND CONNECTIONS

5.1 The manufacturer shall design, construct, test and certify the shells in accordance with the ASME Code Section VIII, Latest Edition. A corrosion allowance of 1/16" shall be provided throughout. The vessel shall be coated internally with protective coating as specified in the attached specifications.

5.2 All welds for nozzles and connections penetrating the vessel shell shall be full penetration.

5.3 Humble shall have access to inspection of vessels during fabrication. Purchaser reserves the right to radiograph any or all vessel welds before or after delivery of the vessel. Defects detected by this inspection shall be repaired at the expense of the manufacturer.

5.4 Manhole davits shall be provided at each manhole to properly handle the cover.

5.5 Shell supports to be adequate to support vessels full of liquid with 20% seismic force when vessels are stacked. The minimum metal thickness for supports is 1/4".

6.0 TECHNICAL DATA

6.1 **Bidders shall furnish details of any deviation proposed from these specifications and drawings.**

6.2 **Supplier shall furnish Humble with 3 copies of shop drawings for approval prior to starting fabrication.**

6.3 Supplier shall furnish Humble 6 copies of certified dimensional drawings and final shop drawings. Six copies of final as-built drawings shall be furnished if any changes are made during fabrication of the vessel.

6.4 Guarantee

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date.

ELECTRICAL SPECIFICATION

PACKAGED PRODUCTION SEPARATORS

AND GAS SCRUBBER

1.0 GENERAL:

This specification applies to the installation of all conduit and junction boxes to be used on production separators V-1A and V-1B, sandstone separator V-1C, and gas scrubber V-3. The packaged units shall be complete and ready for wiring and shall comply with this specification and attached drawings.

2.0 CODES:

The assembly shall conform to the "National Electric Code", latest edition, and to the "State of California Electrical Safety Orders", latest edition. Wherever a conflict arises, the more stringent code shall take precedence. All electrical work shall comply with the Class I Division 1 area classification for hazardous locations. All junction boxes shall have screwed covers.

3.0 SCOPE OF THE WORK:

The Contractors work includes, but is not limited to the following items:

3.1 Furnish and install all conduit to the high and low differential pressure transducers, static pressure transducer and temperature transducer as shown schematically on Drawing No. 084-118.

3.2 Furnish and install all conduit to the high and low level shutdowns, the high pressure shutdowns and the conductivity probes complete with control chassis and solenoid valves as shown schematically on Drawing No. 084-118.

4.0 MATERIALS:

4.1 The Contractor shall use all new materials, first quality, approved by UL wherever standards have been established by that agency and shall meet these specifications and other requirements as shown on the plans. It is intended that the Contractor shall furnish and install all items of material required for a complete installation.

4.2 Conduit shall consist of rigid copper free aluminum conduit having a copper content of 4/10 of 1% or less.

4.3 All junction boxes shall have screwed covers, similar to the Crouse Hinds GUA series, and shall have a copper content of 4/10 of 1% or less.

4.4 All seals and unions shall have a copper content of 4/10 of 1% or less.

5.0 ELECTRICAL CONSTRUCTION:

The installation shall conform to the latest applicable rules of the national and state codes. The workmanship shall be of the highest grade and defective equipment or equipment damaged in the course of installation shall be replaced or repaired in a manner meeting with the approval of the Humble Oil Engineer.

The conduit system installation shall meet or exceed the requirements of the N.E.C. Minimum size of conduit shall be 1/2 inch. Field made bends and off sets shall be made with an approved Hickey or conduit bending machine. Changes in direction of runs shall be made with bends or cast metal fittings. Raceways as installed shall be entirely free of obstructions. All conduit shall be reamed, burrs removed, and cleaned for proper introduction of wires and cables.

6.0 GUARANTEE:

All equipment, material and workmanship to be furnished under this section shall be guaranteed by the Contractor in writing, for a period of one year from the date of acceptance.

SPECIFICATION
MAIN PRODUCTION
DIGITAL GAS MEASUREMENT
EQUIPMENT

1.0 GENERAL

This specification applies to the purchase of equipment for use on a meter-scrubber package for an off-shore platform. The scrubber and meter are to be on a packaged skid mounted module. Flow element and transducers are to be mounted on the skids which are located in a Class 1, Division 1 hazardous location. The flow computer is to be located approximately 100 feet away in a purged control room classified as non-hazardous. Equipment on the skid is to be continuously exposed to wet salt air atmosphere.

2.0 EQUIPMENT

2.1 The following equipment will be utilized at the separator skids:

(1) Meter Tube (1 required)

(a) One tube for V3 scrubber unit is to be Daniel 8" Senior Flangnek meter tube with ASA 150# RF flanged ends. The meter tube to be equipped with straightening vanes. The meter tube to be designed for 275 psig at 100°F. The meter tube shall be standard bore 10" with an overall length of 16'-6". The A' dimension is 12 feet 8 inches; the B dimension is 3 feet 10 inches; the C dimension is 6 feet 1 inch. These are AGA Standard for 0.75 Beta ratio with two elbows in 90° planes.

Straightening vanes to be line model type 304SS, catalog 1103L, type II. Provide two ½" and one 3/4" NPT connection for static pressure, temperature and sample connections.

Tube is to be coated internally with baked phenolic coating for corrosion protection. Furnish with 7.000 and 4.200 orifice plates designed to handle 29 MMSCFD to 9.1 MMSCFD of 0.85 sp. gravity sour gas at 80 psig with 0-100" range at 85°F for the 7.000 plate. The 4.200" plate to handle 9.0 MMSCFD to 2.9 MMSCFD.

(b) Differential Pressure Transducers

(1) Single Range (1 required)
Foxboro E-13 with 5000 psi working pressure stainless steel housing, 0-100" WC range. All wetted parts to be corrosion resistant to sour gas, bellows to be stainless steel. Electrical housing to be explosion proof Class 1, Group D. Unit to have 10-50 MA output signal with 45VDC supply.

(3) Static Pressure Transducers (1 required)
Daniel Model 1209. The range shall be 0-250 psig range. The transducer shall have a stainless steel bourdon tube. All wetted pressure parts to be stainless steel. Electrical housing to be explosion proof for Class 1, Group D. The unit to have a 4 to 20 ma output with a 45 VDC supply.

(4) Temperature Transducers (1 required)
Temperature transducers to be Daniel Model 1204 with 0-120°F range. Furnish type 304 ss thermowell for 1/2" NPT connection for 8" IPS meter tube. Coordinate current range with other transducers listed herein. Electrical housing to be Class 1, Group D explosion proof.

(5) Furnish pipe mounts and stainless steel valves and stainless steel tubing manifold to mount and connect all transducers to the meter tube. The flow computers will be mounted in a control panel.

2.2 The following equipment will be utilized by mounting it in a control panel located in a weathertight purge room classified as non-hazardous.

(1) Flow computer and readout (1 required)
Daniel Model 1272M Wide Range Flow Computer, for flush panel mounting. Each unit to be supplied with mercury wetted transmitter to transmit one pulse per 100 SCF of gas; furnish with divide switch if necessary.

3.0 DRAWINGS AND TECHNICAL DATA

Supplier to furnish, within 14 days of order date, 6 copies of the following:

(1) Outline dimensional drawing all items with recommended panel cut out where applicable.

(2) Electrical connection diagram all items.

(3) Circuit diagrams all items.

(4) Installation, operating and maintenance instructions.

(5) Parts List.

4.0 SERVICE ENGINEER

The supplier as a part of the purchase price shall furnish one day for each test unit of a qualified service engineer at the jobsite to check out and initially operate the equipment.

5.0 GUARANTEE

Supplier and manufacturer to guarantee that all items will meet this specifiation and specifications in the manufacturers published catalogs. They shall guarantee the equipment to be free of defects in material and workmanship for a period of 12 months after first service date. The guarantee shall fully cover field or factory costs due to defects.

Tag all items FR-10.

Addendum: Note that all items in this specification are to be supplied and coordinated by the manufacturer of the Flow Computer. Packaging contractors shall not purchase individual items for the assembly.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — CONTROL VALVES — 10-084PSU-J1 — REV.

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING COMPANY

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			LCV-109 △		LCV-110 △	LCV-111 △	LCV-112 △
MAKE OR APPROVED EQUAL			FISHER		SAME AS LCV-109	SAME AS LCV-109	SAME AS LCV-109
TYPE			GLOBE				
MODEL			667ED				
SIZE	TYPE CONNECTIONS		4"	150# RF			
BODY MATERIAL	RATING		STL	275			
INNER VALVE TRIM MAT'L			316 SS/17-4PH				
INNER VALVE. SIZE	TYPE		4 3/8"	EQUAL %			
TOP WORKS			SIZE 45				
FINS			3-15PSI SIGNAL				
POSITIONER	BOOSTER RELAY		NO	NO			
POSITIONER BYPASS	W/GAGES		NO	NO			
AIR FILTER & REDUCER			NO				
COMMODITY			*CRUDE OIL				
FLOW TEMPERATURE, °F			60°F				
PRESSURE PSIG	IN	OUT	85	70			
SPEC GRAVITY $H_2O = 1.0$	@ 60°F	@ FLOW TEMP.		.93			
SPEC GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP.					
GPM @ 60°	NORM. FLOW	MAX CAP.		440			
SCF/HR	NORM. FLOW	MAX. CAP.	*COAT WETTED STEEL PARTS PER SPEC.				
#/HR	NORM. FLOW	MAX CAP					
VALVE POSITION ON AIR FAILURE	MAX ΔP		CLOSES 275				
Cv			CALC. 165 ACT. 206				
SPECIAL CONSTRUCTION & NOTES VISCOSITY: 7000 SSU @ 100°F			TRIM #4 316 SS/17-4PH INSTALL FLOW DOWN				
OPERATES WITH			LC-109		LC-110	LC-111	LC-112
SERVICE			PROD. SEP. LEVEL		PROD SEP. LEVEL	PROD SEP. LEVEL	PROD SEP. LEVEL
VESSEL			V-1A		V-1A	V-1B	V-1B
PLANT NO							
PURCHASE ORDER NO.							

DATE

BY

CHECKED

ENGINEER

PROJ. ENG

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS · CALIFORNIA

SPECIFICATION — CONTROL VALVES

10-084PSU-J1 | REV.

JOB NO 10-084

CUSTOMER: HUMBLE OIL & REFINING COMPANY

PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			LCV-117 △		LCV-118 △	LCV-124 △		△
MAKE OR APPROVED EQUAL			FISHER		FISHER	FISHER		
TYPE								
MODEL			125 P			125P		
SIZE	TYPE CONNECTIONS		2"	150# RF		2"	300# RF	
BODY MATERIAL	RATING		STL	275#		STL.	720#	
INNER VALVE TRIM MAT'L			SS/440C			SS/440C		
INNER VALVE SIZE	TYPE		3/4"	TAPER		3/4"	TAPER	
TOP WORKS			SIZE 4			SIZE 4		
FINS					LCV-117			
POSITIONER	BOOSTER RELAY							
POSITIONER BYPASS	W/GAGES							
AIR FILTER & REDUCER								
COMMODITY			OIL FIELD BRINE		SAME AS	OIL FIELD BRINE		
FLOW TEMPERATURE, °F			60°F			60°F		
PRESSURE, PSIG	IN	OUT	85	15		350	15	
SPEC. GRAVITY $H_2O = 1.0$	@ 60°F	@ FLOW TEMP		1.0			1.0	
SPEC. GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP.						
GPM @ 60°	NORM. FLOW	MAX. CAP.		60			60	
SCF/HR	NORM. FLOW	MAX. CAP.	COAT WETTED STEEL PER SPEC.			COAT WETTED STEEL PARTS PER SPEC.		
#/HR	NORM. FLOW	MAX. CAP.						
VALVE POSITION ON AIR FAILURE	MAX. ΔP		CLOSES 275 PSI			CLOSES 500 PSI		
Cv			CALC 7.0 ACT. 11.7			CALC. 3.20 ACT. 6.99		
SPECIAL CONSTRUCTION & NOTES			FLOW TO OPEN					
OPERATES WITH			LC-117		LC-118	LC-124		
SERVICE			PROD SEP. WATER DRAW-OFF		PROD SEP WATER DRAW-OFF	SANDSTONE SEP. V-16 INTERFACE		
LINE NO			V1A		V1B	V16		
PLANT NO								
PURCHASE ORDER NO.								

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — CONTROL VALVES — 10-084PSU-J1 — REV.

CUSTOMER: HUMBLE OIL & REFINING COMPANY — JOB NO 10-084

PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			LCV-119 △		PCV-309 △		△		△	
MAKE OR APPROVED EQUAL			FISHER		FISHER					
TYPE			GLOBE		GLOBE					
MODEL			667 ED		667 ED					
SIZE	TYPE CONNECTIONS FLGD		2"	300# RF	2"	300# RF				
BODY MATERIAL	RATING		STL	720	STL	720				
INNER VALVE TRIM MAT'L			316/17-4PH		316/17-4PH					
INNER VALVE SIZE	TYPE		1 5/16	EQUAL %	1 5/16	EQUAL %				
TOP WORKS			* SIZE 40		* SIZE 40					
FINS										
POSITIONER	BOOSTER RELAY		NO	—	NO	—				
POSITIONER BYPASS	W/GAGES		—	—	—	—				
AIR FILTER & REDUCER			NO		NO					
COMMODITY			CRUDE OIL		NAT. GAS					
FLOW TEMPERATURE °F			60°F		60°F					
PRESSURE PSIG	IN	OUT	350	90	350	330				
SPEC GRAVITY H_2O = 1.0	@ 60°F	@ FLOW TEMP.	.90	60°						
SPEC GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP			.85	60				
GPM @ 60°	NORM FLOW	MAX CAP.		150						
SCF HR	NORM. FLOW	MAX CAP				208M				
# HR	NORM FLOW	MAX CAP				13.4 M				
VALVE POSITION ON AIR FAILURE			CLOSES		CLOSES					
Cv			CALC 12		CALC. 1300 ACT. 2140					
SPECIAL CONSTRUCTION & NOTES			* MAX. ΔP 500 PSI 3-15 psi SIGNAL		* MAX ΔP 500 PSI 3-15 psi SIGNAL					
OPERATES WITH			LC-119		PC-309					
SERVICE			SANDSTONE SEPARATOR OIL LEVEL		SANDSTONE SEPARATOR BACK PRESS.					
VESSEL			VIC		VIC					
PLANT NO										
PURCHASE ORDER NO										

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — CONTROL VALVES — 10-084PSU-J1 — REV

CUSTOMER: HUMBLE OIL & REFINING COMPANY — JOB NO 10-084

PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			LCV-122 △		PCV-314A △		PCV-314B △	△
MAKE OR APPROVED EQUAL			FISHER		FISHER		FISHER	
TYPE			GLOBE		GLOBE		GLOBE	
MODEL			667 ED		667 EWT		667 ED	
SIZE	TYPE CONNECTIONS		2"	150# RF	8x6	150# RF	1½"	150# RF
BODY MATERIAL	RATING		STL	275	STL	275	STL.	275
INNER VALVE TRIM MATL			316SS/17-4PH		316SS/17-4PH		316SS/17-4PH	
INNER VALVE SIZE	TYPE		1 5/16	EQUAL %	8"	EQUAL %	1 7/8"	EQUAL %
TOP WORKS			SIZE 40		SIZE 50		SIZE	
FINS								
POSITIONER	BOOSTER RELAY							
POSITIONER BYPASS	W GAGES							
AIR FILTER & REDUCER			NO		NO			
COMMODITY			NAT GAS CONDENSATE		NAT. GAS		NAT. GAS	
FLOW TEMPERATURE °F			60°F		60°F		60°F	
PRESSURE PSIG	IN	OUT	80	10	60	60	80	20
SPEC GRAVITY H_2O 1.0	@ 60°F	@ FLOW TEMP	0.60	.50	.85	50°F	.85	60°F
SPEC GRAVITY @ 60° AIR 1.0	@ 60°F	@ FLOW TEMP						
GPM @ 60°	NORM FLOW	MAX CAP		100				
SCF HR	NORM FLOW	MAX CAP	COAT WETTED STEEL PARTS PER SPEC.					
# HR	NORM FLOW	MAX CAP			75,000		75,000	
VALVE POSITION ON AIR FAILURE		/MAX ΔP	CLOSES 275		CLOSES			
Cv			CALC 12.0 ACT 24.7		CALC. 16,500 ACT. 16,700		CALC. 750 ACT. 1160	
SPECIAL CONSTRUCTION & NOTES			INSTALL FOR FLOW DOWN		INSTALL FOR FLOW DOWN		INSTALL FOR FLOW DOWN	
OPERATES WITH			LC-122		PC 314A		PC 314B	
SERVICE			MAIN GAS SCRUBBER LEVEL		MAIN PROD. GAS B.F.V.		MAIN GAS SPILL VALVE	
VESSEL			V-3		V-3 SKID		V-3 SKID	
PLANT NO								
PURCHASE ORDER NO								

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ENGINEERS - CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

10-084PSU-J1 | REV

CUSTOMER HUMBLE OIL & REFINING COMPANY

JOB NO. 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	LC-109 △	LC-110 △	LC-111 △	LC-112 △
MAKE OR APPROVED EQUAL	FISHER			
TYPE	2300			
MODEL	249 V			
MOUNTING	FLGD			
INDICATING OR RECORDING	—			
INTERFACE OR LEVEL	LEVEL			
COMMODITY	CRUDE OIL			
SPECIFIC GRAVITY AT 60°	.85 TO .93			
OPERATING PRESS. / TEMP	85 / 60°F			
MINIMUM DESIGN PRESS. / TEMP	230 / 100°F			
BODY MATERIAL	* STEEL			
CONNECTIONS	4"-150# RF			
FINS REQUIRED				
FLOAT MATERIAL / SIZE				
PILOT-RIGHT OR LEFT HAND				
THROTTLING RANGE				
AUTOMATIC RESET				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES CONTROL PRESSURE				
SPECIAL CONSTRUCTION & NOTES	*COAT WETTED STEEL PARTS PER SPEC.**	SAME AS LC-109	SAME AS LC-109	SAME AS LC-109
OPERATES WITH	LCV 109	LCV 110	LCV 111	LCV 112
SERVICE ** VISCOSITY 7000 SSU @ 100°F	OIL LEVEL PRODUCTION SEPARATOR	OIL LEVEL PRODUCTION SEPARATOR	OIL LEVEL PRODUCTION SEPARATOR	OIL LEVE PRODUCTIO SEPARATO
VESSEL NO	V1A	V1A	V1B	V1B
PLANT NO				
PURCHASE ORDER NO				

APPROVED

BY DATE

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SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

10-084PSU-J1 REV

CUSTOMER HUMBLE OIL & REFINING COMPANY

JOB NO. 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		LSH-113 △	LSL-114 △	LSH-115 △	LSL-116 △
MAKE OR APPROVED EQUAL		FISHER			
TYPE		2800			
MODEL		252 V			
MOUNTING		FLGD			
INDICATING OR RECORDING		—			
INTERFACE OR LEVEL		LEVEL			
COMMODITY		CRUDE OIL			
SPECIFIC GRAVITY AT 60°		0.85 TO .93			
OPERATING PRESS.	TEMP	85	100°F		
MINIMUM DESIGN PRESS.	TEMP	275	100°F		
BODY MATERIAL		* STL			
CONNECTIONS		4" 150# RF			
FINS REQUIRED		NO			
FLOAT MATERIAL	SIZE	316 SS	3"x10"		
PILOT-RIGHT OR LEFT HAND		—			
THROTTLING RANGE		—			
		SPDT SW.			
AIR FILTER & REDUCER		EX. PR. ENCL.			
MANUAL CONTROL BYPASS		CL. 1 GP D			
CHART NO	SIZE	—	—		
CHART DRIVE	REVOLUTIONS	—	—		
AS LEVEL RISES CONTROL PRESSURE		CONTACTS OPEN	CONTACTS CLOSE	CONTACTS OPEN	CONTACTS CLOSE
SPECIAL CONSTRUCTION & NOTES		* INTERNALLY COAT WETTED PARTS PER SPEC. **	→	→	→
OPERATES WITH					
SERVICE ** VISCOSITY 5000 SSU @ 60°F		HIGH LEVEL SHUTDOWN PROD. SEP.	LOW LEVEL SHUTDOWN PROD. SEP.	HIGH LEVEL SHUTDOWN PROD. SEP.	LOW LEVEL SHUTDOWN PROD. SEP.
VESSEL NO.		VIA	VIA	VIB	VIB
PLANT NO					
PURCHASE ORDER NO					

SAME AS LSH 113

SAME AS LSH 113

SAME AS LSH 113

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HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

0-084PSU-J1 | REV

CUSTOMER HUMBLE OIL & REFINING COMPANY

JOB NO. 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		LC-117 △		LC-118 △		LC-124 △		△
MAKE OR APPROVED EQUAL		NATIONAL TANK CO.		SAME AS LC-117		SAME AS LC-117		
TYPE		ELECT. CONDUCTIVITY						
MODEL		5402						
MOUNTING		MPT						
INDICATING OR RECORDING								
INTERFACE OR LEVEL		INTERFACE						
COMMODITY		OIL/WATER						
SPECIFIC GRAVITY AT 60°		.93/100						
OPERATING PRESS.	TEMP	85	60°F			350	60°F	
MINIMUM DESIGN PRESS.	TEMP	230	100°F			500	100°F	
BODY MATERIAL		* STL						
CONNECTIONS		2" PIPE THDS						
PROBE		* SS						
PROBE DIMS SUBJECT TO CHECK BY NAT'L		A = 8" B = 1/2" C = 8" D = 4"						
AIR FILTER & REDUCER								
MANUAL CONTROL BYPASS								
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE								
SPECIAL CONSTRUCTION & NOTES EX. PR. HOUSING ALL UNITS		* STAINLESS STEEL WETTED PARTS						
OPERATES WITH		LCV-117		LCV-118		LCV-124		
SERVICE		INTERFACE LEVEL CONTROLLER		INTERFACE LEVEL CONTROLLER		INTERFACE LEVEL CONTROLLER		
VESSEL NO		V1A		V1B		V1C		
PLANT NO								
PURCHASE ORDER NO								

APPROVED

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ENGINEER

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HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

10-084PSU-J1 REV

CUSTOMER: HUMBLE OIL & REFINING COMPANY

JOB NO. 10-084

PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		LC-119 △		LSH-120 △		LSL-121 △		△
MAKE OR APPROVED EQUAL		FISHER		FISHER				
TYPE		2500		2800				
MODEL		249V		252V				
MOUNTING		FLGD		FLGD				
INDICATING OR RECORDING		—		—				
INTERFACE OR LEVEL		LEVEL		LEVEL				
COMMODITY		CRUDE OIL		CRUDE OIL		SAME AS LSH 120		
SPECIFIC GRAVITY AT 60°		.85 TO .90		.85 TO .90				
OPERATING PRESS.	TEMP	350	60°F	350	60°F			
MINIMUM DESIGN PRESS.	TEMP	500	100°F	500	100°F			
BODY MATERIAL		STL		STL				
CONNECTIONS		4"-300# R.F.		4"-300# R.F.				
FINS REQUIRED		—		—				
FLOAT MATERIAL	SIZE	316 S.S.	3" x 14"	316 SS	3"x10"			
PILOT-RIGHT OR LEFT HAND		(LATER)		SP DT SWITCH EX. PR. ENCLOSURE CL. 1 GPD				
THROTTLING RANGE		0-10 0-100 %						
AUTOMATIC RESET		NO						
AIR FILTER & REDUCER		YES						
MANUAL CONTROL BYPASS		NO						
CHART NO	SIZE	—	—	—	—			
CHART DRIVE	REVOLUTIONS	—	—	—	—			
AS LEVEL RISES CONTROL PRESSURE		INCREASES		CONTACTS OPEN		CONTACTS CLOSE		
SPECIAL CONSTRUCTION & NOTES								
OPERATES WITH		LCV-119		SHUTDOWN		VIC SEP		
SERVICE		OIL LEVEL CONTROL		HIGH LEVEL SHUTDOWN & ALARM		LOW LEVEL SHUTDOWN & ALARM		
VESSEL NO		VIC		VIC		VIC		
PLANT NO								
PURCHASE ORDER NO								

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PROJ. ENG.

BY DATE

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HOBBS-BANNERMAN CORPORATION

ENGINEERS - CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

0-084PSU-J1 | REV

10-084 JOB NO.

CUSTOMER: HUMBLE OIL & REFINING COMPANY

PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		LC-122 △		LSH-123 △		LSL-123A △		
MAKE OR APPROVED EQUAL		FISHER		FISHER				
TYPE		2500		2800				
MODEL		* 259 B-F4		252V				
MOUNTING		2" FLGD 150# RF		4" FLGD 150# RF				
INDICATING OR RECORDING		—		—				
INTERFACE OR LEVEL		LEVEL		LEVEL				
COMMODITY		CRUDE OIL & COND.		CRUDE OIL & COND.				
SPECIFIC GRAVITY AT 60°		0.60 TO 0.93		0.60 TO 0.93				
OPERATING PRESS.	TEMP	85	60°F	85	60°F			
MINIMUM DESIGN PRESS.	TEMP	275	100°F	275	100°F			
BODY MATERIAL		STL		STL				
CONNECTIONS		2" ASA RF FLGD		4" ASA RF FLGD				
FINS REQUIRED		—		—				
FLOAT MATERIAL	SIZE	316 SS	3"x 14"	316 SS	3"x 10"			
PILOT-RIGHT OR LEFT HAND		(LATER)		—				
THROTTLING RANGE		0-10 0-100		—				
AUTOMATIC RESET		NO		—				
AIR FILTER & REDUCER		YES		—				
MANUAL CONTROL BYPASS		NO		—				
CHART NO	SIZE	—	—	—	—			
CHART DRIVE	REVOLUTIONS	—	—	—	—			
AS LEVEL RISES CONTROL PRESSURE		INCREASES		CONTACTS OPEN				
SPECIAL CONSTRUCTION & NOTES		* SIDE & BOTTOM CONNECTIONS. COAT WETTED STL PARTS PER SPEC		SPDT SW EX. PR. CL. I GPD				
OPERATES WITH		LCV-122						
SERVICE		MAIN GAS SCRUBBER LEVEL		MAIN GAS SCRUBBER HIGH LEVEL SHUTDOWN		MAIN GAS SCRUBBER LOW LEVEL SHUTDOWN		
VESSEL NO		V3		V3		V3		
PLANT NO								
PURCHASE ORDER NO								

SAME AS LSH-123

REV. | BY | DATE

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION

RELIEF VALVES

10-084PSU-J1 | REV

CUSTOMER HUMBLE OIL & REFINING COMPANY

JOB NO 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			PSV-4 △		RD-5 △	PSV-6 △	RD-7 △
MAKE OR APPROVED EQUAL			CROSBY		CONTINENTAL DISK CORP.		
TYPE			4P6		RUPTURE DISK ASSY.		
MODEL BELLOWS TYPE			JB-25		KBA + ASSY #7		
BODY MATERIAL			STL		316 SS		
PIPE SIZE	IN	OUT	4"	6"	3"	5"	
CONNECTIONS	IN	OUT	150# RF	150# RF	150# RF	150# RF	
TRIM MATERIAL	SPRING		SS	STL.	316 S.S.		
LIFTING GEAR	GAG		NO	NO	—		
CALCULATED ORIFICE AREA SQ IN			GAS 2.5 OIL 3.70		—		
SELECTED ORIFICE AREA & LETTER			6.279	P			
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG			275		275	SAME AS PSV-4	SAME AS RD-5
OPERATING PRESSURE OF ASSOCIATED EQUIP			85		85		
RELIEVING PRESSURE PSIG			230		275		
BACK PRESSURE PSIG			—		—		
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			230		275		
FLOW TEMPERATURE °F			60-100°F		100°F		
MW OR S G AT FLOW TEMP		GAS OIL	.85 .93		.85 .93		
DESIGN CAPACITY MAX	GPM		880		880		
	SCFH						
	# HR		40,000		40,000		
BASIS OF SELECTION			* GAS + OIL		* GAS + OIL		
VESSEL AREA EXPOSED TO FIRE			—		—		
COMMODITY			CRUDE OIL & GAS		CRUDE OIL & GAS		
% OVER PRESSURE			10%		10%		
SPECIAL CONSTRUCTION & NOTES *VISCOSITY: 7000 SSU @ 100°F			COAT ALL WETTED STEEL PARTS PER SPEC.		ALL WETTED PARTS TO BE 316 SS	COAT ALL WETTED PARTS PER SPEC.	ALL WETTED PARTS TO BE 316 S.S.
SERVICE			RELIEF ON PROD. SEP.		RELIEF ON PROD. SEP. KNIVES 17-4PH	RELIEF ON PROD SEP.	RELIEF ON PROD. SEP.
LINE OR VESSEL NO			V-1A		V-1A	V-1B	V-1B
PLANT NO							
PURCHASE ORDER NO							

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION

RELIEF VALVES

10-084PSU-J1 | REV

JOB 10-084

CUSTOMER HUMBLE OIL AND REFINING COMPANY

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			PSV-8 △		RD-9 △	△ △
MAKE OR APPROVED EQUAL			CROSBY		CONTINENTAL DISC. CORP.	
TYPE			JB 35		RUPTURE DISK ASSY	
MODEL			2½ J 4		KBA + ASSY #7	
BODY MATERIAL			STL		316 S.S.	
PIPE SIZE	IN	OUT	2½"	4"	3"	3"
CONNECTIONS	IN	OUT	300# RF	150# RF	300# RF	300# RF
TRIM MATERIAL	SPRING		SS	STL	316 S.S.	
LIFTING GEAR	GAG		—	—	—	—
CALCULATED ORIFICE AREA SQ IN			OIL 0.42 GAS 0.37			
SELECTED ORIFICE AREA & LETTER			J	1.287	—	—
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG			500		500	
OPERATING PRESSURE OF ASSOCIATED EQUIP			350		350	
RELIEVING PRESSURE PSIG			425		500	
BACK PRESSURE PSIG						
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			425		500	
FLOW TEMPERATURE °F			60°F		60°F	
MW OR S G AT FLOW TEMP			OIL .90 GAS .85		OIL .90 GAS .85	
DESIGN CAPACITY MAX	GPM	OIL	150		150	
	SCFH	GAS	208 M		208 M	
	# HR	GAS	13.4 M		13.4 M	
BASIS OF SELECTION			OIL PLUS GAS		OIL PLUS GAS	
VESSEL AREA EXPOSED TO FIRE						
COMMODITY			CRUDE OIL & NAT. GAS		CRUDE OIL & NAT. GAS	
OVER PRESSURE			10%		10%	
SPECIAL CONSTRUCTION & NOTES					KNIVES 17-4PH	
[illegible]			RELIEF ON SANDSTONE SEP.		RELIEF ON SANDSTONE SEP.	
[illegible]			VIC		VIC	

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SPECIFICATION

RELIEF VALVES

10-084PSU-J1 REV

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING COMPANY

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO			PSV-10 △		RD-11 △		△		△	
MAKE OR APPROVED EQUAL			CROSBY		CONTINENTAL DISC. CORP.					
TYPE			JB-25		RUPTURE DISK ASSY					
MODEL			3L4		KBA + ASSY 7					
BODY MATERIAL			STEEL		316 S.S					
PIPE SIZE	IN	OUT	3"	4"	3"	3"				
CONNECTIONS	IN	OUT	150# R.F.	150# R.F.	150# R.F.	150# R.F.				
TRIM MATERIAL	SPRING		S.S.	ST'L	316 S.S.					
LIFTING GEAR	GAG		NO	NO	—					
CALCULATED ORIFICE AREA SQ IN			GAS 2.30		—					
SELECTED ORIFICE AREA & LETTER			L	2.853						
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG			275		275					
OPERATING PRESSURE OF ASSOCIATED EQUIP			85		80					
RELIEVING PRESSURE PSIG			230		275					
BACK PRESSURE PSIG			—		—					
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			230		275					
FLOW TEMPERATURE F			60°F		60°F					
MW OR SG AT FLOW TEMP			25		25					
DESIGN CAPACITY MAX	GPM		100		100					
	SCFH									
	# HR		37,000		37,000					
BASIS OF SELECTION			GAS + LIQ.		GAS + LIQ.					
VESSEL AREA EXPOSED TO FIRE			—		—					
COMMODITY			NAT. GAS & CRUDE OIL		NAT. GAS & CRUDE OIL					
OVER PRESSURE			10%		10%					
SPECIAL CONSTRUCTION & NOTES										
SERVICE			RELIEF MAIN SCRUBBER		SAFETY MAIN SCRUBBER					
LINE OR VESSEL NO	VESSEL		V3		V3					
PLANT NO										
PURCHASE ORDER NO										

THIS SPECIFICATION CONSTITUTES A PART OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — PRESSURE INSTRUMENTS

10-084PSU-J1 | REV

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING COMPANY

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	PI-305 △	PI-306 △	PSH-307 △	PSH-308 △
MAKE OR APPROVED EQUAL	WIKA	SAME AS PI-305	CUSTOM COMPONENTS	SAME AS PSH-307
TYPE	PRESS. GA.		PRES. SWITCH	
MODEL	233-		606 GC RW-4	
MOUNTING / LOCATION	½" NPT / BOTTOM		SURFACE	
INDICATING OR RECORDING	IND		—	
NORMAL PRESSURE @ TEMP	85 / 60		85 / 60	
PRESSURE ELEMENT RANGE	0 - 300		0 - 375	
PRESSURE ELEMENT TYPE AND MATERIAL	BOUR / 316 SS		DIA / 347SS	
DIAL SIZE	4".			
PRES TAP			¼" FNPT	
ELECT. CONN.			½" MALE	
ADJUST RANGE			175-375 P.S.I.	
DEAD BAND			40 ± 25	
MANUAL CONTROL BYPASS				
CHART SIZE / NO				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL			CONTACTS OPEN	
LOCATION OF PRESSURE TAP			LOWER	
PULSATION DAMPENER	NO		NO	
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED		FACTORY SET @ 200 PSI INCREASING; 4500 PSI PROOF CASE	
OPERATES WITH	VIA	VIB	VIA	VIB
SERVICE	PROD. SEPARATOR PRESS. INDICATOR	PROD. SEPARATOR PRESS. INDICATOR	HIGH PRESS. SHUTDOWN PROD. SEPARATOR	HIGH PRESS SHUTDOWN PROD. SEPARATOR
PLANT NO				
PURCHASE ORDER NO				

NO	DESCRIPTION	BY	DATE

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — PRESSURE INSTRUMENTS

10-084PSU-J1 | REV.

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING COMPANY

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		PI-312 △		PSH-313 △		PC-314A PC-314B △		PSL 313 △
MAKE OR APPROVED EQUAL		WIKA		CUSTOM COMPONENTS		FISHER		CUSTOM COMPONENTS
TYPE		PRESS. GAGE		PRESS. SWITCH		WIZARD		PRESS. SWITCH
MODEL		233		606GCRW-4		4150		606-GCRW-0
MOUNTING	LOCATION	½" MPT	BOTTOM	SURFACE		ON PCV-314		SURFACE
INDICATING OR RECORDING		IND.		—		—		—
NORMAL PRESSURE @ TEMP		350	60°F	85	60°	70	60°F	85	60°F
PRESSURE ELEMENT RANGE		0 - 300		175-375 DECREASING		0 - 300		10-70 DECREASING
PRESSURE ELEMENT TYPE AND MATERIAL		BOUR	316 SS	DIA.	347 S.S	BOUR.	316 SS	DIA	347 S.S
DIAL SIZE		4"				—		
THROTTLING RANGE						0-10 0-100%		CLASS I GROUP D EXPLOSION-PROOF
AUTOMATIC RESET				CLASS I GROUP D EXPLOSION PROOF ENCLOSURE		NO		
RATE ACTION						NO		
AIR FILTER & REDUCER						YES		
MANUAL CONTROL BYPASS				FACTORY SET @ 200 psi INCREASING		—		FACTORY SET AT 50 psi
CHART SIZE	NO					—	—	
CHART DRIVE	REVOLUTION					—	—	
INDICATING SCALE RANGE						—		
AS PRESSURE INCREASES OUTPUT SIGNAL				CONTACTS OPEN		INCREASES		CONTACTS CLOSE
LOCATION OF PRESSURE TAP						BACK		
PULSATION DAMPENER						NO		NO
SPECIAL CONSTRUCTION & NOTES		GLYCERIN FILLED		DEAD BAND 40 ± 25 PSI		ALL WETTED PARTS 316 S.S.		DEAD BAND 10 ± 6 psi 4500 psi-PROOF ENCLOSURE
OPERATES WITH						PCV-314		
SERVICE		PRESS. INDICATOR MAIN GAS SCRUBBER V-3		HIGH PRESS SHUTDOWN MAIN GAS SCRUBBER V-3		BACK PRESS. MAIN PROD. GAS. & SPILL VALVE		GAS SCRUBBER V-3
PLANT NO						NOTE: 2 REQD.		
PURCHASE ORDER NO								

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — PRESSURE INSTRUMENTS

10-084PSU-J1 | REV.

JOB NO 10-084

CUSTOMER: HUMBLE OIL & REFINING COMPANY

PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		PC-309 △		PI-310 △		PSH-311 △		PSL 311 △
MAKE OR APPROVED EQUAL		FISHER		WIKA		CUSTOM COMPONENTS		CUSTOM COMPONENTS
TYPE		WIZARD		PRES. GAGE		PRES. SWITCH		PRESS. SWITCH
MODEL		4150		233		606 GCRW-5		606-GCRW-4
MOUNTING	LOCATION	ON PCV-309		½" N.P.T.	BOTTOM	SURFACE		SURFACE
INDICATING OR RECORDING		—		IND.		—		—
NORMAL PRESSURE @ TEMP		350	60°F	350	60°F	350	60°F	350	60°F
PRESSURE ELEMENT RANGE		0 - 600		0 - 600		350-725 INCREASING		125-350 DECREASING
PRESSURE ELEMENT TYPE AND MATERIAL		BOUR.	316 S.S.	BOUR.	316 S.S.	DIA.	347 S.S.	DIA.	347 S.S.
DIAL SIZE		—		4"				
THROTTLING RANGE		0 - 10 0 - 100				FACTORY SET @ 400 psi		FACTORY SET AT 225 psi
AUTOMATIC RESET		NO						
RATE ACTION		NO				4500 psi PROOF CASE		4500 psi PROOF CASE
AIR FILTER & REDUCER		YES						
MANUAL CONTROL BYPASS		—						
CHART SIZE	NO	—	—					
CHART DRIVE	REVOLUTION	—	—					
INDICATING SCALE RANGE		—						
AS PRESSURE INCREASES OUTPUT SIGNAL		INCREASES						
LOCATION OF PRESSURE TAP		BACK				CONTACTS OPEN		CONTACTS OPEN
PULSATION DAMPENER		NO				LOWER		
SPECIAL CONSTRUCTION & NOTES		MOJIT CONTROLLER ON VALVE		GLYCERIN FILLED		¼" FNPT PRESS ½" ELEC. DEAD BAND 65 ± 30 PSI		DEAD BAND 40 ± 25 PSI
OPERATES WITH		PCV 309						
SERVICE		BACK PRESS. ON SANDSTONE PROD. SEP. V-16		PRESS. IND. SANDSTONE SEP. V-16		HIGH PRESS. SHUTDOWN SANDSTONE SEP. V-16		LOW PRESS. SHUTDOWN SANDSTONE SEP. V-16
PLANT NO								
PURCHASE ORDER NO								

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION

TEMPERATURE INSTRUMENTS

0-084PSU-J1 REV

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING COMPANY

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	TI-203 △	TI-204 △	TI-205 △	△
MAKE OR APPROVED EQUAL	WESTON			
TYPE	BI-METAL			
MODEL	4500			
MOUNTING	1/2" MPT BACK			
INDICATING OR RECORDING	INDICATING			
STANDARDIZATION	4" x 12"			
NORMAL CONTROL OR RECORDING POINT	5" S.S			
TEMPERATURE RANGE	0-200°F			
THROTTLING RANGE		SAME AS TI-203	SAME AS TI-203	
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NUMBER				
CHART DRIVE / REVOLUTIONS				
THERMOWELL	316 S.S. 3/4" MPT WESTON #173303-124			
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH	V-1A	V-1B	V-1C	
SERVICE	TEMP INDICATOR PROD. SEP.	TEMP INDICATOR PROD. SEP.	TEMP. INDICATOR PROD. SEP.	
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO.				

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SANTA FE SPRINGS CALIFORNIA

SHEET 1 OF 1

SPECIFICATION — PRESSURE INSTRUMENTS

10-084-PSU-31 REV 0

CUSTOMER: HUMBLE OIL & REFINING CO.
PLANT LOCATION: DEEPWATER OFFSHORE PLATFORM
JOB NO: 10-084

IDENTIFICATION TAG NO	PSL 307	PSL 308		
MAKE OR APPROVED EQUAL	CUSTOM COMPONENTS	SAME AS PSL 308		
TYPE	PRESS. SWITCH			
MODEL	6006-GCRW-0			
MOUNTING LOCATION	SURFACE			
INDICATING OR RECORDING	—			
NORMAL PRESSURE / TEMP	55-85 psi 60°F			
PRESSURE ELEMENT RANGE	10-70 DECREASING			
PRESSURE ELEMENT TYPE AND MATERIAL	DIA. 347 S.S.			
REQ. REDUCED PRESSION	CLASS 1 GROUP D EXPLOSION-PROOF			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
SAFETY VALVE	FACTORY SET AT 50 PSI			
MANUAL CONTROL BYPASS				
CHART SIZE NO				
CHART DRIVE REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL	CONTACTS CLOSE			
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER	NO			
SPECIAL CONSTRUCTION & NOTES	DEAD BAND 10 ± 6 PSI 4500 PSI-PROOF ENCLOSURE			
OPERATES WITH SERVICE	PRODUCTION SEPARATOR V-1A	PRODUCTION SEPARATOR V-1B		
PLANT NO				
PURCHASE ORDER NO				

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3.2 WELL TEST UNITS

SPECIFICATION FOR

PACKAGED WELL TEST UNIT

1.0 GENERAL:

This specification and the plans and specifications referenced herein describe the work and material by the Contractor. The work includes furnishing all equipment and material except those specifically stated as furnished by others in the request for quotation by Humble Oil and Refining Company. The packaged unit includes two three-phase oil, gas and water separators complete with base, piping, instruments and controls, electrical wiring and protective coatings. The unit is to be completely assembled and tested prior to shipment. Delivery of the unit shall be made f.o.b. trucks at jobsite location stated in Humble's request for quotation.

The equipment is to be installed by Humble on an off-shore oil drilling and production platform. The unit will be continuously exposed to a wet salt air atmosphere. The electrical work shall be for Class 1 Division 1 hazardous location.

2.0 SCOPE OF WORK:

All equipment, material and work shall be as described in this Specification 10-084 WTU and drawings and specifications listed in Par. 6. Codes and standards referenced herein are a part of these Specifications.

3.0 EQUIPMENT, MATERIALS AND CONSTRUCTION

3.1 Oil, Gas and Water Separators

Specification 10-084-WTUS1 and Drawings 084-105 and 084-106 describe the separators.

3.2 Instruments, Meters and Control Valves

Instruments and control valves are described on data sheets in Specification 10-084-WTU-J1. The net oil analizers including meters and read-out equipment is described in Specification 10-084 WTUM1. The gas meters including transducers and digital readout items are described in 10-084 WTUM2.

Read-out items and other items not to be installed in the packaged assembly shall be delivered to a site specified by Humble for incorporation into the platforms master control panel.

3.3 Skid Base Supports and Access Ladders

The skid base, supports and structural steel shall comply with the applicable parts of the AISC Manual of Steel Construction. All joints shall be solidly welded and continuously sealed so that the protective coatings will be effective. The skid base shall be fabricated as shown on Dwg. 084-103. The contractor shall be responsible to see that all structural items including miscellaneous supports are adequate for marine handling and will withstand a 20% seismic force.

Piping supports are not detailed on the drawings. The Contractor shall be responsible to install these wherever necessary as part of his contract. These supports shall be welded or bolted steel and shall be square plumb and first class in appearance and workmanship. All steel edges and corners shall be ground to 1/8" minimum radius. Steel access ladders to instruments and controls shall be furnished and installed. These shall be located after final assembly of piping of valves and are subject to approval by Humble prior to installation. Ladders shall conform to State of California Safety Orders.

3.4 Piping Valves and Fittings

3.41 Piping valves and fittings shall be installed as shown on drawings 084-101,102 and 103. The Contractor shall be responsible for field checking the dimensions of all items prior to starting the assembly to assure proper fit up.

All piping work shall conform to American Standard Code for Pressure Piping, Petroleum Refinery Piping USAS B31.3 latest edition, Chapters V & VI. All welds shall be subject to radiographic inspection at Humble's request. Initial cost of the inspection is for Humble's account. Repairs due to defects and reinspection costs are for the Contractor's account. The acceptability of welds to be in accordance with ASME Code, Section VIII Par. UW52.

3.42 Valves shall be as shown on Drawing 084-101 (or approved equal).

3.43 Piping materials shall conform to the Piping Specifications for the class shown on Drawing 084-101.

3.44 Instrument tubing materials shall conform to those shown on Drawing 084-104. All instrument tubing shall be run square and plumb. All tubing bends shall be neatly made with tubing benders. All tubing runs shall be supported in steel channels or firmly attached to piping runs. Tubing and support work shall be first class in appearance and workmanship.

3.5 Protective Coatings

3.51 Internal Protective Coatings for all oil, gas and water piping, valves and fittings shall be Tube-Kote TK21(12-15 mils) heat cured epoxy (or approved equal). All welds to be ground smooth prior to application of coating. Surface preparation shall be same as in Specification 10-084-C2. Instrument items shall be coated with this system where specified on data sheets of Specification 10-084-J1.

3.52 External Protective Coatings shall be applied to all metal surfaces except stainless steel and aluminum. Instrument cases, glass and name plates are not to be coated. The coating shall conform to Specification 10-084-C2.

3.53 Separator Internal Coatings - The separator shells heads, nozzles and internals shall be protectively coated in accordance with Specification 10-084-CI. All shell and head welds shall be ground smooth on the interior prior to coating.

3.6 Electrical Work shall comply with Specification 10-084-WTU-E1.

3.7 Testing - After assembly of all piping the oil water and gas piping shall be hydrotested as follows: V2A system at 412 psig and V2B system at 750 spig. All instruments shall be disconnected prior to testing. Test pressure shall be held for a minimum of one hour and equipment carefully inspected for leaks. Humble to be notified of test schedule so they may witness them at their option. Equipment shall be thoroughly dried and cleaned inside. Control systems shall be tested to prove they operate properly. Humble shall be notified prior to check out so they may have the option to witness the tests.

3.8 Drying and Sealing for Shipment - Vessel and piping shall be sealed for shipment with dry air inside and adequate desiccant to maintain dryness in the units. Instruments shall be removed and packaged separately.

4.0 QUOTATIONS shall be for a lump sum firm price to furnish the completed units f.o.b. trucks at the jobsite designated on the Humble request for quotation. Bidders shall summarize and list any exceptions from these Specifications. The quotation shall essentially comply with these specifications. Exceptions will be allowed only on the basis of equal or better units with essentially no change in the arrangement.

5.0 GUARANTEE - The Contractor and the manufacturer shall guarantee all items and the assembly to comply with these Specifications and to be free of defects in material and workmanship for a period of 12 months from first service date.

6.0 SPECIFICATIONS AND DRAWING LIST

Specifications

10-084-WTU	Specification for packaged well test unit
10-084-WTUE1	Electrical specification for packaged well test unit
10-084-WTUS1	Specification V-2A, V-2B test separators
10-084-WTUM1	Specification well test separator oil and water meters, net oil analyzer and flow totalizer
10-084-WTUM2	Specification well test units digital gas measurement equipment
10-084-WTUJ1	Specification instruments and controls
Class A	Specification Piping Class A
Class AA	Specification Piping Class AA
Class B	Specification Class B
10-084-C1	Specification protective coatings coating systems for water handling
10-084-C2	Specifications for application of coatings to external surfaces

Drawings

084-101	Test separators V-2A, V-2B piping and instrumentation diagram
084-102	Test separators V-2A, V-2B piping plan and elevations
084-103	Test separators V-2A, V-2B piping elevations
084-104	Test separators V-2A, V-2B instrumentation details
084-105	Test separator V-2A
084-106	Test Separator V-2B

7.0 TECHNICAL DATA:

Supplier shall furnish 6 copies of all parts lists, operating and maintenance instructions, sectional drawings, wiring schematics, connection diagrams and certified dimensional outline drawings at time of shipment of unit.

SPECIFICATION FOR

TEST SEPARATORS V2A & V2B

1.0 GENERAL

This specification applies to the purchase of two oil production test separators. The separators are to be used in a packaged well test unit for an off-shore platform. The separators are three phase. Drawings referenced herein show the size, arrangement and construction locations. These shall not be changed. Internals equal to or better than those shown may be supplied if the details are approved by the Humble Engineer.

2.0 DESIGN CONDITIONS

The manufacturer shall be responsible for the design and construction of the separator to meet the design conditions as follows:

V2A Separator

Design Pressure	275 psig @ 100°F
Normal Pressure	85 psig @ 110°F
Oil Rate	5000 B/D
Gas Rate	1.25 MMSCFD
Water Rate (max.)	2000 B/D
Oil Gravity	16-23°API
Gas Specific Gravity	0.85
Oil Viscosity	7000 SSU (max.)
Temperature	100°F - 110°F

V2B Separator

Same as V2A except design pressure shall be 500 psig at 100°F and separator also operates at 350 psig with a gas rate of 2MMSCFD.

3.0 SEPARATOR INTERNALS AND ACCESSORIES

3.1 Scrubber Plates. Each separator shall be equipped with anti-foam scrubber plates, Dixon or approved equal. Bidders to specify the total plate area in their proposals. Demister mesh shall not be used.

The scrubber section shall be designed for a maximum of 1 gallon liquid carryover per million SCF of gas.

3.2 The primary scrubber shall be designed by the manufacturer.

3.3 The remainder of the internals shall be essentially as shown on the drawings.

3.4 Separator manufacturer shall check and be responsible to see that all instruments specified in the attached specification sheets will properly fit the separators and clear as necessary all internals.

3.5 All separator internals except the scrubber plates shall be protectively coated in accordance with the attached specifications for protective coatings of vessel internals. Bidders to quote an alternate proposal to coat the scrubber plates.

4.0 CONTROLS AND INSTRUMENTS

These items are to be as specified on the attached data sheets and specifications. The purchaser will specify on the purchase order if these are to be furnished with the separator.

The gage glasses and cocks will be furnished and installed by the separator manufacturer.

5.0 VESSEL SHELL AND CONNECTIONS

5.1 The manufacturer shall design, construct, test and certify the shells in accordance with the ASME Code Section VIII, Latest Edition. A corrosion allowance of 1/16" shall be provided throughout. The vessel shall be coated internally with protective coating as specified in the attached specifications.

5.2 All welds for nozzles and connections penetrating the vessel shell shall be full penetration.

5.3 Humble shall have access to inspection of vessels during fabrication. Purchaser reserves the right to radiograph any or all vessel welds before or after delivery of the vessel. Defects detected by this inspection shall be repaired at the expense of the manufacturer.

5.4 Manhole davits shall be provided at each manhole to properly handle the cover.

5.5 Shell supports to be adequate to support vessels full of liquid with 20% seismic force when vessels are stacked. The minimum metal thickness for supports is 1/4".

6.0 TECHNICAL DATA

6.1 Bidders shall furnish proposed scrubber plate area, spacing, length and metal thickness.

6.2 Bidders shall furnish details of any deviation proposed from these specifications and drawings.

6.3 Supplier shall furnish Humble with 3 copies of shop drawings for approval prior to starting fabrication.

6.4 Supplier shall furnish Humble 6 copies of certified dimensional drawings and final shop drawings. Six copies of final as-built drawings shall be furnished if any changes are made during fabrication of the vessel.

6.5 Guarantee

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date.

SPECIFICATION

WELL TEST SEPARATOR OIL & WATER METERS NET OIL ANALYZER AND FLOW TOTALIZERS

1.0 GENERAL

This specification applies to the purchase of equipment to measure free water and emulsion and to totalize and transmit net oil, emulsion and free water. Equipment will be furnished for two separators. The meters and flow elements will be mounted in the packaged separator modules and the totalizer and read out devices will be mounted in the main control panel in an air purged control room approximately 50 feet from the separators. The separators are to be installed on an off-shore platform and are exposed to wet salt air atmosphere. The separators are in a Class 1 Division 1 hazardous location.

2.0 EQUIPMENT

2.1 The following equipment will be mounted on the separator modules.

2.11 Emulsion Meters

Two are required. One for Separator V2A and one for Separator V2B.

(a) The V2A Separator Meter shall be on A. O. Smith W-28 double case with cast steel housing and standard trim. The safe working pressure of the meter shall be 300 psig @ 100°F. The meter shall be equipped with a gallons to barrels adapter, a 10,000 pulses per barrel Type D transmitter and large numeral, vertical face with 6 integer wheels and a decimal wheel in 1/10 barrels (A. O. Smith Form A169100. The transmitter shall be explosion proof, Class 1 Group D.

(b) The V2B separator meter shall be identical with item (a) above except it shall be an A. O. Smith D-28 with a safe working pressure of 720 psig @ 100°F.

2.12 Free Water Meters

Two meters are required, one for each separator. The meters shall be Halliburton Turbine Flow Meter, 1½" male threaded ends with type 316ss body, 5000 psi working pressure and 500 to 3600 barrels per day range. Meter accuracy is plus or minus 0.5% over the full range. The meter shall be suitable for Class 1 Division 1 hazardous locations.

2.13 Capacitance Probes
Two probes are required. They shall be 3" Halliburton Capacitance Probes with 720 psig safe working pressure, steel body and 3" 300# ASA RF flanged ends. Electrical connections shall be suitable for Class 1 Division 1 hazardous location.

2.2 The following equipment will be furnished for flush panel mounting into the master platform control panel. The control panel is in a weathertight air purged room electrically classified as non-hazardous.

2.21 Net Oil Analyzer Readout Panel - Two required.
These units to be Halliburton standard units with per cent cut indicator, two six digit manual reset totalizers registering net oil and emulsion water in barrels and tenths. Each unit to be equipped with pulse outputs in the form of dry contacts for oil and for water. The pulse output shall be one per 1/10 barrel. The unit is for 115V, 60 Hertz power.

2.22 Free Water Flow Totalizer - Two required.
These units to be Halliburton "L1'L OKIE" standard units except the totalizer shall be a six digit manual reset type with totalizer units in 1/10 barrels. A pulse output in the form of dry contacts shall be furnished to pulse for each 1/10 barrel. The totalizers to be for use with the 1½" Halliburton meters. Power supply to be for 115V, 60 Hertz. Furnish all male and female plug in connectors for all connections. Cable to be standard length. Others will furnish and install field extensions to cables.

3.0 DRAWINGS AND TECHNICAL INFORMATION

Within 14 days of purchase date, the supplier shall furnish 6 copies of the following:

(1) Certified dimensional outline drawings of all items.

(2) Electrical connection drawings.

(3) Electrical circuit diagrams.

(4) Parts Lists.

(5) Installation, maintenance, and operating instructions.

Revised as built material will be supplied at the time the equipment is furnished. All technical material to be supplied to Humble's Engineer as designated on the purchase order.

4.0 TECHNICAL SERVICE

As a part of the purchase price the suppliers shall furnish the services of their Engineer to check out and demonstrate the operation of the units. The allowance shall be one day for each well test unit purchased. Quotations shall specify the cost for additional services requested by Humble.

5.0 GUARANTEE

The suppliers and manufacturer shall guarantee that their equipment meets this specification, their published catalog data and that the equipment shall be free of defects in material and workmanship for a period of 12 months after first service date. The guarantee shall fully cover field or factory costs due to defects.

Tag all items for V2A - PA21
Also tag Emulsion Meter - M21A
" " Water " - M21B
" " Capacitance Probe - CE21

Tag all items for V2B - PA22
Also tag Emulsion Meter - M22A
" " Water Meter - M22B
" " Capacitance Probe - CE22

SPECIFICATION
WELL TEST UNITS
DIGITAL GAS MEASUREMENT
EQUIPMENT

1.0 GENERAL

This specification applies to the purchase of equipment for use on two well test units on one off shore platform. The separators are on packaged skid mounted modules. Flow elements and transducers are to be mounted on the skids which are located in a Class 1 Division 1 hazardous location. The flow computer is to be located approximately 100 feet away in a purged control room classified as non-hazardous. Equipment on the skid is to be continuously exposed to wet salt air atmosphere.

2.0 EQUIPMENT

2.1 The following equipment will be utilized at the separator skids:

(1) Meter Tubes (2 required)

(a) One tube for V2A separator unit is to be Daniel 4" Senior Flangnek meter tube with ASA 150# RF flanged ends. The meter tube to be equipped with straightening vanes. The meter tube to be designed for 275 psig at 100°F. The meter tube shall be standard bore 4" with overall length 6'-8". The dimension A is 5 feet 1 inch; the dimension B is 1-7"; the dimension C is 2 feet 8 inches. These are AGA Standard for 0.75 Beta ratio with two elbows in 90° planes.

Straightening vanes to be line model type 304SS, catalog 11036, type II. Provide two 1/2" and one 3/4" NPT connection for static pressure, temperature and sample connections.

Tube is to be coated internally with baked phenolic coating for corrosion protection. Furnish with 1.625" orifice plate. Designed to handle 140MCFD to 1400 MSCFD of 0.85 sp. gravity sour gas at 85 psig with 0-100" and 0-20" meter ranges at 85°F.

(b) V2B separator meter tube to be identical with that in Item (a) except the flanges are 300# ASA RF and the design pressure of the meter tube is 720 psig @ 100°F. The tube measures same gas as item (a) but in addition it measures 430MCFD to 4300 MCFD of gas at 350 psig.

(c) Differential Pressure Transducers

(1) Low Range (2 required)
Foxboro E-13 with 5000 psi working pressure stainless steel housing, 0-20" WC range. All wetted parts to be corrosion resistant to sour gas, bellows to be stainless steel. Electrical housing to be explosion proof Class 1 Group D.

(2) High Range (2 required)
Same as (1) above except range to be 0-100" WC.

(3) Static Pressure Transducers (2 required)
Daniel Model 1209. For V2A the range shall be 0-250 psig range. For V2B the range shall be 0-500 psia. Each shall have a stainless steel bourdon tube. All wetted pressure parts to be stainless steel. Electrical housing to be explosion proof for Class 1 Group D. Power is 115V 60 Hz.

(4) Temperature Transducers (2 required)
Temperature transducers to be Daniel Model 1204 with 0-120°F range. Furnish type 304 ss thermowell for 1/2" NPT connection for 4" IPS meter tube. Coordinate current range with other transducers listed herein. Electrical housing to be Class 1 Group D explosion proof.

(5) Furnish pipe mounts and stainless steel valves and stainless steel tubing manifold to mount and connect all transducers to the meter tube. The flow computers will be mounted in a control panel.

2.2 The following equipment will be utilized by mounting it in a control panel located in a weathertight purge room classified as non-hazardous.

(1) Flow computer and readout (2required)
Daniel Model 1272M Wide Range Flow Computer, for flush panel mounting. Each unit to be supplied with mercury wetted transmitter to transmit one pulse per 100 SCF of gas; furnish with divide switch if necessary.

3.0 DRAWINGS AND TECHNICAL DATA

Supplier to furnish, within 14 days of order date, 6 copies of the following:

(1) Outline dimensional drawing all items with recommended panel cut out where applicable.

(2) Electrical connection diagram all items.

(3) Circuit diagrams all items.

(4) Installation, operating and maintenance instructions.

(5) Parts List

4.0 SERVICE ENGINEER

The supplier as a part of the purchase price shall furnish one day for each test unit of a qualified service engineer at the jobsite to check out and initially operate the equipment.

5.0 GUARANTEE

Supplier and manufacturer to guarantee that all items will meet this specification and specifications in the manufacturers published catalogs. They shall guarantee the equipment to be free of defects in material and workmanship for a period of 12 months after first service date. The guarantee shall fully cover field or factory costs due to defects.

Tag all items for V2A - FR11
" " " " V2B - FR12

ELECTRICAL SPECIFICATION

WELL TEST UNIT

1.0 GENERAL:

This specification applies to the installation of all conduit and junction boxes to be used on test separators V2A and V2B. The separator wiring shall be complete and ready for operation and shall comply with this specification and attached drawings.

2.0 CODES:

The assembly shall conform to the "National Electric Code", latest edition, and to the "State of California Electrical Safety Orders", latest edition. Wherever a conflict arises, the more stringent code shall take precedence. All electrical work shall comply with the Class I Division 1 **area classification for hazardous locations. All junction boxes shall have screwed covers.**

3.0 SCOPE OF THE WORK:

The Contractors work includes, but is not limited to the following items:

3.1 Furnish and install all conduit to the high and low differential pressure transducers, static pressure transducer and temperature transducer as shown schematically on Drawing No. 084-104.

3.2 Furnish and install all conduit to the water meter (turbine meter), the high frequency pulser on the emulsion meter and the probe for the flow computer as shown schematically on Drawing No. 084-104.

3.3 Furnish and install all conduit to the high and low level shutdowns, the high pressure shutdown and the conductivity probe complete with control chassis and solenoid valve as shown schematically on Drawing No. 084-104.

3.4 **Furnish and install all conduit to the air solenoid** valves on the Bettis operator (V2B only) and furnish and install a selector switch as shown schematically on Drawing No. 084-104.

4.0 MATERIALS:

4.1 The Contractor shall use all new materials, first quality, approved by UL wherever standards have been established by that agency and shall meet these specifications and other re-

quirements as shown on the plans. It is intended that the Contractor shall furnish and install all items of material required for a complete installation.

4.2 Conduit shall consist of rigid copper free aluminum conduit having a copper content of 4/10 6f 1% or less.

4.3 All junction boxes shall have screwed covers, similar to the Crouse Hinds GUA series, and shall have a copper content of 4/10 of 1% or less.

4.4 All seals and unions shall have a copper content of 4/10 of 1% or less.

5.0 ELECTRICAL CONSTRUCTION:

The installation shall conform to the latest applicable rules of the national and state codes. The workmanship shall be of the highest grade and defective equipment or equipment damaged in the course of installation shall be replaced or repaired in a manner meeting with the approval of the Engineer.

The conduit system installation shall meet or exceed the requirements of the N.E.C. Minimum size of conduit shall be 1/2 inch. Field made bends and off sets shall be made with an approved Hickey or conduit bending machine. Changes in direction of runs shall be made with bends or cast metal fittings. Raceways as installed shall be entirely free of obstructions. All conduit shall be reamed, burrs removed, and cleaned for proper introduction of wires and cables.

6.0 GUARANTEE:

All equipment, material and workmanship to be furnished under this section shall be guaranteed by the Contractor in writing, for a period of one year from the date of acceptance.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION

RELIEF VALVES

084-WTU-J1 | REV.

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	PSV-1 △		RD-2 △		PSV-3 △		RD-4 △	
MAKE OR APPROVED EQUAL	CROSBY		CONTINENTAL DISC CORP.		CROSBY		CONTINENTAL DISC CORP.	
TYPE	2J3		RUPTURE DISC ASSEMBLY		2½ J4		RUPTURE DISC ASSEMBLY	
MODEL BELLOWS TYPE	JB-25		KBA PLUS ASSEMBLY #7		JB-35		KBA PLUS ASSEMBLY #7	
BODY MATERIAL	STL.		316 S.S.		STL.		316 S.S.	
PIPE SIZE IN / OUT	2"	3"	2"	2"	2½"	4"	2"	2"
CONNECTIONS IN / OUT	150 RF	150 RF	150 RF	150 RF	300 RF	150 RF	300 RF	300 RF
TRIM MATERIAL / SPRING	S.S.	STL.	316 S.S.		STL.	STL.	316 S.S.	
LIFTING GEAR / GAG	NO	NO	—	—	—	—	—	—
CALCULATED ORIFICE AREA SQ IN	GAS 0.42 OIL 0.60		—		GAS 0.54 OIL 0.40		—	
SELECTED ORIFICE AREA & LETTER	1.287	J	—	—	1.287	J	—	—
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG	275		275		500		500	
OPERATING PRESSURE OF ASSOCIATED EQUIP	85		85		85-350		85-350	
RELIEVING PRESSURE PSIG	230		275		450		500	
BACK PRESSURE PSIG	∅		∅		∅		∅	
DIFFERENTIAL OR FACTORY SET PRESSURE PSI	230		275		450		500	
FLOW TEMPERATURE °F	60-100°F		100°F		60-100°F		100°F	
GAS IS 0.70 SP. GR. MW OR S.G. AT FLOW TEMP.	S.P. GR. (GAS) 0.85 (OIL) 0.93		(GAS) 0.85 (OIL) 0.93		(GAS) 0.85 (OIL) 0.93		(GAS) 0.85 (OIL) 0.93	
DESIGN CAPACITY MAX — GPM	150		150		150		150	
DESIGN CAPACITY MAX — SCFH	104 M		104 M		311 M		311 M	
DESIGN CAPACITY MAX — #/HR								
BASIS OF SELECTION	LIQUID PLUS GAS		FURNISH STUDS FOR MATING ASA RF FLANGES		LIQUID PLUS GAS		FURNISH STUDS FOR MATING ASA RF FLANGES	
VESSEL AREA EXPOSED TO FIRE	—				—			
COMMODITY	* CRUDE OIL NATURAL GAS				* CRUDE OIL NATURAL GAS			
% OVER PRESSURE	10%		10%		10%		10%	
SPECIAL CONSTRUCTION & NOTES	COAT ALL WETTED STEEL PARTS PER SPEC.		ALL WETTED PARTS TO BE 316 S.S. STUDS - B7		COAT ALL WETTED STEEL PARTS PER SPEC.		ALL WETTED PARTS TO B 316 S.S. STUDS - B7	
SERVICE	TEST SEPARATOR SAFETY		TEST SEPARATOR SAFETY KNIVES 17-4 PH		TEST SEPARATOR SAFETY		TEST SEPARATOR SAFETY KNIVES 17-4	
LINE OR VESSEL NO	V2A		V2A		V2B		V2B	
PLANT NO								
PURCHASE ORDER NO								

* VISCOSITY OF OIL IS 7000 SSU @ 100°F

BY	DATE

DATE 12-22-70

BY RLH

CHECKED

ENGINEER

PR. ENG

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORPORATION

ENGINEERS - CONSTRUCTORS
SANTA FE SPRINGS, CALIFORNIA

SHEET 2 OF 8

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

084-WTU-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO		LC101 △		LC102 △		△		
MAKE OR APPROVED EQUAL		FISHER		FISHER				
TYPE		2500		2500				
MODEL		249V		249V				
MOUNTING		FLG'D.		FLG'D.				
INDICATING OR RECORDING		———		———				
INTERFACE OR LEVEL		LEVEL		LEVEL				
COMMODITY		CRUDE OIL		CRUDE OIL				
SPECIFIC GRAVITY AT 60°		.85 TO .93		.85 TO .93				
OPERATING PRESS.	TEMP	85	60°F	85/350	60°F			
MINIMUM DESIGN PRESS.	TEMP	230	100°F	500	100°F			
BODY MATERIAL		STEEL *		STEEL *				
CONNECTIONS		4"-150# R.F.		4" 300# R.F.				
FINS REQUIRED		NO		NO				
FLOAT MATERIAL	SIZE	316 S.S.	3"x14" **	316 S.S.	3"x14" **			
PILOT-RIGHT OR LEFT HAND		(LATER)		(LATER)				
THROTTLING RANGE		0-10% TO 0-100%		0-10% TO 0-100%				
AUTOMATIC RESET		NO		NO				
AIR FILTER & REDUCER		YES		YES				
MANUAL CONTROL BYPASS		** CENTER OF FLOAT TO BE 9" BELOW ℄ OF FLANGE		** CENTER OF FLOAT TO BE 9" BELOW ℄ OF FLANGE				
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE		INCREASES		INCREASES				
SPECIAL CONSTRUCTION & NOTES		* COAT WETTED STEEL PARTS PER SPEC.		* COAT WETTED STEEL PARTS PER SPEC.				
OPERATES WITH		LCV-101		LCV-102				
SERVICE VISCOSITY = 7,000 S.S.U. @ 100°F		TEST SEP. OIL LEVEL		TEST SEP. OIL LEVEL				
VESSEL NO		V-2A		V-2B				
PLANT NO								
PURCHASE ORDER NO								

REV.	BY	DATE

APPROVED

DATE 12-22-70

BY RLH

CHECKED

ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

084-WTU-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	LC-103 △	LC-104 △	△	△
MAKE OR APPROVED EQUAL	NATIONAL TANK CO.			
TYPE	ELECTRIC. CONDUCTIVITY			
MODEL	5402			
MOUNTING	M-P-T-			
INDICATING OR RECORDING	—			
INTERFACE OR LEVEL	INTERFACE			
COMMODITY	OIL / WATER			
SPECIFIC GRAVITY AT 60°	.93/1.00			
OPERATING PRESS. / TEMP	85 / 60°			
MINIMUM DESIGN PRESS. / TEMP	230 / 100°			
BODY MATERIAL	* STL.			
CONNECTIONS	2" PIPE THRD.			
PROBE	* 58			
PROBE DIMENSION	A=8" B=1/2" C=8" D=4"			
THROTTLING RANGE	SUBJECT TO CHECK BY NATIONAL			
AUTOMATIC RESET				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES CONTROL PRESSURE	CONTACTS CLOSE			
SPECIAL CONSTRUCTION & NOTES EXPLOSION-PROOF HOUSING ALL UNITS	* STAINLESS STEEL WETTED PARTS			
OPERATES WITH	LCV-103	LCV-104		
SERVICE 1000 SSU VISCOSITY @ 100°F	INTERFACE CONTROLLER	INTERFACE CONTROLLER		
VESSEL NO	V2A	V2B		
PLANT NO				
PURCHASE ORDER NO				

SAME AS LC-103

REV. | BY | DATE

APPROVED

DATE 12-22-70

BY RLH

CHECKED

ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORPORATION
ENGINEERS - CONSTRUCTORS
SANTA FE SPRINGS, CALIFORNIA

SHEET 4 OF 8

SPECIFICATION LIQUID LEVEL INSTRUMENTS 084-WTU-J1 REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB No. 10-084.

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	LSH105 △		LSL106 △		LSH107 △		LSL108 △
MAKE OR APPROVED EQUAL	FISHER		SAME AS LSH-105		FISHER		SAME AS LSH-107
TYPE	2800				2800		
MODEL	252V				252V		
MOUNTING	FLG'D.				FLG'D.		
INDICATING OR RECORDING	———				———		
INTERFACE OR LEVEL	LEVEL				LEVEL		
COMMODITY	CRUDE OIL				CRUDE OIL		
SPECIFIC GRAVITY AT 60°	.85 TO .93				.85 TO .93		
OPERATING PRESS. / TEMP	85	60°F			85/350	60°F	
MINIMUM DESIGN PRESS. / TEMP	275	100°F			500	100°F	
BODY MATERIAL	STEEL *				STEEL*		
CONNECTIONS	4" 150# R.F.				4" 300# R.F.		
FINS REQUIRED	NO				NO		
FLOAT MATERIAL / SIZE	316 S.S.	3"x 10"			316 S.S.	3"x10"	
PILOT-RIGHT OR LEFT HAND	———				———		
THROTTLING RANGE	———				———		
AUTOMATIC RESET	S.P.D.T. SWITCH				S.P.D.T. SWITCH		
AIR FILTER & REDUCER	EX. PROOF ENCL.				EX. PROOF ENCL.		
MANUAL CONTROL BYPASS	CL. 1, DIV. 1				CL. 1, DIV. 1		
CHART NO / SIZE	———	———			———	———	
CHART DRIVE / REVOLUTIONS	———	———			———	———	
AS LEVEL RISES CONTROL PRESSURE	CONTACTS OPEN		CONTACTS CLOSE		CONTACTS OPEN		CONTACTS CLOSE
SPECIAL CONSTRUCTION & NOTES	*INTERNALLY COAT WETTED STEEL PARTS PER SPEC.						
OPERATES WITH							
SERVICE — VISCOSITY = 7,000 SSU @ 100°F	HIGH LEVEL SHUTDOWN & ALARM		LOW LEVEL SHUTDOWN & ALARM		HIGH LEVEL SHUTDOWN & ALARM		LOW LEVEL SHUTDOWN & ALARM
VESSEL NO	V-2A		V-2A		V-2B		V-2B
PLANT NO							
PURCHASE ORDER NO							

REV. BY DATE

APPROVED

DATE 12-22-70
BY RLH
CHECKED
ENGINEER
PROJ. ENG.

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HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — CONTROL VALVES — 084-WTU-J1 — REV.

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO.			LCV-101 △		LCV-102 △	LCV-103 △		LCV-104 △
MAKE OR APPROVED EQUAL			FISHER			FISHER		FISHER
TYPE			GLOBE					
MODEL			667 ED			125 P		125 P
SIZE	TYPE CONNECTIONS		2"	300# R.F. FLG.		2"	150# R.F. FLG.	2" 300# R.F.F
BODY MATERIAL	RATING		STEEL	720 P.S.I.		STEEL	275 PSI	STEEL 275
INNER VALVE TRIM MAT'L			316 S.S./17-4 PH			SS/440 C		SS/440 C
INNER VALVE SIZE	TYPE		2 5/16"	EQUAL %		1/2"	TAPER	1/2" TAPE
TOP WORKS			SIZE 40			SIZE 4		SIZE 4
~~FING~~			3-15 psi SIGNAL					
POSITIONER	BOOSTER RELAY		NO	NO				
POSITIONER BYPASS	W/GAGES		NO	NO				
AIR FILTER & REDUCER			NO					
COMMODITY			*CRUDE OIL			OIL FIELD BRINE		OIL FIELD BR
FLOW TEMPERATURE, °F			60°F			60°F		60°F
PRESSURE, PSIG	IN	OUT	85	50		85	15	85/350 15
SPEC. GRAVITY $H_2O = 1.0$	@ 60°F	@ FLOW TEMP.		.93			1.0	
SPEC. GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP.						
GPM @ 60°	NORM. FLOW	MAX. CAP.		150			30	30
SCF/HR.	NORM. FLOW	MAX. CAP.	COAT WETTED STEEL PARTS PER SPEC.			COAT WETTED STEEL PARTS PER SPEC.		COAT WETTED STEEL PARTS PER SPEC.
# HR.	NORM. FLOW	MAX. CAP.						
VALVE POSITION ON AIR FAILURE	/ MAX. ΔP		CLOSES/275		CLOSES/500	CLOSES/275		CLOSES/50
Cv			CALC. 45.0 ACT. 59.7		CALC. 45.0 ACT. 59.7	CALC. 3.50 ACT. 5.50		CALC. 3.5 ACT. 5.5
SPECIAL CONSTRUCTION & NOTES			TRIM #4 316 S.S./17-4PH INSTALL FLOW DOWN		TRIM #4 316 S.S./17-4 PH INSTALL FLOW DOWN	FLOW TO OPEN AIR TO OPEN		
OPERATES WITH			LC-101		LC-102	LC-103		LC-104
SERVICE			TEST SEP. LEVEL		TEST SEP. LEVEL	TEST SEP. INTERFACE LEVEL		TEST SEP. INTERFACE LEVEL
VESSEL NO.			V-2A		V-2B	V-2A		V-2B
PLANT NO.								
PURCHASE ORDER NO.								

SAME AS LCV-101

* VISCOSITY = 7,000 SSU @ 100°F

DATE	BY

DATE 12-22-70

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HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET 6 OF 8

SPECIFICATION

TEMPERATURE INSTRUMENTS

084-WTU-J1 REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO.	T1-201	T1-202			
MAKE OR APPROVED EQUAL	WESTON				
TYPE	BI-METAL				
MODEL	4500				
MOUNTING	1/2" MPT-BACK				
INDICATING OR RECORDING	INDICATING				
STEM LENGTH	1/4" x 12"				
DIAL	5" SS				
TEMPERATURE RANGE	0-200°F				
THROTTLING RANGE	—				
AUTOMATIC RESET	—				
RATE ACTION	—				
AIR FILTER & REDUCER	—				
MANUAL CONTROL BYPASS	—				
CHART SIZE / NUMBER	— / —				
CHART DRIVE / REVOLUTIONS	— / —				
NUMBER OF POINTS					
THERMOWELL	316 S.S. 3/4" N.P.T. WESTON NO. 73303-124	SAME AS T1-201			
ELEVATION OF BULB ABOVE INSTRUMENT					
TUBING MATERIAL & LENGTH					
TUBING COMPENSATION					
AS TEMPERATURE RISES OUTPUT SIGNAL					
SPECIAL CONSTRUCTION & NOTES					
OPERATES WITH	V-2A	V-2B			
SERVICE	TEMP. INDICATOR	TEMP. INDICATOR			
PRIMARY ELEMENT LOCATION					
PLANT NO					
PURCHASE ORDER NO					

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SHEET 7 OF 8

SPECIFICATION — PRESSURE INSTRUMENTS

084-WTU-J1 | REV

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	P1-301 △	P1-302 △	PSH-303 △	PSH-304 △
MAKE OR APPROVED EQUAL	WIKA	WIKA	CUSTOM COMPONENTS	CUSTOM COMPONENT
TYPE	PRESS. GAGE	PRESS. GAGE	PRESS. SWITCH	PRESS. SWITC
MODEL	233	233	6006 G-RW-4	6006 G-RW-5
MOUNTING / LOCATION	1/2" MPT / BOTTOM	1/2" NPT / BOTTOM	SURFACE	SURFACE
INDICATING OR RECORDING	INDICATING	INDICATING	—	—
NORMAL PRESSURE @ TEMP	85 / 60°F	85/350 / 60°F	85 / 60°F	85/350 / 60°
PRESSURE ELEMENT RANGE	0-300 P.S.I.G.	0-600 P.S.I.G.	0-375 P.S.I.G.	350-725 PSI
PRESSURE ELEMENT TYPE AND MATERIAL	BOURDON / 316 S.S.	BOURDON / 316 S.S.	DIA. / 347 S.S.	DIA. / 347
DIAL SIZE	4"	4"		
PRESS. TAP			1/4" F.N.P.T.	1/4" F.N.P.T.
ELECT. CONN.			1/2" MALE	1/2" MALE
ADJUST RANGE			175-375 P.S.I.G.	350-725 P.S.I
DEAD BAND			40 ± 25	65 ± 30
MANUAL CONTROL BYPASS				
CHART SIZE / NO				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL			CONTACTS OPEN	CONTACTS OPE
LOCATION OF PRESSURE TAP			LOWER	LOWER
PULSATION DAMPENER	NO	NO	NO	NO
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED	GLYCERIN FILLED	FACTORY SET @ 200 PSI INCREASING. 4500 PSI PROOF CASE	FACTORY SET @ 400 PSI INCREASING. 4500 PSI PRO CASE
OPERATES WITH	V-2A	V-2B	V-2A	V-2B
SERVICE	TEST SEP. PRESS. IND.	TEST SEP PRESS. IND.	TEST SEP. HIGH PRESS. SHUTDOWN	TEST SEP. HIGH PRESS SHUTDOWN
PLANT NO				
PURCHASE ORDER NO				

REV	DATE	BY

DATE 12-22-70

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HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

084-WTU-J1 | REV.

SPECIFICATION — PRESSURE INSTRUMENTS

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION DEEPWATER OFFSHORE PLATFORM

IDENTIFICATION TAG NO	PSL 303	PSL 304
MAKE OR APPROVED EQUAL	CUSTOM COMPONENTS	CUSTOM COMPONENTS
TYPE	PRESS. SWITCH	PRESS. SWITCH
MODEL	606-GCFW-0	606-GCFW-4
MOUNTING / LOCATION	SURFACE	SURFACE
INDICATING OR RECORDING	—	—
NORMAL PRESSURE @ TEMP	55-85 60°F	250-350 60°F
PRESSURE ELEMENT RANGE	10-70 DECREASING	125-350 DECREASING
PRESSURE ELEMENT TYPE AND MATERIAL	DIA. 347 S.S.	DIA. 347 S.S.
REQUIRED SUPPRESSION	—	—
THROTTLING RANGE	CLASS I GROUP D EXPLOSION-PROOF	CLASS I GROUP D EXPLOSION-PROOF
AUTOMATIC RESET		
RATE ACTION		
AIR FILTER & REDUCER	FACTORY SET AT 50 psi	FACTORY SET AT 225 psi
MANUAL CONTROL BYPASS		
CHART SIZE / NO		
CHART DRIVE / REVOLUTION		
INDICATING SCALE RANGE		
AS PRESSURE INCREASES OUTPUT SIGNAL	CONTACTS CLOSE	CONTACTS CLOSE
LOCATION OF PRESSURE TAP		
PULSATION DAMPENER	NO	NO
SPECIAL CONSTRUCTION & NOTES: MOUNT WIZARD ON VALVE	DEAD BAND 10±6 psi; 4500 psi-PROOF ENCLOSURE	DEAD BAND 40±25 psi; 4500 psi-PROOF ENCLOSURE
OPERATES WITH		
SERVICE	TEST SEPARATOR V-2A	TEST SEPARATOR V-2B
VESSEL NO.	V-2A	V-2B
PURCHASE ORDER NO		

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3.3 WELL CLEAN SEPARATOR
& TANK

SPECIFICATION FOR PACKAGED WELL CLEAN SEPARATOR UNIT

1.0 GENERAL:

This specification and the plans and specifications referenced herein describe the work and material by the Contractor. The work includes furnishing all equipment and material except those specifically stated as furnished by others in the request for quotation by Humble Oil and Refining Company. The packaged unit includes one two-phase oil and gas separator, complete with base, piping, instruments and controls and protective coatings. The unit is to be completely assembled and tested prior to shipment. Delivery of the unit shall be made f.o.b. trucks at jobsite location stated in Humble's request for quotation.

The equipment is to be installed by Humble on an off-shore oil drilling and production platform. The unit will be continuously exposed to a wet salt air atmosphere.

2.0 SCOPE OF WORK:

All equipment, material and work shall be as described in this Specification 10-084-WCS and drawings and specifications listed in Par. 6. Codes and standards referenced herein are a part of these Specifications.

3.0 EQUIPMENT, MATERIALS AND CONSTRUCTION:

3.1 Oil and Gas Separator

The oil and gas separator shall be in accordance with the attached Specification 10-084-WCS and Drawing 10-084-131.

3.2 Instruments, Meters and Control Valves

Instruments and control valves are described on data sheets in Specification 10-084-WCU-J1.

3.3 Skid Base Supports and Access Ladders

The skid bases, supports and structural steel shall comply with the applicable parts of the AISC Manual of Steel Construction. All joints shall be solidly welded and continuously sealed so that the protective coatings will be effective. The skid base shall be fabricated as shown on Dwg. 084-130 . The contractor shall be responsible to see that all structural items including

3.3 Skid Base Supports and Access Ladders (cont'd)

miscellaneous supports are adequate for marine handling and will withstand a 20% seismic force.

Piping supports are not detailed on the drawings. The Contractor shall be responsible to install these wherever necessary as part of his contract. These supports shall be welded or bolted steel and shall be square plumb and first class in appearance and workmanship. All steel edges and corners shall be ground to 1/8" minimum radius. Steel access ladders and platforms for instruments and controls shall be furnished and installed if required. These shall be located after final assembly of piping and are subject to approval by Humble prior to installation. Ladders shall conform to State of California Safety Orders.

3.4 Piping Valves and Fittings

3.41 Piping valves and fittings shall be installed as shown on the Drawings. The Contractor shall be responsible for field checking the dimensions of all items prior to starting the assembly to assure proper fit up.

All piping work shall conform to American Standard Code for Pressure Piping, Petroleum Refinery Piping USAS B31.3 latest edition, Chapters V & VI. All welds shall be subject to radiographic inspection at Humble's request. Initial cost of the inspection is for Humble's account. Repairs due to defects and reinspection costs are for the Contractor's account. The acceptability of welds to be in accordance with ASME Code, Section VIII Par. UW52.

3.42 Valves shall be as shown on Drawings (or approved equal). Bidders to quote manufacturer's and catalog numbers on base bid plus alternate makes with a pricing schedule.

3.43 Piping materials shall conform to the Piping Specification for the class shown on the Drawings.

3.44 Instrument tubing materials shall conform to those shown on Drawings. All instrument tubing shall be run square and plumb. All tubing bends shall be neatly made with tubing benders. All tubing runs shall be supported in steel channels or firmly attached to piping runs. Tubing and support work shall be first class in appearance and workmanship.

3.5 Protective Coatings

3.51 Internal Protective Coatings for all oil, gas and water piping, valves and fittings shall be Tube-Kote TK21 (12-15 mils) heat cured epoxy (or approved equal). All welds to be ground smooth prior to application of coating. Surface preparation shall be same as in Specification 10-084-C2. Instrument items shall be coated with this system where specified on data sheets of Specification 10-084-WTU-J1.

3.52 External Protective Coatings shall be applied to all metal surfaces except stainless steel and aluminum. Instrument cases, glass and name plates are not to be coated. The coating shall conform to Specification 10-084-C2.

3.53 Separator Internal Coatings - The separator shells, heads, nozzles and internals shall be protectively coated in accordance with Specification 10-084-C1. All shell and head welds shall be ground smooth on the interior prior to coating.

3.6 Testing - After assembly of all piping the oil water and gas piping shall be hydrotested at 2160 psig. All instruments shall be disconnected prior to testing. Test pressure shall be held for a minimum of one hour and equipment carefully inspected for leaks. Humble to be notified of test schedule so they may witness them at their option. Equipment shall be thoroughly dried and cleaned inside. Control systems shall be tested to prove they operate properly. Humble shall be notified prior to check out so they may have the option to witness the tests.

3.7 Drying and Sealing for Shipment - Vessel and piping shall be sealed for shipment with dry air inside and adequate desiccant to maintain dryness in the units. Instruments shall be removed and packaged separately.

4.0 QUOTATIONS shall be for a lump sum firm price to furnish the completed units f.o.b. trucks at the jobsite designated on the Humble request for quotation. Bidders shall summarize and list any exceptions from these Specifications. The quotation shall essentially comply with these specifications. Exceptions will be allowed only on the basis of equal or better units with essentially no change in the arrangement.

5.0 GUARANTEE - The Contractor and the manufacturer shall guarantee all items and the assembly to comply with these Specifications and to be free of defects in material and workmanship for a period of 12 months from first service date.

6.0 SPECIFICATIONS AND DRAWING LIST

Specifications

10-084-WCU	Specification for packaged well clean separator unit
10-084-WCS	Specification for Production Separator VID
Class C	Specification Class C Piping
10-084-C1	Specification Protective Coatings, Epoxy-mastic for Internal Surfaces
10-084-C2	Specification for Application of Protective Coatings to External Surfaces

Drawings

084-126	Well Clean Separator V1D Diagram
084-131	Well Clean Separator V1D
084-130	Well Clean Separator Unit Assy.

7.0 TECHNICAL DATA:

Supplier shall furnish 6 copies of all parts lists, operating and maintenance instructions, sectional drawings wiring schematics, connection diagrams and certified dimensional outline drawings at time of shipment of unit.

SPECIFICATION FOR

WELL CLEAN SEPARATOR V1D

1.0 GENERAL:

This specification applies to the purchase of one oil production separator. The separator is to be used in a packaged unit for an off-shore platform. The separator is two phase. Drawings referenced herein show the size, arrangement and construction locations. These shall not be changed. Internals equal to or better than those shown may be supplied if the details are approved by the Humble Engineer.

2.0 DESIGN CONDITIONS:

The manufacturer shall be responsible for the design and construction of the separator to meet the design conditions as follows:

V1D Separator

Design Pressure	1440 psig @ 100°F
Normal Pressure	85-1000 psig @ 60°F
Oil Rate	5,000 B/D
Gas Rate	5.0 MMSCFD
Water Rate (max.)	2,000 B/D
Oil Gravity	16-23°API
Gas Specific Gravity	0.85
Oil Viscosity	7000 SSU (max.)
Temperature	100°F - 110°F

3.0 SEPARATOR INTERNALS AND ACCESSORIES:

3.1 The internals shall be essentially as shown on the drawings.

3.2 Separator manufacturer shall check and be responsible to see that all instruments specified in the attached specification sheets will properly fit the separators and clear as necessary all internals.

3.3 All separator internals except the scrubber plates shall be protectively coated in accordance with the attached specifications for protective coatings of vessel internals.

4.0 CONTROLS AND INSTRUMENTS:

These items are to be as specified on the attached data sheets and specifications. The purchaser will specify on the purchase order if these are to be furnished with the separator.

The gage glasses and cocks will be furnished and installed by the separator manufacturer.

5.0 VESSEL SHELL AND CONNECTIONS:

5.1 The manufacturer shall design, construct, test and certify the shells in accordance with the ASME Code Section VIII, Latest Edition. A corrosion allowance of 1/16" shall be provided throughout. The vessel shall be coated internally with protective coating as specified in the attached specifications.

5.2 All welds for nozzles and connections penetrating the vessel shell shall be full penetration.

5.3 Humble shall have access to inspection of vessels during fabrication. Purchaser reserves the right to radiograph any or all vessel welds before or after delivery of the vessel. Defects detected by this inspection shall be repaired at the expense of the manufacturer.

5.4 Manhole davits shall be provided at each manhole to properly handle the cover.

5.5 Shell supports to be adequate to support vessels full of liquid with 20% seismic force when vessels are stacked. The minimum metal thickness for supports is 1/4".

6.0 TECHNICAL DATA:

6.1 Bidders shall furnish proposed scrubber plate area, spacing, length and metal thickness.

6.2 Bidders shall furnish details of any deviation proposed from these specifications and drawings.

6.3 Supplier shall furnish Humble with 3 copies of shop drawings for approval prior to starting fabrication.

6.4 Supplier shall furnish Humble 6 copies of certified dimensional drawings and final shop drawings. Six copies of final as-built drawings shall be furnished if any changes are made during fabrication of the vessel.

6.5 Guarantee

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date.

SPECIFICATION
MISCELLANEOUS VESSELS

VENT SURGE TANK V6
WATER SUMP V7
OIL SUMP V8
WELL CLEAN TANK V10

1.0 GENERAL

This specification applies to the design and construction of the above vessels. The vessels are to be used on a Humble Oil and Refining Company Offshore Platform near Santa Barbara, California. The vessels are to be constructed in accordance with ASME Code Section VIII.

2.0 CONSTRUCTION

The vessels shall be constructed as shown on Drawings 084-128, 084-143 and 084-144. The design pressure is 25 psig at 100°F for all vessels V6, V7 and V8 with 1/16" corrosion allowance. V10 is to be designed for 50 PSIG at 100°F and 1/16" corrosion allowance.

All joints and connections both externally and internally shall be continuously seal welded. Welds internally shall be ground smooth prior to coating.

3.0 PROTECTIVE COATING

The vessels and appurtenances shall be coated externally in accordance with the attached Specification 10-084C2 and coated internally in accordance with Specification 10-084-C1.

4.0 DELIVERY

The vessels shall be delivered f.o.b. trucks or barges at the jobsite specified in the Humble request for quotation.

5.0 DRAWINGS

Supplier shall submit three (3) copies of shop drawings for approval prior to fabrication. The purchaser reserves the right to change the location of nozzles and appurtenances until the approval of these drawings.

6.0 GUARANTEE

The supplier shall guarantee the vessels to meet the requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from the delivery date. Defects or deficiencies shall be corrected at no additional cost to Humble.

Humble Job 10240
H-B Job 10-084

10-084-WCSFR

WELL CLEAN SEPARATOR

GAS METER TUBE

For FR14 (one req'd)

This specification applies to the purchase of one meter tube complete with all ends flanged and internally lined with bakelite. The tube shall be adequate to measure 1.25 MMSCFD of 0.70 specific gravity sour gas at pressures varying from 85 to 1000 psig and at temperatures 60-100°F. The meter tube shall be a 3" 600# ANSI RF senior flangnek meter tube with flanged connections on both ends of the tube. The tube shall meet AGA specifications and dimensions. The design pressure is 1440 psig at 100°F. The tube shall be fitted with type 304 stainless steel straightening vanes.

The overall tube length is 60 inches face-to-face. The dimension from inlet end to orifice is 46 inches. The dimension from inlet to downstream end of vanes is 23 inches. The dimension from orifice to outlet end is 14 inches. Furnish two 1/2" and one 3/4" pressure sampler and temperature connections with stainless steel plugs.

Furnish one each 1.750 end bore and 1.00 inch bore orifice plates.

HOBBS-BANNERMAN CORPORATION

ENGINEERS - CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	LAH 161 △	LSH 125 △	LC154A △	LC154B △
MAKE OR APPROVED EQUAL		FISHER		
TYPE		2800		
MODEL		252V		
MOUNTING		FLGD.		
INDICATING OR RECORDING				
INTERFACE OR LEVEL		LEVEL		
COMMODITY		CRUDE OIL		
SPECIFIC GRAVITY AT 60°		.85 TO .93		
OPERATING PRESS. / TEMP		85 TO 1000 / 60°F		
MINIMUM DESIGN PRESS. / TEMP		1440 / 100°F		
BODY MATERIAL		STEEL		
CONNECTIONS		4"-600# RF		
FINS REQUIRED				
FLOAT MATERIAL / SIZE		316SS / 3"x10"		
PILOT-RIGHT OR LEFT HAND		—		
THROTTLING RANGE				
AUTOMATIC RESET		—		
AIR FILTER & REDUCER		—		
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES, CONTROL PRESSURE		CONTACTS OPEN	CONTACTS CLOSE	CONTACTS OPEN
SPECIAL CONSTRUCTION & NOTES: * COAT ALL WETTED PARTS PER SPEC. 10-084-C2	*	* SPDT CONTACTS IN EX. PR. EXCL.	*	*
OPERATES WITH			LCV-154	LCV-154
SERVICE	WELL CLEAN SEPARATOR	HIGH LEVEL S.D. WELL CLEAN SEPARATOR	LEVEL CONTROL WELL CLEAN SEPARATOR	LEVEL CONTROL WELL CLEAN SEPARATOR
VESSEL NO	VID	VID	VID	VID
PLANT NO				
PURCHASE ORDER NO				

LSH 125 AS SAME

LSH 125 AS SAME

LSH 125 AS SAME

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DATE

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SANTA FE SPRINGS, CALIFORNIA

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SPECIFICATION

CONTROL VALVES

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO			PCV 338△		LCV 154△		FCV-155△	FCV-155A
MAKE OR APPROVED EQUAL			FISHER		FISHER		FISHER	
TYPE			GLOBE		GLOBE		BUTTERFLY	
MODEL			667 ED		667 ED		DOUBLE R/L	
SIZE	TYPE CONNECTIONS		2"	FLGD	2"	FLGD	4"	FLG.
BODY MATERIAL	RATING		STL	600# RF	STL	600# RF	STL.	150# RF
INNER VALVE TRIM MATL			316 SS 17-4 PH		316 SS 17-4 PH		BUNA-N	
INNER VALVE SIZE	TYPE		2 5/16	EQUAL %	2 5/16	QO	4"	BF
TOP WORKS			SIZE 40		SIZE 40		656-30	667
FINS			—					
POSITIONER	BOOSTER RELAY		NO	NO	NO	NO	NO	NO
POSITIONER BYPASS	W-GAGES		NO	NO	NO	NO	NO	NO
AIR FILTER & REDUCER			NO		NO		YES	
COMMODITY			NAT. GAS		CRUDE OIL		CRUDE OIL	
FLOW TEMPERATURE, °F			60°F					
PRESSURE PSIG	IN	OUT	*95	75	*95	75		
SPEC GRAVITY H_2O = 1.0	@ 60°F	@ FLOW TEMP.	.85	60	.90	60		
SPEC GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP						
GPM @ 60°	NORM FLOW	MAX CAP.				175		
SCFHR	NORM FLOW	MAX CAP		104M				
#/HR	NORM FLOW	MAX CAP		7000				
VALVE POSITION ON AIR FAILURE			CLOSES		CLOSES		CLOSES	OPENS
CV			CALC. 1400 ACT. 2140		CALC. 58 ACT. 75.1			
SPECIAL CONSTRUCTION & NOTES * OPERATIONS VARY TO UP TO 1000 PSI			MAX ΔP 1100 PSI 3-15 PSI SPRING		MAX ΔP 1100 PSI 3-15 PSI SPRING		316 SS STEM C.I. DISC	
OPERATES WITH			PC 338		LC 154 A LC 154 B			
SERVICE			WELL CLEAN BACK PRESS.		WELL CLEAN TANK		WELL CLEAN TANK EMERGENCY OVERFLOW	WELL CLEA TANK EMERGENC OVERFLOW GAS SHUTO
VESSEL			VID		VID			
PLANT NO								
PURCHASE ORDER NO								

SAME AS FCV-155

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SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		PI-315 △		PSH 316 △		PC 338 △		PSL 316 △
MAKE OR APPROVED EQUAL		WIKA		CUSTOM COMPONENTS		FISHER		CUSTOM COMPONENTS
TYPE		PRESS. GA.		PRESS. SWITCH		WIZARD		PRESS. SWITCH
MODEL		233		606-GCRW-7		4150		606-GCRW-0
MOUNTING	LOCATION	½ MPT	BOTTOM	SURFACE		ON PCV 317		SURFACE
INDICATING OR RECORDING		IND		—				—
NORMAL PRESSURE @ TEMP.		85 TO 1000	60°	85 TO 1000	60°	70	60°F	85 TO 1000	60°F
PRESSURE ELEMENT RANGE		0-1500		1000-1750 INCREASE		0-1500		10-70 DECREASE
PRESSURE ELEMENT TYPE AND MATERIAL		BOUR	316SS	DIA	347SS	BOUR	316SS	
DIAL SIZE		4".				—		
THROTTLING RANGE						0-10 0-100%		
AUTOMATIC RESET				CLASS 1 GROUP D		NO		CLASS 1 GROUP D
RATE ACTION				EXPLOSION PROOF		NO		EXPLOSION-PROOF
AIR FILTER & REDUCER				ENCLOSURE		YES		ENCLOSURE
MANUAL CONTROL BYPASS				FACTORY SET @ 1100 PSI		—		FACTORY SET @ 50 PSI
CHART SIZE	NO			INCREASING		—	—	DECREASING
CHART DRIVE	REVOLUTION					—	—	
INDICATING SCALE RANGE								
AS PRESSURE INCREASES OUTPUT SIGNAL				CONTACTS OPEN		INCREASES		CONTACTS CLOSE
LOCATION OF PRESSURE TAP						BACK		
PULSATION DAMPENER						NO		
SPECIAL CONSTRUCTION & NOTES		GLYCERIN FILLED		DEAD BAND. 200 ± 60 PSI 4500 PSI PROOF PRESSURE		MOUNT & PIPE TO PCV 317 WITH S.S. TUBING		DEAD BAND 10 ± 6 4500 PSI PROOF
OPERATES WITH						PCV 338		
SERVICE		WELL CLEAN SEP. V-1D		WELL CLEAN SEP. V-1D		BACK PRESS. WELL CLEAN SEP.		WELL CLEAN SEP. V-1D
PLANT NO								
PURCHASE ORDER NO								

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SANTA FE SPRINGS, CALIFORNIA

SHEET OF

SPECIFICATION

FLOW INSTRUMENTS

CUSTOMER	HUMBLE OIL & REFINING CO.	B 10-084
PLANT LOCATION		
IDENTIFICATION TAG NO	FR 14	
MAKE OR APPR	BARTON	
TYPE	FLOW RECORDER	
MODE	202A	
MOUNTING	PIPE	
PRESSURE RATING	SWP 3000 PSI	
	RECORDING	
	* 0-50"	
	—	
	—	
	—	
MANUAL INDICATOR	—	
CHART SIZE	—	
	SPRING 24 HR.	
NUMBER OF PENS	TWO	
	1000 316 SS BOURDON	
METER MANIFOLD	YES	
METER BY	NO	
	—	
	SOUR GAS	
	80-1000 PSI	
SPECIAL INSTRUCTION	* 316 SS HOUSING & BELLOWS	
	CHARTAMATIC PENS	
OPERATED WITH		
SERVICE	GAS OUT WELL CLEAN SEPARATOR	
PLANT NO		
PURCHASE ORDER NO		

MATERIAL & THICKNESS	
METER DIFFERENTIAL RANGE	
STATIC SPRING RANGE	
CHART TYPE PRESSURE BASE	
SPECIAL CONSTRUCTION & NOTES	

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

10-084-WCU-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LC/LAH/LSH 155 △		LSL 164 △		△		△
MAKE OR APPROVED EQUAL		FISHER		FISHER				
TYPE		2500		2800				
MODEL		B		252V				
MOUNTING		(STD)		FLG'D				
INDICATING OR RECORDING		IND.		—				
INTERFACE OR LEVEL		LEVEL		LEVEL				
COMMODITY		CRUDE OIL MUD, WATER		CRUDE OIL				
SPECIFIC GRAVITY AT 60°		.85 TO 1.02		.85-.93				
OPERATING PRESS.	TEMP	5	60°F	85 TO 1000	60°F			
MINIMUM DESIGN PRESS.	TEMP	50	100°F	1440	100°F			
BODY MATERIAL		ALUM.		STL				
CONNECTIONS		1½" CPLG.		4"-600# RF				
FINS REQUIRED		—		—				
FLOAT MATERIAL	SIZE	FOAM GLASS & S.S.	15"	316 S.S.	3"x10"			
PILOT-RIGHT OR LEFT HAND		—		—				
THROTTLING RANGE		—		—				
AUTOMATIC RESET		—		SPDT SWITCH EXPLOSION-PROOF HOUSING				
AIR FILTER & REDUCER								
MANUAL CONTROL BYPASS								
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE				CONTACTS CLOSE				
SPECIAL CONSTRUCTION & NOTES		FURN. W/ FIG. 2587 PROGRAMMER & 4 SPDT SWITCHES EXP. PR. UL LABEL						
OPERATES WITH		LCV 154		—				
SERVICE		WELL CLEAN		WELL CLEAN SEPARATOR LOW LEVEL SHUT DOWN				
VESSEL NO				V-10				
PLANT NO		TANK V-10						
PURCHASE ORDER NO								

REV. | BY | DATE

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SPECIFICATION

RELIEF VALVES

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		PSV-12 △		RD 13 △		PSV-26 △	RD-27 △	
MAKE OR APPROVED EQUAL		CROSBY		CONTINENTAL DISC. CORP.		CROSBY	CONTINENTAL DISC. CORP.	
TYPE		1½"G 2½		RUPTURE DISC.			RUPTURE DISC.	
MODEL		JB 45		KBA ASSY #7		JB-25	KBA ASSY #7	
BODY MATERIAL		STL.		316 SS		STL.	316 S.S.	
PIPE SIZE	IN / OUT	1½"	2½"	2"	2"	4" / 6"	4"	4"
CONNECTIONS	IN / OUT	600#RF	150#RF	600#RF	600#RF	150#RF / 150#RF	150#RF	150#RF
TRIM MATERIAL	SPRING	SS	STL	316SS	STL.	S.S. / STL.	316S.S.	STL.
LIFTING GEAR	GAG	NO	NO	—	—	NO. / NO		
CALCULATED ORIFICE AREA SQ IN		GAS 0.10 OIL 0.30		GAS 0.10 OIL 0.30		GAS 1.70 OIL 1.75	GAS 1.70 OIL 1.75	
SELECTED ORIFICE AREA & LETTER		G	.503			L	3.60	
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG		1440 PSI		1440 PSI		50		
OPERATING PRESSURE OF ASSOCIATED EQUIP		85 TO 1000		85 TO 1000		0-25		
RELIEVING PRESSURE PSIG		1250		1440		50		
BACK PRESSURE PSIG		0		0		0		
DIFFERENTIAL OR FACTORY SET PRESSURE PSI		1250		1440		50		
FLOW TEMPERATURE F		60°F		100°F		100°F		
MW OR S G AT FLOW TEMP GAS/OIL		.80/.93		.80/.93		.80/.93		
DESIGN CAPACITY MAX	GPM	175		175		175		
	SCFH	375 M		375 M		100 M		
	#/HR					60000		
BASIS OF SELECTION		OIL & GAS		FURNISH STUDS FOR MATING ASA RF FLGS		OIL & GAS		
VESSEL AREA EXPOSED TO FIRE		—						
COMMODITY		CRUDE OIL MUD & GAS				CRUDE OIL, MUD & GAS		
OVER PRESSURE		10%		10%		10%		
SPECIAL CONSTRUCTION & NOTES		COAT ALL WETTED STEEL PARTS PER SPEC.		ALL WETTED PARTS TO BE 316 SS KNIVES 17-7PH STUDS B-7		COAT ALL WETTED STL. PARTS PER SPEC.	ALL WETTED PARTS TO BE 316 S.S. KNIVES	
SERVICE		WELL CLEAN SEP.		WELL CLEAN SEP.		WELL CLEAN TANK	WELL CLEAN TANK	
LINE OR VESSEL NO		VID		VID		V-10	V-10	
PLANT NO								
PURCHASE ORDER NO								

SAME AS PSV-12 LP

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PI-315A △	△	△	△
MAKE OR APPROVED EQUAL	WIKA			
TYPE	PRESS. GAGE			
MODEL	233			
MOUNTING LOCATION	1/2" MPT BOTTOM			
INDICATING OR RECORDING	INDICATING			
NORMAL PRESSURE TEMP	0-30 100°F			
PRESSURE ELEMENT RANGE	0-60			
PRESSURE ELEMENT TYPE AND MATERIAL	BOURD. 316 SS			
REQUIRED SUPPRESSION DIAL SIZE	4"			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE NO				
CHART DRIVE REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED			
OPERATES WITH SERVICE	WELL CLEAN TANK V-10			
PLANT NO				
PURCHASE ORDER NO				

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THIS SPECIFICATION

4.0 CRUDE OIL SHIPPING & SURGE

PACKAGED PRODUCTION SURGE TANKS

1.0 GENERAL

This specification applies to the design, fabrication and delivery of one (1) packaged skid-mounted unit, consisting of three (3) 12'-0" diameter x 9'-0" s/s production surge tanks together with associated piping, valves and instruments. The packaged unit will be installed in an outdoor marine exposure on an off-shore platform near Santa Barbara, California. The unit shall be suitable for use in a Class 1, Division 1, Group D hazardous area.

2.0 SCOPE OF WORK

Supplier shall provide all labor, equipment and material required to furnish the packaged unit as specified herein, except for any items of material specifically excluded by Humble's request for quotation. The packaged unit shall be designed and fabricated as specified below, and as shown and specified by drawings and other specifications referenced herein.

3.0 PRODUCTION SURGE TANKS

3.1 Production surge tanks (V-4A, V-4B, V-4C) shall be designed, fabricated, tested and certified in accordance with the latest edition of the ASME Code, Section VIII, for 50 psig maximum allowable working pressure at 150°F, with 1/16" (minimum)corrosion allowance.

3.2 All nozzles and shell penetrations shall have full-penetration welds. All welds are subject to radiograph inspection by Humble either before or after delivery. Any defects so detected shall be repaired and re-inspected at supplier's expense.

3.3 The production surge tanks shall be constructed as shown by Drawings 084-140 and -141. Vessel shell support skirt, base ring and bolted attachment to skid shall be designed to withstand 20% seismic loading with vessel full of water. Support members shall be ½" minimum plate thickness.

4.0 SKID BASE

Production surge tanks and associated piping, valves and instruments shall be mounted on a structural steel skid base, as shown and specified on Drawing 084-171. Fabrication of the skid base shall comply with applicable sections of the AISC Manual of Steel Construction. All joints and seams shall be solidly welded. Open areas of top surface of skid shall be covered with non-skid floor plate, with all seams seal-welded to prevent leakage of fluids. All rough surfaces shall be ground to prevent leakage of fluids. All rough shall be ground smooth, and all edges and corners shall be ground to 1/8" (minimum) radius.

5.0 PIPING, VALVES AND INSTRUMENTS

5.1 Piping, valves and instruments shall be installed as shown by Drawings 084-123 and -166. Valves shall be as specified thereon. Instruments shall be as described by specification data sheets 084-PST-J1 (9 sheets). Instruments shall be installed and connected as specified and shown by Drawing 084-173. Instrument tubing shall be neatly run, plumb and square. Long runs shall be continuously supported in steel channel or firmly clamped to piping runs.

5.2 All piping on the skid unit shall comply with Class A Piping Specification 10-084-A. Piping fabrication shall comply with American Standard Code for Pressure Piping ASA B31.3. latest edition, Section V and Section VI. All welds are subject to radiograph inspection in accordance with ASME Code, latest edition, Section VIII, par. UW-51, at Humble's expense. Any defects so detected shall be repaired and reinspected at supplier's expense.

5.3 After assembly, all piping shall be hydrotested at 410 psig, held for one hour. All leaks shall be located and repaired. Pneumatic instruments and controls shall be tested to demonstrate correct operation. Humble may require that hydrotest and operational test be witnessed and approved by its representative.

5.4 Steel access ladders, complying with the requirements of the State of California Safety Orders, shall be provided to give access to all valves and instruments for operation or removal. Ladders shall be attached to and supported from skid base and/or vessels by bolted clip attachments.

5.5 Supplier shall provide and install pipe supports at locations shown on the drawings. Pipe supports shall be rigid, welded or bolted steel attachments from skid base or vessels. Attachment to pipe shall be bolted. Pipe supports shall be capable of withstanding operating loads without deformation or vibration. All seams, crevices or openings shall be completely seal welded and ground smooth.

6.0 PROTECTIVE COATINGS

6.1 All piping, valves and fittings shall be internally coated with Tube-Kote TK21 heat-cured epoxy, 12-15 mils total dry film thickness, or approved equal. Surfaces shall be prepared as required by Specification 10-084-C2. Instrument items shall be internally coated as above, where specified on individual Specification Data Sheets 084-PST-J1.

6.2 All external metal surfaces shall be prepared and coated in accordance with Specification 10-084-C2, except stainless steel and aluminum items, instrument cases, glass, and name plates.

6.3 Internal surfaces of the surge vessels, including all internal appurtenances and the interior of nozzles out to flange faces, shall be prepared and coated in accordance with Specification 10-084-C1.

7.0 ELECTRICAL WORK

7.1 The electrical installation shall comply with the requirements of the National Electric Code and the State of California Electrical Safety Orders for an outdoor Class 1, Division 1, Group D hazardous area. Where these codes differ, the more stringent shall apply.

7.2 Conduit, fittings and junction boxes shall be installed and connected to electrical devices as shown and specified on Drawing 084-172. Conduit shall be aluminum with a maximum copper content of 0.4%. Junction boxes, seals, unions and other fittings shall have a maximum copper content of 0.4%. All other materials shall be selected for best service in an outdoor, marine exposure.

7.3 Conduit shall be installed and supported in accordance with the specified codes. Changes in direction shall be made with bends or cast metal fittings. Bends shall be made with an approved conduit bender. Completed raceways shall be unrestricted, with all ends reamed, burrs removed, and free of metal particles or other foreign material. Seals shall be left unfilled. All threaded connections shall be made up tight with white lead.

8.0 SHIPMENT AND DELIVERY

8.1 Vessels and piping shall be completely dried internally, charged with sufficient dessicant to maintain dryness, and have all openings plugged or sealed prior to shipment. Instruments shall be dismounted and separately packed.

8.2 Unit shall be cribbed and braced to prevent impact damage, vibration or strain of any component during shipment and handling. Exposed flange faces shall be protected from impact damage with full-face covers. All exposed surfaces shall be protected from deterioration by coverings of weather-resistant, waterproof material.

8.3 All shipping containers shall be piece-marked and tagged "production surge tanks".

8.4 Any damage incurred during shipment shall be repaired by supplier at his expense.

8.5 Delivery shall be made fob carrier at the destination specified in Humble's request for quotation.

9.0 BASIS FOR BIDS

Bidders shall quote a firm, lump sum price for the complete packaged unit as specified herein, fob carrier at the specified destination. Bids shall state any and all proposed exceptions or deviations from these specifications.

10.0 INFORMATION REQUIRED

Supplier shall furnish six (6) copies of fully dimensioned fabrication drawings, showing all functional details and certified to be correct for construction, at least six weeks prior to shipment.

11.0 GUARANTEE

Supplier shall guarantee all items to meet these specifications and to be free of defects in material or workmanship, for a period of 12 months from first service date.

12.0 APPLICABLE SPECIFICATIONS AND DRAWINGS

12.1 Specifications

10-084-A	Class A Piping
084-PST-J1	Specification Data Sheets
10-084-C1	Coating Systems for Water Handling
10-084-C2	Application of Coatings to External Surfaces

12.2 Drawings

084-140	Production Surge Vessels V4A, V4B
084-141	Production Surge Vessel V4C
084-171	Skid Framing Plan & Details
084-123	P & I Diagram, Production Surge Tanks
084-166	Piping Plan & Elevations, Vessels V4A, V4B & V4C
084-172	Electrical Details, Equipment Packages
084-173	Instrumentation Details, Equipment Packages

Humble Job 10240
H-B Job 10-084

Specification 10-084-V4LT

CRUDE OIL SURGE TANK V4A

LIQUID LEVEL TRANSMITTER

AND RECEIVER

(MARK LI-142A)

This specification applies to the purchase of one Foxboro 13FA d/p cell pneumatic transmitter and Foxboro MR-S 4½" 3-15 psi receiver indicator for use on an offshore platform near Santa Barbara to indicate the level in a 10'-6" high crude oil tank with oil of 0.95 specific gravity and 4000 SSU viscosity. The transmitter is exposed to H_2S and carbon dioxide gas and corrosive crude oil. The instrument is externally exposed to wet salt air atmosphere. The receiver is to be flush mounted in the main control panel which is inside the control room.

The transmitter shall be Foxboro 13FA with all wetted parts of 316 ss. The instrument shall be adjustable for 0-200 inches water input level with 3-15 psig pneumatic output signal. The receiver and transmitter shall be within 0.5 percent of span. The receiver shall be graduated in 0 to 100% level.

Furnish air filter regulator for air supply to the transmitter.

HOBBS-BANNERMAN CORPORATION

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

084-PST-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LC 126 △		LC 127 △		LS 128 △		LS 129 △
MAKE OR APPROVED EQUAL		FISHER				FISHER		
TYPE		2500				2800		
MODEL		249V				252V		
MOUNTING		FLGD				FLGD		
INDICATING OR RECORDING								
INTERFACE OR LEVEL		LEVEL				LEVEL		
COMMODITY		CRUDE OIL*				CRUDE OIL*		
SPECIFIC GRAVITY AT 60°		.90				.90		
OPERATING PRESS.	TEMP	ATM	110°F	SAME AS LC 126		ATM	110°F	SAME AS LC 128
MINIMUM DESIGN PRESS.	TEMP	50	150°F			50	150°F	
BODY MATERIAL		STL.				STL.		
CONNECTIONS		4" 150# R.F.				4" 150# R.F.		
FINS REQUIRED		—						
FLOAT MATERIAL	SIZE	316 S.S.	3"x14"			316 S.S.	3"x10"	
PILOT-RIGHT OR LEFT HAND		(LATER)						
THROTTLING RANGE		0-10 0-100						
AUTOMATIC RESET		NO						
AIR FILTER & REDUCER		YES						
MANUAL CONTROL BYPASS		NO						
CHART NO	SIZE	—	—					
CHART DRIVE	REVOLUTIONS	—	—					
AS LEVEL RISES CONTROL PRESSURE		INCREASES				CONTACTS OPERATE		
SPECIAL CONSTRUCTION & NOTES		COAT WETTED STEEL PARTS PER SPEC.				COAT WETTED STEEL PARTS PER SPEC.		
OPERATES WITH								
SERVICE *VISCOSITY: 7,000 SSU @100°F		LEVEL CONTROL SHIP TANK		LEVEL CONTROL SHIP TANK		PUMP CONTROL		PUMP CONTROL
VESSEL NO		V4A		V4B		V4A		V4B
PLANT NO								
PURCHASE ORDER NO								

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LIQUID LEVEL INSTRUMENTS

084-PST-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	LS130 △	LS131 △	LS132 △	LS133
MAKE OR APPROVED EQUAL				
TYPE				
MODEL				
MOUNTING				
INDICATING OR RECORDING				
INTERFACE OR LEVEL				
COMMODITY				
SPECIFIC GRAVITY AT 60°				
OPERATING PRESS. / TEMP				
MINIMUM DESIGN PRESS. / TEMP				
BODY MATERIAL	SAME AS LS 128	SAME AS LS 128	SAME AS LS 128	SAME AS LS 128
CONNECTIONS				
FINS REQUIRED				
FLOAT MATERIAL / SIZE				
PILOT-RIGHT OR LEFT HAND				
THROTTLING RANGE				
AUTOMATIC RESET				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES CONTROL PRESSURE				
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH				
SERVICE	OIL SHIP. PUMP CONTROL	OIL SHIP PUMP CONTROL	OIL SHIP PUMP CONTROL	OIL SHIP PUMP CONTROL
VESSEL NO	V4A	V4B	V4A	V4B
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

084-PST-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	LS-134 △	LS-135 △	LSH 136 △	LSH 137 △
MAKE OR APPROVED EQUAL				
TYPE				
MODEL				
MOUNTING				
INDICATING OR RECORDING				
INTERFACE OR LEVEL				
COMMODITY				
SPECIFIC GRAVITY AT 60°				
OPERATING. PRESS. / TEMP	SAME AS LS 128	SAME AS LS 128	SAME AS LS 128	SAME AS LS 128
MINIMUM DESIGN PRESS. / TEMP				
BODY MATERIAL				
CONNECTIONS				
FINS REQUIRED				
FLOAT MATERIAL / SIZE				
PILOT-RIGHT OR LEFT HAND				
THROTTLING RANGE				
AUTOMATIC RESET				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES CONTROL PRESSURE				
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH				
SERVICE	OIL SHIP PUMP CONTROL	OIL SHIP PUMP CONTROL	HIGH LEVEL S.D. SHIPPING TANK	HIGH LEVE S.D. SHIPPI TANK
VESSEL NO	V4A	V4B	V4A	V4B
PLANT NO				
PURCHASE ORDER NO				

REV.	BY	DATE

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

084-PST-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	LAH 138 △	LAH 139 △	LSL 140 △	LSL 141
MAKE OR APPROVED EQUAL				
TYPE				
MODEL				
MOUNTING				
INDICATING OR RECORDING				
INTERFACE OR LEVEL				
COMMODITY				
SPECIFIC GRAVITY AT 60°	SAME AS LSL 28	SAME AS LSL 28	SAME AS LSL 28	SAME AS LSL 28
OPERATING PRESS. / TEMP				
MINIMUM DESIGN PRESS. / TEMP				
BODY MATERIAL				
CONNECTIONS				
FINS REQUIRED				
FLOAT MATERIAL / SIZE				
PILOT-RIGHT OR LEFT HAND				
THROTTLING RANGE				
AUTOMATIC RESET				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES CONTROL PRESSURE				
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH				
SERVICE	HIGH LEVEL ALARM SHIPPING TANK	HIGH LEVEL ALARM SHIPPING TANK	LOW LEVEL SHUTDOWN SHIPPING TANK	LOW LEVEL SHUTDOWN SHIPPING TANK
VESSEL NO	V4A	V4B	V4A	V4B
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION — LIQUID LEVEL INSTRUMENTS

084-PST-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LC 142 △		LC 143 △		△		△
MAKE OR APPROVED EQUAL		NATIONAL TANK CO.						
TYPE		ELECTRIC CONDUCTIVITY						
MODEL		5402						
MOUNTING		MPT						
INDICATING OR RECORDING		—						
INTERFACE OR LEVEL		INTERFACE						
COMMODITY		OIL / WATER						
SPECIFIC GRAVITY AT 60°		.93 / 1.00						
OPERATING PRESS.	TEMP	ATM	110°					
MINIMUM DESIGN PRESS.	TEMP	50	150°					
BODY MATERIAL		* STL.						
CONNECTIONS		2" PIPE THD.						
PROBE DIMENSION		A = 8" B = ½"						
		C = 8'	D = 4"					
PILOT - RIGHT OR LEFT HAND		SUBJECT TO						
THROTTLING RANGE		CHECK BY NATIONAL						
AUTOMATIC RESET								
AIR FILTER & REDUCER								
MANUAL CONTROL BYPASS								
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE		CONTACTS CLOSE						
SPECIAL CONSTRUCTION & NOTES		* STAINLESS STEEL WETTED PARTS						
OPERATES WITH		LCV-142		LCV-143				
SERVICE 7000 SSV VISCOSITY @ 100°F		INTERFACE CONTROLLER		INTERFACE CONTROLLER				
VESSEL NO		V-4A		V-4B				
PLANT NO								
PURCHASE ORDER NO								

SAME AS J-142

SAME

REV. | DATE | BY

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SANTA FE SPRINGS CALIFORNIA

SHEET OF

084-PST-J1 REV

SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JCB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PI 317 △		PI 318 △	PI 319 △		PI 320 △	
MAKE OR APPROVED EQUAL	WIKA		SAME AS PI-317	WIKA		WIKA	
TYPE	PRESS. GA.			PRESS. GA.		PRESS. GA.	
MODEL	233			233		233	
MOUNTING / LOCATION	½" MPT	BOTTOM		½" MPT	BOTTOM	½" MPT	BOTTOM
INDICATING OR RECORDING	IND.			IND.		IND.	
NORMAL PRESSURE @ TEMP	0	110°		75	110°	1000	110°
PRESSURE ELEMENT RANGE	0-60			0-160		0-1500	
PRESSURE ELEMENT TYPE AND MATERIAL	BOUR	316SS		BOUR	316SS	BOUR	316SS
DIAL SIZE	4"			4"		4"	
THROTTLING RANGE							
AUTOMATIC RESET							
RATE ACTION							
AIR FILTER & REDUCER							
MANUAL CONTROL BYPASS							
CHART SIZE / NO							
CHART DRIVE / REVOLUTION							
INDICATING SCALE RANGE							
AS PRESSURE INCREASES OUTPUT SIGNAL							
LOCATION OF PRESSURE TAP							
PULSATION DAMPENER							
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED			GLYCERIN FILLED		GLYCERIN FILLED	
OPERATES WITH	V4A		V4B	P4A		P4B	
SERVICE	PROD. SURGE TANK		PROD. SURGE TANK	BOOSTER PUMP DISCH.		SHIP. PUMP DISCH.	
PLANT NO							
PURCHASE ORDER NO							

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084-PST-J1

PRESSURE INSTRUMENTS

CUSTOMER INFORMATION	
	PI 359
	WIKA
	PRESS. GAGE
	233
	1/2" MPT BOTTOM
	INDICATING
	0 110°F
	0-600 psi
	BOUR. 316 S.S.
DIAL SIZE	4"
	NO GLYCERIN FILLED
	OIL SURGE TANK V-40

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION

RELIEF VALVES

084-PST-J1 | REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO			PSV 14 △	PSV 15 △	RD 16 △	RD 17 △
MAKE OR APPROVED EQUAL			CROSBY	SAME AS PSV. 14	CONTINENTAL DISC. CORP.	SAME AS RD. 16
TYPE			JB-25		RUPTURE DISC ASSY.	
MODEL			4P6		KBA + ASSY #7	
BODY MATERIAL			STL.		316 SS	
PIPE SIZE	IN	OUT	4" 6"		4" 4"	
CONNECTIONS	IN	OUT	150#RF 150#RF		150#RF 150#RF	
TRIM MATERIAL	SPRING		SS STL.		316 S.S.	
LIFTING GEAR	GAG		NO NO		—	
CALCULATED ORIFICE AREA SQ IN			GAS - 1.8 OIL - 0.0		—	
SELECTED ORIFICE AREA & LETTER			* P 6.379		—	
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG			50 PSIG		50	
OPERATING PRESSURE OF ASSOCIATED EQUIP			0 PSIG		0	
RELIEVING PRESSURE PSIG			40 PSIG		50	
BACK PRESSURE PSIG			Ø		0	
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			40 PSIG		50	
FLOW TEMPERATURE °F			110°F		110°F	
MW OR S G AT FLOW TEMP			.90		.90	
DESIGN CAPACITY MAX	GPM	OIL	880		880	
	SCFH					
	# HR	GAS	8000#		8000#	
BASIS OF SELECTION						
VESSEL AREA EXPOSED TO FIRE						
COMMODITY			** CRUDE OIL NAT. GAS		CRUDE OIL + NAT. GAS	
% OVER PRESSURE			10%			
SPECIAL CONSTRUCTION & NOTES * RUPTURE DISC. TAKES EXCESS ** VISCOSITY 4000 SSU @ 110°F.			COAT ALL STL. WETTED PARTS PER SPEC.	COAT ALL STL. WETTED PARTS PER SPEC.	ALL WETTED PARTS 316 SS KNIVES 17-4 PH	ALL WETTED PARTS 316 SS KNIVES 17-4 PH
SERVICE			SHIP SURGE TANK	SHIP SURGE TANK	SHIP SURGE TANK	SHIP SURGE TANK
LINE OR VESSEL NO			V4A	V4B	V4A	V4B
PLANT NO						
PURCHASE ORDER NO						

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SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION

TEMPERATURE INSTRUMENTS

084-PST-J1

CUSTOMER				
PLANT LOCATION				
IDENTIFICATION TAG NO	TI 229			
MAKE OR APPROVED EQUAL	WESTON			
TYPE	BI-METAL			
MODEL	4500			
MOUNTING	1/2" MPT BACK			
INDICATING OR RECORDING	INDICATING			
STEM LENGTH	12" S.S.			
NORMAL CONTROL OR RECORDING POINT				
TEMPERATURE RANGE	0-200°F			
THROTTLING RANGE				
DIAL SIZE	5" S.S.			
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NUMBER				
CHART DRIVE REVOLUTIONS				
NUMBER OF POINTS				
TYPE BULB OR THERMOCOUPLE	3/4" MPT 316 S.S. WESTON THERMOWELL #173303-124			
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES	EXPLOSION-PROOF CLASS 1 GROUP D			
OPERATES WITH SERVICE	OIL SURGE TANK V-4C			
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION — PRESSURE INSTRUMENTS — 084-PST-J1 — REV

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PR329 △	PSH 355 △	PSH 356 △	PSH-357 △
MAKE OR APPROVED EQUAL	BARTON	CUSTOM COMPONENTS	SAME AS PSH 355	SAME AS PSH 355
TYPE	RECIEVER RECORDER	PRESSURE SWITCH		
MODEL	242	6006-GCRW-0		
MOUNTING LOCATION		SURFACE MOUNTED		
INDICATING OR RECORDING	RECORDER			
NORMAL PRESSURE & TEMP	1000			
PRESSURE ELEMENT RANGE psi	0-1500	0-80		
PRESSURE ELEMENT TYPE AND MATERIAL	HELIX 316 S.S.	DIA 347 S.S.		
REQUIRED SUPPRESSION	—	CLASS I GROUP D EXPLOSION-PROOF ENCLOSURE		
THROTTLING RANGE	—			
AUTOMATIC RESET	—			
RATE ACTION	—			
AIR FILTER & REDUCER	—	FACTORY SET AT 30 PSIG		
MANUAL CONTROL BYPASS				
CHART SIZE NO				
CHART DRIVE REVOLUTION	SPRING 24 HR			
INDICATING SCALE RANGE	0-1500			
AS PRESSURE INCREASES OUTPUT SIGNAL	—	CONTACTS OPEN		
LOCATION OF PRESSURE TAP	BACK			
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	CHARTOMATIC PEN	DEAD BAND: 10 ± 6 psi		
OPERATES WITH SERVICE	SHIPPING PRESSURE OIL PIPELINE	HIGH PRESS. SHUT DOWN CRUDE SURGE TANK V-4A	TANK V-4B	TANK V-4C
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION — CONTROL VALVES

0804-PST-J1 | REV.

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.			PCV 332△		PCV 333△		△	△
MAKE: OR APPROVED EQUAL			VAREC		VAREC			
TYPE			VAC. LINE		REPRESS.			
MODEL			FIG. 180		FIG. 181			
SIZE	TYPE CONNECTIONS		8"	FLGD.	2"	FLGD.		
BODY MATERIAL	RATING		ALUM.	50#	ALUM	50#		
INNER VALVE TRIM MAT'L			18-8 SS		18-8 SS			
INNER VALVE, SIZE	TYPE		—	—	—	—		
TOP WORKS			STD.		STD.			
FINS			—		—			
POSITIONER	BOOSTER RELAY		—	—	—	—		
POSITIONER BYPASS	W/GAGES		—	—	—	—		
AIR FILTER & REGULATOR			—		—			
COMMODITY								
FLOW TEMPERATURE °F								
PRESSURE, PSIG	IN	OUT	0	+3	5	0		
SPEC. GRAVITY AIR=1.0	@ 60°F	@ FLOW TEMP.	.80	110°F	.80	110°F		
SPEC. GRAVITY @ 60° AIR=1.0	@ 60°F	@ FLOW TEMP.						
GPM @ 60°	NORM. FLOW	MAX. CAP.						
SCF/HR.	NORM. FLOW	MAX. CAP.		6000		6000		
#/HR.	NORM. FLOW	MAX. CAP.		10,000		900		
VALVE POSITION ON AIR FAILURE			—		—			
Cv			SET TO START		SET TO START			
SPECIAL CONSTRUCTION & NOTES			OPENING AT +1/10" W WITH FULL OPEN AT +3/10" WC		OPENING AT -1/10" WC WITH FULL OPEN AT -5/10 WC			
OPERATES WITH								
SERVICE			PRODUCTION SURGE TANKS		PRODUCTION SURGE TANKS			
LINE NO.								
PLANT NO.								
PURCHASE ORDER NO.								

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SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION

RELIEF VALVES

084-PST-J1 REV

JOB NO

CUSTOMER

PLANT LOCATION

IDENTIFICATION TAG NO					PSV 24		RD 25			
MAKE, OR APPROVED EQUAL					CROSBY		CONTINENTAL DISC CORP.			
TYPE					JB-25		RUPTURE DISC ASS'Y.			
MODEL					4PG		KBA + ASS'Y #7			
BODY MATERIAL					STL.		316 S.S.			
PIPE SIZE	IN	OUT			4"	6"	4"	4"		
CONNECTIONS	IN	OUT			150# RF	150# RF	150# RF	150# RF		
TRIM MATERIAL	SPRING				S.S.	C.S.	316 S.S.			
LIFTING GEAR	GAG				NO	NO	—	—		
CALCULATED ORIFICE AREA SQ. IN					GAS 1.8 OIL 8.0		—			
SELECTED ORIFICE AREA & LETTER					*P	6.379	—	—		
DESIGN PRESSURE OF ASSOCIATED EQUIP. PSIG					50		50			
OPERATING PRESSURE OF ASSOCIATED EQUIP					0		0			
RELIEVING PRESSURE PSIG					40		50			
BACK PRESSURE PSIG					0		0			
DIFFERENTIAL OR FACTORY SET PRESSURE PSI					40		50			
FLOW TEMPERATURE °F					110°F		110°F			
MW OR S.G. AT FLOW TEMP					SG. = 0.90		0.90			
DESIGN CAPACITY MAX	GPM				880 (OIL)		880 (OIL)			
	SCFH									
	#/HR				8000 (GAS)		8000 (GAS)			
BASIS OF SELECTION					OIL + GAS		OIL + GAS			
VESSEL AREA EXPOSED TO FIRE					—		—			
COMMODITY					** CRUDE OIL + NAT. GAS		** CRUDE OIL + NAT. GAS			
% OVER PRESSURE					10%					
SPECIAL CONSTRUCTION & NOTES ** VISCOSITY: 4000 CSU @ 110°F					COAT ALL WETTED PARTS PER SPEC. * RUPTURE DISC TAKES EXCESS		ALL WETTED PARTS 316 S.S. KNIVES 17-4PH			
SERVICE					SHIPPING SURGE TANK V-40		SHIPPING SURGE TANK V-40			
LINE OR VESSEL NO										
PLANT NO										
PURCHASE ORDER NO										

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SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION CONTROL VALVES 084-PST-11 REV.

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.			LCV142 △	LCV143 △	△	△
MAKE: OR APPROVED EQUAL			FISHER	SAME AS LCV142		
TYPE			DOUBLE. RL			
MODEL			9110			
SIZE	TYPE CONNECTIONS		2" / 150# RF			
BODY MATERIAL	RATING	*	STL / 275#			
INNER VALVE TRIM MAT'L			BUNA-N			
INNER VALVE SIZE	TYPE		2" / BF			
TOP WORKS			656-30			
FINS			—			
POSITIONER	BOOSTER RELAY		NO / NO			
POSITIONER BYPASS	W/GAGES		— / —			
AIR FILTER & REDUCER			—			
COMMODITY			OIL FIELD BRINE			
FLOW TEMPERATURE, °F			110°F			
PRESSURE, PSIG	IN	OUT	3 / 0			
SPEC. GRAVITY $H_2O = 1.0$	@ 60°F	@ FLOW TEMP.	1.02			
SPEC. GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP				
GPM @ 60°	NORM. FLOW	MAX CAP.	100			
SCF/HR	NORM. FLOW	MAX. CAP.				
#/HR.	NORM. FLOW	MAX. CAP.				
VALVE POSITION ON AIR FAILURE			CLOSES			
Cv			CALC. 58 / ACT. 70			
SPECIAL CONSTRUCTION & NOTES: * DUCTILE IRON IS ACCEPTABLE			316 SS STEM, BUNA-N SEALS			
OPERATES WITH			LC-142	LC-143		
SERVICE			OIL SURGE TANK V-4A WATER	OIL SURGE TANK V-4B WATER		
LINE NO.						
PLANT NO						
PURCHASE ORDER NO.						

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SANTA FE SPRINGS CALIFORNIA

SPECIFICATION

TEMPERATURE INSTRUMENTS

SHEET ___ OF ___

10-084-PST-J1 REV 0

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION

JOB NO 10-084

IDENTIFICATION TAG NO.	TC-[illegible] △	TAL-280 △	TI-213 △	TI-214 △
MAKE OR APPROVED EQUAL		FENWAL	WESTON	
TYPE		80016-4	BI-METAL	
MODEL			4500	
MOUNTING			1/2" MPT BACK	
INDICATING OR RECORDING			INDICATING	
STEM LENGTH			12"	
NORMAL CONTROL OR RECORDING POINT			—	
TEMPERATURE RANGE		32°-400°F	0-200°F	
THROTTLING RANGE		—	—	
AUTOMATIC RESET		—	5" DIAL SIZE	
RATE ACTION		—		
AIR FILTER & REDUCER		—		
MANUAL CONTROL BYPASS		—		
CHART SIZE / NUMBER		— / —		
CHART DRIVE / REVOLUTIONS		— / —		
THERMOWELL		3/4" M.P.T. 316 S.S. THERMOSWITCH	3/4" MPT 316 S.S. WESTON NO. 173303-124	
TYPE BULB OR THERMOCOUPLE				
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES		EXPL. PROOF W/U.L. LABEL	EXPL.-PROOF CLASS 1 GROUP D	
OPERATES WITH				
SERVICE	HEAT OIL	CRUDE OIL HEATERS OUTLET	OIL SURGE TANK V-4A	OIL SURGE TANK V-4B
PRIMARY ELEMENT LOCATION				
PLANT NO.				
PURCHASE ORDER NO.				

SAME AS TI-213

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SANTA FE SPRINGS · CALIFORNIA

SHEET ___ OF ___ REV.

SPECIFICATION

CONTROL VALVES

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.			FCV-332A △		FCV-332B △	△		△
MAKE: OR APPROVED EQUAL			FISHER					
TYPE			BUTTERFLY 9110					
MODEL			DOUBLE R/L					
SIZE	TYPE CONNECTIONS		10"	FLG.				
BODY MATERIAL	RATING		STL.	ASA 150#				
INNER VALVE TRIM MAT'L			316 S.S. SHAFT CI DISC BUNA-N-SEAT					
INNER VALVE SIZE	TYPE		10"	BF				
TOP WORKS			656-40		667			
FINS			—					
POSITIONER	BOOSTER RELAY		NO	NO				
POSITIONER BYPASS	W/GAGES		—	—				
AIR FILTER & REDUCER			YES					
COMMODITY			CRUDE OIL					
FLOW TEMPERATURE, °F			110° F					
PRESSURE, PSIG	IN	OUT						
SPEC. GRAVITY H_2O = 1.0	@ 60°F	@ FLOW TEMP						
SPEC. GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP.						
GPM @ 60°	NORM. FLOW	MAX. CAP.						
SCF/HR	NORM. FLOW	MAX. CAP.						
# HR.	NORM. FLOW	MAX CAP						
VALVE POSITION ON AIR FAILURE			OPENS		CLOSES			
Cv								
SPECIAL CONSTRUCTION & NOTES			6-30 PSI SPRING		6-30 PSI SPRING			
OPERATES WITH								
SERVICE			EMERGENCY CRUDE OVERFLOW CRUDE SURGE TK.		EMERGENCY CRUDE OVERFLOW CRUDE SURGE TK.			
LINE NO.			SHUTS OFF GAS OUT OF TANKS		OPENS OIL TO EMERGENCY TANK			
PLANT NO.								
PURCHASE ORDER NO.								

SAME AS FCV-332A

REV	BY	DATE

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4.2 CRUDE OIL PUMPS

SPECIFICATION

CRUDE OIL BOOSTER PUMPS
P4A, P4C, P4E
(3 Req'd)

1.0 GENERAL

These specifications apply to the purchase of 3 electrically driven crude oil pumps for use as booster pumps on an offshore platform. The pumps are to meet all State of California and federal safety orders. They operate in a hazardous location classified as Class 1, Division 1, Group D. The pumping units are to be complete with skid base motor, gear box, couplings, coupling guards, lubrication equipment, relief valves, pressure controls, control valves and bypass piping. The units are to be in continuous service in sour crude oil containing H_2S and CO_2. Long life and low maintenance equipment will be given preference in the selection.

2.0 DESIGN AND CONSTRUCTION

The pumps shall be capable of pumping 625 gpm (minimum) of 1500 to 7000 SSU viscosity 0.93 specific gravity crude oil with a differential pressure of 75 psi. The pumps shall be Worthington Type GR with steel case, cast iron gears, cast steel stuffing box, asbestos-lead packing, steel shafts, double row roller bearings. The Worthington pump is a 6 GR operating at 380 RPM. The pump shall be driven by a motor and gear box suitable for the speed and power required. The motor shall be a 100 hp squirrel cage induction motor, explosion proof, Class 1, Group D with UL label for use with 440 V 60 Hz, 3 phase power. Motor shall be for outdoor service exposure to wet salt air atmosphere. The gear box shall meet all AGA standards for continuous service in the applicable class. The base shall be fabricated steel adequately rigid to maintain alignment of all items when installed upon a flexible steel deck. The base shall be covered with steel plate and provided for a drip lip to prevent oil from the pump or gear running onto the deck.

Each pump shall be provided with a relief valve Crosby 4M6 JO-25 set at 100 psig (or approved equal). Each pump shall be equipped with a 3" 300# steel body Fisher 7610 butterfly valve with stainless steel liner, shield tubes, disc and shaft, and with 656-40 top works and with a Fisher 4150 Wizard pressure controller mounted on valve. The Wizard to have 0-100 psig steel bourdon tube with chemical seal and filled system. The lower seal to be stainless steel with a 1" inlet connection. Capillary from seal to bourdon tube to be armored stainless steel.

All above items shall be mounted and piped. The oil piping shall conform to Class A Piping Specification (attached). The oil piping shall be coated on the interior with 15 mils of Tube-Kote TK21 or approved equal. The external areas of all steel and cast iron items shall be coated in accordance with 10-084C2. The attached sketch indicates the proposed outline dimensions and arrangement of equipment.

3.0 TECHNICAL DATA

3.1 Information Required with Bid (3 copies)

Each proposal shall include three copies of each of the following:

a. Pump design data sheet.

b. Preliminary dimensional outline drawing showing plans and elevations of all items including piping and instruments.

c. Typical pump cross-section drawing showing details of construction.

d. List of equipment items furnished as accessories with the pump and driver showing manufacturer, model or catalog number and description of the item.

e. Characteristic pump performance data at viscosities specified.

f. Specific mention of all proposed deviations from this specification.

3.2 Information Required with Purchase (6 copies)

Within one week of date of order vendor shall submit approval drawings. Within three weeks of date of order vendor shall submit data listed in Section 3.1.

3.21 Approval Drawings:

Following receipt of order and prior to fabrication, vendor shall submit three (3) copies of dimensional outline drawings for approval.

3.22 Data Required:

Promptly after approval of dimensional drawings the vendor shall furnish six (6) copies of the following data.

a. Final dimensional outline drawings, including driver.
b. Installation, operation and maintenance instruction manual.
c. Manufacturers pump data sheets.
d. Pump sectional drawing including parts list with materials of construction.
e. Driver data as required by this specification including that on the manufacturers Pump Data Sheet.

Following final inspection and testing the vendor shall furnish six (6) copies of the pump test curves which shall include the following:

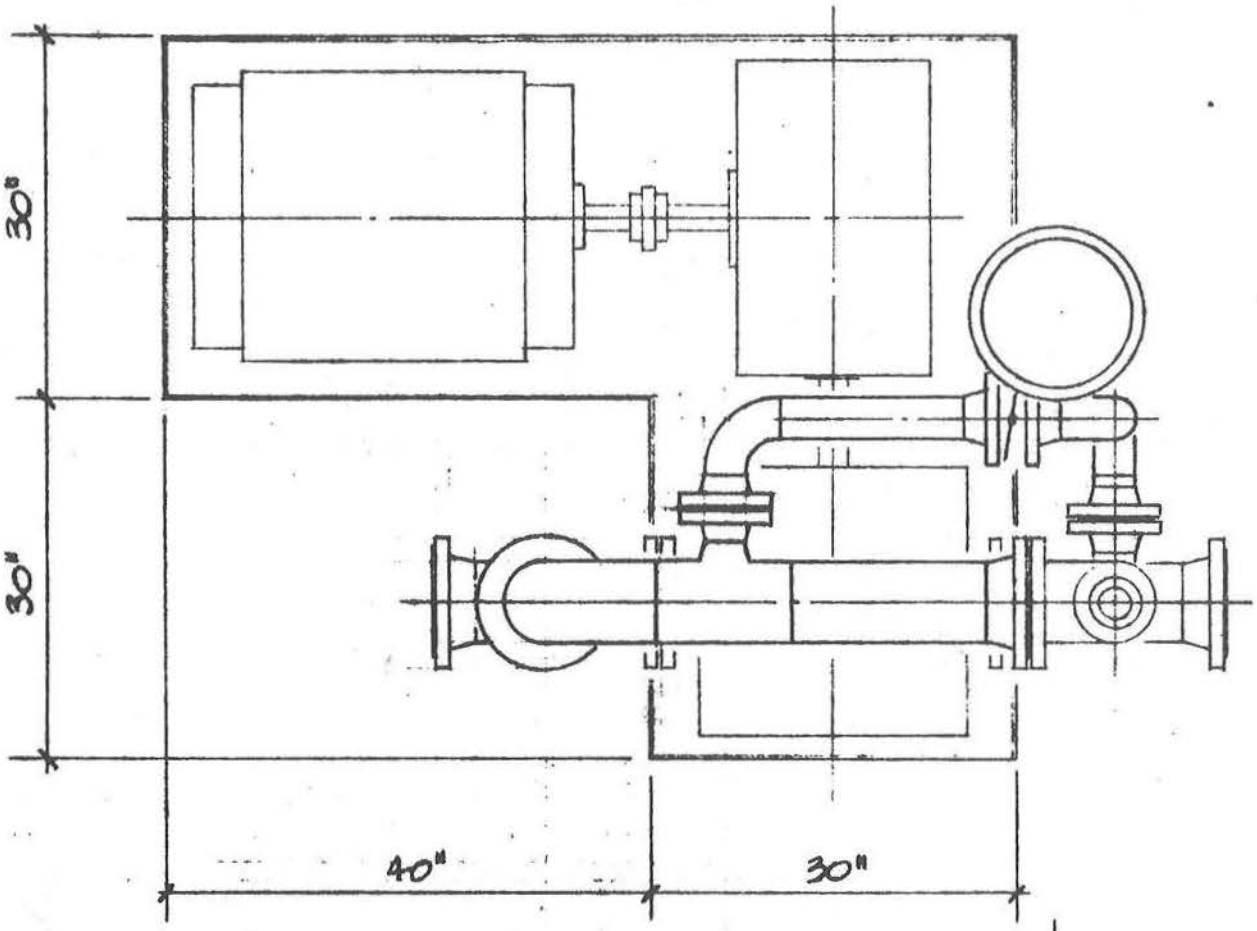
a. Performance curves at final speed and viscosity.

4.0 GUARANTEE

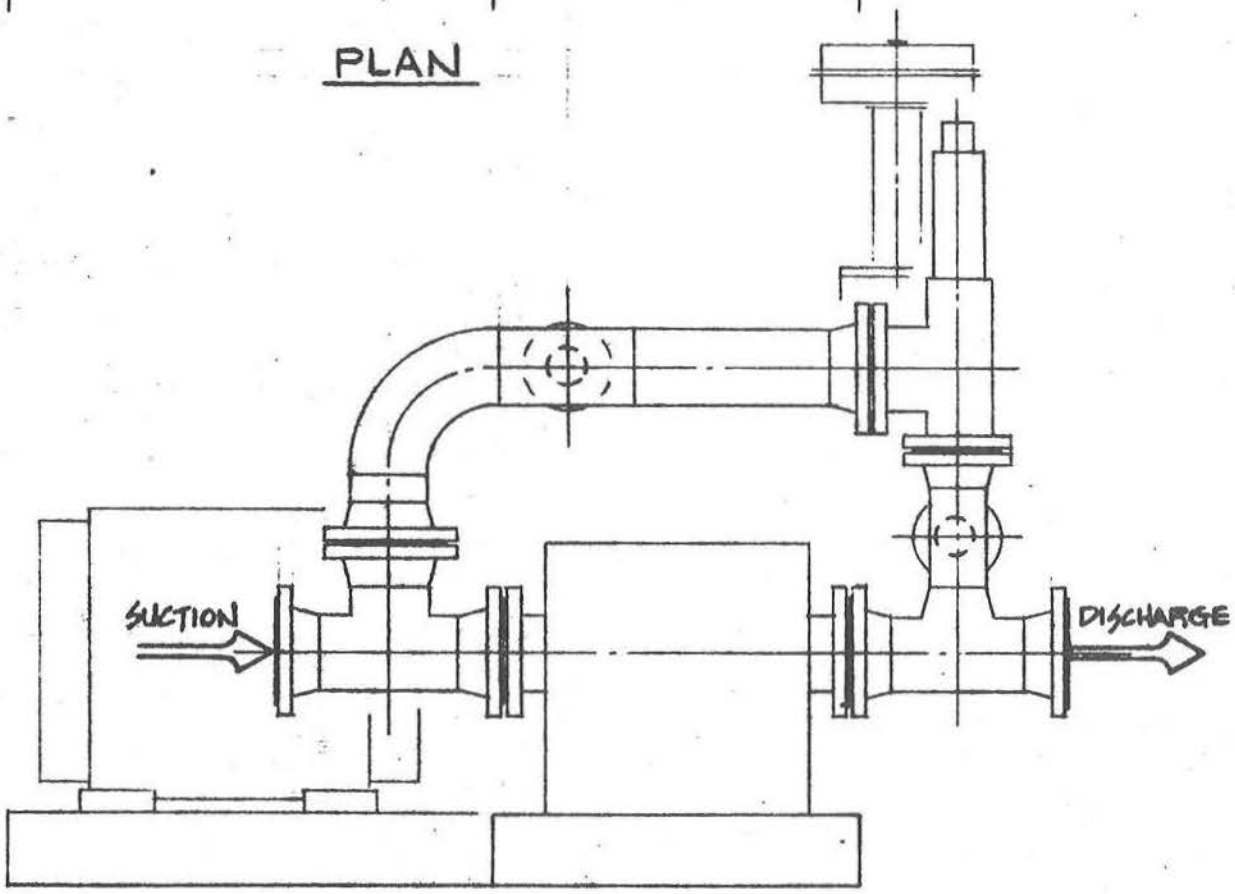
The supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification. The bid data listed in Par. 3.0 a thru f and furnished by the successful bidder shall become part of this specification and therefore become a part of the suppliers guarantee. He shall guarantee the equipment to be free of defects in workmanship and material for 12 months after the first service date. Deficiencies shall be corrected and paid for by the supplier.

5.0 SHIPMENT

All items shall be packaged and shipped to location designated by Humble on the Request for Quotation. The supplier shall be responsible for safe arrival of the equipment.



PLAN



ELEVATION

CRUDE OIL BOOSTER PUMP
DIMENSIONS & ARRANGEMENT

Humble Job 10240
H-B Job 10-084

CRUDE OIL SHIPPING PUMPS

P4B, P4D & P4F

3 Req'd.

1.0 GENERAL

This specification applies to the purchase of three crude oil shipping pumps for use on an offshore platform near Santa Barbara, California. The pumps are for continuous service in a location classified as Class 1, Division 1, Group D. They are continuously exposed to wet salt air atmosphere. They pump a crude oil emulsion that contains hydrogen sulphide and carbon dioxide. The crude oil emulsion contains some sand and grit. Pumps will be selected on basis of long life, low maintenance and dependable operation.

2.0 DESIGN CONDITIONS

Each pump shall pump a minimum of 590 gpm with a suction pressure between 25 and 75 psig and a discharge pressure of 1000 psig. The suction temperature is normally 100 to 110°F. The maximum suction temperature is 110°F. The commodity is 16° to 20° API gravity crude oil. The normal viscosity at 100°F is 4000 SSU. The maximum viscosity is 7000 SSU. The crude contains sand and grit and up to 30% water. The crude and water are high in hydrogen sulphide and carbon dioxide.

3.0 CONSTRUCTION

The pumps shall be positive displacement screw type pumps such as Warren FSXA 2030 for 1750 RPM, 1 3/4P plus pitch (or approved equal). The bearings are oil lubricated and sealed from the commodity. The mechanical seals shall have 316 stainless steel wetted parts and tungsten carbide faces. The seals shall be John Crane or Borg Warner.

The pump case shall be steel or ductile iron. The interior shall be chrome lined. The rotors shall be steel with Colomony hard facing.

The motor shall be a 4160V, 3 phase, 60 hertz squirrel cage inducation motor. The bearings shall be oil lubricated sleeve type with Trico or equal oilers. The windings shall be epoxy sealed. The motor to be suitable for Class 1, Division 1 hazardous location. Only those motors manufactured by nationally known and reputable manufacturers are acceptable. Motor manufacturer is subject to approval

by Humble. The motor shall be four pole (1750 RPM) with 1.00 service factor. The motor shall be sized for the design capacity at maximum viscosity. The motor to be TEFC Type. Bidders to quote the guaranteed efficiency of their motors and if alternate premium efficiency motors are available at added cost quote these as alternates.

The pumps and motor are to be mounted on a common base adequately rigid for mounting on a steel platform deck. Concrete foundations are not feasible. The base plates shall be of the drain type complying with API 610 Section B-19A. A spacer coupling (Thomas or equal) shall be provided to allow removal of all seals without disturbing the motor to pump alignment.

4.0 TECHNICAL DATA

4.1 Information Required with Bid (3 copies)

Each proposal shall include three copies of each of the following:

a. Pump design data sheet.
b. Preliminary dimensional outline drawing.
c. Typical pump cross-section drawing showing details and materials of construction.
d. List of equipment items furnished as accessories with the pump and driver showing manufacturer, model or catalog number and description of the item.
e. Characteristic pump performance data which shall include the following:

    1. Pressure capacity data for maximum and bid rotor pitch impellers. Curves to be corrected for gravity and viscosity given under Par. 2.
    2. Efficiency and brake horsepower with bid screw pitch rated speed, specified commodity at design conditions, and at maximum screw pitch.
    3. NPSH performance data.

f. Specific mention of all proposed deviations from this specification.

4.2 Information Required with Purchase (6 copies)

Within one week of date of order vendor shall submit approval drawings. Within three weeks of date of order vendor shall submit data listed in Section 4.22 (a) thru (f).

4.21 Approval Drawings:

Following receipt of order and prior to fabrication, vendor shall submit three (3) copies of dimensional outline drawings for approval.

4.22 Data Required:

Promptly after approval of dimensional drawings the vendor shall furnish six (6) copies of the following data:

a. Final dimensional outline drawings, including driver.
b. Installation, operation and maintenance instruction manual.
c. Manufacturers pump data sheet.
d. Pump sectional drawing including parts list with materials of construction.
e. Mechanical seal sectional drawing (where applicable) including parts list with materials of construction.
f. Driver data as required by this specification including that on the manufacturers Pump Data Sheet.

Following final inspection and testing the vendor shall furnish six (6) copies of the pump test data which shall include the following:

a. Head-capacity data for final screw pitch and speed.
b. Efficiency and brake horsepower data corrected to final speed, pitch and specified commodity.
c. Representative water NPSH data for the speed, pitch and viscosity.

5.0 GUARANTEE

The supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification. The bid data listed in Par. 4.1 a thru f and furnished by the successful bidder shall become part of this specification and therefore become a part of the suppliers guarantee. He shall guarantee the equipment to be free of defects in workmanship and material for 12 months after the first service date. Deficiencies shall be corrected and paid for by the supplier.

6.0 SHIPMENT

All items shall be packaged and shipped to location designated by Humble on the Request for Quotation. The supplier shall be responsible for safe arrival of the equipment.

7.0 ALTERNATE QUOTE

Submit alternate price for some units with motors suitable for Class 1, Division 2 location. Motors to have epoxy sealed windings and cast iron junction boxes.

CRUDE OIL SHIPPING PUMPS

P4B, P4D, P4F

Addendum No. 1

Each motor stator winding shall have a motor winding temperature device, preferably Spencer 'Klixon' or approved equal. The switches shall be set to open with increasing temperature at motor supplier's recommended setting. The leads from these three switches shall be brought separately to a terminal strip located in an explosion-proof junction box mounted on the motor frame. The junction box shall have a threaded (½" minimum) conduit connection. If thermistor type devices are proposed, the control module shall be contained in an explosion-proof enclosure mounted on the motor frame or skid base. All on-skid wiring, conduit and fittings shall be furnished and installed by supplier, so that purchaser need only connect 120V power supply to the control module and connect output contacts. Output contacts shall be SPDT or SPST normally-closed, rated 10A at 120VAC.

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION

B NO. 10-084

IDENTIFICATION TAG NO	PI 321 △	PI 322 △	PI 323 △	PI 324 △
MAKE OR APPROVED EQUAL	WIKA	WIKA	SAME AS PI-321	SAME AS PI-322
TYPE	PRESS. GAGE	PRESS. GAGE		
MODEL	233	233		
MOUNTING LOCATION	1/2" MPT BOTTOM	1/2" MPT BOTTOM		
INDICATING OR RECORDING	IND.	IND.		
NORMAL PRESSURE & TEMP	75 110°	1000 110°		
PRESSURE ELEMENT RANGE	0-160	0-1500		
PRESSURE ELEMENT TYPE AND MATERIAL	BOUR. 316 S.S.	BOUR. 316 S.S.		
DIAL SIZE	4"	4"		
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE	NO			
CHART DRIVE	REVOLUTION			
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED	GLYCERIN FILLED		
OPERATES WITH SERVICE	BOOSTER PUMP DISCH. (P-4C)	SHIPPING PUMP DISCH. (P-4D)	BOOSTER PUMP DISCH. (P-4E)	SHIPPING PUMP DISCH. (P-4F)
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. — J.P. NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PSL 325 △	PSL 326 △	PSL 327 △	PI 328 △
MAKE OR APPROVED EQUAL	CUSTOM COMPONENT	SAME AS PSL-325	SAME AS PSL-325	WIKA
TYPE	PRESS. SWITCH			PRESS. GAG
MODEL	606-GCRW-O			233
MOUNTING LOCATION	SURFACE			1/2" MPT | BOTTO
NO. OF MOTOR RECORDING	—			1 I.D.
NORMAL PRESS. RE. TEMP	75 110°			85 | 65°
PRESS. RE. ELEMENT RANGE (DECREASING)	10-70			0-600
PRESS. RE. ELEMENT TYPE AND MATERIAL	DIA | SS 347			BOUR. | 316 S.S.
MOD. REDUC. PRESSION				4"
THROTTLING RANGE	CLASS 1 GROUP D EXPL. PROOF ENCLOSURE			
AUTOMATIC RESET				
RATE ACTION				
TIMER & RECORDER				
MANUAL CONTROL BYPASS				
CHART SIZE NO				
CHART DRIVE REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES CONTACTS SIGNAL	CONTACTS CLOSE			
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	DEAD BAND 10 PSI ± 6 PSI			GLYCERIN FILLED
OPERATES WITH SERVICE	SHIPPING PUMP SUCT. SET AT 25 PSIG (P-4B)	SHIPPING PUMP SUCT. SET AT 25 PSIG (P-4D)	SHIPPING PUMP SUCT. SET AT 25 PSIG (P-4F)	SHIPPING PIG LAUNCHER
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION

RELIEF VALVES

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.	PSV-21 △	PSV-22 △	PSV-23 △	△
MAKE OR APPROVED EQUAL	CROSBY	SAME AS PSV-21	SAME AS PSV-21	
TYPE	JB-55			
MODEL	2½ J4			
BODY MATERIAL	STL			
PIPE SIZE IN / OUT	2½" 600# RF / 4" 150# RF			
CONNECTIONS IN / OUT	S.S. / S.S.			
BONNET / SPRING	NO / NO			
FLING GEAR / GAG				
CALCULATED ORIFICE AREA @ SQ IN	0.93			
SELECTED ORIFICE AREA & DIAMETER	1.287 J			
MAXIMUM PRESSURE OF ASSOCIATED EQUIP PSIG	1440			
OPERATING PRESSURE OF ASSOCIATED EQUIP	1000			
RELIEVING PRESSURE PSIG	1440			
BACK PRESSURE PSIG	75			
DIFFERENTIAL BETWEEN OPERATING & SET PRESSURE PSIG	1440			
FLOW TEMPERATURE °F	110°F			
MW OR SG AT FLOW TEMP	0.90			
GPM	590			
BASIS OF SELECTION	*CRUDE OIL			
VESSEL AREA EXPLOSION HAZARD	—			
COMMODITY	CRUDE OIL			
OVERPRESSURE	10%			
SPECIAL CONSTRUCTION REQUIRED	PUMP. DISH. OIL SHIPPING PUMPS	PUMP DISH. OIL SHIPPING PUMPS	PUMP DISH. OIL SHIPPING PUMPS	
*VISCOSITY: 4000 SSU @ 110°F				
SERVICE				
LINE OR VESSEL NO.	P4B	P4D	P4F	
PLANT NO.				
PURCHASE ORDER NO.				

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SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.		PAH 362A △		△		△		△
MAKE OR APPROVED EQUAL								
TYPE								
MODEL								
MOUNTING	LOCATION							
INDICATING OR RECORDING								
NORMAL PRESSURE @ TEMP								
PRESSURE ELEMENT RANGE								
PRESSURE ELEMENT TYPE AND MATERIAL								
REQUIRED SUPPRESSION								
THROTTLING RANGE								
AUTOMATIC RESET								
RATE ACTION								
AIR FILTER & REDUCER								
MANUAL CONTROL BYPASS								
CHART SIZE	NO							
CHART DRIVE	REVOLUTION							
INDICATING SCALE RANGE								
AS PRESSURE INCREASES OUTPUT SIGNAL								
LOCATION OF PRESSURE TAP								
PULSATION DAMPENER								
SPECIAL CONSTRUCTION & NOTES		SAME AS PSH-362						
OPERATES WITH								
SERVICE		CRUDE SHIPPING HEADER						
PLANT NO								
PURCHASE ORDER NO								

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SPECIFICATION

TEMPERATURE INSTRUMENTS

REV

CUSTOMER	HUMBLE OIL & REFINING CO.		10-034
PLANT LOCATION			
IDENTIFICATION TAG NO	TSH 229 △	TSH 230 △	TSH 231 △ △
MAKE OR APPROVED EQUAL	FENWALL	SAME AS TSH-229	SAME AS TSH-229
TYPE	THERMOSWITCH		
MODEL	47000-0		
MOUNTING			
INDICATING OR RECORDING			
STANDARDIZATION			
FACTORY SET INCR. TEMP.	225° F.		
TEMPERATURE RANGE	32-400°F		
THROTTLING RANGE			
AUTOMATIC RESET			
RATE ACTION			
AIR FILTER & REDUCER			
MANUAL CONTROL BYPASS			
CHART SIZE / NUMBER			
CHART DRIVE REVOLUTIONS			
NUMBER OF POINTS			
TYPE BULB OR THERMOCOUPLE	CLASS I GROUP D EXPL. PROOF U.L. LABEL		
ELEVATION OF BULB ABOVE INSTRUMENT			
TUBING MATERIAL & LENGTH			
TUBING COMPENSATION			
AS TEMPERATURE RISES OUTPUT SIGNAL			
SPECIAL CONSTRUCTION & NOTES	FURNISH W/ 316 S.S. THERMOWELL		
OPERATES WITH SERVICE	SHIPPING PUMP P-4B DISCHARGE	SHIPPING PUMP P-4D DISCHARGE	SHIPPING PUMP P-4E DISCHARGE
PRIMARY ELEMENT LOCATION			
PLANT NO			
PURCHASE ORDER NO			

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SPECIFICATION

CONTROL VALVES

CUSTOMER: HUMBLE OIL & REFINING CO.

JOB NO: 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.			FCV 126 △		FCV 127 △	FCV 128 △	△
MAKE OR APPROVED EQUAL			FISHER				
TYPE			GLOBE				
MODEL			6667-ED				
SIZE	TYPE CONNECTIONS		1 1/2"	FLG'D			
BODY MATERIAL	RATING		STL	600# RF			
INNER VALVE TRIM MAT'L			STD. TRIM #1				
INNER VALVE SIZE	TYPE		1 7/8"	EQUAL %			
TOP WORKS			SIZE 34				
FINS			NO				
POSITIONER	BOOSTER RELAY		NO	NO			
POSITIONER BYPASS	W/GAGES		NO	NO			
AIR FILTER & REDUCER			NO				
COMMODITY			CRUDE OIL		SAME AS FCV 126	SAME AS FCV 126	
FLOW TEMPERATURE, °F			60°F				
PRESSURE, PSIG	IN.	OUT	450	50			
SPEC GRAVITY $H_2O = 1.0$	@ 60°F	@ FLOW TEMP.		0.93			
SPEC. GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP.					
GPM @ 60°	NORM. FLOW	MAX CAP.		590			
SCF/HR.	NORM. FLOW	MAX CAP.					
# HR.	NORM. FLOW	MAX. CAP.					
VALVE POSITION ON AIR FAILURE			CLOSED-AIR TO OPEN				
Cv			REQ'D 32 AVAIL 35.8				
SPECIAL CONSTRUCTION & NOTES			4000 SSU VISC. 3-15psi SIGNAL 1000psi MAX ΔP				
OPERATES WITH			LC 126 & 127				
SERVICE			OIL SHIPPING PUMP P4B SPILL VALVE		OIL SHIPPING PUMP P4D SPILL VALVE	OIL SHIPPING PUMP P4F SPILL VALVE	
LINE NO.							
PLANT NO.							
PURCHASE ORDER NO.							

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PSH 362 △	PSL 363 △	PSH 364 △	PSL 365 △
MAKE OR APPROVED EQUAL	CUSTOM COMPONENTS	CUSTOM COMPONENTS	SAME AS PSH 362	SAME AS PSL 363
TYPE	PRESS. SWITCH	PRESSURE SWITCH		
MODEL	6006GCRW-7	6006GCRW-2		
MOUNTING / LOCATION	SURFACE	SURFACE		
INDICATING OR RECORDING	—	—		
NORMAL PRESSURE / TEMP	1000 / 100°F	1000 / 100°F		
PRESSURE ELEMENT RANGE	1000-1750 INCREASING	75-145 DECREASING		
PRESSURE ELEMENT TYPE AND MATERIAL	DIA. 347 S.S.	DIA. 347 S.S.		
REQUIRED SUPPRESSION	CLASS 1 GROUP D EXPLOSION-PROOF ENCLOSURE	CLASS 1 GROUP D EXPLOSION-PROOF ENCLOSURE		
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER	FACTORY SET @ 1300 psi	FACTORY SET @ 100 psi		
MANUAL CONTROL BYPASS				
CHART SIZE / NO				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL	CONTACTS OPEN	CONTACTS CLOSE		
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	DEAD BAND: 200 ± 60 psi; 4500 psi-PROOF ENCLOSURE	DEAD BAND 25 ± 12 psi; 4500 psi-PROOF ENCLOSURE		
OPERATES WITH SERVICE	OIL SHIPPING PIPELINE	OIL SHIPPING PIPELINE	CRUDE OIL SHIPPING PUMP P-4B	CRUDE OIL SHIPPING PUMP P-4B
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PSH 366 △	PSL 367 △	PSH 368 △	PSL 369 △
MAKE OR APPROVED EQUAL				
TYPE				
MODEL				
MOUNTING / LOCATION				
INDICATING OR RECORDING				
NORMAL PRESSURE @ TEMP.				
PRESSURE ELEMENT RANGE				
PRESSURE ELEMENT TYPE AND MATERIAL				
REQUIRED SUPPRESSION	SAME AS PSH 362	SAME AS PSL 363	SAME AS PSH 362	SAME AS PSL 363
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NO				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH SERVICE	CRUDE OIL SHIPPING PUMP P-4D	CRUDE OIL SHIPPING PUMP P-4D	CRUDE OIL SHIPPING PUMP P-4F	CRUDE OIL SHIPPING PUMP P-4F
PLANT NO.				
PURCHASE ORDER NO				

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SPECIFICATION

TEMPERATURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.	TSH 229 △	TSH 230 △	TSH 231 △	△
MAKE OR APPROVED EQUAL	FENWAL			
TYPE	800100-4			
MODEL				
MOUNTING				
INDICATING OR RECORDING				
STANDARDIZATION				
NORMAL CONTROL OR RECORDING POINT				
TEMPERATURE RANGE	32°-400°F			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION		SAME AS TSH 229	SAME AS TSH 229	
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NUMBER				
CHART DRIVE / REVOLUTIONS				
THERMOWELL	3/4" M.P.T. 316 S.S.			
TYPE BULB OR THERMOCOUPLE	THERMOSWITCH			
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES	EXPL. PROOF W/ U.L. LABEL			
OPERATES WITH SERVICE	OIL SHIPPING PUMP P4B	OIL SHIPPING PUMP P4D	OIL SHIPPING PUMP P4F	
PRIMARY ELEMENT LOCATION				
PLANT NO.				
PURCHASE ORDER NO				

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4.3 CRUDE OIL METERING

OIL METERING PACKAGE

1.0 GENERAL. This specification applies to the design, fabrication and delivery of one (1) packaged, skid-mounted unit, consisting of three (3) emulsion meters with their associated piping, valves and instruments. The packaged unit will be installed in an outdoor, marine exposure on an offshore platform near Santa Barbara, California. The unit shall be suitable for use in a Class 1, Division 1, Group D hazardous area.

2.0 SCOPE OF WORK. Supplier shall provide all labor, equipment and material required to furnish the packaged unit as specified herein, except for any items of material specifically excluded by Humble's request for quotation. The packaged unit shall be fabricated as specified below, and as shown and specified by drawings and other specifications referenced herein. The emulsion meters and capacitance probes shall be as specified in Specification 10-084-OSM.

3.0 SKID BASE. All components shall be mounted on a structural steel skid base as shown by Drawing 084-168. Fabrication of the skid base shall comply with applicable sections of the AISC Manual of Steel Construction. All joints and seams shall be solidly welded. Open areas of top surface of skid shall be covered with non-skid floor plate, with all seams seal welded to prevent leakage of fluids. All rough surfaces shall be ground smooth, and all edges and corners shall be ground to 1/8" (minimum) radius.

4.0 MECHANICAL INSTALLATION. Piping, valves, emulsion meters and capacitance cells shall be installed on the skid as shown and specified on Drawing 084-168. Piping shall comply with Class A and B Piping Specifications 10-084-A and 10-084-B, as applicable. Piping fabrication shall comply with American Standard Code for Refinery Piping ASA B31.3. latest edition, Section V and Section VI. All welds are subject to radiograph inspection at Humble's expense, in accordance with ASME Code, latest edition, Section VIII, par. UW-51. Any defects so detected shall be repaired and reinspected at supplier's expense. The assembled Class A and Class B piping shall be hydrotested at 410 psig and 1080 psig respectively; held for one hour. All leaks shall be located and repaired. Humble may require that hydrotest be witnessed and approved by its representative.

5.0 PROTECTIVE COATINGS

5.1 All piping, valves and fittings shall be internally coated with Tube-Kote TK21 heat-cured epoxy, 12-15 mils total dry film thickness, or approved equal. Surfaces shall be prepared as required by Specification 10-084-C2.

5.2 All external metal surfaces shall be prepared and coated in accordance with Specification 10-084-C2, except stainless steel, aluminum and glass items, and nameplates.

6.0 SHIPMENT AND DELIVERY

6.1 Prior to shipment, piping shall be completely dried internally, charged with sufficient dessicant to maintain dryness, and shall have all openings plugged or sealed. All exposed surfaces shall be protected from deterioration by coverings of weather-resistant, water proof material.

6.2 Unit shall be cribbed and braced to prevent impact damage, vibration or strain of any component during shipment and handling. Exposed flanges shall be protected from impact damage with full-face covers. Any damage incurred during shipment shall be repaired by supplier at his expense.

6.3 Delivery shall be made FOB carrier at the destination specified in Humble's request for quotation.

7.0 BASIS FOR BIDS. Bidders shall quote a firm, lump sum price for the complete packaged unit as specified herein, FOB carrier at the specified destination. Bids shall state any and all proposed exceptions or deviations from these specifications.

8.0 GUARANTEE. Supplier shall guarantee all items to meet these specifications and to be free of defects in material or workmanship, for a period of 12 months from first service date.

9.0 APPLICABLE SPECIFICATIONS AND DRAWINGS

9.1 Specifications

10-084-A	Class A Piping
10-084-B	Class B Piping
10-084-C2	Application of Coatings to External Surfaces
10-084-OSM	Oil Skipping Emulsion Meters, Net Oil Analyzer and Flow Totalizers

9.2 Drawings

084-168	Oil Metering Skid Piping Plan and Sections

SPECIFICATION

OIL SHIPPING EMULSION METERS
NET OIL ANALYZER AND FLOW TOTALIZERS

1.0 GENERAL

This specification applies to the purchase of equipment to measure emulsion and to totalize and transmit net oil and emulsion. Equipment will be furnished for three parallel streams. The meters and flow elements will be mounted in the packaged metering modules and the totalizer and read out devices will be mounted in the main control panel in an air purged control room approximately 50 feet from the meters. The meters are to be installed on an off-shore platform and are exposed to wet salt air atmosphere. The meters and capacitance elements are in a Class 1 Division 1 hazardous location.

2.0 EQUIPMENT

2.1 The following equipment will be mounted on the separator modules.

2.11 Emulsion Meters

Three are required. One for each parallel stream.

(a) The meters shall be Liquid Control with steel housing and standard trim. The safe working pressure of the meter shall be 150 psig @ 150°F. The meter shall be equipped as follows:

(1) Dual head adapter

(2) Continuous automatic temperature compensater with manual gravity selector.

(3) Vertical face gross counter for non-temperature compensated side, totalizer with six integer wheels and a decimal wheel capable of being interpolated to 0.001 bbl.

(4) Vertical face counter on net side (same as (3)). Temperature compensated to read net barrels at 60°F.

(5) A 10,000 pulse per barrel transmitter mounted on the net side equipped with a telephone-type jack connector for meter proven use shall be furnished. The transmitter shall be explosion proof Class 1 Group D (equal to A. O. Smith Type D, D10M5A).

2.12 Capacitance Probes

Three probes are required. They shall be 6" Halliburton Capacitance Probes with 720 psig safe working pressure, steel body and 6" 150# ASA RF flanged ends. Electrical connections shall be suitable for Class 1 Division 1 hazardous location.

2.2 The following equipment will be furnished for flush panel mounting into the master platform control panel. The control panel is in a weathertight air purged room electrically classified as non-hazardous.

2.21 Net oil analyzer readout panel - One required.
This unit to be a Halliburton Standard Unit with special provisions for accepting and totalizing the three meters simultaneously. The unit shall have a selector switch and the necessary terminal strips for selecting which of the three probes would be used to compute net oil. The unit to have a flow rate indicator, two six digit manual reset totalizers registering net oil and emulsion water in barrels and tenths. The unit shall be equipped with dry contacts for oil and for water the pulse output shall be one per 1/10 barrel. The flow rate indicator shall have a 4-20MA DC output for remote readout. The unit is for 120 volt 60 Hz power.

2.3 The supplier to be responsible for putting the total system together and making necessary tests to prove the system to be operative to comply with these specifications in all respects.

3.0 DRAWINGS AND TECHNICAL INFORMATION

Within 14 days of purchase date, the supplier shall furnish 6 copies of the following:

(1) Certified dimensional outline drawings of all items.

(2) Electrical connection drawings.

(3) Electrical circuit diagrams.

(4) Parts Lists.

(5) Installation, maintenance, and operating instructions.

Revised as built material will be supplied at the time the equipment is furnished. All technical material to be supplied to Humble's Engineer as designated on the purchase order.

4.0 TECHNICAL SERVICE

As a part of the purchase price the suppliers shall furnish the services of their Engineer to check out and demonstrate the operation of the units. The allowance shall be one day for each well test unit purchased. Quotations shall specify the cost for additional services requested by Humble.

5.0 GUARANTEE

The suppliers and manufacturer shall guarantee that their equipment meets this specification, their published catalog data and that the equipment shall be free of defects in material and workmanship for a period of 12 months after first service date. The guarantee shall fully cover field or factory costs due to defects.

Tag all items for #1 unit as follows:
Meter M4A
Probe CE4A

Tag all items for #2 unit as follows:
Meter 4C
Probe CE4C

Tag all items for #3 unit as follows:
Meter M4E
Probe CE4E

Tag readout unit:
Readout PA4A

4.4 METER PROVER

SPECIFICATION

METER PROVER

1.0 GENERAL

This specification applies to the purchase of one mechanical displacement meter prover, bidirectional folded type with inclined ends. The prover is to be permanently installed on an off-shore platform near Santa Barbara, California. The prover skid is to be located in a Class I, Division 1, hazardous location. The equipment is continuously exposed to wet salt air atmosphere. The meter prover handles 16° to 25° API crude oil with viscosities up to 7,000 SSU @ 60°F and temperatures up to 120°F. The prover will also be used to prove produced water meters. The crude oil and water contains hydrogen sulphide and carbon dioxide in addition to considerable sand and grit.

2.0 DESIGN CONDITIONS

The meter prover shall be designed for 500 psig @ 150°F. The maximum meter rate to be proven is 450 GPM. Other meter rates vary from 30 to 150 GPM. The meter prover shall conform to all requirements of "Mechanical Displacement Meter Provers", API Standard 2531, latest edition. The volume in the prover between switches shall be not less than 135 U.S. gallons. The prover shall be shop calibrated and shall have an operating accuracy and repeatability within 0.02%. The displacing devise shall be an elastomer spheroid liquid filled. The prover is to be compact type skid mounted with overall dimensions not exceeding 15' X 6' X 6'.

3.0 CONSTRUCTION

The meter prover barrel shall be 10" schedule 40 pipe. All flanges to be either 300# A.N.S.I. RF welding neck or blind flanges. All piping to conform to attached specification, Class B. The inlet and by-pass piping shall be 6". A 6", 4-way 300# ANSI steel body bubble-tight switching valve, General Twinseal (or equal), shall be used. The valve shall be equipped with a Philadelphia Gear Limitorque SMB-type electric operator with 440V, 3Ø, 60 hertz, explosion-proof. The operator shall have indicating lights, pushbutton controls, reversing starter and remoting connection.

All electrical conduit, J-boxes and fittings shall be copper free aluminum. J-boxes and fittings to be Crouse-Hinds GUA type. All wiring to conform to National Electrical Code and State of California, Title 24, for hazardous location, Class 1, Division 1, Group D.

The detector switches shall be explosion proof and shall be of type proven by the manufacturer to be accurate and reliable. The following items shall be furnished and installed in several connections: (a) Two (2) Palmer #229 industrial thermometers and thermowells with 12" stems and scales. The range shall be 0-120°F with 1/2°F graduations. Install these in proper location and to obtain proper immersion; (b) Two (2) 4½" face Ashcroft 1279S pressure gauges with ½" sockets and Dragon 5507 needle valves; (c) One (1) ½" steel body Circle-Seal relief valve set at 720 psig; (d) Four (4) ½" Vogt #9873

globe valves with plugs for vents and drains.

Each bypass connection shall have a flanged check valve at the barrel, Missions Duo-Check steel body with 316 ss trim and buna-N seal (or approved equal).

The barrel shall be fabricated so that the bore is continuously smooth throughout. All welds shall be ground flush on the interior. The barrel shall be reinforced at connections in accordance with the ANSI Code for Refinery Piping B31.3, latest edition. Reinforcement pads shall be provided at the main supports. The barrel and the by-pass piping shall be coated on the inside. The barrel shall be coated with Coatings, Inc. TE-201-RFE thermally applied to a minimum of 15 mils. All other piping to be coated internally in accordance with Specification 10-084-C1. All piping valves and structural steel to be externally coated in accordance with Specification 10-084-C2.

The readout panel shall be for installation in the platform master control panel. It shall be for flush panel mounting. The panel is to be located inside a non-hazardous control room. The readouw device shall be Daniel 1822 (or approved equal).

The skid assembly shall be shipped fully tested and assembled. The skid base shall be adequate for safe marine handling.

Calibration certificates as specified in API 2351, Appendix A, shall be furnished with the equipment. Six copies shall be mailed to Humble purchaser at time of shipment of the prover.

4.0 SHIPMENT

The manufacturer and supplier are responsible for packaging and safe shipment and arrival of the equipment. The prover and the readout device shall be shipped to location stated on Humble's Request for Quotation.

5.0 TECHNICAL DATA

The bidders shall furnish 3 copies of the following with their proposal:

(1) Drawing showing arrangement of all items and overall dimensions.

(2) Manufacturer's specifications and list of all equipment including manufacturer's and Catalog Numbers.

(3) Electrical schematic.

(4) Details of skid base construction.

(5) Exceptions or variations from those specifications, if any.

The supplier shall furnish 6 copies of the following within 14 days of order date:

(1) Certified Dimensional Outline Drawings.

(2) Electrical schematic and details.

(3) Readout dimensions for panel cutout and mounting.

(4) Complete itemized parts list.

(5) Installation, operating and maintenance instructions.

6.0 GUARANTEE

The manufacturers and suppliers shall guarantee the equipment to meet all requirements of these specifications. He shall guarantee all items to be fre of defects in material and workmanship for a period of 12 months from first service date. Defects or deficiencies shall be corrected at no cost to Humble.

5.0 CRUDE OIL HEATING SYSTEM

5.1 THERMINOL CIRCULATION

SPECIFICATION

THERMINOL HEATING SYSTEM
CIRCULATION PUMPS
P20A & P20B

1.0 GENERAL

This specification applies to the purchase of two centrifugal pumps for a hot oil heating system using Therminol for the heating fluid. The pumps are to be used on an off-shore platform near Santa Barbara, California. The pump location is in an area classified as hazardous. All electrical items to comply with State of California Codes and National Electrical Code for Class 1, Division 1, Group D.

2.0 DESIGN BASIS

The pumps circulate Therminol material which is a product of Monsanto. The normal pumping temperature is 250°F. The maximum pumping temperature is 550°F. The design pumping rate for each pump is 350 gpm with a differential head of 80 feet. Therminol has a specific gravity range of .82 to 1.1 and a viscosity of 2.6 to 4.0 centipoises at 250°F.

Pumps are to be for continuous service.

3.0 CONSTRUCTION

3.1 The pumps shall be vertically split end suction, vertical discharge, single stage, enclosed impeller, heavy duty steel case, centrifugal type. The units shall be complete with (1) 1750 rpm, 480 volt, 60 hertz, 3 phase, explosion proof induction motors with UL label for Class 1, Group D; (2) cast iron or steel base with drip lip and drain connection; (3) and required lubrication equipment for oil lubricated pump bearings; and coupling guard meeting Federal and State of California safety orders.

3.2 The base shall be adequately rigid for mounting on a steel plate floor.

3.3 The pump shall be a Dean Brothers Pumps, Inc. 2"X3"X11½" type R434 with a 10 horsepower four pole motor. Mechanical design shall comply with their R434 standards with Class 40 materials. The base shall be fabricated steel. Furnish with a mechanical seal that the manufacturer has had experience with in this same service including the maximum design temperature. A closed circulating jacket water cooling system will be used to cool the bearings and seals. Pumps of approved equal construction and experience in this service may be accepted.

Suction and discharge connections to be 150# ANSI RF or 350# ANSI RF flanged.

4.0 TECHNICAL DATA

4.1 Submit 3 copies of the following data with the proposals:

(1) Performance curves including NPSH.
(2) Cross-sectional drawings showing details of construction including all materials.
(3) Stuffing box and mechanical seal details.
(4) Overall dimensional drawings.
(5) Motor manufacturer and description.
(6) List of installations and experience where pumps have been used in this service (required only if other than the specified pump).

4.2 Supplier to submit 6 copies of above final data (excluding item 6) and in addition 6 copies of (a) installation operating and maintenance instruction (b) parts lists for all items (c) certified dimensional outline drawings and (d) recommended spare parts.

5.0 SHIPMENT

Supplier shall be responsible for the packaging shipment and safe arrival of the units at the destination stated in Humble's Request for Quotation.

6.0 GUARANTEE

Supplier and manufacturer shall guarantee the units to meet all requirements of this specification and to be free of defects in material and workmanship for 12 months after the delivery date. Defects or deficiencies shall be corrected at no additional cost to the purchaser.

SPECIFICATION
THERMINOL EXPANSION TANK T-20
DIESEL FUEL DAY TANK T-23

1.0 GENERAL

This specification applies to the design and construction of the above vessels for use on a Humble Oil and Refining Company offshore platform near Santa Barbara. The vessels are to be non-code, however, they are to be constructed in accordance with the ASME Section VIII but not stamped.

2.0 CONSTRUCTION

The vessels shall have a minimum metal thickness of 3/16". They shall be tested at 30 psig. The ASME code shall be followed as to construction details including welding and welder qualification.

The vessels shall be constructed as shown on Drawing 084-132.

3.0 PROTECTIVE COATING

The vessels and appurtenances shall be coated externally in accordance with the attached Specification 10-084-C2. The vessels shall be sandblasted internally as described in 10-084-C2 and dried for shipment. They shall be sealed with adequate desiccant to prevent rusting during delivery.

4.0 DELIVERY

The vessels shall be delivered f.o.b. trucks or barges at the jobsite specified in the Humble request for quotation.

5.0 DRAWINGS

Supplier shall submit three (3) copies of shop drawings for approval prior to fabrication. Thr purchaser reserves the right to change the location of nozzles and appurtenances until the approval of these drawings.

6.0 GUARANTEE

The supplier shall guarantee the vessels to meet the requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from the delivery date. Defects or deficiencies shall be corrected at no additional cost to Humble.

Humble Job 10240
H-B Job 10-084

Specification 10-084-FSL
REV. 1

FLOW SWITCHES
FOR THERMINOL HEATING SYSTEM
FSL 401, 402 & 403
(3 Req'd.)

Furnish three flow switches for installation in a Therminol heat exchange fluid system. The switches are to be installed in a 3" pipe covered with 2" of insulation. The normal temperature ranges from 250°F to 500°F. The normal pipeline velocity is 4 feet per second. This may go up to 6 feet per second in the future. The flow switch shall be satisfactory up to 12 feet per second. The flow switch shall be adjustable from 1FPS to 4 FPS on increasing flow. The unit shall be equipped with cooling fins rated for temperatures up to 600°F.

All wetted parts shall be steel or stainless steel. The unit is to be designed to saddle into a 3" pipe with a 2"-150# ANSI RF flanged connection to the flow switch unit. Provision shall be made in the installation for 2" thickness of pipe insulation.

The switch enclosure shall be Class 1, Group D, explosion proof. Underwriters label is preferred if available and switches bearing the label will be given preference in the order. The switches shall be microswitches (mercury switches are not acceptable) with SPDT contacts rated for 5A minimum induction load at 115VAC.

Furnish installation details along with construction and performance data with the proposal (3 copies).

Furnish 6 copies of all final data upon receipt of purchase order.

HOBBS-BANNERMAN CORPORATION

ENGINEERS . CONSTRUCTORS
SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

REV

SPECIFICATION — LIQUID LEVEL INSTRUMENTS

CUSTOMER: HUMBLE OIL & REFINING CO. — JOB No.: 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LSL 105 △		△		△		△
MAKE OR APPROVED EQUAL		FISHER						
TYPE		2800						
MODEL		252 V						
MOUNTING		FLGD						
INDICATING OR RECORDING		—						
INTERFACE OR LEVEL		LEVEL						
COMMODITY		THERMINOL						
SPECIFIC GRAVITY AT 60°		- 1.29						
OPERATING PRESS.	TEMP	0	150°F					
MINIMUM DESIGN PRESS.	TEMP	275	100°F					
BODY MATERIAL		STEEL						
CONNECTIONS		4"-150# RF						
FINS REQUIRED		NO						
FLOAT MATERIAL	SIZE	316 S.S.	3"x10"					
PILOT-RIGHT OR LEFT HAND		—						
THROTTLING RANGE		SPDT SWITCH EXPLOSION-PROOF ENCLOSURE						
AUTOMATIC RESET								
AIR FILTER & REDUCER								
MANUAL CONTROL BYPASS								
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE		CONTACTS CLOSE						
SPECIAL CONSTRUCTION & NOTES								
OPERATES WITH		—						
SERVICE		THERMINOL EXPANSION TANK T-20 LOW LEVEL SHUT DOWN						
VESSEL NO		T-20						
PLANT NO								
PURCHASE ORDER NO								

		BY DATE

APPROVED

DATE

BY

CHECKED

ENGINEER

PROJ. ENG.

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SANTA FE SPRINGS CALIFORNIA

SHEET OF

SPECIFICATION

TEMPERATURE INSTRUMENTS

REV

CUSTOMER HUMBLE OIL & REFINING CO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	TI-215 △	TI-216 △	TI-217 △	TI-218 △
MAKE OR APPROVED EQUAL	WESTON	WESTON		
TYPE	BI-METAL	BI-METAL		
MODEL	4500	4500		
MOUNTING	1/2" MPT BACK	1/2" MPT BACK		
INDICATING OR RECORDING	INDICATING	INDICATING		
STANDARDIZATION	—	—		
NORMAL CONTROL OR RECORDING POINT	—	—		
TEMPERATURE RANGE	150-750°F	150-750°F		
THROTTLING RANGE	—	—		
AUTOMATIC RESET	—	—		
DIAL SIZE	5" S.S.	5" S.S.		
STEM LENGTH	9" S.S.	6" S.S.		
MANUAL CONTROL BYPASS				
CHART SIZE NUMBER				
CHART DRIVE REVOLUTIONS				
NUMBER OF POINTS				
TYPE BULB OR THERMOCOUPLE	3/4" MPT THERMOWELL WESTON # 173302-124	3/4" MPT THERMOWELL WESTON # 96133-124	SAME AS TI-216	SAME AS TI-216
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH	316 S.S.	316 S.S.		
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH SERVICE	P-20A&B DISCHARGE	E-5A OUTLET	E-5B OUTLET	E-5C OUTLET
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO				

DATE

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PI-336 △	PI-337 △	△	△
MAKE OR APPROVED EQUAL	WIKA	SAME AS PI-336		
TYPE				
MODEL	233			
MOUNTING / LOCATION	1/2" MPT / LOWER			
INDICATING OR RECORDING	IND			
NORMAL PRESSURE @ TEMP	25 / 500°F			
PRESSURE ELEMENT RANGE	0-60 PSI			
PRESSURE ELEMENT TYPE AND MATERIAL	BOUR. / STEEL			
DIAL SIZE	4".			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NO				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP	GLYCERIN FILLED			
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	FURNISH W/ X-H PIPE SIPHON PIGTAIL ASHCROFT # 1/2 1098 OR APPR. EQUAL			
OPERATES WITH SERVICE	THERMINOL CIRCULATION PUMP F-20A	THERMINOL CIRCULATION PUMP F-20B		
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION

TEMPERATURE INSTRUMENTS

CUSTOMER: HUMBLE OIL & REFINING CO.

PLANT LOCATION

OR N: 10-084

IDENTIFICATION TAG NO	TI 225 △	TI 226 △	TI 227 △	TI 228 △
MAKE OR APPROVED EQUAL	WESTON	SAME AS TI 225	SAME AS TI 225	WESTON
TYPE	BI-METAL			BI-METAL
MODEL	4500			4500
MOUNTING	1/2" MPT BACK			1/2" MPT BACK
INDICATING OR RECORDING	INDICATING			INDICATING
STANDARDIZATION	—			—
NORMAL CONTROL OR RECORDING POINT	—			—
TEMPERATURE RANGE	50-500°F			150-750°F
THROTTLING RANGE	—			—
DIAL SIZE	5" S.S.			5" S.S.
STEM LENGTH	6" S.S.			9" S.S.
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE NUMBER				
CHART DRIVE REVOLUTIONS				
NUMBER OF POINTS				
TYPE BULB OR THERMOCOUPLE	3/4" MPT THERMOWELL WESTON # 96133-124 316 S.S.			3/4" MPT THERMOWELL WESTON # 173302-124 316 S.S.
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES	EXPLOSION-PROOF CLASS 1 GROUP D			EXPLOSION-PROOF CLASS 1 GROUP D
OPERATES WITH SERVICE	THERMINOL OUTLET OIL HEATER E-2A	THERMINOL OUTLET OIL HEATER E-1A	THERMINOL OUTLET OIL HEATER E-1B	THERMINOL TO OIL HEATER
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION

TEMPERATURE INSTRUMENTS

REV.

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.	TC-221A △	TC-222A △	TC-223A △	△
MAKE OR APPROVED EQUAL	ROBERTSHAW	SAME AS TC-221A	SAME AS TC-221A	
TYPE	PNEUMATIC			
MODEL	DT 150 A11			
MOUNTING	SURFACE			
INDICATING OR RECORDING	IND.			
STANDARDIZATION				
NORMAL CONTROL OR RECORDING POINT	500°F			
TEMPERATURE RANGE	0-600°F			
THROTTLING RANGE	YES			
AUTOMATIC RESET	NO			
RATE ACTION	NO			
AIR FILTER & REDUCER	YES			
MANUAL CONTROL BYPASS	YES			
CHART SIZE / NUMBER				
CHART DRIVE / REVOLUTIONS				
NUMBER OF POINTS THERMOWELL 3" LAG	CLASS VA			
TYPE BULB OR THERMOCOUPLE				
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH	TYPE 316 S.S. 15 FT.			
TUBING COMPENSATION	NO			
AS TEMPERATURE RISES OUTPUT SIGNAL	DECREASES			
	6-30 PSI OUTPUT			
SPECIAL CONSTRUCTION & NOTES				
OPERATES WITH SERVICE	DAMPER ON WASTE HEAT EXCHANGER E5A	E5B	E5C	
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO				

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REVISIONS

BY DATE

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SPECIFICATION

TEMPERATURE INSTRUMENTS

REV

CUSTOMER PLANT LOCATION	HUMBLE OIL & REFINING CO.			JOB NO. 10-084
IDENTIFICATION TAG NO	TSH-221 △	TSH-222 △	TSH-223 △	TI-211 △
MAKE OR APPROVED EQUAL	FENWAL	SAME AS TSH-221	SAME AS TSH-221	WESTON
TYPE	80010-5 *			BI-METAL
MODEL	THERMOSWITCH 17002-0			4500
MOUNTING	THERMOWELL			½" MPT BACK
INDICATING OR RECORDING	—			
STANDARDIZATION	FACTORY SET AT 575°F			STEM LENGTH 6"
NORMAL CONTROL OR RECORDING POINT	500°F			DIAL SIZE 5"
TEMPERATURE RANGE	(-)100°F TO (+)600°F			150-750°F
THROTTLING RANGE	—			
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NUMBER				
CHART DRIVE / REVOLUTIONS				
THERMOWELL	* 316 S.S. 3/4" M.P.T.			THERMO WELL 316SS 3/4" MPT WESTON 96133-12A
TYPE BULB OR THERMOCOUPLE				
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES	EXPL. PROOF CLASS I GROUP D			
OPERATES WITH SERVICE	THERMINOL TO E-5A	THERMINOL TO E-5B	THERMINOL TO E-5C	THERMINOL OUT OF E-3
PRIMARY ELEMENT LOCATION				
PLANT NO.				
PURCHASE ORDER NO				

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5.2 CRUDE OIL HEAT EXCHANGERS

SPECIFICATION

CRUDE OIL HEAT EXCHANGERS
E1A, E1B & E2A
(one each req'd)

1.0 GENERAL:

This specification applies to the purchase of three heat exchangers for use in heating crude oil with Therminal FR-1 heating fluid. The exchangers are to be used on an off-shore platform near Santa Barbara, California.

2.0 DESIGN BASIS:

The attached Heat Exchanger data sheets Specification 10-084-CHE (two sheets) give the requirements for the heat exchangers.

3.0 CONSTRUCTION:

The heat exchangers are to be constructed in accordance with the Standards of Tubular Exchanger Manufacturers Association, Class C, latest edition. The overall length shall not exceed 20 feet. Supports for stacking the units shall be furnished. The exchangers are to be insulated (by others) with 2" thick insulation and provisions shall be made for this in the construction. Three quarter inch thermowell connections shall be provided at all inlets and outlets.

4.0 TECHNICAL DATA:

Furnish 3 copies of the following data with the proposal:

(1) Data sheets with all items completed.
(2) Dimensional outline drawings.
(3) Cross sectional drawings showing details of construction including materials.
(4) Weight of each unit.

Within two weeks of order date, furnish 6 copies of final data same as above in addition to certified dimensional drawings.

5.0 GUARANTEE:

Supplier and manufacturer shall guarantee that the heat exchangers will meet all the requirements of these Specifications. They shall guarantee the units to be free of defects in material and workmanship for a period of 12 months from first service date. Deficiencies shall be corrected at no additional cost to Humble.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION — **HEAT EXCHANGER** — 10-084-CHE — REV.

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO. 10-084

PLANT LOCATION

SERVICE OF UNIT (PRODUCTION SEPARATORS) CRUDE OIL HEATER — ITEM No E-1A E-1B (2 req'd)

SIZE — TYPE BEU — CONNECTED IN

SURFACE/UNIT — NET SQ. FT. — SHELLS/UNIT — SURFACE/SHELL — NET SQ. FT.

PERFORMANCE OF ONE UNIT

		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		CRUDE OIL & GAS		* THERMINOL FR-1	
TOTAL FLUID ENTERING	#/HR	220,000		70,500	
TOTAL VAPOR	#/HR	20,000			
TOTAL LIQUID	#/HR	200,000		70,500 (110 G.P.M.)	
TOTAL STEAM	#/HR				
TOTAL NON CONDENSABLES	#/HR				
FLUID VAPORIZED OR CONDENSED	#/HR				
STEAM CONDENSED	#/HR				
GRAVITY--LIQUID SP. GR.		0.93		1.29 @ 375°F	
VISCOSITY -LIQUID (4000 CP @ 110°F)		7000 SSU	100°F	1.16	CP @ 375°F
MOLECULAR WEIGHT--VAPORS		45			
SPECIFIC HEAT--LIQUIDS		0.50	B.T.U./#	0.312	B.T.U./#
LATENT HEAT--VAPORS			B.T.U./#		B.T.U./#
TEMPERATURE IN		100	°F	500	°F
TEMPERATURE OUT		150	°F	250	°F
OPERATING PRESSURE		85	PSIG		PSIG
NUMBER OF PASSES					
VELOCITY			FT./SEC		FT./SEC.
PRESSURE DROP		CALC.	PROPOSED 2.0 PSI	CALC.	PROPOSED 5 PSI
DESIGN VISCOSITY (CENTIPOISES)		Cp. @	°F.	Cp. @	°F.

HEAT EXCHANGED—B.T.U./HR. (EACH EXCHANGER) 5,500,000 M. T. D. (CORRECTED)

TRANSFER RATE—SERVICE CLEAN — FOULING RESISTANCE .002

CONSTRUCTION

		SHELL SIDE		TUBE SIDE	
DESIGN PRESSURE		240	#/SQ. IN.	150	#/SQ. IN.
TEST PRESSURE		360	#/SQ. IN.	275	#/SQ. IN.
DESIGN TEMPERATURE		200	°F	600	°F

TUBES No. 1" O.D 12 BWG MIN AVE LENGTH PITCH SQUARE

SHELL STEEL I.D. O.D. THICKNESS

SHELL COVER STEEL FLOATING HEAD COVER

CHANNEL STEEL CHANNEL COVER

TUBE SHEETS—STATIONARY FLOATING

BAFFLES—CROSS TYPE THICKNESS SPACING

BAFFLE—LONG TYPE THICKNESS

TUBE SUPPORTS THICKNESS

GASKETS

CONNECTIONS—SHELL—IN OUT SERIES 150# USAS RF

CHANNEL—IN OUT SERIES 150# USAS RF

CORROSION ALLOWANCE—SHELL SIDE 1/8" TUBE SIDE 1/16" (EXCEPTING TUBES)

CODE REQUIREMENTS ASME VIII TEMA CLASS C CUST. SPEC.

WEIGHTS—EACH SHELL BUNDLE FULL OF WATER

NOTE: INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)

REMARKS

* MONSANTO PRODUCT

DATE

BY

CHECKED

ENGINEER

PROJ ENG

DATE BY

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION — **HEAT EXCHANGER** — 10-084-CHE — REV

JOB NO

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION

SERVICE OF UNIT (L.P. TEST SEPARATOR) CRUDE OIL HEATER — ITEM No E 2A (1 req'd)

SIZE — TYPE BEU — CONNECTED IN

SURFACE UNIT — NET SQ FT — SHELLS UNIT — SURFACE/SHELL — NET SQ FT

PERFORMANCE OF ONE UNIT

		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		CRUDE OIL & GAS		* THERMINOL FR-1	
TOTAL FLUID ENTERING	#/HR	73,370		23,500	
TOTAL VAPOR	#/HR	6,670			
TOTAL LIQUID	# HR	66,700		23,500 (36.5 G.P.M.)	
TOTAL STEAM	#/HR				
TOTAL NON CONDENSABLES	# HR				
FLUID VAPORIZED OR CONDENSED	#/HR				
STEAM CONDENSED	#/HR				
GRAVITY - LIQUID SP. GR.		0.93		1.29 @ 375°F	
VISCOSITY LIQUID (1,000 CP @ 60°F)		264	CP @ 100 °F	1.16	CP @ 375 °F
MOLECULAR WEIGHT - VAPORS		25			
SPECIFIC HEAT LIQUIDS		0.50	BTU/#	.312	BTU/#
LATENT HEAT VAPORS			BTU/#		BTU/#
TEMPERATURE IN		60	°F	500	°F
TEMPERATURE OUT		110	°F	250	°F
OPERATING PRESSURE			PSIG		PSIG
NUMBER OF PASSES					
VELOCITY			FT/SEC		FT/SEC
PRESSURE DROP		CALC	PROPOSED 15 PSI	CALC	PROPOSED 5 PSI
DESIGN VISCOSITY (CENTIPOISES)		Cp @	°F	Cp. @	°F

HEAT EXCHANGED - B.T.U./HR. 1,830,000 — M.T.D. (CORRECTED)

TRANSFER RATE SERVICE — CLEAN — FOULING RESISTANCE .002

CONSTRUCTION

DESIGN PRESSURE	1434	#/SQ IN	150	#/SQ IN
TEST PRESSURE	2151	#/SQ IN	413	#/SQ IN
DESIGN TEMPERATURE	110	°F	500	°F

TUBES — No — 1" O.D. — 12 BWG — MIN/AVE — LENGTH — PITCH SQUARE

SHELL STEEL — I.D. O.D. — THICKNESS

SHELL COVER STEEL — FLOATING HEAD COVER

CHANNEL STEEL — CHANNEL COVER

TUBE SHEETS - STATIONARY STEEL — FLOATING

BAFFLES—CROSS — TYPE — THICKNESS — SPACING

BAFFLE—LONG — TYPE — THICKNESS

TUBE SUPPORTS — THICKNESS

GASKETS

CONNECTIONS SHELL—IN — OUT — SERIES

CHANNEL—IN — OUT — SERIES

CORROSION ALLOWANCE—SHELL SIDE 1/8" — TUBE SIDE 1/16" EXCEPTING TUBES

CODE REQUIREMENTS ASME VIII — TEMA CLASS C — CUST. SPEC.

WEIGHTS—EACH SHELL — BUNDLE — FUEL OF WATER

NOTE: INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)

REMARKS

* MONSANTO PRODUCT

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HOBBS–BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION: CONTROL VALVES

REV.

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO			TCV 219A △		TCV-219B △	TCV-219C △		△
MAKE OR APPROVED EQUAL			FISHER		↑	FISHER		
TYPE			3 WAY			3 WAY		
MODEL			657-YY			657-YY		
SIZE	TYPE CONNECTIONS		2"	FLGD.		1½"	FLG.	
BODY MATERIAL	RATING		STL.	ASA 150#		STL.	ASA 150#	
INNER VALVE TRIM MAT'L			S.S.			S.S.		
INNER VALVE SIZE	TYPE		2"	V PORT		1½"	V PORT	
TOP WORKS	SIZE		40			34		
FINS			YES			YES		
POSITIONER	BOOSTER RELAY		—	—		—	—	
POSITIONER BYPASS	W/GAGES		—	—		—	—	
AIR FILTER & REDUCER			NO			NO		
COMMODITY			FR-1 THERMINOL			FR-1 THERMINOL		
FLOW TEMPERATURE, °F			550° F			550° F		
PRESSURE PSIG	IN	OUT	50	30		50	30	
SPEC GRAVITY H_2O = 1.0	@ 60°F	@ FLOW TEMP	1.39			1.39		
SPEC GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP						
GPM @ 60°	NORM FLOW	MAX CAP	110			37		
SCF HR	NORM FLOW	MAX CAP						
# HR	NORM FLOW	MAX CAP						
VALVE POSITION ON AIR FAILURE			STRAIGHT THRU			STRAIGHT THRU		
Cv			CALC. 20 ACT. 42			CALC. 9.5 ACT. 13.9		
SPECIAL CONSTRUCTION & NOTES			DIVERTS THRU BOTTOM ON AIR INCREASE		↓	DIVERTS THRU BOTTOM ON AIR INCREASE		
OPERATES WITH			TC-219A		TC-219B	TC-219C		
SERVICE			CRUDE EXCH. E-1A		CRUDE EXCH. E-1B	CRUDE EXCH. E-2A		
LINE NO								
PLANT NO								
PURCHASE ORDER NO.								

REV — DATE — BY

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SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION

TEMPERATURE INSTRUMENTS

REV.

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	TI-206 △	TI-207 △	TI-208 △	TI-209 △
MAKE OR APPROVED EQUAL	WESTON			
TYPE	BI-METAL			
MODEL	4500			
MOUNTING	1/2" NPT BACK			
INDICATING OR RECORDING	INDICATING			
STEM LENGTH	6"			
DIAL SIZE	5" SS			
TEMPERATURE RANGE	0-200°F			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NUMBER				
CHART DRIVE / REVOLUTIONS				
NUMBER OF POINTS				
THERMOWELL	316 SS 3/4" MPT WESTON Nº 96133-124	SAME AS TI-206	SAME AS TI-206	SAME AS TI-206
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH				
TUBING COMPENSATION				
AS TEMPERATURE RISES OUTPUT SIGNAL				
SPECIAL CONSTRUCTION & NOTES	EXPLOSION-PROOF CLASS 1 GROUP D			
OPERATES WITH				
SERVICE	OIL TEMP TO E1A & E1B EXCH.	OIL TEMP OUTLET E1A EXCH.	OIL TEMP. OUTLET E1B EXCH.	OIL TEMP. OUTLET E-2A EXCHR.
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO.				

REV	BY	DATE

DATE

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HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET OF

SPECIFICATION

TEMPERATURE INSTRUMENTS

REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	TC-219A △	TC-219B △	TC-219-C △ △
MAKE OR APPROVED EQUAL	ROBERTSHAW	SAME AS TC-219A	SAME AS TC-219A
TYPE	PNEUMATIC		
MODEL	DT 150 A11		
MOUNTING	SURFACE		
INDICATING OR RECORDING	IND		
STANDARDIZATION			
NORMAL CONTROL OR RECORDING POINT	120° F		
TEMPERATURE RANGE	0-200		
THROTTLING RANGE	YES		
AUTOMATIC RESET	NO		
RATE ACTION	NO		
AIR FILTER & REDUCER	YES		
MANUAL CONTROL BYPASS	YES		
CHART SIZE NUMBER			
CHART DRIVE REVOLUTIONS			
THERMOWELL 3" LAG	316 SS 3/4" NPT		
TYPE BULB OR THERMOCOUPLE	SPIRAL BOURD. CL 1B		
ELEVATION OF BULB ABOVE INSTRUMENT			
TUBING MATERIAL & LENGTH	TYPE 316 SS 15FT		
TUBING COMPENSATION	NO		
AS TEMPERATURE RISES OUTPUT SIGNAL	INCREASES 3-15 PSI OUTPUT		
SPECIAL CONSTRUCTION & NOTES			
OPERATES WITH	TCV-219A	TCV-219B	TCV-219C
SERVICE	CRUDE EXCH. E1A	CRUDE EXCH. E1B	CRUDE EXCH. E 2A
PRIMARY ELEMENT LOCATION			
PLANT NO			
PURCHASE ORDER NO			

DATE

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6.0 PIPELINE EQUIPMENT

PIPELINE SHUTIN VALVE

FCV - 17

(1 required)

1.0 GENERAL

This specification applies to the purchase of a 12" size, full opening, 1440 psi WOG, forged steel ball valve with ANSI 600 RF flanged connections and corrosion-resistant trim; with pneumatic, cylinder - type, spring return, 90° rotary actuator and actuator mounting adapter.

2.0 VALVE

Valve shall be a Cameron ball valve figure 800601-7-20, or approved equal. *

3.0 ACTUATOR

The actuator shall be scotch - yoke type, with all moving parts submerged in a sealed oil bath. Actuator shall be suitable for operation in either a vertical or horizontal position. All bearing surfaces shall be coated with a permanent, lubricating and protective material. Actuator shall be weatherproof, with protective coating and corrosion-resistant construction suitable for marine exposure. Actuator shall be sized to break, stroke and close valve against 1,440 psi differential pressure with 100 psig operating air. Construction shall permit actuator to be safely disassembled in the field without special equipment. Actuator mounting adapter shall have provisions for mounting actuator either in line with or at right angles to the run of the valve. Actuator shall have a three-way, normally closed, solenoid valve with explosion proof and watertight (NEMA 4, 7, 9) solenoid enclosure, 120 VAC, single phase, 60 H_z operation, and 125 psi allowable operating pressure differential with air. Solenoid valve shall be mounted and piped to actuator cylinder. With solenoid valve deenergized, cylinder shall be vented and valve shall be spring-closed. Actuator shall be a Matryx model 104-SR, Bettis model 746A-2SR, or approved equal.

4.0 INFORMATION REQUIRED WITH BIDS

Bidders shall submit a fully dimensioned assembly drawing, with all parts identified and shown in functional clarity.

5.0 SHIPMENT

Supplier shall be responsible for packaging, shipment and safe arrival of the valve assembly at the destination stated in Humble's request for quotation. All shipping containers shall be piece-marked and tagged "FCV-17".

.0 GUARANTEE

Supplier and manufacturer shall guarantee the unit to meet all requirements of this specification and to be free of defects in material and workmanship for 12 months after the delivery date. Defects or deficiencies shall be corrected at no additional cost to the purchaser.

* Orbit No. 1423 with Vulcan Model OLG20D-5 actuator and Model No. 22065-50 air reserve tank is acceptable.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER / PLANT LOCATION	HUMBLE OIL & REFINING CO.			P.O. 10-08A
IDENTIFICATION TAG NO	PC-126A △	△	△	△
MAKE OR APPROVED EQUAL	FISHER			
TYPE	WIZARD II			
MODEL	4150			
MOUNTING / LOCATION	FLUSH / PIPE SUPPORT			
INDICATING OR RECORDING	—			
NORMAL PRESSURE @ TEMP	0-1000 / 110° F			
PRESSURE ELEMENT RANGE	0-1500			
PRESSURE ELEMENT TYPE AND MATERIAL	* BOILR STEEL			
REQUIRED SUPPRESSION				
THROTTLING RANGE	0-10 / 0-100 %			
AUTOMATIC RESET	NO			
RATE ACTION	NO			
AIR FILTER & REDUCER	YES			
MANUAL CONTROL BYPASS	NO			
CHART SIZE / NO	— / —			
CHART DRIVE / REVOLUTION	— / —			
INDICATING SCALE RANGE	—			
AS PRESSURE INCREASES OUTPUT SIGNAL	INCREASES			
LOCATION OF PRESSURE TAP	—			
PULSATION DAMPENER	—			
SPECIAL CONSTRUCTION & NOTES	FURNISH CHEMSEAL FILLED SYSTEM W/ 316 S.S. LOWER HOUSING & DIAPHRAGM 1" CONN. & 15' S.S. ARMORED CAPILLARY			
OPERATES WITH	PCV-126-128			
SERVICE	OIL PIPELINE HIGH PRESSURE CONTROL			
PLANT NO				
PURCHASE ORDER NO				

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7.0 GAS SYSTEMS

GAS SYSTEM

PLAN OF OPERATION FOR GAS HANDLING FACILITIES

1.0 ABSTRACT

The gas handling facilities consist of the equipment for compressing, cooling, scrubbing, and dehydrating the gas streams from the crude oil surge tanks, the sour (Monterey Chert production) gas separators, and the sweet (Sandstone production) gas separators. These facilities will be arranged in two prefabricated and skid-mounted packages; one containing two small compressors to compress the low pressure gas from the surge tanks to the pressure of the sour gas separator, and one to contain the large compressors for delivery of all gas to 1000 psig for dehydration or to 3500 psi for injection. The 1000 psig dehydrated gas will be available for transport to shore for treating and sales. The injection cylinders are connected for injection service so that oil production might be continued even if gas sales are interrupted.

The small package containing the surge tank vapor (also called stock tank vapor, or S.T.V.) compressors will be located as shown on Dwg. 084-149. Location of the large package containing the main compressors (also called Sales-Injection Compressors) and the dehydration unit is shown on Dwgs. 084-149A.

The construction plans require that the prefabricated small skid-mounted package be shipped to the site where the other production facilities will be assembled for installation in the deck section, prior to transport of the deck section to the platform site and installation on the structure template. The installation of the large packaged compressor and dehydration plant will be made by pre-assembly onshore of all facilities to be installed on this skid, transport of it separately to the platform site, and installation of it on the top deck by a single lift with the derrick barge crane. Tie-ins and installation of necessary inter-connections between the two gas facility packages and the other production equipment will be made in the field, the designs being such that the field work will be minimized.

2.0 INTRODUCTION

The drawings and equipment specifications for the gas facilities, shown in the Appendix, have been prepared on the basis that two separate Requests for Quotation will be issued, one for the small package and one for the large, and different compressor manufacturers-packagers may be selected for the two packages. The specifications are specific in principle and general in detail with the aim that each compressor manufacturer must perform the detailed engineering design and layout that best satisfies his particular machines while complying with all design guidelines laid out in the flow sheets and specifications.

Screening studies have been made to determine the availability of types and arrangements of equipment required to fulfill the design criteria, and several alternates appear to be available. For purposes of illustration a particular selection, Cooper-Bessemer horizontal balanced opposed reciprocating compressors, has been made and described in the plan of operation. Later, when performance requirements may be revised or when formal quotations are received, a different selection than described herein could be appropriate.

Contained in the Drawings are the following:

A. For Use With Both the Small and the Large Package:
Drwg. No. 084-190: "Simplified Process Flow Diagram"
Drwg. No. 084-191: "General Process Flow Diagram"
"Gas Plant General Specification", Sections to be selected as appropriate.

B. For the Small, S.T.V. Compressor Package:
Drwg. No. 084-193: "Mechanical Flow Diagram, STV Compressors"
Drwg. No. 084-194: "Utility Flow Diagram, STV Compressors"
"Specifications for Stock Tank Vapor Compressor Units"

C. For the Large, Sales-Injection Compression-Dehydration Package:
Drwg. No. 084-192: "Mechanical Flow Diagram-Compressors"
Drwg. No. 084-196: "Mechanical Flow Diagram-Dehydration"
Drwg. No. 084-195: "Utility Flow Diagram-Compressors"
"Specifications for Sales-Injection Compression-Dehydration Plant"

3.0 DESIGN CRITERIA AND OBJECTIVES

1. Processing Objectives

a) Design rates for the gas handling facilities are shown on the Simplified Process Flow Sheet. The initial installation will provide two compressors each with capacity for 50% of the design volume for the stock tank vapor service, two sales-injection compressors each capable of 25% of design volume, and one 100% design capacity dehydration unit. The addition of one or two duplicate sales-injection compressor packages will be made later when the need arises. The design will be such that at all times the production of oil and gas will be curtailed to the extent that there is sufficient compressor capacity to handle the produced gas without flaring or venting. The above capacities and numbers of compressors could vary somewhat, depending on the specific units selected for purchase.

b) The characteristics of the gas streams are shown in detail on the General Process Flow Sheet for the gas handling facilities. The gas will contain sufficient H_2S that it will be toxic and corrosive, and sufficient CO_2 that it will be corrosive in the presence of water and oxygen and relatively more corrosive at higher pressures and lower temperatures. Design features will provide for containment of all operating leakage of sour gas, minimizing the need for venting in start-stop operations or for maintenance, purging of equipment in

sour gas service with sweet gas prior to entry, and redundant alarms to permit corrective actions before automatic relieving or shut-downs occur. In addition, special materials resistant to the corrosive atmospheres will be selected, extra corrosion allowances will be specified in certain equipment and provisions for corrosion surveillance and inhibition will be made at critical points.

c) Design pressures for the gas handling facilities are shown on the Mechanical Flow Sheet. In summary, the Surge Tank Vapor Suction is designed to operate at a slight vacuum and discharge at 100 psia to match the inlet sour gas, the combined stream to be compressed to 1015 psia in three stages for dehydration, only one stage being intercooled. The small amount of sweet gas production will be introduced at the sales compressor first interstage at 230 psia. The dehydration pressure of 1000 psia was set to meet sales line and processing plant conditions. The injection service is designed for two stages of compression to 3525 psia at design rate or 4000 psia at slightly reduced capacity. Where two-staging without intercooling is used, (S.T.V., Sales 2nd and 3rd Stages, and Injection), the interstage pressure is not important except for cylinder sizing and limiting rod loads.

2. Safety Shut-in System

Each shut-down of the compressors will cause the inlet and discharge power-operated valves to close. A shut-down caused by the platform manual emergency system, the fire detector system, or the combustible gas detector system will close the suction and discharge valves and also will open the vent lines to depressure the gas facilities.

In addition to all safety shut-down devices specified in the OCS Order No. 8, other safety shut-down devices have been provided which are intended to protect the equipment from damage or failure, the result of which would further decrease the risk of injury to operating personnel and damage to the environment.

3. Vapor Control System

Each compressor cylinder will be equipped with a vented packing and a double compartment distance piece. The packing and compartment next to the cylinder will contain sour gas which will be connected to the stock tank vapor compressor suction. A low pressure sweet gas blanket will be placed on the frame-side compartment to insure that no oxygen will leak into the sour gas compartment. By this means the normal operating leakage of sour gas will be contained.

A blowdown header will connect each compressor manual blowdown valve to the stock tank vapor suction. If at least one train of compressors is running then the depressuring and purging for maintenance can be done without venting or flaring. If all compressors are down, only then would it be necessary to vent gas for entry into equipment for repairs.

Each compressor stage will be equipped with automatic block and equalizing valves to facilitate starting without the necessity for depressuring. Standard practice in sweet gas, engine-driven compressor facilities is to depressure the compressor cylinders and lead lines for each "start".

The glycol regenerator still column vent will be connected to the blanket gas system on the production water settling tank, and all gas in this vapor line will be contained and sent to the stock tank vapor compressor rather than vented as in sweet gas operations.

Gas detector heads will be located around the sales-injection compressor plant and the stock tank vapor compressor package.

4. Fire Protection System

Ultra-violet sensing fire detector heads will be located around the main compressor plant and also near the small compressor package.

Fire fighting equipment for the main gas handling facilities will consist of fire-water monitor nozzles, hose reels, 150-pound dry chemical type wheeled fire extinguishers and 30-pound dry chemical hand extinguishers as shown on Drawing 084-124. The small compressors will be protected by monitors, hose reels, and dry chemical extinguishers also shown on Drawing 084-124 and provided for the production equipment as described elsewhere.

4.0 DESCRIPTION OF MAJOR EQUIPMENT AND SUBSYSTEMS

1. Deck and Equipment Layout

a) The Appendix contains a simplified layout plan for the large package containing the first two sales-injection compressors and the dehydration unit. The skid-mounted compressors will contain individual unit air-cooled heat exchangers and scrubbers with all associated process and utility piping. No detailed layout drawings are presented because the engineering design of these details will be the packager's responsibility.

A shed-type structure will cover the compressors with two sides open and two sides closed down to four feet above the floor level. An under-slung bridge crane with a hand operated trolley hoist will be provided above the compressors. The air-cooled heat exchangers will be located above the shed covering the compressors. The dehydration unit contactor, residue scrubber, flash tank, pumps, filter and regenerator-unit will be located along the side of the compressor site.

b) **The simplified layout drawing contained in the Appendix also shows the general orientation of the master scrubber and the two compressors contained on the small skid. A bridge crane to service these compressors will be mounted from the upper deck structural members.**

2. Process Descriptions and Flow Diagrams

a) Surge Tank Vapor Compressors

The main features of the process can be described best by consideration of the features for start-stop operation, load control operation, and safety and maintenance.

The suction and discharge lead line block valves will be closed and the equalizer valves opened automatically by the power operated valves on every shut-down. The 100 psi platform instrument air system can be used for the valve operation, and if Orbit valves are selected only 50 psi will be required. The cylinder and all piping in the STV compressor process will have the same MWP; and normally at start-up, the entire piping system, from first stage suction to second stage discharge, will be at some equalized pressure near that of normal operating interstage pressure, or about 20-25 psig. When the motor is started, there will be no load on it except for frictional losses necessary to circulate gas through the cylinders and piping. When the "load" sequence begins, the discharge lead block valve will open, the bypass valve will close and the suction valve will open, in that sequence and with proper time delay. When shut-down occurs, the valves are reversed in position and sequence, and no gas will be vented unless the shut-down was caused by manual emergency shut-down, fire detector, or combustible gas detector. If depressuring must be done, in order to enter the cylinder or piping, then the gas can be vented through the suction valve if the second unit is operating or it must be vented to flare if both units are down.

The load control of the STV compressors will be strictly manual. Suction pressure control will be automatic with one pressure controller set to limit the suction from getting too high, which would overload the compressor, and one controller set to keep the suction from getting too low which might cause too high a discharge temperature. If the suction pressure is low and the controller is operating to maintain pressure by throttling 85# sour gas inlet into the STV suction, then the compressor capacity is too great for the available STV gas supply. The man operating in the Central Control Room will know this fact by the signal from the low pressure controller transmitted to the Control Room.

The operator can manually open a cylinder clearance packet or lift suction valves, according to a programmed capacity table which will be supplied to him. This manual capacity control will be simple

but it will not be practical if the load variations are very frequent. It has been selected on the basis that normal production will occur at a fairly steady rate, in which case the cylinder capacity can be "tuned" to the available gas.

Relief valves on interstage and discharge of the STV Compressor have been set for pressures determined by allowable rod loads. Also provided are "High Pressure Alarms" at the interstage and discharge as well as a "High Pressure Shut-Down" on discharge. The alarms will allow the operator to take action before relief valves have to operate, thus reducing possible venting.

All relief valves are provided with both inlet and discharge block valves. These valves must be locked or sealed open for normal operation. The valves are necessary to permit maintenance or replacement due to the presence of sour gas in the flare knockout drum and line.

A slight amount of superheat on the main gas inlet is provided by contact with discharge piping. The objective is to insure that no condensation will occur in the cylinder, which is known to be the cause for increased valve and ring wear problems in compressors handling sour gas.

Entry into the compressor cylinders or piping can not be made until the sour gas has been purged. The sweet gas supply will be used for this purpose. After depressuring the sour gas, the system should be blocked in and pressured-up with sweet gas and then depressed again. This repressuring (to 50 psig) and venting (to atmospheric pressure) must be done six times to dilute the system from 1% H_2S to .001% H_2S, i.e. from 10,000 ppm to 10 ppm which is the maximum allowed for working contact.

b) Sales-Injection Compressor

The process scheme for the main compressor follows the same principles as described above for the STV compressor in regard to start-stop operation, capacity control, and safety and maintenance, except that in this case there are three levels of equalization and low suction pressure control. High suction pressure control will only be necessary on the sour gas inlet. There will be three recycle pressure controllers sending signals to the Central Control Room to alert the operator when manual cylinder capacity changes are needed. If changes to reduce cylinder capacity are not made when indicated, no harm will be done except that excess power costs will be incurred.

Sales gas discharge temperature control may be necessary in cold weather to insure that the 1000# gas remains above its hydrate temperature until it reaches the contactor. This will be done manually by louvers on the air side of the Sales Discharge Cooler Sections.

The purging pressure can be higher on the Sales-Injection Compressor, up to 150 psig relief pressure; but to be safe, it will still take three complete cycles of pressuring with sweet gas and depressuring. In view of the time and value of vented gas, it may be practical to provide more valves, to isolate smaller groups of equipment, than have been indicated.

Meter runs have been provided to measure the capacity of the STV Compressors and the Sales-Injection Compressors. For accurate individual stage capacities, corrections must be made for flash gas recycle, calculated from measured condensate rates and properties.

c) Dehydration Unit

The gas and glycol flow schemes for the dehydration unit are standard except for minor variations. An additional exchanger, "E-6 Glycol/Glycol Cooler," has been provided which is not usually installed. This exchanger will provide some heat to the flash tank inlet stream and thus improve condensate/glycol separation and reduce foaming problems. This exchanger also will insure that the Kimray pumps do not handle glycol that is too hot. Stripping vapors will be available from the Kimray pump slippage but the stripping vapors will be metered to insure that too much gas is not used. The still vapors will be vented to the closed blanket system over the water settling tanks so that no venting to atmosphere is required. The stripping gas will be helpful in sweeping the still vent line free of water condensate, and the still vapor line should be insulated to reduce condensate problems.

The dehydration unit safety shut-down system illustrated on the drawings conforms with Humble's new standards for protecting the reboiler vessels from overpressure. High pressure on the Reboiler Chamber will shut-off all flow into the flash tank and into the Reboiler and it will also block and bypass all heating medium.

The dehydration unit will be isolated from the compressors on every shut-down, and consequently it has been provided with its own emergency automatic blowdown valve. A second blowdown valve is needed and has been provided for the flash tank.

3. Utility Systems for Gas Facilities

The utility systems for the compressor packages include the lube oil system, jacket water system, and the distance piece blanket and vent system.

a) S.T.V. Compressors

The lube oil system is separate for each compressor. Full-pressure lubrication is applied to all main, connecting-rod and crosshead

pin bearings by a positive-displacement, mechanically-driven, gear-type main oil pump. This pump will be backed-up by a full capacity spare pump driven by an electric motor. The spare will be used for prelube and post lube as well as for automatic start if the main pump should fail. The lube oil will be cooled by a shell and tube exchanger using 120°F supply water. The piston and packing lubrication will use a standard shaft-driven mechanical pump and Trabon-type distribution system. Lube oil make-up will be supplied by gravity flow from the main compressor barrel rack.

The jacket water system contains two unusual features. The STV Compressors will use cooling provided by the main Compressors, and by this means the systems are interconnected. The STV compressor j.w. temperature control valve will divert some hot water to the main compressor surge tank and the STV units will receive 120°F make-up water from the main units on level control. The second unusual feature is the immersion heater in the j.w. surge tank set to maintain 150°F temperature. The objective of this feature is to insure that cold compressor cylinders do not cause the heavy, wet inlet gas at 140°F to condense on any cylinder part. The immersion heater would be used only during times of extended shut-down periods.

The distance piece blanket and vent system is unusual. Two objectives are accomplished: first, the toxic gas is vented to STV suction and not to the atmosphere; and second, a sweet gas blanket on the frame-side compartment insures no air leakage into the STV stream. In addition, the rod is equipped with an oil flinger and is long enough that there will be no over-travel into the crankcase of any part that has been in contact with sour gas. The sweet gas blanket of 1.0 psig will be supplied to all compressors by one two-stage regulating station located on the STV Compressor skid.

b) Sales-Injection Compressors

The lube oil system for the large compressors will be exactly like that on the small compressors except for sizes. The blanket gas and vent for the double distance pieces of the compressors will be identical to the STV system. The supply of sweet gas will come from the one two-stage regulator station located on the STV Compressor skid, and the vents of all compressors are connected to the STV Compressor Suction Scrubber.

The jacket water system on the Sales-Injection Compressors is identical except for size and the fact that an air cooler section is provided for each of the large compressor units. Manually operated louvers will prevent too much cooling, and an immersion electric heater is provided in one of the two stand pipes to maintain heat during long downtimes. The standpipes of both large units and their pumps are so manifolded that one pump can circulate a side stream of warm water through the other unit when the second unit is down. Also make-up from the platform portable water supply, as well as chemical injection, needs to be connected to only one Compressor unit.

PLATFORM PRODUCTION FACILITIES

LIST OF MAJOR EQUIPMENT

GAS HANDLING AND INJECTION

1.0 STOCK TANK VAPOR COMPRESSOR SKID

1 - 36" O.D. X 10' S to S X 150 psi MWP Suction Scrubber

2 - Cooper-Bessemer, Model EM-2, Horizontal, balanced-opposed process compressors, each with one 21-1/4" dia x 9" stroke x 250 MWP class CHC cast iron compressor cylinder and one 16-1/4" dia X 9" stroke X 400# MWP class CF105 cast iron compressor cylinder, complete with 250 BHP 514 RPM induction motor, 3 phase, 60 cycle, 4160 Volt drivers.

1 - Gauge and instrument panel with pneumatic alarm and shutdowns and annunciation.

2 - Complete sets of suction and discharge pulsation dampers with all interconnecting gas process piping, J.W., Lube oil, vent, and drain piping, valves, instruments, and controls.

2.0 SKID-MOUNTED SALES-INJECTION COMPRESSION - DEHYDRATION PLANT

A. Sales Injection Compression

2 - Packaged Compressor Units, each consisting of:

1 - Cooper-Bessemer, Model FM-5, Horizontal balanced-opposed process compressors mounting cylinders as follows:

1 - 16-1/4" dia X 10-1/2" Stoke X 400#MWP Class CF-105
1 - 11" dia X 10-1/2" Stroke X 1000#MWP Class CD-105
1 - 6-3/4" dia X 10-1/2" Stroke X 1500#MWP Class CC-105
1 - 4-1/2" dia X 10-1/2" Stroke X 3500#MWP Class C-10B-105
1 - 4" dia X 10-1/2" Stroke X 6000#MWP Class C10BF-105

1 - Westinghouse 1750 hp, 450 rpm horizontal synchronous motor, direct connected to compressor shaft, 3-phase 60-cycle, 4160-volt, 0.8 power factor, 1.0 service factor, with direct-connected brushless exciter, class B insulation, NEMA WP II enclosure.

3 - Vertical 10' S to S gas scrubbers as follows:

1 - 36' O.D. X 150#MWP ASME Code constructed and stamped.
1 - 30" O.D. X 400#MWP ASME Code constructed and stamped.
1 - 24" O.D. X 1100# MWP ASME Code constructed and stamped.

1 - Air cooled heat exchanger with 4 gas sections and one jacket water section, approximately 1635 square feet bare tube surface, with two 15 hp electric motor driven fans, for total duty of 5,696 MBtu/Hr.

1 - Gauge and instrument panel with pneumatic alarm and shutdowns and annunciation.

1 - Set of suction and discharge pulsation dampers with all interconnecting process piping, J.W., lube oil, vent, and drain piping, valves, instruments and controls. Two units to be installed initially, and space and connections to be provided for future addition of two identical units.

B. Dehydration

1 - Packaged Triethylene Glycol Dehydration Unit, consisting of:

1 - 36" O.D. X 1100 psig MWP Glycol contactor with 6-bubble cap trays.

2 - 100% capacity Kimray glycol pumps for 4 GPM circulation.

1 - 24" O.D. X 8' S to S vertical, three-phase glycol-condensate-gas flash tank, 150 psig MWP ASME Code constructed and stamped.

1 - 36" O.D. X 1100 psig MWP X 10' S to S glycol contactor overhead scrubber.

1 - PECO series REF-336 glycol filter.

1 - Glycol regeneration unit, approximately 500,000 Btu/Hr capacity, including stripping column, reboiler chamber, surge tank, heat transfer medium reboiler heater, and glycol/glycol heat exchanger.

1 - Set gas process interconnecting piping, and all necessary valves, fittings, instruments and controls.

7.1 SWEET GAS & FUEL GAS

PACKAGED SWEET GAS UNIT

1.0 GENERAL

This specification applies to the design, fabrication and delivery of one (1) packaged, skid-mounted unit, consisting of one (1) 24" diameter x 6'-0" S/S sweet gas scrubber, two (2) fuel gas filter-separators, and associated piping, valves, controllers, control valves and instruments. The packaged unit will be installed in an outdoor, marine exposure on an offshore platform near Santa Barbara, California. The unit shall be suitable for use in a Class 1, Division 1, Group D hazardous area.

2.0 SCOPE OF WORK

Supplier shall provide all labor, equipment and material required to furnish the packaged unit as specified herein, except for any items of material specifically excluded by Humble's request for quotation. The packaged unit shall be designed and fabricated as specified below, and as shown and specified by drawings and other specifications referenced herein.

3.0 SWEET GAS SCRUBBER

3.1 Sweet gas scrubber (V-5) shall be constructed as shown by drawing 084-142. The vessel shall be designed, fabricated, tested and certified in accordance with the ASME Code, latest edition, Section VIII, for 500 psig maximum allowable working pressure at 100°F, with 1/16" (minimum) corrosion allowance.

3.2 All nozzles and shell penetrations shall have full-penetration welds. All welds are subject to radiograph inspection by Humble either before or after delivery. Any defects so detected shall be repaired and reinspected at supplier's expense.

4.0 FUEL GAS FILTER-SEPARATORS

These items shall be as specified by Specification 10-084-F1.

5.0 SKID BASE

Scrubber (V-5), filter-separators, and associated piping, valves and instruments shall be mounted on a structural steel skid base as shown by drawing 084-167. Fabrication of the skid base shall comply with applicable sections of the AISC Manual of Steel Construction. All joints and seams shall be solidly welded. Open areas of top surface of skid shall be covered with non-skid floor plate; with all seams seal-welded to prevent leakage of fluids. All rough surfaces shall be ground smooth, and all edges and corners shall be ground to 1/8" (minimum) radius.

6.0 PIPING, VALVES AND INSTRUMENTS

6.1 Piping, valves and instruments shall be installed in accordance with Drawing 084-121 and as shown by drawing 084-167. Valves shall be as shown thereon. Meter tube and transducers shall be furnished and installed in accordance with Specification 10-084-SGM-1. Other instruments and controls shall be as specified on Specification Data Sheets 084-SGU-J1 (4 sheets), and shall be installed and connected as specified and shown by Drawing 084-173. Instrument tubing shall be neatly run, plumb and square. Long runs shall be continuously supported in steel channel or firmly clamped to piping runs.

6.2 Piping shall comply with Class A and Class B Piping Specifications 10-084-A and 10-084-B, as applicable. Piping fabrication shall comply with American Standard Code for Pressure Piping ASA B31.3, Section V and Section VI. All welds are subject to radiograph inspection at Humble's expense, in accordance with ASME Code, latest edition, Section VIII, par. UW-51. Any defects so detected shall be repaired and reinspected at supplier's expense.

6.3 Supplier shall provide and install pipe supports at locations shown on the drawings. Pipe supports shall be rigid, welded or bolted steel attachments from skid base or vessels. Attachment to pipe shall be bolted. Pipe supports shall be capable of withstanding operating loads without deformation or vibration. All seams, crevices or openings shall be completely seal welded and ground smooth.

7.0 PROTECTIVE COATINGS

7.1 All piping, valves and fittings shall be internally coated with Tube-Kote TK21 heat-cured epoxy, 12-15 mils total dry film thickness, or approved equal. Surfaces shall be prepared as required by Specification 10-084-C2. Instrument items shall be internally coated as above, where specified on individual Specification Data Sheets 084-SGU-J1.

7.2 All external metal surfaces shall be prepared and coated in accordance with Specification 10-084-C2, except stainless steel and aluminum items, instrument cases, glass, and nameplates.

7.3 Internal surfaces of the sweet gas scrubber (V-5), including all internal appurtenances and the interior of nozzles out to flange flaces, shall be prepared and coated in accordance with Specification 10-084-C1.

8.0 ELECTRICAL WORK

8.1 The electrical installation shall comply with the requirements of the National Electric Code and the State of California Electrical Safety Orders for an outdoor Class 1, Division 1, Group D hazardous area. Where these codes differ, the more stringent shall apply.

8.2 Conduit, fittings and junction boxes shall be installed and connected to electrical devices as shown and specified on Drawing 084-172. Conduit shall be aluminum with a maximum copper content of 0.4%. Junction boxes, seals, unions and other fittings shall have a maximum copper content of 0.4%. All other materials shall be selected for best service in an outdoor, marine exposure.

8.3 Conduit shall be installed and supported in accordance with the specified codes. Changes in direction shall be made with bends or cast metal fittings. Bends shall be made with an approved conduit bender. Completed raceways shall be unrestricted, with all ends reamed, burrs removed, and free of metal particles or other foreign material. Seals shall be left unfilled. All threaded connections shall be made up tight with white lead.

9.0 SHIPMENT AND DELIVERY

9.1 Vessels and piping shall be completely dried internally, charged with sufficient dessicant to maintain dryness, and have all openings plugged or sealed prior to shipment. Instruments shall be dismounted and separately packed.

9.2 Unit shall be cribbed and braced to prevent impact damage, vibration or strain of any component during shipment and handling. Exposed flange faces shall be protected from impact damage with full-face covers. All exposed surfaces shall be protected from deterioration by coverings of weather-resistant, waterproof material.

9.3 All shipping containers shall be piece-marked and tagged "sweet gas unit".

9.4 Any damage incurred during shipment shall be repaired by supplier at his expense.

9.5 Delivery shall be made fob carrier at the destination specified in Humble's request for quotation.

10.0 BASIS FOR BIDS

Bidders shall quote a firm, lump sum price for the complete packaged unit as specified herein, fob carrier at the specified destination. Bids shall state any and all proposed exceptions or deviations from these specifications.

11.0 INFORMATION REQUIRED

Supplier shall furnish six (6) copies of fully dimensioned fabrication drawings, showing all functional details and certified to be correct for construction, at least six weeks prior to shipment.

12.0 GUARANTEE

Supplier shall guarantee all items to meet these specifications and to be free of defects in material or workmanship, for a period of 12 months from first service date.

13.0 APPLICABLE SPECIFICATIONS AND DRAWINGS

13.1 Specifications

10-084-F1	Fuel Gas Filters F1A & F1B
10-084-SGM-1	Sweet Gas Production Digital Gas Measurement Equipment
084-SGU-J1	Specification Data Sheets
10-084-A	Class A Piping
10-084-B	Class B Piping
10-084-C1	Coating Systems for Water Handling
10-084-C2	Application of Coatings to External Surfaces

13.2 Drawings

084-121	Piping and Instrumentation Diagram, Sweet Gas System
084-142	Sweet Gas Scrubber (V-5)
084-167	Sweet Gas Scrubber and Filters, Piping Plan andSections
084-172	Electrical Details, Equipment Packages
084-173	Instrumentation Details, Equipment Packages

SPECIFICATION

FUEL GAS FILTERS F1A & F1B

(two req'd)

1.0 GENERAL

This specification applies to the purchase of two fuel gas filter-separators for use in fuel gas systems to gas turbines on an off-shore platform. The units are exposed externally to wet salt air atmosphere.

2.0 DESIGN CONDITIONS

The filter separators shall each be capable of handling 1.5 MMSCFD of 0.70 sp. gr. gas at 140 psig operating pressure. The normal gas rate is approximately 660 MSCFD. The units shall be designed for 200 psig at 220°F with 1/16" corrosion allowance. The units shall remove 98.0% of all liquid particles one micron and larger with an overall removal efficiency of 99.9% when operated within 10% to 100% of the rated capacity.

3.0 CONSTRUCTION

The units shall be constructed and certified in accordance with ASME Code, Section VIII.

The units shall be PECO Series 85-2-FG36 (or approved equal). The gauge glasses shall be Daniel TL (steel body) with 3/4 XXH nipples and 3/4" Daniel IS steel gage valves.

Furnish and pipe Ashcroft 4½" - 1279 RT (or approved equal) pressure gage on each filter to determine pressure drop through the unit. All fittings and pipe to be steel. Pipe to be Schedule 80. Tubing to be.035 wall stainless steel with Imperial Hi-Seal (or equal) stainless steel fittings. Valves to be Dragon 5507 or approved equal.

All steel external surfaces shall be coated in accordance with Specification 10-084-C2.

4.0 SPARE ELEMENTS & GASKETS

Two complete sets of spare filter elements for each unit shall be furnished complete with new gaskets for the closure.

5.0 DRAWINGS & PARTS LIST

Furnish 6 copies of certified construction drawings and sectional drawings showing internals and identifying all parts with a parts list. These data to be supplied to Humble within two weeks of order date.

6.0 GUARANTEE

The supplier and the manufacturer shall guarantee the equipment to comply with these Specifications and to be free of defects in material and workmanship for a period of 12 months from first service date. Substandard or defective equipment will be replaced or improved to meet these specifications at no cost to Humble.

7.0 SHIPMENT

Manufacturer to be responsible for packaging, shipment and safe arrival of all items at location stated on the "Request for Quotation".

SPECIFICATION
SWEET GAS PRODUCTION
DIGITAL GAS MEASUREMENT
EQUIPMENT

1.0 GENERAL

This specification applies to the purchase of equipment for use on an off-shore platform. The meter is to be on a packaged skid mounted module. Flow element and transducers are to be mounted on the skids which are located in a Class 1, Division 1 hazardous location. The flow computer is to be located approximately 100 feet away in a purged control room classified as non-hazardous. Equipment on the skid is to be continuously exposed to wet salt air atmosphere.

2.0 EQUIPMENT

2.1 The following equipment will be utilized at the skid:

(1) Meter Tube (1 required)

(a) One tube unit is to be Daniel 4" Senior Flangnek meter tube with ASA 300# RF flanged ends. The meter tube to be equipped with straightening vanes. The meter tube to be designed for 720 psig at 100°F. **The meter tube shall be standard bore 4" with an overall length of 6'-8". The A dimension is 5 feet 7 inches; the B dimension 1 foot 7 inches; the C dimension is 2 feet 5 inches. These are AGA Standard for 0.75 Beta ratio with two elbows in 90° planes.**

Straightening vanes to be line model type 304SS, catalog 1103L, type II. Provide two ½" and one 3/4" NPT connection for static pressure, temperature and sample connections.

Furnish with 2.250" orifice plate designed to handle 5.85 MMSCFD of 0.70 sp. gravity gas at 350 psig with 0-100" range at 60°F.

(b) Differential Pressure Transducers

(1) Single Range (1 required)
Foxboro E-13 with 5000 psi working pressure stainless steel housing, 0-100" WC range. All wetted parts to be corrosion resistant to sour gas, bellows to be stainless steel. Electrical housing to be explosion proof Class 1, Group D. **Unit to have 10-50 ma output signal with 45 VDC supply.**

(2) Static Pressure Transducers (1 required)
Daniel Model 1209. The range shall be 0-500 psig range. The transducer shall have a stainless steel bourdon tube. All wetted pressure parts to be stainless steel. Electrical housing to be explosion proof for Class 1, Group D. The unit to have 4 to 20 ma output with a 45VDC supply.

(3) Temperature Transducers (1 required)
Temperature transducers to be Daniel Model 1204 with 0-120°F range. Furnish type 304 ss thermowell for 3/4" NPT connection for 8" IPS meter tube. Coordinate current range with other transducers listed herein. Electrical housing to be Class 1, Group D explosion proof.

(4) Furnish pipe mounts and stainless steel valves and stainless steel tubing manifold to mount and connect all transducers to the meter tube. The flow computers will be mounted in a control panel.

2.2 The following equipment will be utilized by mounting it in a control panel located in a weathertight purge room classified as non-hazardous.

(1) Flow computer and readout (1 required)
Daniel Model 1272M Wide Range Flow Computer, for flush panel mounting. Each unit to be supplied with mercury wetted transmitter to transmit one pulse per 100 SCF of gas; furnish with divide switch if necessary.

3.0 DRAWINGS AND TECHNICAL DATA

Supplier to furnish, within 14 days of order date, 6 copies of the following:

(1) Outline dimensional drawing all items with recommended panel cut out where applicable.

(2) Electrical connection diagram all items.

(3) Circuit diagrams all items.

(4) Installation, operating and maintenance instructions.

(5) Parts List.

4.0 SERVICE ENGINEER

The supplier as a part of the purchase price shall furnish one day for each test unit of a qualified service engineer at the jobsite to check out and initially operate the equipment.

5.0 GUARANTEE

Supplier and manufacturer to guarantee that all items will meet this specification and specifications in the manufacturers published catalogs. They shall guarantee the equipment to be free of defects in material and workmanship for a period of 12 months after first service date. The guarantee shall fully cover field or factory costs due to defects.

Tag all items FR13.

Addendum: All items of this equipment shall be furnished and coordinated by manufacturer of the flow computer. Packaging contractor shall not purchase individual items for this assembly.

SPECIFICATION

FUEL GAS HEATER

1.0 GENERAL:

This specification applies to the purchase of one fuel gas heat exchanger in accordance with sheet 2 of this specification. The unit shall be a Brown Fintube 51-1E-000-010 or approved equal. The unit shall comply with the requirements of the attached data sheet Specification 10-084-FGHE. Furnish outline drawing and completed data sheet with the proposal.

2.0 SHIPMENT:

Supplier to package and ship to destination specified in the Request for Quotation.

3.0 GUARANTEE:

Supplier to guarantee the unit to be free from defects in workmanship and material for 12 months after first service date.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET 2 OF 2

SPECIFICATION — HEAT EXCHANGER — 10-084-FGHE — REV.

JOB NO

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION

SERVICE OF UNIT FUEL GAS HEATER — ITEM No E3

SIZE — TYPE — CONNECTED IN

SURFACE UNIT — NET SQ FT — SHELLS UNIT — SURFACE SHELL — NET SQ FT

PERFORMANCE OF ONE UNIT

		SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED		FUEL GAS		THERMINOL FR-1	
TOTAL FLUID ENTERING	# HR	2200		280	
TOTAL VAPOR	# HR	2200			
TOTAL LIQUID	# HR			283 (0.43 G.P.M.)	
TOTAL STEAM	# HR				
TOTAL NON CONDENSABLES	# HR				
FLUID VAPORIZED OR CONDENSED	# HR				
STEAM CONDENSED	# HR				
GRAVITY SP. GR.		0.70	API	1.29 @ 375°F	API
VISCOSITY LIQUID			CP F	1.16	CP 375 °F
MOLECULAR WEIGHT VAPORS		20			
SPECIFIC HEAT LIQUIDS		0.60	BTU #	.312	BTU #
LATENT HEAT VAPORS			BTU #		BTU #
TEMPERATURE IN		60	°F	500	°F
TEMPERATURE OUT		80	°F	250	°F
OPERATING PRESSURE		150	PSIG	50	PSIG
NUMBER OF PASSES					
VELOCITY			FT SEC		FT SEC
PRESSURE DROP	CALC	PROPOSED	PSI	CALC PROPOSED	PSI
DESIGN VISCOSITY CENTIPOISES		Cp @	F	Cp @	°F

HEAT EXCHANGED B.T.U. HR 22,000 — M T D (CORRECTED)

TRANSFER RATE SERVICE CLEAN — FOULING RESISTANCE

CONSTRUCTION

DESIGN PRESSURE	200	# SQ IN	150	# SQ IN
TEST PRESSURE	300	# SQ IN	275	# SQ IN
DESIGN TEMPERATURE	300	F	600	°F

TUBES — N — O D — BWG — MIN AVE — LENGTH — PITCH

SHELL — D O D — THICKNESS

SHELL COVER — FLOATING HEAD COVER

CHANNEL — CHANNEL COVER

TUBE SHEETS STATIONARY — FLOATING

BAFFLES CROSS — TYPE — THICKNESS — SPACING

BAFFLE LONG — TYPE — THICKNESS

TUBE SUPPORTS — THICKNESS

GASKETS

CONNECTIONS SHELL IN — OUT — SERIES

CHANNEL IN — OUT — SERIES

CORROSION ALLOWANCE SHELL SIDE — TUBE SIDE

CODE REQUIREMENTS API ASME — TEMA CLASS — CUST SPEC

WEIGHTS EACH SHELL — BUNDLE — FULL OF WATER

NOTE. INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S R) AND WHETHER RADIOGRAPHED (X-R)

REMARKS USE BROWN FINTUBE 51-1E-000-010 10.3 FT²
FURNISH CERTIFIED DRAWING

DATE

BY

CHECKED

ENGINEER

PROJ ENG

DATE

BY

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___ REV

SPECIFICATION **PRESSURE INSTRUMENTS**

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PC 334 △		PC 335 △		PSH 346 △		PI-347 △	
MAKE OR APPROVED EQUAL	FISHER		FISHER		CUSTOM COMPONENTS		WIKA	
TYPE	WIZARD		WIZARD		PRESSURE SWITCH		PRESSURE GAGE	
MODEL	4150		4150		606-GCRW-5		233	
MOUNTING / LOCATION	ON PCV 334		ON PCV 335		SURFACE		½" MPT	BOTTOM
INDICATING OR RECORDING	—		—		—		IND.	
NORMAL PRESSURE @ TEMP	350	60°F	150	60°F	350	60°F	350	60°F
PRESSURE ELEMENT RANGE	0 - 600		0 - 300		INCREASING 350 - 725		0 - 600	
PRESSURE ELEMENT TYPE AND MATERIAL	BOUR	316SS	BOUR	316SS	DIA	347SS	BOUR	316SS
REQUIRED SUPPRESSION	—		—					
THROTTLING RANGE	0-10 0-100%		0-10% 0-100%		CLASS 1 GP. D EXPL PROOF ENCL. DEAD BAND 65 PSI ± 30		4" DIAL	
AUTOMATIC RESET	NO		NO					
RATE ACTION	NO		NO					
AIR FILTER & REDUCER	YES		YES					
MANUAL CONTROL BYPASS	—		—					
CHART SIZE / NO	—	—	—	—				
CHART DRIVE / REVOLUTION	—	—	—	—				
INDICATING SCALE RANGE	—							
AS PRESSURE INCREASES OUTPUT SIGNAL	INCREASES		DECREASES		CONTACTS OPEN			
LOCATION OF PRESSURE TAP	—		—					
PULSATION DAMPENER	NO		NO					
SPECIAL CONSTRUCTION & NOTES	MOUNT ON ¢ PIPE TO CONTROL VALVE WITH 304SS TUBING & FITTINGS		MOUNT ON ¢ PIPE TO CONTROL VALVE WITH 304SS TUBING & FITTINGS		SET AT 400 PSIG		GLYCERIN FILLED	
OPERATES WITH	PCV-334		PCV-335					
SERVICE	BACK PRESSURE SWEET GAS SYSTEM		PRESSURE RED. TO FUEL GAS SYSTEM		SWEET GAS SCRUBBER V-5		SWEET GAS SCRUBBER V-5	
PLANT NO								
PURCHASE ORDER NO								

DATE

BY

CHECKED

ENGINEER

PROJ ENG

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION

RELIEF VALVES

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO			PSV18 △		RD 19 △		PSV 20 △	△
MAKE OR APPROVED EQUAL			CROSBY		CONTINENTAL DISC. CORP		CROSBY	
TYPE			JB-35		RUPTURE DISC. ASSY		JB-25	
MODEL			1½" G 2½		KBA ASSY #7		1½ H 3	
BODY MATERIAL			STL.		316 SS		STL.	
PIPE SIZE	IN	OUT	1½"	2½"	1½"	1½"	1½"	3"
CONNECTIONS	IN	OUT	300# RF	150# RF	300# RF	300# RF	150# RF	150# RF
TRIM MATERIAL	SPRING		SS	STL	316 SS		SS	STL
LIFTING GEAR	GAG		NO				NO	
CALCULATED ORIFICE AREA SQ IN			0.38				0.56	
SELECTED ORIFICE AREA & LETTER			0.503	G			0.785	H
DESIGN PRESSURE OF ASSOCIATED EQUIP. PSIG			500		500		275	
OPERATING PRESSURE OF ASSOCIATED EQUIP			350		350		150	
RELIEVING PRESSURE PSIG			460		500		275	
BACK PRESSURE PSIG			Ø		Ø		Ø	
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			460		500		275	
FLOW TEMPERATURE °F			60°F		60°F		60°F	
MW OR S G AT FLOW TEMP			0.70		0.70		0.70	
DESIGN CAPACITY MAX	GPM							
	SCFH							
	# HR		12,000		12,000		11,000	
BASIS OF SELECTION			GAS INPUT		GAS INPUT		GAS INPUT	
VESSEL AREA EXPOSED TO FIRE			—					
COMMODITY			SWEET GAS		SWEET GAS		SWEET GAS	
OVER PRESSURE			10%		10%		10%	
SPECIAL CONSTRUCTION & NOTES								
SERVICE			SWEET GAS SCRUBBER		SWEET GAS SCRUBBER		FUEL GAS SYSTEM	
LINE OR VESSEL NO			V-5		V-5			
PLANT NO								
PURCHASE ORDER NO								

DATE

BY

CHECKED

ENGINEER

PR. ENG

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

REV

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LC-144 △		LSH-145△		LSL-145A△			△
MAKE OR APPROVED EQUAL		FISHER		FISHER					
TYPE		2500		2800					
MODEL		259B		252V					
MOUNTING		F4 (FLG)		FLG.					
INDICATING OR RECORDING		—		—					
INTERFACE OR LEVEL		LEVEL		LEVEL					
COMMODITY		GAS COND.		GAS COND.					
SPECIFIC GRAVITY AT 60°		0.70		0.70					
OPERATING PRESS.	TEMP	350	60°F	350	60°F	SAME AS LSH-145			
MINIMUM DESIGN PRESS.	TEMP	500	100°F	500	100°F				
BODY MATERIAL		STL.		STL.					
CONNECTIONS		1½"-300# RF		4"-300# RF					
FINS REQUIRED		—		—					
FLOAT MATERIAL	SIZE	S.S.	3"×14"	S.S.	3"×10"				
PILOT-RIGHT OR LEFT HAND		(LATER)							
THROTTLING RANGE		0-10 0-100%							
AUTOMATIC RESET		NO							
AIR FILTER & REDUCER		YES							
MANUAL CONTROL BYPASS		—							
CHART NO	SIZE	—	—						
CHART DRIVE	REVOLUTIONS	—	—						
AS LEVEL RISES CONTROL PRESSURE		INCREASES		CONTACTS OPEN					
SPECIAL CONSTRUCTION & NOTES		3-15 PSI BOURDON TUBE		S.P.D.T. EXPL. PROOF					
OPERATES WITH		LCV 144							
SERVICE		SWEET GAS SCRUBBER		SWEET GAS SCRUBBER		SWEET GAS SCRUBBER			
VESSEL NO		V-5		V-5		V-5			
PLANT NO									
PURCHASE ORDER NO									

APPROVED

BY DATE

DATE

BY

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ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS–BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___ REV.

SPECIFICATION — CONTROL VALVES

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LCV-144△		PCV 334△		PCV 335△		TCV 224△
MAKE OR APPROVED EQUAL		FISHER		FISHER		FISHER		LESLIE
TYPE		125 P		667 ED		125 P		DIAR OPER. NEEDLE VA.
MODEL						WITH "D" BODY		DOS
SIZE	TYPE CONNECTIONS	1"	SCR.	1½"	FLG.	2"	FLG.	½" SCD.
BODY MATERIAL	RATING	STL.	3000#	STL.	300# RF	STL.	300# RF	STL. 1180# 500°
INNER VALVE TRIM MAT'L		S.S.				S.S.		S.S.
INNER VALVE SIZE	TYPE	½" OR	TAPER	1⅞	EQ %	¾	MICRO FORM	¼" OR NDLE
TOP WORKS		SIZE 4		SIZE 34		SIZE 40		STD. FOR 3-15 PSI
FINS		—		—		—		
POSITIONER	BOOSTER RELAY	—	—	—	—			
POSITIONER BYPASS	W/GAGES	—	—	—	—			
AIR FILTER & REDUCER		—		—				
COMMODITY		GASO. COND.		NAT. GAS		NAT. GAS		PROPANE FOR THERMINOL
FLOW TEMPERATURE °F		60°F		60°F		60°F		500°F
PRESSURE PSIG	IN / OUT	325	10	350	300	325	150	50 25
SPEC GRAVITY H_2O = 1.0	@ 60°F / @ FLOW TEMP	.70	60°	0.70	60°	0.70	60°	
SPEC GRAVITY @ 60° AIR = 1.0	@ 60°F / @ FLOW TEMP							
GPM @ 60°	NORM FLOW / MAX CAP		50					0.5
SCF HR	NORM FLOW / MAX CAP.				208M		835M	
# HR	NORM FLOW / MAX CAP				11,000		4400	
VALVE POSITION ON AIR FAILURE		CLOSES		CLOSES		CLOSES		
Cv	CALC. / ACT.	1.2 / 5.03		CALC. 846 / ACT. 1160		CALC. 110 / ACT. 410		CALC. 0.10 / ACT. 0.16
SPECIAL CONSTRUCTION & NOTES				3-15 psi SPRING				3-15 psi SPRIN
OPERATES WITH		LC-144		PC 334		PC 335		TC 224
SERVICE		SWEET GAS SCRUBBER V-5		SPILL VALVE SWEET GAS TO 500# COMPR. SUCTION		PRESS. RED. VALVE FOR FUEL GAS		THERMINOL TO FUEL GAS HEATER
LINE NO								
PLANT NO								
PURCHASE ORDER NO.								

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SHEET OF

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. 10-084

PLANT LOCATION

INSTALLATION TAG	PSL 346 △	△	△	△
MAKE OR APPROVED EQUAL	CUSTOM COMPONENTS			
TYPE	PRESS. SWITCH			
MODEL	6006-GCRW-4			
MOUNTING LOCATION	SURFACE			
INDICATING OR RECORDING	—			
DESIGN PRESSURE TEMP	250-350 60°F			
MEASURED PRESSURE RANGE	125-350 DECREASING			
MEASUREMENT FLUID AND MATERIAL	DIA. 347 S.S.			
PRESSURE SETTINGS	FACTORY SET AT 225 psi			
PRESSURE RANGE				
ALTERNATE POINT				
LOCATION				
ALTERNATE SENSOR				
MAIN FLUID BYPASS				
INSTRUMENT SIZE				
CHART DRIVE REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL	CONTACTS CLOSE			
ACTION AT PRESSURE				
ALARM COMPONENT	NO			
SPECIAL CONSTRUCTION NOTES	DEAD BAND 40±25 psi 4500 psi-PROOF ENCLOSURE			
OPERATES WITH SIGNAL	SWEET GAS SCRUBBER V-5			

PLANT NO

PURCHASE ORDER NO

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SHEET ____ OF ____

SPECIFICATION

TEMPERATURE INSTRUMENTS

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	TI-210 △	△	TC-224 △	△
MAKE OR APPROVED EQUAL	WESTON		ROBERTSHAW	
TYPE	BI-METAL	BI-METAL	PNEUMATIC	
MODEL	4500		DT 150 A11	
MOUNTING	1/2" MPT BACK		SURFACE	
INDICATING OR RECORDING				
STEM LENGTH	6"			
DIAL SIZE	5" S.S.			
TEMPERATURE RANGE	0-200°F		0-200°F	
THROTTLING RANGE			YES	
AUTOMATIC RESET			NO	
RATE ACTION			NO	
AIR FILTER & REDUCER			YES	
MANUAL CONTROL BYPASS			YES	
CHART SIZE NUMBER				
CHART DRIVE REVOLUTIONS				
NUMBER OF POINTS	316 SS 3/4" MPT		316 SS 3/4" MPT	
THERMOWELL	WESTON NO. 96133-124		SPIRAL BOURD CL. 1B	
ELEVATION OF BULB ABOVE INSTRUMENT				
TUBING MATERIAL & LENGTH			TYPE 316 SS 15 FT.	
TUBING COMPENSATION			NO	
AS TEMPERATURE RISES OUTPUT SIGNAL			INCREASES	
SPECIAL CONSTRUCTION & NOTES			3-15 PSI OUTPUT	
OPERATES WITH			TCV-224	
SERVICE	FUEL GAS OUTLET FROM E3 FUELGAS HEATER		GAS TEMP. OUT OF E3	
PRIMARY ELEMENT LOCATION				
PLANT NO				
PURCHASE ORDER NO				

REV — BY — DATE

DATE

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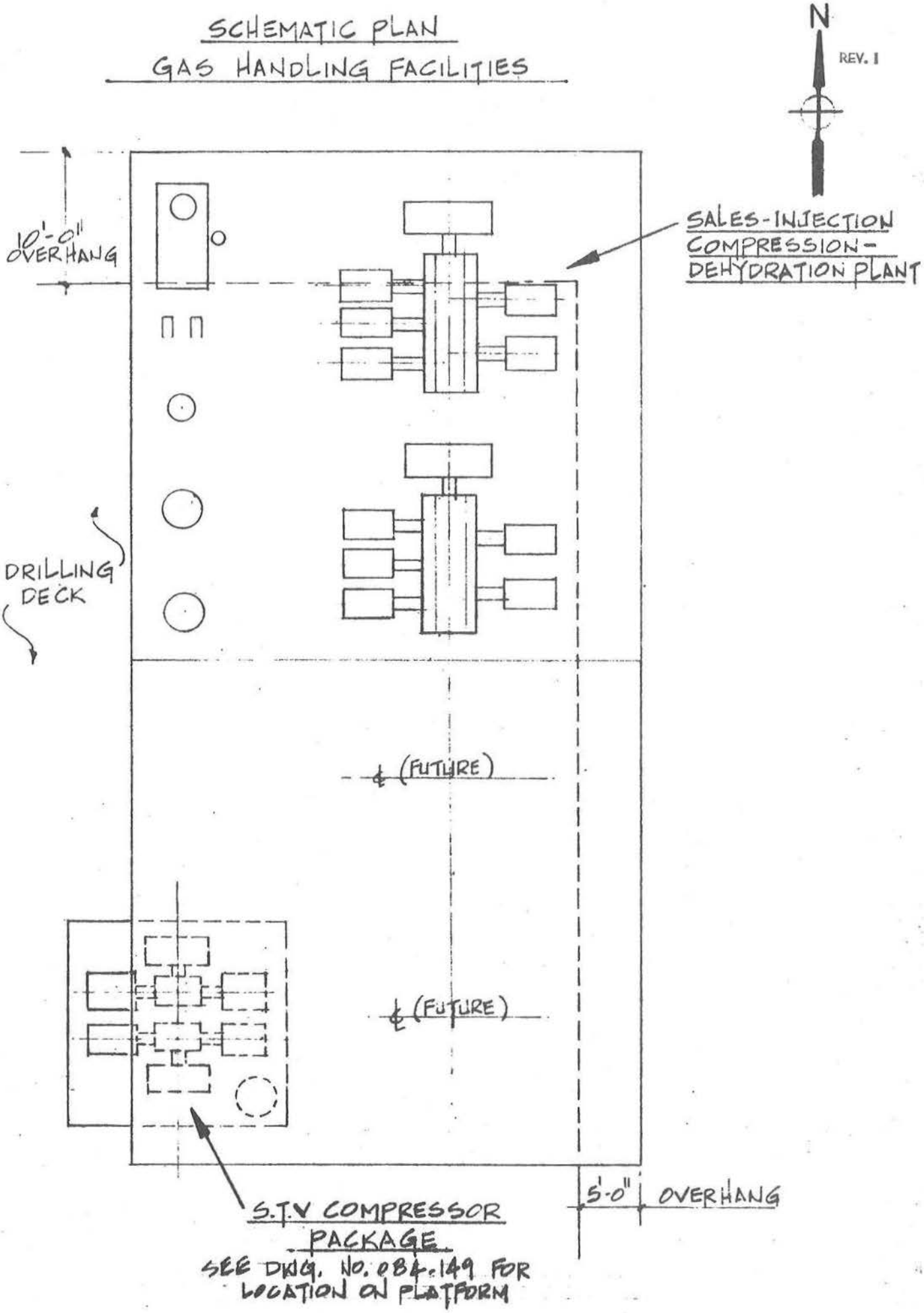
7.21 SALES-INJECTION PLANT

SCHEMATIC PLAN
GAS HANDLING FACILITIES



SPECIFICATIONS FOR PACKAGED

SALES-INJECTION COMPRESSION AND DEHYDRATION PLANT

INTRODUCTION

This specification and the plans and specifications referenced herein describe the work and material by the Contractor. The work includes furnishing all equipment and material except those specifically stated as furnished by others in the request for quotation by Humble Oil and Refining Co. The packaged plant shall consist of two identical 1750 horsepower direct-connected electric motor driven horizontal balanced-opposed five-stage compressor units, with provisions for future addition of a third and fourth identical unit, and a glycol dehydration unit, all to be mounted on a common skid arranged for a single hook, four-point lift by a derrick barge crane for offshore platform installation. The package plant is to be completely assembled and tested prior to shipment. Delivery of the skid-mounted packaged plant shall be made f.o.b. barge at jobsite location stated in Humble's request for quotation.

DESIGN CONSTRAINTS

1. The equipment is to be installed by Humble on an off-shore oil drilling and production platform and will be continuously exposed to a wet salt air atmosphere.

2. The process design and control features shall be so arranged that no mode of operation of these units or any inter-related operating equipment shall be allowed which requires the continuous venting or flaring of gas. The gas to be handled is toxic and corrosive, containing as much as 2% H_2S and 6% CO_2 and is water saturated at 135°F and 14.7 psia for the stock tank vapor stream and 140°F and 100 psia for the sour gas inlet stream. Provisions shall be made so that all normal operating leakage of sour gas shall be contained. No air entrainment into the sour gas streams can be tolerated. The paramount consideration for design guidelines shall be safety to personnel and protection for the environment. To this end redundant shut-downs and alarms and fail-safe operation shall be provided in the design.

3. Oil and gas production will be curtailed to the extent necessary to match the capacity of the compressors in this service, and for this reason the basic approach shall be to adhere to proven and conservatively designed equipment with field proven operating reliability and good maintainability.

4. Electric power for driving the compressors will be purchased, and an economic incentive exists to provide the means to unload the compressors to the extent permitted by the available gas production.

5. **The completed package will be allotted deck area shown on Drawing 084-149; height restrictions, structural support, etc. are also shown on Drawing 084-149.**

6. The completely assembled skid shall be designed to withstand a 20% seismic force.

7. To indicate style or quality required, reference may be made to specific manufacturer's products; however, products of equal or better quality may be offered, subject to Humble approval.

8. Unless otherwise specified, compressor equipment and unit design shall conform with API Standard 618 (latest edition), and the "Special Provisions" section of the attached specification contain amplifications, modifications or deletions to the API specification with the numbered paragraphs conforming to the paragraph numbers of that standard. Where additions are required, the new paragraphs are inserted in the appropriate section in alphabetical order.

9. A separate "Special Provisions" section, covering the Dehydration Unit equipment included in the packaged plant has been prepared and follows the Compressor Special Provisions.

10. The following "Special Provisions" make reference to "General Specifications" section, attached, including the following:

    Pressure Vessels
    Heat Exchangers
    Instruments and Controls
    Piping and Fabrication
    Buildings and Structures
    Electrical
    Insulation, Coatings and Miscellaneous
    Testing and Cleaning

    Should there be a difference between the "Special Provisions" and the "General Specifications", the "Special Provisions" shall govern.

SALES - INJECTION

COMPRESSOR SPECIFICATIONS

SPECIAL PROVISIONS

(See API Standard 618)

Section 1 - General

1. SCOPE

a) The facility covered by these Special Provisions includes the compression part of the larger, completely integrated packaged compression and dehydration plant, and will consist of two identical 1750 hp electric motor driven, five-stage, horizontal balanced-opposed compressors; suction, interstage and discharge scrubbers and coolers; all interconnecting process piping including suction and discharge pulsation bottles, with flanged connections to all external piping tie-ins brought to skid limit; crankcase lubricating oil system with barrel rack bulk storage; cylinder and rod mechanical lubricating oil system; compressor cylinder and lube oil cooler jacket water system; special distance piece vent and blanket gas system, including a sweet gas purge system for maintenance; a gauge board and pneumatic annunciator panel; and all other necessary accessories and appurtenances; all installed on a structural steel base as a unit with a shed-type building having partial walls on the two outside walls and containing a traveling crane hoisting system above the compressors and motor drivers.

b) The total packaged plant shall be designed for a single hook, four-point lift, and field tie-ins to be made to the following connections:

A. Surge Tank Vapor Compressor Discharge
B. Sour Gas Supply Line
C. Sweet Gas Supply Line
D. Injection Well Connection
E. Liquid dump line to surge tanks
F. Purge gas line to STV compressor suction scrubber
G. Liquid dump line to sour gas production separators
H. Vent line to flare knockout drum
I. Make-up water line
J. Cold jacket water supply to STV compressor
K. Hot jacket water return from STV compressor
L. Lube oil make-up to STV
M. Instrument air supply
N. Manual emergency shut-down system (loop form, normally pressured)
O. Drain headers to platform oil and water sumps

P. Recycle controller output signals to Central Control Room
Q. Frame lube oil pressure on/off signal to Central Control Room
R. Dehydration unit flash tank vapor line to sour gas separator
S. Dehydration unit still vapor line to water sump
T. Supply and return lines for heating medium to glycol regenerator
U. All electrical tie-ins.

c) Connections between the compressor packages and the dehydration unit shall be furnished prefabricated and assembled as part of the packaged plant and they are listed here for clarity as follows: Sales gas discharge header; contactor residue scrubber vapor line to injection suction header; flash tank condensate line to first stage sales gas suction scrubber dump line; blowdown and relief line to header; drain header line.

d) Flanged connections on all headers shall be provided for future compressor extension on one or both sides depending on where allowance is made for expansion.

e) The rated capacity of each compressor unit shall be 25% of the design operating conditions shown on the attached Data Sheet and the General Process Flow Sheet. Five step minimum unloading shall be provided.

f) Specifications for suction, interstage and discharge scrubbers are listed under Section IV of these Special Provisions and in the General Specifications.

g) Specifications for the shed-type building are listed in these Special Provisions under Section II, paragraph 27, and in the General Specifications.

SECTION II - BASIC DESIGN

6. GENERAL

a) Where practical redundant alarms shall be provided set for lower values than the relieving device set points.

b) Protective devices to prevent damage to the equipment shall be provided and shall include process controls, reliefs, and/or alarms to prevent overload on the electric motor drivers.

c) The compressor manufacturer has the responsibility for the overall design and performance of the compressor, driver, skid and auxiliaries and all other equipment included as part of the package. The unit responsibility for the entire train consisting of the compressor, driver, power transmission, and associated auxiliary equipment shall include, but is not limited to, the following:

Torsional analysis
Selection and rating of power transmission components
Compressor piping analog study
Equipment layout.

The compressor vendor shall resolve all engineering questions or problems related to the equipment design.

d) The resultant of the primary inertial forces, the resultant of the secondary forces, and the couples produced by these forces shall be minimized.

e. Crank shafts shall be manufactured from single forgings.

7. Allowable Speeds:

a) Maximum acceptable average piston speed shall be 900 fpm, and maximum acceptable rotative speed shall be 600 rpm.

10. Compressor Cylinders:

a) Maximum allowable working pressure shall exceed rated discharge pressure by at least 10 percent or 50 psi, whichever is greater.

b) Top discharge shall not be furnished

g) An independent jacket water air-cooled exchanger, circulating pump, and standpipe shall be furnished for each compressor and one of the two standpipes shall be equipped with an immersion type electric heating element sized for maintaining minimum water temperature of 120°F when ambient temperature is 40°F and the compressors are not operating. The standpipes and pumps shall have interconnections so that if one unit is operating and one is down, the operating unit can circulate a sidestream of warm water through the down unit, with the object of maintaining cylinder temperatures above gas dew points at all times.

i) Separate jackets are required for cylinder bodies and for cylinder heads.

j) Special construction is required for sour and corrosive gas service. Copper and copper alloy parts shall not be used. Materials for rings, packing, gaskets, etc., normally made from copper metals, shall be selected by the compressor manufacturer and shall be designated in his proposal. Ferrous metals in contact with the sour gas during normal operation, or on an expected failure, shall have a maximum hardness of Rockwell "C" 20. Where this is not possible due to conditions of wear or stress, the ferrous parts shall be chrome plated for a thickness of 0.005 inch minimum.

k) Compressor cylinders shall be furnished with threaded and plugged ½-inch NPS connections for future use of cylinder analyzers. Connections shall not pass through water jackets (see paragraph h).

l) Cylinders shall be furnished with flushing oil passages in inlet nozzle drilled, tapped and plugged for future installation of a flushing oil system.

m) Compressor cylinders shall be provided with cold supports.

11. Valves:

b) Valve design shall be such that valve assemblies cannot inadvertently be reversed or a suction valve assembly fitted into a discharge port.

12. Pistons:

c) Locking nuts attaching the piston to the piston rod and the rod to the crosshead shall be tightened to the manufacturer's standard, but as a minimum the vendor's tightening procedure must assure a prestress level of twice the operating stress of the rod.

14. Distance Pieces:

a) The primary requirements dictate that 1) no sour gas leakage shall be vented to the atmosphere but must be contained and delivered into the STV inlet at near atmospheric pressure; and 2) no air can be permitted to enter the gas stream because of the presence of CO_2 and water. To meet these conditions the following design is preferred: The cylinders shall be provided with two-compartment distance pieces, (API, Type 3). The outboard compartment shall be vented to the STV suction scrubber and shall be capable of operating at 15 psig. The inboard compartment shall be blanketed with sweet gas at a pressure of 2" Hg and shall be capable of operating at 15 psig. Double wiper rings at the frame diaphragm of the inboard compartment shall be furnished to minimize sweet gas leakage into crankcase.

A single compartment distance piece with length sufficient for no overtravel and equipped with an oil flinger ring, a vented packing with vent to STV suction, a double frame-side wiper ring, and a sweet gas pressure on the compartment may be offered as an alternate provided the arrangement can satisfy the two requirements mentioned above.

15. Stuffing Boxes and Packing:

a) The manufacturer's recommendation is desired.

c) The packing shall be vented, the vent is to be piped to the outside of the distance piece by vendor and connected in a separate line to the closed line to vent.

d) If cooling of rod packing is required, it shall be provided by circulating cylinder jacket water through the packing.

16. Compressor Frame Lubrication:

c) A direct-driven main oil pump is preferred. A separate explosion proof electric motor-driven spare pump, sized for full capacity and equipped for automatic starting, shall be provided. A pressure relief valve shall be included if a positive displacement pump is provided.

d) The spare pump shall be connected so that it can be started manually for pre-lube, shut-down automatically after main oil pump is running, and restarted automatically for post-lube when the compressor is shut down or at loss of main oil pump pressure.

e) Manufacturer's standard edge-type full flow filter, cleanable while in service, may be supplied, provided filtration is 40 microns or finer.

g) If a crankcase lube oil cooler is required, it shall be sized for 120°F cold water supply, 10°F rise, and shall be made using seamless carbon steel tubes 16BWG minimum thickness. A fixed tube sheet design will be accepted provided the channels and covers are flanged and removable.

h) A Ren Model RB-K oil level regulator and slo-flow meter, Ren Model MRA, shall be provided for automatic crankcase make-up. Bulk storage will be furnished from a barrel rack with a permanent distribution header to all compressors and gravity flow.

17. Cylinder and Packing Lubrication:

a) A McCord or Trabon distribution block system with Gerhardt or Trabon diesel injector type pump, flow meter, and pneumatic no-flow shutdown shall be furnished. Oil make-up from the crankcase through a Pall Trinity Micro "Ultipor 0.9" filter with pressure reducing and relief regulators and a Ren RAUB oil level regulator shall be provided.

b) Lube oil injection passages to the cylinder bore by means of pipes or tubes through the water jacket shall not be permitted. The passages must be through the metal provided in the cylinder water jacket casting or weldment.

18. Synthetic Lubrication of Cylinders:

a) The cylinders will not be lubricated by synthetic lubricants.

19. Piping and Connections:

b2) Process piping shall be seamless pipe. Corrosion allowance shall be 0.125 inches minimum. All process piping welds shall be post weld stress relieved and subjected to 100% radiographic inspection. No steel materials shall have minimum yield strengths that exceed 90,000 psi. No copper bearing metals shall be used.

3) The gas in the vapor line between each suction scrubber and the cylinder it connects shall be given approximately 3-5°F superheat by use of the discharge pipe from the same cylinder placed next to, bonded together, and insulated with a short run of the suction vapor line.

19. Piping and Connections (cont'd):

4) A "figure eight" blind shall be installed in the lead lines on the compressor side of and next to the suction and discharge block valves.

5) A water sample connection shall be provided in the bottom of each suction scrubber. A retractable type corrosion coupon test connection shall be provided in the inlet and outlet piping and in the water section of each suction scrubber, in the inlet and vapor outlet lines on the glycol flash tank, in the vapor space of the reboiler chamber, and in the still vapor outlet. Inhibitor injection points shall be provided on the inlet piping to each air cooler and in the lean glycol suction to the circulating pumps.

d2) Cooling water piping on the compressor shall be supplied by vendor.

20. Pulsation Damping:

a) Suction and discharge surge bottles shall be pulsation dampers. As an alternate, fabricator may quote a design, based upon Southwest Research Institute analog study, which will equal the guarantees for pulsation and pressure drop for dampers. Bottle nozzle reinforcement, either saddle or pad, shall be provided in all cases and shall be one schedule heavier than required by code, and weldment details shall be finished as shown on standard drawing GA-146 attached.

b) Pressure drop through pulsation damping equipment shall not exceed 1 percent of the absolute pressure.

d) Pulsation damping equipment for maximum working pressures 1000 psig and below shall be designed and fabricated in accordance with USAS B31.3, Petroleum Refinery Piping Code. For maximum working pressures above 1000 psig the dampers shall be fabricated in accordance with the ASME Code (Div 1) with code stamp applied. In general, suction and discharge bottles should be designed for cylinder maximum allowable working pressure, but in no event should they be designed for less than 10% or 100 psi over maximum cylinder operating pressure. Suction bottles shall have a male-female drain valve, AGCO "H-UVC-44R", installed in every compartment, and discharge bottles shall have drains plugged. Siphon drains are not acceptable for surge bottles.

21. Guards:

b) Guards shall be provided by the compressor vendor and shall be constructed of solid metal sheets according to safety orders of the State of California.

22. Platforms, Stairs, and Railings:

(See General Specification Section, Fabrication).

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26. Air Intake Filters: (not applicable)

27. Weather Protection and Winterization:

a) The equipment is to be installed on an off-shore drilling and production platform and will be continuously exposed to a wet salt air atmosphere. The compressors and drivers will be covered by shed-type building, open on one side and end and closed to 4' above the deck on the other side and end. Construction specifications are found in the General Specifications. The maximum ambient temperature is 85°F and the minimum is 40°F.

SECTION III - CONTROLS AND INSTRUMENTATION

28. General:

a) Controls for shut-down, alarm and control shall be pneumatic when the sensing point is local. Shut-down and control signals originating from remote sensing or actuating points (furnished by others) may be electric or pneumatic and provision shall be made to receive both kinds. Annunciation that a compressor has been shut down shall be by an electric signal from each compressor to a remote panel in the central control room..

b) Instrument and controls shall be furnished, sized, and set for operation in accordance with USGS, OCS Order No. 8

c) All electrical components shall be suitable for Class I, Division II location.

e) Upon signal from Manual Emergency Shut-down System, Combustible Gas Detector System, and Fire Detector System the power operated suction and discharge valves shall close, the equalizing valves shall open, and the blowdown valves to flare shall open. Upon all other shut-downs, manually or automatically initiated, the suction and discharge valves shall close and the equalizing valves shall open, but the blowdown valves to flare shall remain closed. The low level shut-down signal on the suction scrubber shall vent the air signal to the level control valve and shut-down the compressor.

f) Refer to the attached "General Specification, Instruments and Controls", for additional requirements for selection of components and installation features.

29. Capacity Control:

a) Capacity control shall be by suction throttling and make-up, clearance pocket (both head-end and crank-end, if feasible), and suction valve unloading. As many steps as practical are preferred provided the devices will permit safe, long-term operation and do not cause increased maintenance. Suction valve unloading shall be manual, but a simple and reliable automatic system may be proposed as an alternate.

b) Not applicable

c) Clearance pockets shall be the manual, two-position type.

29. Capacity Control (Cont'd):

d) Start up with unloading is preferred. Each compressor shall be equipped with an equalizing line and valve connecting the discharge lead to the suction. This valve and the suction and discharge valves shall be equipped for remote manual operation using the platform 100 psig instrument air system. Shut-down of the compressor shall cause the suction valve to close, equalizing valve to open, and discharge valve to close, iin that sequence and with proper time delay. Upon start-up, without venting the suction and discharge lead lines and bottles, and by manual signal, the valves will be reversed in position and sequence to load the compressor. As an alternate to this system, Vendor may quote a motor driver with full load torque starting characteristics.

30. Instrument Panels:

a) A weatherproof instrument panel shall be furnished and located centrally for each compressor. The type of instruments to be furnished on the panel is covered in the General Specifications. The panels shall include the following:

a. Pressure Gages:

	Panel	Local
STV Discharge Header	x	
Sour Gas Supply Header	x	
Sweet Gas Supply Header	x	
First Stage Suction Scrubber	x	
First Stage Discharge	x	
Second Stage Suction Scrubber		x
Second " Discharge	x	
Third " Discharge	x	
Sales Gas Discharge Scrubber		x
Injection Suction	x	
Injection Interstage	x	
Injection Discharge	x	
Dehydrator Residue Header	x	
Injection Header	x	
J.W. Pump Discharge	x	
L.O. Header Pressure	x	
Instrument Air Supply		x
Utility Air Supply		x

b. Annunciators:

First-Stage Suction Scrubber Hi/Lo SD P	x
" " " " Hi/Lo SD L	x
Second " " " Hi/Lo SD P	x
" " " " Hi/Lo SD L	x
Sales Discharge Scrubber Hi/Lo SD P	x
" " " Hi/Lo SD L	x
High Discharge Temp (each cyl) (5)	x

b. Annunciators (Cont'd):

	Panel	Local
Low Lube Oil Press S.D.	x	
Low Lube Oil Level Alarm/Shutdown	x	
Low J.W. Pressure Shutdown	x	
High J.W. Surge Tank Temperature	x	
Low Oil Level and/or Drive Failure, Mech Lubricator	x	
Excessive Main Bearing Temperatures Alarms/Shutdowns	x	
Excessive Vibration Shut-Down, Compressor	x	
" " " , Cooler Fans(2)	x	
Excessive Rod Packing Temperature Alarm, each cyl.	x	
Manual Emergency Shut-Down	x	
Explosive Gas Detector Alarm & Shutdown	x	
Fire Detector Snut-Down	x	
First Stage Discharge High Press Alarm	x	
Second Stage Discharge High Press Alarm	x	
Injection Interstage High Press Alarm	x	
Injection Discharge " " "	x	

c. Electric Motor Controls:

1. The compressor motor driver shall be equipped with 6 Resistance Temperature Detectors, McGraw-Edison or equal, embedded 60° apart and so connected that excessive temperature will shut-down the motor. One annunciator shall be tripped by any of the RTD signals on each compressor driver.

2. Instead of space heaters a relay with appropriate interlocks shall be provided to impose 24-volts A.C. supply to the motor when it is shut-down. The relay, interlocks, motor starter and switchgear will be furnished by others and installed in the pressurized room housing all switchgear and motor controls.

3. The spare lube oil pump motor shall have a start-stop-automatic switch and be connected so that prelube cycle can be started manually, the main oil pump pressure will stop the spare pump on normal pressure or start it automatically on low pressure, and the spare pump will run in the post lube cycle until manually shut-down.

4. The main motor drivers for the compressor shall have a remote start-stop switch located in the central control room, but a local start-stop switch shall be provided to over-ride the remote signal and prevent unauthorized or accidental remote starting during maintenance work.

d. Controllers:

The recycle pressure controls shall operate the control valves through a valve positioner. The controllers' output signal will be transmitted to a direct reading receiver-recorder located in the central control room furnished and installed by others.

31. Pressure and Temperature Gages:

a) Pressure gages mounted in the Instrument Panels are covered in Paragraph 30, above. Gages mounted locally shall include the following:

Temperatures:	Panel	Local
STV Discharge Cooler Inlet		x
" " " Outlet		x
Sour Gas Supply Inlet		x
" " Precooler Inlet		x
" " " Outlet		x
Sweet Gas Supply Inlet		x
First Stage Suction Scrubber		x
" " " Bottle		x
" " Discharge		x
Sales Gas Intercooler Inlet		x
" " " Outlet		x
Second Stage Suction Scrubber		x
" " " Bottle		x
" " Discharge		x
Third " Suction Bottle		x
" " Discharge		x
Sales Gas Discharge Cooler Inlet		x
" " " " Outlet		x
" " " Scrubber		x
Injection Suction Header		x
" First Stage Suction Bottle		x
" " " Discharge		x
" Second " Suction Bottle		x
" " " Discharge		x
Lube Oil Sump Temperature		x
Lube Oil Cooler Inlet Oil		x
Lube Oil " Outlet Oil		x
Lube Oil Header		x
Lube Oil Cooler Water Inlet		x
Lube Oil " " Outlet		x
J.W. Cooler Inlet		x
" " Outlet		x
Compressor Cyl (each) J.W. Outlet (5)		x
Compressor Cyl J.W. Supply		x

b) Pressure gages shall be OICO, Marshalltown, or equal, liquid filled, flush mounted, range twice operating pressure and at least 1½ times MWP. Bleed valves shall be installed between isolating valves and gages, positioned for installation of test gages.

32. Alarms and Shutdowns:

b) Shutdown devices are required for each annunciated function listed under paragraph 30 above.

33. Tachometers:

A tachometer is not required for the direct-connected constant speed electric motor driver; however, an 18" minimum access space to the crankshaft shall be provided for use of an analyzer speed transducer.

SECTION IV - INTERCOOLERS AND AFTERCOOLERS

35. Construction and Materials:

a) Each compressor unit shall be equipped with an independent horizontal air-cooled heat exchanger unit containing sections for Stock Tank Vapor Discharge Cooler, Sour Gas Precooler, Sales Gas Intercooler, Sales Gas Discharge Cooler, and Jacket Water Cooler. All headers shall be fabricated from steel. Separate headers shall be used for each service and designed with 1/8 inch corrosion allowance. Shoulder type access plugs with bare Armco iron gaskets shall be used for all services. Headers shall be stress relieved and 100 percent radiographically inspected, or magnaflux of welds that cannot be radiographed. Design temperature shall be 350°F or 50°F above rated operating temperature whichever is higher. Tubes shall be seamless steel ASTM Grade 179.
Design and construction shall conform with TEMA Class R. Each cooler unit shall be equipped with two 50% capacity explosion proof electric motor driven fans. Electrical construction this area to be for Class I Division II location otherwise. The Jacket Water and Sales Gas Discharge Cooler sections shall be equipped with manually adjustable louvers. (See "General Specification" section for additional requirements).

b) Not applicable.

c) No condensate pots are required. However, each compressor unit shall be equipped with a Sales Gas Suction Scrubber, a Sales Interstage Scrubber, and a Sales Discharge Scrubber. These vessels may be located on the same elevation with the compressor and motor driver or on the overhead structure containing the air-cooled heat exchanger section. The design and construction of the vessels shall be in accordance with the ASME (Div. 1) Code with stamp applied and each vessel shall be sized as shown on the Mechanical Flow Diagram and equipped as indicated in the Mechanical Flow Diagram and the "General Specification" sections attached.

SECTION V - MATERIALS

36. General:

a) Welded joints on pressure castings (cylinders) shall be completely radiographed, have full penetration and be stress relieved.

g2) (Exception) Cast iron or ductile (nodular) iron castings shall not be repair-welded, peened, burned-in, impregnated or plugged.

j) Fully enclosed cored voids (including voids closed by plugging, but excluding water jackets) are prohibited.

37. Compressor Piston Rods:

(See Para. 10j). Manufacturer's alternate rod and Packing Specifications, based upon his equipment's proven field experience in similar corrosive atmospheres, will be considered.

SECTION VI - DRIVERS

38. General:

a) The drivers shall be direct connected electric motors.

b) The driver size of each compressor shall be 1750 horsepower. The design of the compressor instruments and controls for suction and discharge pressure control shall insure that motor driver cannot be overloaded.

c) Provisions shall be made for barring-over and for mechanically locking the motor rotor, coupling and compressor crankshaft drive train.

39. Motor Drivers:

a) The electric motor drivers shall be slow speed synchronous motors, appropriate RPM, 3 phase, 60 cycle, 4160 volt, 1.0 S.F., 0.8 P.F., Class B insulation, NEMA WP11 enclosure with direct connected brushless exciter, to be furnished with outboard bearing and structural steel skid for stator shift. The motor starting shall be full voltage, with starting torque capabilities sufficient for starting when the compressor cylinders are under pressure at "equalized" pressure and the bypass line is open. The "equalized" pressure will be dependent upon the space volumes contained in the suction, interstage and discharge piping volumes and upon the operating pressures and temperatures, and, for each stage it will be greater than operating suction pressure for that stage. Six resistance temperature detectors shall be embedded 60° apart. The outboard motor bearing shall be pressure lubricated from the frame oil system and it shall be equipped with a high temperature alarm/shut-down and annunciated. The electrical design shall be appropriate for Class I, Division 2 location based on API RP 500. Additional specifications are contained in the "General Specifications".

40, 41, 42. Not applicable.

43. Couplings:

b) Coupling torsional stiffness shall be selected in accordance with requirements determined by the torsional analysis of the entire motor-coupling-crankshaft drive train.

SECTION VII - SHOP INSPECTION

46. General:

a) The term "Inspector" refers to the purchaser's representative. Shop inspection by the inspector shall be required and the hydrostatic, mechanical, and performance tests shall be witnessed.

c) The manufacturer shall furnish the following to the inspector:

1. Physical and chemical data on compressors cylinders (except cast iron) or certification of compliance with a particular manufacturer's or national specification.

2. Evidence, such as purchase specifications or bills of materials, to establish that other critical parts are of specified materials.

3. Requested number of certified copies of hydrostatic and running test record. This shall include performance data for all final tests, including any difficulties.

SECTION VIII - SHOP TESTS

48. Hydrostatic and Pressure Tests:

b) A pressure test with helium is not required.

49. Other Tests:

c) Auxiliary equipment shall be used for the shop tests. No shop running tests for the motor-compressor unit will be required; but all instruments, controls, shut-downs, alarms and annunciator panel shall be thoroughly shop tested to insure proper settings and operation of all functions.

d) Dismantling is not required except where malfunctions are detected during testing.

(Requirements for the following sections will be furnished with Humble's Request for Quotations.)

SECTION IX - PREPARATION FOR SHIPMENT

SECTION X - DRAWINGS AND OTHER DATA

SECTION XI - PROPOSALS

APPENDIX A - CHECK LIST

APPENDIX C - DATA SHEETS

SPECIAL PROVISIONS

SPECIFICATIONS FOR GLYCOL GAS DEHYDRATOR

I. INTRODUCTION

The following specifications cover the dehydration equipment to be included as a part of the total packaged plant for sales-injection compression and dehydration service. The specification for the compression equipment is covered elsewhere in a separate "Special Provisions" Section. All equipment, materials, construction and fabrication details for the dehydration unit are to be in accordance with these "Special Provisions" and the applicable "General Specifications" attached. Should conflicts exist between the "General" and the "Special" specifications, the "Special Provisions" shall govern. Unless otherwise noted, equipment shall conform with applicable portions of the ASME Code for Unfired Pressure Vessels, Section VIII, Division 1; USAS Code for Pressure Piping B31.3; TEMA Standards Class "R" or "C";API Standard 610; and Standards of the Hydraulic Institute. To indicate style or quality, reference will be made to specific manufacturer's products; however, products of equal quality may be offered for Humble approval. A mechanical flow diagram is attached to illustrate general features desired and should not be construed as limiting of fabricator's design.

II. GENERAL

The facility contemplated herein is a totally integrated gas dehydration system with a gas/glycol contactor, contactor residue scrubber, glycol flash tank, pumps for glycol circulation, glycol filter, glycol conditioner and reconcentrator, and heat exchangers for heat conservation and waste heat rejection. The equipment layout must conform to the limited space available for both the compressors and the dehydration equipment. Generally the group including pumps, filter, reconcentrator and heat exchangers can be placed together and should be near the northwest corner of the site in order to be nearest to the heating medium supply and return lines. The second group consisting of the contactor, residue scrubber, and flash tank may be placed as a unit or not as required. In any case the interconnecting piping between items of the dehydration unit and the compressor shall be furnished prefabricated and packaged with all necessary instruments and controls for a complete system with companion flanges and union halves for all lines to be connected to facilities outside the limits of the plant.

III. SERVICE DATA

The rated conditions of operation are shown on the attached General Process Flow Diagram. Stream No. 27 shows both the design quantity and stream composition for the dehydration unit design. Attention is directed to fact that the gas stream to be dehydrated contains about 3.5% CO_2 and 0.4% H_2S and will be both toxic and corrosive. The inlet gas will be water saturated at rated inlet conditions and shall be dehydrated to a water content of not more than 7#/mmscf. The glycol loss shall not exceed 0.1 gal/mmscf. The heating medium (Therminol) will be circulated and heated by others and the supply temperature will be 500°F.

IV. EQUIPMENT SPECIFICATIONS

A. Pressure Vessels

1. Glycol Contactor

a) Design Parameters: The contactor shall have a maximum working pressure of 1100 psig and be designed to dehydrate gas saturated with water at 1010 psia and 100°F to a water content of 7#/mmsef. Lean glycol circulation shall be 4 gal/# of water removed, minimum, and glycol loss shall be guaranteed 0.1 gal/mmscf, maximum. As a minimum, contactor shall be sized according to the following modified Sauders-Brown equation:

$$A = \frac{W}{600 \left[dg(dl-dg)\right]^{\frac{1}{2}}} + A_D$$

where A = Vessel internal cross-section (ft^2)
W = Vapor load (#/hr)
A_D = Downcomer cross section (ft^2)
dg = Gas density at operating P & T (#/ft^3)
dl = Liquid density at " " " (")

b) Construction: The contactor shall be constructed in conformance with the ASME Code, Div. 1, with stamp applied and shall contain a minimum of six bubble cap trays on 24" centers with a vane or mesh pad mist eliminator. A 16" davited manway and internal manways shall be provided. The bottom section shall be large enough below the inlet gas nozzle to contain the full volume of glycol contained on the contacting trays, and the space between the top tray and mist eliminator shall be 36" minimum.

c) Equipment: The contactor shall be equipped with a full capacity spring-loaded relief valve piped to the closed vent line to flare and complete with a full opening inlet block valve and test insert, a check valve on the glycol inlet nozzle, a 1" plug or ball drain valve, and a valved glycol outlet with a "Y" type strainer. Rich glycol-powered circulating pumps shall be provided, but the contactor shall also be equipped with two nozzles, blind flanged, for possible future installation of an external float level control, Fisher 2500-249B. It shall also be equipped with a reflex gage glass with offset cocks, Penberthy type "X"/325 with drain valve, and the rich glycol line to the pumps shall have a shut-off valve to be actuated by the reboiler shutdown system.

2. Contactor Residue Scrubber

A Peerless vane type or Anderson centrifugal type line scrubber of contactor MWP and capacity shall be provided. It shall be furnished with a Fisher 2500-249B level controller with isolating and drain valves, reflex gage glass with cocks and drain valve, and a 1" 667D or DA dump valve. The reboiler shutdown system shall vent the signal to the dump valve.

3. Glycol Flash Tank

The glycol flash tank shall be an ASME Code constructed and so stamped vertical vessel with 150 psig MWP designed for minimum of ten minutes retention time. It shall be equipped with external float level controllers, Fisher 2500-249B, with isolating and drain valves; dump valves, 1" Fisher 667D or DA; transparent gage glass at glycol/hydrocarbon interface, with offset cocks, Penberthy XT/325 with drain valve; relief valve, sized for pump failure, and piped to the closed vent line to flare and with an inlet full opening block valve with test insert; back pressure regulator, Fisher Series 98; and 1" plug or ball drain valves for both glycol and hydrocarbons. Gas from this vessel will be used for stripping with excess returned to the Sour Gas Inlet Separator. A retractable type corrosion coupon holder shall be provided in the inlet and vapor outlet lines of the flash tank. The reboiler shutdown system shall vent the signal to the flash tank glycol dump valve.

4. Glycol Filter

A Peco Series RFF-336 sized for five micron removal and 5 psi maximum clean pressure drop shall be furnished. It shall be equipped with block and bypass valves for element change, an external relief valve by-pass, and a filter differential pressure gage.

B. Glycol Reconcentration Unit

1. Surge Tank

The surge tank shall be ASME Code designed for 15 psi MWP and shall be fabricated from 1/4" minimum pipe or plate with welded dished heads or flanged flat heads. The internal glycol/glycol exchanger shall be removable. The surge tank shall be equipped with a reflex gage glass, Penberthy "X"/325 with drain valve; an indicating thermometer, Palmer 35A; a 2" minimum fill connection; and a 3/4" minimum drain valve.

2. Reboiler Chamber

The reboiler shell shall be ASME Code designed for 15 psi MWP and shall be fabricated from 3/8" minimum plate. Internal baffels for level control, heating tube support, and thermo-siphon circulation shall be 1/4" minimum plate. The heating medium heat exchanger tube bundle shall be removable. The reboiler chamber shall be equipped with a reflex gage glass, Penberthy "X"/325 with drain valve; a temperature controller, Foxboro model 43A with 1A thermal system and proportional and reset modes; high temperature shutdown, Kimray T12; pressure shut-down set at 2.0 psig, Moore EC-67 or Amot 4047; an indicating thermometer; Palmer 35A; and a 3/4" minimum drain valve;

a retractable type corrosion coupon holder in the vapor space of the reboiler chamber; a pressure indicator; and a spring loaded relief valve set for 10 psig and piped to the closed vent line to flare, complete with full opening inlet block valve and test insert.

3. Stripping Column

The stripping column shall be fabricated from 3/8" minimum thickness pipe or plate, and shall have 3/8" minimum perforated plate packing support(s). Packing shall be 316 stainless steel mesh or stainless or ceramic rings and/or saddles. If a reflux coil is furnished it shall be removable for coil replacement. A retractable type corrosion coupon connection shall be installed in the vapor space of the still. The vapor line will be connected off the skid to the blanket gas system on the platform water sump.

C. Heat Exchangers

1. Glycol/Glycol

A heat exchanger shall be provided to cool the lean glycol from the surge tank to approximately 225°F. This exchanger may be a "U" tube or helical coil in the surge tank, or it may be an external concentric pipe type at the Fabricator's option. For either type, the rich glycol shall be on the tube side, and the tube material shall be seamless steel ASTM A-214. The "U" tube type exchangers shall conform to TEMA, Class C, as applicable, and concentric pipe type shall be the equivalent of Brown Fintube. Fouling resistance for both sides shall be 0.002.

2. Reboiler Heater

The heat transfer medium shall be an inorganic fluid compound (Dowtherm, Therminol, etc.), and the heating tube bundle shall be seamless steel in a carbon steel tubesheet and shall be designed and constructed according to TEMA, Class "C", Type "BU". The maximum heat flux shall be 7500 Btu/hr/ft^2. The temperature controller shall control a 3-way control valve installed to spring-open the by-pass port, and the high pressure and high temperature shutdowns shall vent the air to the 3-way control valve causing it to block and bypass the heater.

3. Glycol/Glycol Cooler

A separate exchanger, of the removable tube bundle or concentric pipe type, shall be provided to further cool the lean glycol from the exchanger in the surge tank, designed to reduce the lean glycol temperature to the Kimray pumps to 175°F or lower, and add this heat to the rich glycol discharge

from the pumps to the flash tank. The rich glycol shall be on the tube side and the MWP shall be 1100 psig. Construction shall conform to TEMA Class "R" for the shell and tube type or equivalent to Brown Fintube if concentric pipe type and with ASME code inspection and stamp applied. Fouling resistance for both sides shall be 0.002.

4. Gas/Glycol Cooler

A heat exchanger to cool the lean glycol to the contactor to within 10°F of the gas overhead shall be provided. This exchanger may be TEMA Class "C" Type BEM fixed tube sheet, or unit removable concentric pipe type at the Fabricator's option. All steel construction shall be used and gas shall be on the tube side. Fouling resistance for both sides shall be 0.002.

5. Reflux Condenser

Manufacturer's standard design of 316 stainless steel, field replaceable, shall be furnished if required.

D. Pumps

1. Rich glycol-powered, Kimray or equal, lean glycol injection pumps of carbon steel construction shall be provided with 100% standby capacity. External tubing cross-over connections shall be type 316 stainless steel with Swagelok tube fittings of type 316 stainless steel. The pump and its associated piping shall be hydrostatically tested to 1½ times the contactor MWP after installation.

2. An explosion proof electric motor driven barrel pump shall be furnished for transfer of glycol from 55 gal. storage drums to the glycol surge tank

E. Instruments and Controls

1. Pressure Indicators

Provide OICO liquid-filled pressure gages with stainless steel boudons on the contactor, the glycol flash tank, downstream of each pump, and downstream of all pressure reducing regulators. The range shall be at least 1½ times the MWP of the system and approximately twice the operating pressure. Install with block and vent valves. A pressure indicator shall be provided on the reboiler chamber.

2. Temperature Indicators

Provide Palmer type 35 installed in stainless steel wells on the reboiler chamber and on the lines to and from each heat exchanger.

3. Pressure Regulators

For upstream pressures over 150 psig use pilot actuated regulators, Fisher 4160-667D or E. For lower upstream pressures, use Fisher series 98, series 95, 620, 630, 730, etc., as dictated by the service. To the extent possible, all hydrocarbon piping shall be of steel construction. Provide relief valves downstream of all pressure reducing regulators. All relief valve outlets shall be piped to the closed vent line to flare and provided with a full opening inlet block valve and test insert.

V. PIPING AND FABRICATION

All piping materials in hydrocarbon and glycol services shall be steel. Equipment shall be arranged for easy access for adjustment and maintenance and for neat and orderly piping. Piping shall generally run parallel to the skid axis and be arranged for convenient clamping and bracing to skid members, or vessels. Piping shall be designed in accordance with USAS Code for Pressure Piping B31.3, latest edition. All gas piping 1½" and larger shall be of welded construction. All glycol piping shall be of socket weld construction with Master Union "Flex Seat" union joints as required. Pipe shall be ASTM A-106 Grade B, and fittings shall be ASTM A-234. All valves, flanges and screwed fittings shall be ASTM A-181, Grade I or A-105, Grade II. Instrument piping shall be ¼" type 304 stainless steel tubing with Swagelok type 316 fittings.

VI. INSULATION AND FINISH

A. Insulation

For the stripping column and reboiler shell and other areas where required for heat conservation, provide hydrous calcium silicate or amosite asbestos insulation. Preformed factory fabricated segments in standard lengths and thickness shall be used where possible and shall be secured with 16-gage galvanized wire ties on 9" centers. On irregular surfaces, castable insulation cement reinforced with 20-gage poultry mesh may be used. Aluminum jacketing with epoxy inner coating shall be applied over all insulated surfaces. Jacket shall be secured at seams with aluminum self-tapping screws and at sheet centers with 3/4" X0.020" type 304 stainless steel bands.

B. Finish

All materials with surface temperature less than 750°F and not subject to damage from sandblasting or pickling shall be coated with Rust-Ban 191 or hot dip galvanized. Material with surface temperature below 200°F subject to damage from the above coatings shall be hand cleaned and solvent degreased, and coated with one coat Rust-Ban AK-6272, one coat RB AK-6273, and one coat RB AK-6453. For similar surfaces 200°F to 500°F, use RB SA-6237 and RB SA-6236. For material with surface temperature above 750°F, sandblast and coat with two coats RB SL-6231. Should doubt exist as to application technique, contact the Enjay Chemical Company for technical assistance.

VII. PROPOSAL

A. General

Furnish five (5) copies of proposal.

B. Information Requirements

1. Construction details of each pressure vessel, including: ID or OD, S-S, MWP at T; materials of construction, shell heads, and internals; and size and rating of all openings.

2. Standard manufacturer's data sheet for all heat exchangers.

3. Standard manufacturer's data sheet for all pumps.

4. Make, model, size, and rating of all instruments and controls.

5. Reconcentrator data, including details of construction, heat flux in heater tube, and glycol conditions.

6. Unit performance data, including performance curves at pressures and temperatures +/-20% of those specified, key temperatures, pressures, and flow rates; and guaranteed glycol consumption. Where applicable, this data may be shown on a single line flow diagram.

7. Approximate unit weights and volume of glycol charge.

VIII. ADDITIONAL REQUIREMENTS FOR THE SUCCESSFUL BIDDER

A. Four copies of preliminary drawings, including flow sheets, piping, structural, electrical, and manufacturer's drawings, as many issues as required to resolve all design details. Drawings shall be submitted marked "Preliminary" until Humble returns copies marked "Approved".

B. Four copies of major equipment rating sheets for Humble approval, before award of purchase orders.

C. Five sets of "As Built" drawings.

D. Five sets of "Job Books" including operating instructions, performance curves, ASME Code reports, and parts list for all items of equipment.

7.22 STV COMPRESSER
PACKAGE

SPECIFICATIONS FOR PACKAGED STOCK TANK VAPOR COMPRESSOR UNITS

INTRODUCTION

This specification and the plans and specifications referenced herein describe the work and material by the Contractor. The work includes furnishing all equipment and material except those specifically stated as furnished by others in the request for quotation by Humble Oil and Refining Co. The package shall consist of two identical 250 horsepower direct-connected electric motor driven, horizontal, balanced-opposed, two-stage compressor units packaged and mounted on a common skid. The packaged units are to be completely assembled and tested prior to shipment. Delivery of the skid-mounted packages shall be made f.o.b. trucks at jobsite location stated in Humble's request for quotation.

Design Constraints

1. The equipment is to be installed by Humble on an off-shore oil drilling and production platform and will be continuously exposed to a wet salt air atmosphere.

2. The process design and control arrangements shall be so arranged that no mode of operation of these units or any inter-related operating equipment shall be allowed which requires the continuous venting or flaring of gas. The gas to be handled is toxic and corrosive, containing as much as 2% H_2S and 6% CO_2, and is water saturated at 135°F and 14.7 psia. Provisions shall be made so that all normal operating leakage of sour gas shall be contained. No air entrainment into the sour gas stream can be tolerated. The paramount consideration for design guidlines shall be safety to personnel and protection for the environment. To this end redundant alarms and fail-safe operation shall be provided in the design.

3. Oil and gas production will be curtailed to the extent necessary to match the capacity of the compressors in this service, and for this reason the basic approach shall be to adhere to proven and conservatively designed equipment with field proven operating reliability and good maintainability.

4. Electric power for driving the compressors will be purchased, and an economic incentive exists to provide the means to unload the compressors to the extent permitted by the available gas production.

5. The completed package will be allotted a deck area approximately 16' X 38', and a height clearance of 14'. Exact location of platform deck beams for support of skid will be furnished to selected vendor prior to final design of his skid.

6. The completely assembled skid shall be designed to withstand a 20% seismic force.

7. Unless otherwise specified, equipment and unit design shall conform with API Standard 618, latest edition, and the following numbered paragraphs conform with the paragraph numbers of that Standard and are included herein for amplification, modification or deletion. Where additions are required the new paragraphs are inserted in the appropriate section in alphabetical order.

8. To indicate style or quality required, reference may be made to specific manufacturer's products; however, products of equal or better quality may be offered, subject to Humble approval.

9. The following special provisions make reference to General Specification Sections, attached, including the following:

   Pressure Vessels
   Instruments and Controls
   Piping and Fabrication
   Electrical

   Should there be a difference between these Special Provisions and the General Specifications, the Special Provisions shall govern.

SPECIFICATIONS FOR PACKAGED STOCK TANK VAPOR COMPRESSOR UNIT

SPECIAL PROVISIONS
SECTION 1 - GENERAL

1. Scope:

a) The facility contemplated herein is a totally integrated stock tank vapor (STV) compressor package containing one master inlet scrubber; two identical 250 hp electric motor driven, two-stage, horizontal, balanced-opposed compressors; suction and discharge pulsation bottles and piping with flanged connections for all process and utility piping at skid limit; crankcase lubricating oil system; cylinder and rod mechanical lubricating system; independent compressor cylinder jacket water circulating and temperature control system with cooling to be furnished externally by others; special distance piece vent and blanket gas system, including sweet gas purge system for maintenance; one panel board for the unitized package; and all other necessary accessories and appurtenances; all installed on a structural steel base as a unit.

b) The total packaged skid shall be designed for a single hook, four point lift with the following connections to be made in the field;

A. Surge tank vapor inlet gas line, and blanket gas system inlet.
B. Stock tank compressor second stage discharge gas line.
C. 85# Recycle gas supply line (from 85# inlet gas separator line).
D. Inlet scrubber liquid dump line.
E. Jacket water supply line.
F. Jacket water return line.
G. Distance piece sweet gas purge supply line.
H. Vent gas to flare knockout drum line.
I. Distance piece blanket and vent lines to sales-injection compressors.
J. Manual emergency shutdown line (s) (loop form, normally pressured).
K. Lube oil make-up line.
L. Electric power.
M. Instrument air supply line.
N. Service air supply line.

c) Inter-stage cooling and scrubbing will not be required. After-cooling will be provided in facilities furnished by others outside the limits of the STV compressor package.

d) The rated capacity of each unit shall be 50% of the design operating conditions shown on the attached data sheet and the plant process flow diagram, attached. Five-step minimum unloading shall be provided.

e) A master suction scrubber, 36" O.D. X 10' seam to seam, vertical ASME Code (Div. 1) constructed vessel with 150 psi MWP shall be furnished. Detailed requirements are listed under Section IV of these Special Provisions.

SECTION II - BASIC DESIGN

6. General:

b) Protective devices to prevent damage to the equipment shall be provided and shall include facilities for preventing electric motor overload and/or vacuum greater than 2" Hg at first stage suction.

c) The compressor manufacturer has the responsibility for the overall design and performance of the compressor, driver, skid and auxiliaries and all other equipment included as part of the package. The unit responsibility for the entire train consisting of the compressor, driver, power transmission, and associated auxiliary equipment shall include, but is not limited to, the following:

Torsional analysis
Selection and rating of power transmission components
Compressor piping analog study
Equipment layout

The compressor vendor shall resolve all engineering questions or problems related to the equipment design.

d) The resultant of the primary inertial forces, the resultant of the secondary forces, and the couples produced by these forces shall be minimized.

e) Crank shafts shall be manufactured from single forgings.

7. Allowable Speeds:

a) Maximum acceptable average piston speed shall be 900 fpm, and maximum acceptable rotative speed shall be 600 rpm.

10. Compressor Cylinders:

a) Maximum allowable working pressure shall exceed rated discharge pressure by at least 10 percent or 50 psi, whichever is greater.

b) Top discharge shall not be furnished

g) An independent jacket water circulating pump and stand pipe shall be furnished for each compressor unit and the stand pipe shall be equipped with an electric heating element sized for maintaining minimum water temperature of 150°F when minimum ambient temperature is 40°F and compressor is not operating. When compressor is operating excess heat will be dissipated to coolers external to compressor package and provided by others.

i) Separate jackets are required for cylinder bodies and for cylinder heads.

j) Special construction is required for sour and corrosive gas service. Copper and copper alloy parts shall not be used. Materials for rings, packing, gaskets, etc., normally made from copper metals, shall be selected by the compressor manufacturer and shall be designated in his proposal. Ferrous metals in contact with the sour gas during normal operation, or on an expected failure, shall have a maximum hardness of Rockwell "C" 20. Where this is not possible due to conditions of wear or stress, the ferrous parts shall be chrome plated for a thickness of 0.005 inch minimum.

k) Compressor cylinders shall be furnished with threaded and plugged ½-inch NPS connections for future use of cylinder analyzers. Connections shall not pass through water jackets (see paragraph h).

l) Cylinders shall be furnished with flushing oil passages in inlet nozzle drilled, tapped and plugged for future installation of a flushing oil system.

m) Compressor cylinders shall be provided with cold supports.

11. Valves:

b) Valve design shall be such that valve assemblies cannot inadvertently be reversed or a suction valve assembly fitted into a discharge port.

12. Pistons:

c) Locking nuts attaching the piston to the piston rod and the rod to the crosshead shall be tightened to the manufacturer's standard, but as a minimum the vendor's tightening procedure must assure a prestress level of twice the operating stress of the rod.

14. Distance Pieces:

a) The primary requirements dictate that 1) no sour gas leakage shall be vented to the atmosphere but must be contained and delivered into the STV inlet at near atmospheric pressure; and 2) no air can be permitted to enter the gas stream because of the presence of CO_2 and water. To meet these conditions the following design is preferred: The cylinders shall be provided with two-compartment distance pieces, (API, Type 3). The outboard compartment shall be vented to the STV suction scrubber and shall be capable of operating at 15 psig. The inboard compartment shall be blanketed with sweet gas at a pressure of 2" Hg and shall be capable of operating at 15 psig. Double wiper rings at the frame diaphragm of the inboard compartment shall be furnished to minimize sweet gas leakage into crankcase.

A single compartment distance piece with length sufficient for no overtravel and equipped with an oil flinger ring, a vented packing with vent to STV suction, a double frame-side wiper ring, and a sweet gas pressure on the compartment may be offered as an alternate provided the arrangement can satisfy the two requirements mentioned above.

15. Stuffing Boxes and Packing:

a) The manufacturer's recommendation is desired.

c) The packing shall be vented, the vent is to be piped to the outside of the distance piece by vendor and connected in a separate line to the closed line to vent.

d) If cooling of rod packing is required, it shall be provided by circulating cylinder jacket water through the packing.

16. Compressor Frame Lubrication:

c) A direct-driven main oil pump is preferred. A separate explosion proof electric motor-driven spare pump, sized for full capacity and equipped for automatic starting, shall be provided. A pressure relief valve shall be included if a positive displacement pump is provided.

d) The spare pump shall be connected to be manually started for pre-lube, automatically shut-down after main oil pump is running, automatically started-up at loss of main oil pump pressure or compressor shut-down, and manually shut-down after post lube.

e) Manufacturer's standard edge-type full flow filter, cleanable while in service, may be supplied, provided filtration is 40 microns or finer.

g) If a crankcase lube oil cooler is required, it shall be sized for 120°F cold water supply, 10°F rise, and shall be made using seamless carbon steel tubes 16BWG minimum thickness. A fixed tube sheet design will be accepted provided the channels and covers are flanged and removable.

h) A Ren or Kenco crankcase level regulator and Slo Flow meter shall be provided. Bulk storage of lube oil at 20' elevation will be furnished by others.

17. Cylinder and Packing Lubrication:

a) A McCord or Trabon distribution block system with Gerhardt or Trabon diesel injector type pump, flow meter, and pneumatic no-flow shutdown shall be furnished. Oil make-up from the crankcase through a Pall Trinity Micro "Ultipor 0.9" filter with pressure reducing and relief regulators and a Ren RAUB oil level regulator shall be provided.

b) Lube oil injection passages to the cylinder bore by means of pipes or tubes through the water jacket shall not be permitted. The passages must be through the metal provided in the cylinder water jacket casting or weldment.

18. Synthetic Lubrication of Cylinders:

a) The cylinders will not be lubricated by synthetic lubricants.

19. Piping and Connections:

b 2) Process piping shall be seamless pipe. Corrosion allowance shall be 0.125 inches minimum. All process piping welds shall be post weld stress relieved and subjected to 100% radiographic inspection. No steel materials shall have minimum yield strengths that exceed 90,000 psi. No copper bearing metals shall be used.

3) The gas in the vapor line from the First Stage Suction Scrubber shall be given approximately 3-5°F superheat by use of the first-stage discharge pipe placed next to a short run of the inlet vapor line, the two lines being banded together and insulated.

4) A "figure eight" blind shall be installed in the lead lines on the compressor side of and next to the suction and discharge block valves.

5) A water sample connection shall be provided in the bottom of the suction scrubber. A corrosion coupon test connection shall be provided in the inlet to the suction scrubber, and in the water section of the scrubber. Connections shall also be provided for future inhibitor injection into the inlet stream. (Additional specifications for piping components are detailed separately in the attached "Gas Plant General Specifications, Piping and Fabrication").

d 2) Cooling water piping on the compressor shall be supplied by vendor.

20. Pulsation Damping:

a) Suction and discharge surge bottles shall be pulsation dampers. As an alternate, fabricator may quote a design, based upon Southwest Researth Institute analog study, which will equal the guarantees for pulsation and pressure drop for dampers. Bottle nozzle reinforcement, either saddle or pad, shall be provided in all cases and shall be one schedule heavier than required by code, and weldment details shall be finished as shown on standard drawing GA-146 attached.

b) Pressure drop through pulsation damping equipment shall not exceed 1 percent of the absolute pressure.

d) Pulsation damping equipment shall be designed and fabricated in accordance with USAS B31.3, Petroleum Refinery Piping Code. In general, suction and discharge bottles should be designed for cylinder maximum allowable working pressure, but in no event should they be designed for less than 10% or 100 psi over maximum cylinder operating pressure. Suction bottles shall have a male-female drain valve, AGCO "H-UVC-44R", installed in every compartment, and discharge bottles shall have drains plugged. Siphon drains are not acceptable for surge bottles.

21. Guards:

b) Guards shall be provided by the compressor vendor and shall be constructed of solid metal sheets according to safety orders of the State of California.

22. Platforms, Stairs and Railings - (not applicable).

25. Tools:

In addition to special tools for compressor maintenance the vendor shall furnish a Wright Model B-36 underslung type bridge crane, with a hand operated Wright 600 low headroom trolley hoist or a Safeway army type trolley hoist, sized to handle the heaviest removable component of the motor-compressor package. Hoists 3 tons and larger shall be gear-driven. Crane systems 5 tons and larger shall include a 1 ton Safeway clevis connected hoist on the bridge beam. The support points for the rails will be from the upper deck structural members and the exact location of these points will be furnished to the selected vendor. The crane system shall be shipped loose with the packaged equipment and will be installed in the field by others.

26. Air Intake Filters - (not applicable).

27. Weather Protection and Winterization:

a) The equipment is to be installed on an off-shore oil drilling and production platform and will be continuously exposed to a wet salt air atmosphere. The equipment will be placed on the lower deck of a double-deck structure. Maximum ambient temperature is 85°F and minimum temperature is 40°F.

SECTION III - CONTROLS AND INSTRUMENTATION

28. General:

a) Controls for shut-down, alarm and control shall be pneumatic when the sensing point is local. Shut-down and control signals originating from remote sensing or actuating points (furnished by others) may be electric or pneumatic and provision shall be made to receive both kinds. Annunciation that a compressor has been shut down shall be by an electric signal from each compressor to a remote panel in the central control room.

b) Instrument and controls shall be furnished, sized, and set for operation in accordance with USGS, OCS Order No. 8.

c) All electrical components shall be suitable for Class I, Division I location.

e) Upon signal from Manual Emergency Shut-down System, Combustible Gas Detector System, and Fire Detector System the power operated suction and discharge valves shall close, the equalizing valves shall open, and the blowdown valves to flare shall open. Upon all other shut-downs, manually or automatically initiated, the suction and discharge valves shall close and the equalizing valves shall open, but the blowdown valves to flare shall remain closed. The low level shut-down signal on the suction scrubber shall vent the air signal to the level control valve and shut-down the compressors.

f) Refer to the attached "General Specification, Instruments and Controls", for additional requirements for selection of components and installation features.

29. Capacity Control:

a) Capacity control shall be by suction throttling and make-up, clearance pocket (both head-end and crank-end, if feasible), and suction valve unloading. As many steps as practical are preferred provided the devices will permit safe, long-term operation and do not cause increased maintenance. Suction valve unloading shall be manual, but a simple and reliable automatic system may be proposed as an alternate.

c) Clearance pockets shall be the manual, two-position type.

d) Start up with unloading is preferred. Each compressor shall be equipped with an equalizing line and valve connecting the discharge lead to the suction. This valve and the suction and discharge valves shall be equipped for remote manual operation using the platform 100 psig instrument air system. Shut-down of the compressor shall cause the suction valve to close, equalizing valve to open, and discharge valve to close, in that sequence and with proper time delay. Upon start-up, without venting the suction and discharge lead lines and bottles, and by manual signal, the valves will be reversed in position and sequence to load the compressor. As an alternate to this system, Vendor may quote a motor driver with full load torque starting characteristics.

30. Instrument Panels:

a) A weatherproof instrument panel shall be furnished and located centrally on the skid. The type of instruments to be furnished on the panel is listed in the "General Specification, Instruments and Controls." The panel shall include the following:

a. Pressure Gages:
   - Surge Tank Inlet Gas
   - First Stage Suction (each compressor)
   - Second Stage Suction (each compressor)
   - Second Stage Discharge (each compressor)
   - Bearing Oil Header (each compressor)
   - Jacket Water Pump Discharge (each compressor)
   - Instrument Air Supply Pressure

b. Annunciators:

High Pressure Shut-down, Suction Scrubber
Low Pressure " " " "
High Level " " " "
Low Level " " " "
High Interstage Pressure Alarm, each unit
Excessive Discharge Gas Temperature Shut-down (each cylinder)
High Discharge Gas Pressure Shut-down
High Discharge Gas Pressure Alarm
Low Pressure Shut-down, Frame Oil System (each compressor)
Low Crankcase Oil Level Shut-down (each compressor)
Low Jacket-water Pressure Shut-down (each compressor)
High J.W. Surge Tank Temperature (each compressor)
Low Oil Level and Drive Failure Shut-down, Forced-Feed Lubrication (each compressor)
Excessive Main Bearing Temperature Shut-down (each main bearing)
Excessive Vibration Shut-down (each compressor)
Excessive Rod Packing Temperature alarm (each cylinder)
Manual Emergency Shut-down
Combustible Gas Detector Alarm and Shut-down
Fire Detector Alarm and Shut-down

c. Electric Motor Controls:

1. The compressor motor driver shall be equipped with 6 Resistance Temperature Detectors, McGraw-Edison or equal, embedded 60° apart and so connected that excessive temperature will shut-down the motor. One annunciator shall be tripped by any of the RTD signals on each compressor driver.

2. Instead of space heaters a relay with appropriate interlocks shall be provided to impose 24-volts A.C. supply to the motor when it is shut-down. The relay, interlocks, motor starter and switchgear will be furnished by others and installed in the pressurized room housing all switchgear and motor controls.

3, The spare lube oil pump motor shall have a start-stop-automatic switch and be connected so that prelube cycle can be started manually, the main oil pump pressure will stop the spare pump on normal pressure or start it automatically on low pressure, and the spare pump will run in the post lube cycle until manually shut-down.

4. The main motor drivers for the compressor shall have a remote start-stop switch located in the central control room, but a local start-stop switch shall be provided to over-ride the remote signal and prevent unauthorized or accidental remote starting during maintenance work.

d. Controllers:

The recycle pressure control shall operate the control valve through a valve positioner. The controller output signal will be transmitted to a direct reading receiver-recorder located in the central control room furnished and installed by others.

31. Pressure and Temperature Gages:

a) Pressure gages mounted in the instrument panel are covered in paragraph 30 above. Gages mounted locally shall include the following:

Surge Tank Inlet Gas Temperature
85# Sour Gas Make-up Supply Temperature
Inlet Suction Scrubber Temperature
Inlet Suction Temperature (each cylinder)
Discharge Gas Temperature (each cylinder)
Oil Cooler Inlet and Outlet Oil Temperatures (each compressor)
Oil Cooler Inlet and Outlet Water Temperature (each compressor)
Compressor Cylinder Water Outlet Temperature (each cylinder)

b) Pressure gages shall be OICO, Marhalltown, or equal, liquid filled, flush mounted, range twice operating pressure and at least 1½ times MWP. Bleed valves shall be installed between isolating valves and gages, positioned for installation of test gages.

32. Alarms and Shutdowns:

b) Shutdown devices are required for each annunciated function listed under paragraph 30 above.

33. Tachometers:

A tachometer is not required for the direct-connected constant speed electric motor driver; however, an 18" minimum access space to the crankshaft shall be provided for use of an analyzer speed transducer.

SECTION IV - INTERCOOLERS AND AFTERCOOLERS

a. No intercoolers or aftercoolers required.

c. No intercooler and aftercooler condensate pots are required. However, a master suction scrubber, 36" O.D. x 10' S to S x 150 psi MWP ASME Code (Div. 1) constructed and so stamped, shall be furnished on the skid completely equipped, including the following: A vane or mesh pad mist extractor; external float level control, Fisher 2500S-249B (or N) with isolating and drain valves; 2" dump valve, Fisher 667D (or DA); high liquid level shutdown, Magnetrol A-1500-519 with isolating and drain valves; reflex gauge glass with offset cocks, Jerguson 46-U or Penberthy 325, with drain valve; full capacity relief valve with isolating and test valves; 1" plug or ball drain valve; a 2" soft-seated swing type check valve in dump line; and a pressure gage with isolating and bleed valves.

SECTION V - MATERIALS

36. General:

a) Welded joints on pressure castings (cylinders) shall be completely radiographed, have full penetration and be stress relieved.

g2) (Exception) Cast iron or ductile (nodular) iron castings shall not be repair-welded, peened, burned-in, impregnated or plugged.

j) Fully enclosed cored voids (including voids closed by plugging, but excluding water jackets) are prohibited.

37. Compressor Piston Rods:

(see paragraph 10j). Manufacturer's alternate rod and packing specification, based upon proven field experience on his equipment operating in similar corrosive atmospheres, will be considered.

SECTION VI - DRIVERS

38. General:

a) The driver shall be a direct connected electric motor.

b) The drivers shall be 250 hp with a 1.15 service factor. Design of the compressor instruments and controls for suction and discharge pressure control shall insure that motor driver cannot be overloaded.

c) Provisions shall be made for barring over and for mechanically locking the motor rotor, coupling and crankshaft drive train.

39. Motor Drivers:

a) The electric motor drivers shall be squirrel cage induction type, NEMA design D, 4160 volt, 3-phase, 60-cycle, for full voltage starting, NEMA weather protected II enclosure, and with premium, Class B insulation. The motor starting torque shall be sufficient for starting when the compressor cylinders are under pressure at "equalized" pressure and the bypass line is open. The "equalized" pressure will be dependent upon the space-volumes contained in the suction, interstage, and discharge piping, and the operating temperatures and pressures, and should be less than 50 psia.

40., 41 & 42 (not applicable).

43. Couplings:

b) Coupling torsional stiffness shall be selected in accordance with requirements determined by the torsional analysis of the entire motor-coupling-crankshaft drive train.

SECTION VII - SHOP INSPECTION

46. General:

a) The term "Inspector" refers to the purchaser's representative. Shop inspection by the inspector shall be required and the hydrostatic, mechanical, and performance tests shall be witnessed.

c) The manufacturer shall furnish the following to the inspector:

1. Physical and chemical data on compressor cylinders (except cast iron) or certification of compliance with a particular manufacturer's or national specification.

2. Evidence, such as purchase specifications or bills of materials, to establish that other critical parts are of specified materials.

3. Requested number of certified copies of hydrostatic and running test record. This shall include performance data for all final tests, including any difficulties.

SECTION VIII - SHOP TESTS

48. Hydrostatic and Pressure Tests:

b) A pressure test with helium is not required.

49. Other Tests:

c) Auxiliary equipment shall be used for the shop tests. No shop running tests for the motor-compressor unit will be required; but all instruments, controls, shut-downs, alarms and annunciator panel shall be thoroughly shop tested to insure proper settings and operation of all functions.

d) Dismantling is not required except where malfunctions are detected during testing.

(Requirements for the following sections will be furnished with Humble's Request for Quotations.)

SECTION IX - PREPARATION FOR SHIPMENT

SECTION X - DRAWINGS AND OTHER DATA

SECTION XI - PROPOSALS

APPENDIX A - CHECK LIST

APPENDIX C - DATA SHEETS

7.23 GAS PLANT GENERAL SPECIFICATIONS

GAS PLANT GENERAL SPECIFICATIONS

EQUIPMENT IDENTIFICATION

1. General:

To facilitate the training of operating personnel, give information to those taking emergency actions, and give order to the task of record keeping it is essential that all equipment, controls, and piping be named and labeled for quick recognition.

1.1 Equipment:

Major pieces of equipment, such as vessels, exchangers, compressors, pumps, shall be labeled by name and item number in accordance with information on the "as-built" Mechanical Flow Sheet. The data shall be painted on the equipment in systematic manner in a position easily read from the normal operating isle in letters 1½" high. The same data shall be stencilled on the equipment nameplate, if convenient, or on a laminated bakelite of similar dimensions and permanently attached to the equipment item.

1.2 Piping:

All piping shall be conspicuously identified as to service, such as "1st Stage Suction", "lube oil to cooler", etc. Identification shall be made in two ways: 1) by a stencilled metal tag securely fastened to the line; and 2) by painting on the lines. "As-built" flow diagram nomenclature shall be used in all labels.

1.3 Controls:

Every relief valve, shut-down sensor instrument, and process controller with its valve, shall be labeled by a permanent stencilled metal tag to be securely fastened to the item. The tag shall be in easily read letters using "as-built" Mechanical Flow Diagram nomenclature.

1.4 Color Code:

The only color coding used shall be that indicated in the "Coatings" section: i.e. "Yellow" for emergency shut-down stations; and "Red" for fire system components.

1.5 Nameplates, Electric Circuit Breakers

Nameplates shall be constructed by 3 ply laminated phenolic (Black-White-Black) and engraved through the white lamination. Edges of all nameplates shall be beveled at 45°. The circuit number shall appear on the last row on the left with the motor horsepower or circuit breaker trip on the right. The first and second lines shall describe the service. A list of nameplates shall be a part of the manufacturer's drawings.

GAS PLANT GENERAL SPECIFICATIONS

CONSTRUCTION FOR CORROSIVE FLUIDS

1.0 General:

1.1 This section covers special requirements for construction and materials to resist corrosion and embrittlement in system in which hydrogen sulfide, carbon dioxide, and water are present with or without amine. The requirements listed are considered the minimum acceptable and more stringent requirements may be necessary in special cases where called for by good engineering practice. The following control practices shall be used:

1.1.1 Provide adequate corrosion allowance to metals or provide special corrosion resistant materials.
1.1.2 Require proper post heat treatment of metals to eliminate residual stresses.
1.1.3 Use seamless pipe.
1.1.4 Eliminate the use of (1) malleable iron, (2) copper or copper base alloys, and (3) cadmium plated materials in these services.
1.1.5 Provide adequate inhibitor injection connections.
1.1.6 Provide adequate corrosion test locations to monitor expected areas of corrosion.

2.0 Design Requirements:

2.1 Minimum corrosion allowances for carbon steel are:

2.1.1 Vessels and exchangers, 1/8-inch.
2.1.2 Piping, 1/16-inch.

2.2 Pipe nozzles and connections in vessels and exchangers shall be flanged except that for USAS Class 300 and lower ratings, 6000 pound threaded couplings may be used for 3/4-inch, 1-inch and 1½-inch nominal pipe size instrument and piping connections, and 3000 pound threaded couplings may be used for 1½-inch and 2-inch nominal pipe size inspection openings.

2.3 Seal or back-welded threaded connections are not acceptable substitutes for socket-weld construction.

2.4 Slip-on flanges shall not be used in piping. Slip-on flanges used in shell and tube exchangers for shell and channel closures, shall be drilled so that hydrogen cannot collect in the unwelded annular space.

2.5 All asbestos gaskets in sour gas service shall be soaked in sodium silicate (water glass) solution when making up to reduce the possibility of leaks.

3.0 Material Requirements:

3.1 General

3.1.1 The minimum yield strength of any steel material used shall not exceed 90,000 psi, regardless of H_2S concentration or system pressure or temperature. The manufacturer or supplier shall be required to certify that materials comply with the appropriate section of these specifications.

3.1.2 Copper bearing metals shall not be used.

3.1.3 Dissimilar metals shall not be used unless they can be selected and arranged to minimize electrolytic corrosion.

3.1.4 In no case shall a pressure restraining carbon steel material have a single hardness reading above Brinell 226.

3.2 Plate

3.2.1 Carbon steel plate for stressed components of USAS Class 400 and higher rated vessels and exchangers shall comply with ASTM-A-516.

3.3 Bolting

3.3.1 General

a. Regardless of service, all pipe flange bolts shall comply with Paragraphs 2 and 3 below when the plant or facility has any system within the scope of this Specification.

b. Bolting covered by these specifications includes bolts for flanges, valve bonnets, equipment closures, and instruments such as control valves, level controllers, level switches, etc.

3.3.2 Bolt specifications for systems beyond the pressure and temperature limits of USAS Class 150.

a. ASTM A-193 B7 modified by drawing at 1275°F to 1325°F to produce a hardness of Rockwell C-25 or less, a minimum yield strength of 80,000 psi, and a minimum tensile strength of 100,000 psi. Bolts shall be marked "B7M".

b. Age-hardened K-Monel with a 95,000 psi minimum yield strength and 115,000 psi minimum tensile strength.

c. Nuts shall be ASTM A-194 2H heavy hex series.

3.3.3 Bolt specifications for systems within the pressure and temperature limits of USAS Class 150.

a. ASTM A-307 Grade B.

b. Higher strength bolting when required or furnished shall comply with Paragraph 2 above.

3.3.4 The bolting for carbon steel trays and other carbon steel vessel internals shall be annealed monel meeting ASTM A-164 specifications. Each monel bolt shall have a monel washer on each side of the fastening and a teflon washer shall be provided between each monel washer and the carbon steel tray or other vessel internals.

3.4 Pipe, Flanges, and Fittings

Only A-106 Grade B seamless pipe and ASTM-234 Grade WPB welding fittings will be acceptable. Only weld neck flanges ASTM A-105 Grade II material may be used.

3.5 Valves

Valves shall be manufacturers standard pattern but with trim and metallurgy to give corrosion and hydrogen stress cracking protection in services where hydrogen sulfide, carbon dioxide and water are present with or without amine. All carbon steel parts shall have a hardness less than 225 Brinell. For gate valves the trim shall be monel for stems and wedges and monel or No. 6 stellite overlay for seat rings.

3.6 Electrical

All conductors shall be stranded aluminum. Equipment terminals and connections shall be suitable for aluminum connections. Splices shall be made using Penetrox compound liberally.

In general, cadmium plated hardware is to be avoided. Hardware items in electrical devices shall be made of aluminum or stainless steel. Hardware used for mounting and general mechanical attachments shall be hot dipped galvanized steel.

The switchgear, motor control centers, relay cabinets and similar electrical apparatus with numerous and/or critical copper components shall be located indoors in a pressurized room.

Pushbutton stations located outdoors shall be oil immersed Crouse Hinds type OFC or equal. Wherever feasible, control devices located outdoors shall be of the oil immersed or mercury capsule type.

4.0 <u>Fabrication Requirements</u>:

4.1 Radiograph Examination of Piping Pressure Welds

4.1.1 The following minimum percentages of welds in each pipe size shall be evaluated by radiograph examination and found acceptable.

10%	for USAS Class 300 lines
30%	for USAS Class 400 lines
70%	for USAS Class 600 lines
100%	for USAS Class 900 lines
100%	for gathering and distribution systems operating at pressures above 750 psig
50%	for gathering and distribution systems operating at between 275 psig and 750 psig.

4.1.2 Radiograph examination shall be in accordance with USAS B31.3, Code for Petroleum Refinery Piping. The radiograph procedure is covered in Chapter VI and the evaluation is covered in Chapter V, Table 327.4.2, with the following two exceptions:

a. Any type crack, or zone of incomplete fusion or penetration, is unacceptable.

b. Evaluation shall be based on 100% radiography in Table 327.4.2 in every case.

4.1.3 Where less than 100% of the welds will be examined, each unacceptable weld found shall increase the total number of welds to be examined ten welds or until 100% is reached.

4.1.4 Unacceptable welds shall be cut from the pipeline and replaced. Repairs to unacceptable welds shall not be made unless written approval is given by Humble.

4.2 Stress Relieving

4.2.1 Required for all piping welds in sour services at pressure-temperature conditions beyond the limit of USAS Class 300 flanges and all welds in rich sweetening agent services regardless of pressure and temperature.

4.2.2 Vessels, vessel trays and exchangers shall be stress relieved, including those in lean sweetening agent (amine, etc.) service.

4.2.3 No welding will be permitted after stress-relief.

4.3 Preheat and Postheat Treatment

4.3.1 All pipe welds in gathering and distribution systems made of material with specified minimum yield strength of 42,000 psi or greater shall be subjected to the following temperature controls:

a. Preheat - 250°F minimum.

b. Temperature between passes - 200°F minimum

c. The pipe joint shall be insulated, immediately after the weld is complete, with two layers of asbestos paper and a 1-1/2-inch thick layer of preformed calcium silicate or fiberglass. The insulation shall cover the pipe for 18 inches on both sides of the weld and remain in place for at least 4 hours.

4.4 Welding

4.4.1 All pressure welds shall be made with E-6010 and E-7010 weld rod or approved equal.

4.5 Vessel Nozzles and Couplings

4.5.1 Nozzles and couplings on vessels shall be attached as shown by Fig. UW-16.1 Detail (a), (b), (c), (g), (h), (n), (o), (q-1,2,3 & 4), (r-1 & 2), (t), and (w-1 & 2) in Section VIII, Division I of the ASME Boiler and Pressure Vessel Code. For attachments shown by Details (n), (o), (r-1 & 2), and (t), a bleed hole shall be drilled to vent the internal space isolated by welds. That part of each nozzle or coupling which projects inside the vessel shall be trimmed flush with the shell or head and the surface at that location shall be ground smooth.

5.0 Corrosion Monitoring and Inhibition:

5.1 Provision shall be made for sampling water from every vessel through the syphon drain or a special connection for this purpose.

5.2 Corrosion coupon test locations shall be provided at points indicated in the Special Provisions Sections and in the Mechanical Flow Diagram and shall be according to Standard Drawing GA-105, attached.

5.3 When specified an inhibitor system shall be provided including the following:

5.3.1 Inhibitor storage shall consist of a 100-gallon, closed-top, atmospheric storage tank containing a gage glass and a drain connection.

5.3.2 The metering injectors shall be Lapp or Miltonroy controlled volume pumps of all steel construction, pumping 0 to 0.5 gallons per hour from flooded suction to a maximum of 1000 psi discharge. Each metering injector shall be equipped with a discharge check and relief valve, with a gauge glass, and with a Trabon type distribution block for multiple injection points from the same pump.

5.3.3 The inhibitor suction piping shall be 1-inch threaded and coupled seamless steel line pipe. Injector discharge piping shall be 3/4-inch threaded and coupled seamless steel line pipe and shall terminate into 3/4-inch steel gate valves attached by 3-inch long pipe nipples to a pipe collar at the treating location.

GAS PLANT GENERAL SPECIFICATIONS

UNFIRED PRESSURE VESSELS

1. General:

1.1 Unless otherwise specified, the maximum allowable working pressure of vessels shall be the operating pressure plus 50 psi or plus 10 percent of operating pressure, whichever is greater in value. The minimum wall thickness of pressure vessels shall be 1/4 inch. Manufacturer shall not take credit for corrosion allowance or 1/4 inch minimum wall thickness when calculating nozzle reinforcement requirements. Vessels shall be stamped with highest maximum working pressure at design temperature. This will be based on the actual minimum measured wall thickness excluding corrosion allowance if this is governing. For example, if 100 psig is all that is required for the process but the vessel is constructed for 115 psig, it should be stamped 115 psig.

1.2 All pressure vessels in hydrocarbon or air service shall conform with the ASME Code for Unfired Pressure Vessels, except as modified herein, and be so stamped. ASME Code Inspection Reports shall be furnished for all Code vessels. Detailed shop fabrication drawings and material design calculations shall be submitted for Humble's approval prior to shop fabrication of vessels and internal equipment.

1.3 Refer to the Special Provisions section preceding these General Specifications for specifications pertaining to sour gas or MEA services and vessel design criterion.

1.4 Unless otherwise approved by Humble, the vessel manufacturer shall install the trays where required. Trays for glycol contractors (and other trayed vessels having low liquid rates where priming of trays during start-up may be a problem) shall be equipped with bubble caps, and slot velocities shall be kept to the minimum possible without substantially reducing tray efficiency. For other services, bubble cap, sieve or valve type trays may be used where suitable. Valve trays of the type manufactured by Glitsch, Koch or Nutter are acceptable. Other types of trays may be used only upon obtaining prior approval from Humble.. Tray valves shall have guides and stops and shall be maintained in a clean and dry condition until plant start-up to prevent sticking. Tray valves shall also have seat offsets to prevent positive seals with trays which could cause sticking. Following hydrostatic testing, columns with valve trays shall be drained and dried completely. Internal manways approximately 17 inches x 18 inches shall be provided on all trays in vessels 30 inches I.D. or larger and shall be removable from top or bottom. All trayed vessels from the absorbers through and including the stills shall have one or more weep holes at the bottom of each weir so that glycol cannot build up on the bottom of trays.

2. Nozzles, Manholes and Other Connections:

2.1 In general, vessel nozzles and threaded pipe connections shall conform to the piping standards. Nozzle connections 2 inches and larger shall be flanged. Flanged or screwed 1-1/2-inch connections and smaller are acceptable. Any special flange facings shall have approval by Humble.

For large and special service vessels, to be designated by Humble, all connections of all sizes shall be flanged and no screwed connections will be permitted.

2.2 Connections for piping 1 inch and larger on vessels in hot services above 350°F or steam condensate service shall be flanged.

2.3 All tray vessels 30 inches I.D. and larger shall be provided with a minimum of two 16-inch I.D. manholes located near top and bottom of vessel, and trays shall have removable sections to provide a means of internal passage.

2.4 Vessels 36 inches I.D. and larger containing internals other than trays shall be provided with a minimum of one 16-inch I.D. manhole. Where bootlegs are provided, the bootleg flange may be used as the manhole.

2.5 All vessels shall be provided with a separate manual siphon drain and those operating above 100 psig shall be equipped with two valves in series, one ball or gate and a globe. Check valves shall be provided on all drains on vessels operating near atmospheric pressure if a vacuum can occur during normal operating conditions. All compressor scrubbers, except those operating near atmospheric pressure, shall have a positive choke in the dump line installed downstream of the hand drain tie-in.

2.6 Pressure gauge, liquid level gauge and liquid level control connections on all vessels shall be oriented so that the instruments face the operating aisle. Manual drain and liquid level control valves shall be located so that an operator can observe the liquid level gauges while operating either of these valves.

2.7 All vessels not having a top head pipe connection shall have a 1-inch minimum size vent connection. The vent to be complete with valve shall be protected with a hex steel plug after hydrostatic testing is completed.

2.8 All vessels downstream of glycol contactors, through and including demethanizer, shall be provided with glycol drain pots and sight glass.

2.9 External rather than internal DP cells or float controls shall be used on all refrigerant services. Float cages instead of DP cells shall be used to control all liquid-liquid interfaces.

2.10 Frost plugs and/or pressure bulls-eyes should be used on refrigerant service for levels in addition to 12-inch chambered reflex gauge glasses.

2.11 For vessels designated by Humble as large or thick wall requiring level gauges, level controls, etc., a 3-inch size, full coverage "bridle" shall be provided for mounting these devices. On hot services, provisions for the thermal expansion requirements of the bridle shall be made. The lower 3-inch connection for the bridle shall be located 3 inches above the internal bottom wall and shall extend from the head of horizontal vessels.

3. Vessel Supports:

3.1 Vertical vessels shall be supported by skirts which shall be at least one-tenth the vessel wall thickness with 1/4-inch minimum and provided with adequate access openings on opposite sides of the skirt to permit ventilation and inspection of bottom head and inside of skirt. Vessel skirts shall be provided with a minimum of one 18-inch access opening and four small ventilation holes. Vessel skirts requiring fireproofing shall be protected on the inside as well as the outside of the skirt. See Steel Structures section for fireproofing details.

3.2 Vessels and vessel supports shall be designed to withstand seismic forces and wind forces of magnitude and applied in accordance with American Standards Association A58.1 for the area in which the plant is located.

3.3 Anchor bolt chairs or lug rings shall be used where required and in all cases where vessel height exceeds 40 feet. Bolt chairs or lug rings shall be of the enclosed type to prevent accumulation of dirt and moisture around anchor bolts.

4. Ladders, Cages and Platforms:

4.1 Vessels provided with manholes, liquid level controls, or gauge glasses 12 feet or more above grade shall be equipped with safety cage ladders and access platforms. Such platforms shall be of a size to provide sufficient access and working room for maintenance and operations. These platforms shall have provisions to adequately drain them of standing rain water. Ladders and safety cages shall be designed in accordance with The National Safety Council's Safe Practice Pamphlet No. 1 and shall have entrances belled out 4 inches. Where convenient, because of vessel grouping, a common ladder and safety cage may be used for access to platforms on two or more vessels.

4.2 Uninsulated vertical vessels 25 feet above grade and higher shall be provided with a painter's trolley and track.

5. Miscellaneous Vessel Attachments:

5.1 Ladder clips, platform supports, insulation ring supports, davits, etc. shall be shop welded. If the vessel is to be stress relieved, these attachments shall be welded to the vessel before it is stress relieved.

5.2 Sufficient thermometer wells, sample connections with valves and pressure measurement connections with valves shall be provided on towers to adequately test them for designed performance. Sample connections shall be thermometer wells with tips cut off and shall be immersed a minimum of 8 inches inside vessel wall.

6. Davits or Hinges:

Davits shall be provided on vertical vessels to support manhole covers and hinges shall be provided on horizontal vessels to support manhole covers and bootlegs when used as manholes.

7. Corrosion:

Corrosion allowance is not required unless otherwise specified, but inhibitor injection connections and corrosion testing connections shall be provided as outlined in the Corrosion section of these specifications.

8. Inspection - Shop:

8.1 All pressure vessels shall be subject to inspection and approval by an authorized representative of Humble prior to shipment from shop. Contractor shall furnish Humble with a fabrication schedule at least two weeks prior to start of shop work so that Humble may arrange for shop inspection during fabrication. If inspection is waived by Humble, this should not be construed to mean that the workmanship is accepted without reservation.

8.2 Copies of the following report and data sheets shall be made available to Humble's representatives, preferably during progress of fabrication, but in all events prior to shipment of equipment.

8.2.1 Manufacturer's data sheet, in accordance with ASME Code.

8.2.2 Certified material report showing location, heat numbers, chemical analysis, and physical properties of all materials used in the fabrication of the equipment.

8.2.3 Photostatic copies of the temperature recording chart obtained during thermal stress relief showing heating, soaking and cooling.

8.2.4 A photostatic copy of the hydrostatic test pressure chart will be required for all equipment weighing over 10,000 pounds; a certified statement of pressure applied and test procedures followed will be acceptable for equipment weighing 10,000 pounds or less.

8.3 Radiographs, X-rays, and/or ultrasonic testing other than those required by ASME Code may be required by Humble, and their cost will be borne by Humble except where defects are revealed. The cost of these radiographs revealing defects, and the cost of corrective measures necessary to remedy these defects, shall be borne by the vendor. Each vendor shall quote per shot, per film length, etc. costs for extra testing by each of these methods which Humble might require above those included in vendor's base price.

8.4 Pressure vessels fabricated from ASTM A-516 Grade 70, A-515 Grade 70, with wall thickness of 2 inches and greater shall be Magnaflux inspected. These Magnaflux tests are to be in addition to the radiograph, hydrostatic and other tests required by the ASME Code.

8.5 The following requirements apply to vessels with wall thickness of 2 inches and greater:

8.5.1 In those cases where the design of nozzle connections permits

inspection by radiography, backgouging of all nozzle connecting welds shall be 100 percent Magnafluxed, followed by 100 percent radiography inspection of all completed welds after postweld heat treatment.

In those cases where the design of nozzle connections does not permit inspection by radiography, all nozzle connecting welds shall be inspected by magnetic particle examination as follows:

After second pass
After each 3/4 inch of weld thickness is completed
After backgouge from reverse side
After second pass on reverse side
After each 3/4 inch of weld thickness is completed on reverse side

All cover beads after postweld heat treatment

8.5.2 All main seams shall be inspected by magnetic particle examination as follows:

After second pass
After first 3/4 inch of weld thickness is completed
After backgouge from reverse side
All cover beads after postweld heat treatment

8.5.3 In no case shall the temperature of the metal during Magnafluxing be permitted to fall below the required preheat temperature, as established by code.

8.6 Ultrasonic tests shall be made on 100 percent of welds made using microwire inert gas welding techniques. Defects indicated by ultrasonics shall be confirmed with radiographic inspection and, in addition to other defects requiring repair, all "cold-lap" defects shall be removed and the weld repaired.

9. Inspection - Field

It is required that final internal inspection of trayed columns be made by Contractor in the field for intactness of internals and cleanliness. Humble may also inspect the internal elements at the time of Contractor's inspection.

10. Internal Equipment:

10.1 Mist eliminator elements shall be installed in all gas scrubbers, separators, absorbers, glycol contactors and any other vessels where a minimum of liquid entrainment is required. Stainless steel woven mesh or other mist eliminator or scrubber elements of efficient design are acceptable. For the glycol separator, a Peerless vane-type mist extractor complete with inlet agglomerator is preferred.

10.2 Where mesh type elements are used, mesh shall be 6 inches thick of Type 316 stainless steel or better, York Style 325 or equal, approximately full tower inside diameter, and removable in sections through the tower manway. Mesh shall be supported above and below by a carbon steel grid, except in corrosive services where grid shall be alloy material. Use "J" bolt installation for support ring which fastens the upper and lower support grids. Individual tie wires shall be used at alternate grid intersections for internal fastening.

10.3 Liquid feeds to vessels with trays shall be provided with slotted openings in the internal pipe distributors.

10.4 The vapor exit nozzle on vertical vessels which are equipped with mist pads shall be side (shell) entry and shall turn up to cause flow reversal into outlet nozzle downstream of the mist pad.

11. Tolerances:

11.1 Tray deflection shall be limited to 1/8 inch for the design live loads of 300 pounds at any point on the fully assembled equipment except that for vessel diameters over 8 feet, the deflection shall not exceed I.D./720 inches.

11.2 Vessel trays shall be flat within plus or minus 1/8 inch.

11.3 Vessel trays shall be level within plus or minus 1/8 inch unless a greater tolerance is specifically approved by Humble.

11.4 The location of all foundation bolt holes shall be within 1/8 inch plus or minus the dimensions shown on manufacturer's drawing for vessels 72 inches diameter or smaller and within 1/4 inch plus or minus for vessels larger than 72 inches diameter.

11.5 Vessel shells shall have a maximum deviation from a straight line of 1/8 inch in 10 feet of length.

11.6 Vessel base rings shall be level within the following tolerances:

Vessel ID	Inches
42" and smaller	1/8
48" through 84"	3/16
90" through 120"	1/4
126" through 144"	5/16

12. Double-deck Vessels:

Humble prefers that double-deck vessels such as an absorber in the top section and scrubber in the bottom section should not be used. Contractor may bid double-deck vessels as an alternate if there is a saving involved.

13. Materials:

Ferrous metals for pressure containing parts at low temperatures shall, in general, conform to the following ASTM specifications:

	Metal Design Temperature (a)		
	650° thru 32°F	31° thru -20°F	-21° thru -50°F
Pipe	A-53 or A-106 Gr. B (limit A-53 above 60°F)	A-106 Gr. B with Stress Relief	A-333 Gr. 0 c/w Stress Relief
Plate	A-516 Gr. 70 A-515 Gr. 70 or A-285 Gr. C. (limit A-285 & A-515 to above 60°F)	A-516 Gr. 70 c/w Stress Relief	A-300 Cl. 1 c/w Stress Relief (use A-516 Gr. 70 metal)
Forged Nozzles & Parts (b)(c)	A-105 Gr. II all Service & temp. (A-105 Gr. I - 600# ASA, A-181 Gr. I 300# & 150# ASA above 60°F)	A-105 Gr. II	A-350 Gr. LF-1
Cast Nozzles & Parts (b)(c)	A-216 Gr. WCB	A-216 Gr. WCB	A-352 Gr. LCB

(a) Metal design temperature shall be the design operating temperature plus 10% or 50°F whichever is larger for services above 60°F. For operating temperatures 60°F and lower subtract 5°F or 10% whichever gives lower temperature.

(b) All couplings shall be 6000# WOG. Slip on flanges 14" and larger are not acceptable.

(c) Cast or forged nozzles shall be used when reinforcement is required unless waived by Humble.

14. Preparation for Shipment:

All flange facings shall be coated with Rust Ban 326 or equal and all flanged openings protected by suitable covers. Threaded couplings shall be protected by thread protectors screwed in place. See Protective Coatings section for shop painting prior to shipment.

15. Compressor Scrubber Sizing Criteria:

Compressor suction, interstage, and discharge scrubbers containing steel woven mesh pads for mist eliminators shall have diameters selected by use of the modified Brown equation as follows:

$$A = \frac{W}{C\left[Dg(Dl-Dg)\right]^{\frac{1}{2}}}$$

where A = Minimum cross sectional area, (ft^2)
W = Total vapors flow rate, (#/hr)
Dg = Gas density at operating P & T, (#/ft^3)
Dl = Liquid " " " " " (#/ft^3)
C = Brown's constant, 600 to 1000

For average operating conditions using preliminary performance requirements the diameter selections should be in manufacturer's standard O.D. sizes; e.g. 20", 24", 30", 36", 42", 48", etc., in 6" increments. Vessels handling large quantities of liquid should use C-values near 600, and vessels handling small volumes of liquid may be selected using higher C-values near 1000. The Mechanical Flow Sheet indicates a preliminary vessel selection for all services. If Contractor proposes more efficient scrubbing elements and can guarantee equal performance with smaller diameter vessels, Humble will consider such alternates.

GAS PLANT GENERAL SPECIFICATIONS

HEAT EXCHANGERS

1. Air Cooled Heat Exchanger:

Unless otherwise specified below, the design, materials, fabrication, inspection, and testing of the air-cooled heat exchanger units shall conform with the API Standard 661, latest edition. A prepared Data Sheet and Check List will be provided with the request for quotation.

1.1 Type

Vertical with outside air intake and vertical discharge is acceptable for compressors up to 600 hp. For larger compressors horizontal coolers with intake below and discharge upward shall be furnished. Either type may be induced or forced draft at the Fabricator's option. For horizontal coolers, if the induced draft design is used the design shall include the motor mounted below the tubes with a jacketed drive shaft extending through the tube rows. Belt tension adjustment shall be made through the use of jack-screws on a standard motor mount. All belts, shafts and fans shall be enclosed in a protective guard. Lubrication connections shall be piped to the outside of the unit to facilitate lubrication of the unit without shutting down the fan. Vibration shutdown switches shall be installed on each fan and shall be Robertshaw-Fulton Vibraswitch Model 65 for hazardous locations, Model 66 for weatherproof location, or equal.

1.2 Fans

Fans shall have manually or automatically adjustable pitch blades and a maximum diameter of 12 feet. For fan diameters of 4 feet and larger, the tip speed shall not exceed 12,000 fpm. For fans smaller than 4 feet in diameter, the tip speed may be designed to 14,000 fpm. Each fan shall be driven by a 1750 rpm, 3-phase, 60-cycle, 440-volt, single-speed or two-speed electric motor through a poly-V or static resistant multi-V belt drive.

1.3 Structural Design

The exchanger frame and plenum shall be designed for a wind load of 50 psf. Plenum shall be 12 BWG minimum sheet formed and/or braced to minimize vibration. The frame shall be standard structural steel members designed in accordance with AISC specifications. Each fan shall be partitioned to ensure no recirculation of air if only one fan is operating. There should be a minimum of 7 feet of head room under the cooler. Where bolted construction is employed, fasteners shall have castellated or elastic stop nuts in addition to lock washers.

1.4 Exchanger Sections

The tube bundles shall be rigid and self-contained, designed to be handled as a complete assembly. Expansion of the tube bundles shall be provided for by floating head design incorporated in headers and frame-

1.4 Exchanger Sections (Cont'd)

work construction. The tube bundles shall be free to expand independently of the structure. Exchange sections shall not be arranged in a manner which provides air flow in series across the unit. Each section shall contain the same number of tube rows, tube pitch, fin configuration, and tube size. Construction shall be in accordance with applicable portion of TEMA Standards and ASME Code, Section 8, unless otherwise specified. Water and lube oil sections shall be designed for 125 psig and gas sections for 10% or 100 psi, whichever is greater, above the highest operating pressures. Gas section shall be ASME code stamped.

1.5 Tubes and Headers

Tubes shall be individually aluminum finned 5/8", 3/4" or 1" O.D. x 18 BWG minimum average wall and shall be secured to headers by rolling. Tubes shall be horizontal and shall be supported at 5' maximum intervals. Headers shall be fabricated steel with plugs opposite each tube; tapered steel plugs for water and oil sections, and steel shoulder plugs with soft iron ring gaskets for gas sections.

1.6 Thermal Design

Ambient air temperature shall be assumed to be 85°F. Fouling factors shall be 0.002 for gas, 0.0015 for water and oil and 0.001 for outside air (bare tube). Jacket water and lube oil sections shall be designed for 10% overload without exceeding manufacturers recommended temperatures. Gas duty shall include duty of condensation based on saturated inlet gas to each stage.

1.7 Jacket Water Surge Tank(s)

Surge tanks shall be furnished complete with gauge glass (polyethylene acceptable) with steel cocks, combination breather and blowout cap, and connections for fill and drain. A treating chemical injector for each independent system shall be provided having inlet from pump discharge and outlet to pump suction.

1.8 Air Control

Manually operated shutters shall be provided over the designated sections and they shall be adjustable from the deck level.

1.9 Finish

Air cooled heat exchanger headers shall be given a zinc metallized finish after fabrication and stress relieving. All cooler structural members shall be coated in accordance with the schedule in "Protective Coatings Section."

2. Shell and Tube Exchangers

2.1 Tubes:

2.1.1 Tubes shall be 5/8-inch O.D. minimum except in water service (tube side) which shall contain 3/4-inch O.D. minimum size tubes. All tubes shall be installed on a triangular pitch. Tube minimum thickness shall be 18 BWG except for cooling tower water where 16 BWG shall be the minimum.

2.1.2 Tube lengths shall be limited to 20 feet on exchangers having removable bundles.

2.1.3 Tubes shall be designed to withstand the maximum internal or external pressure that may exist when one side of a service is reduced to atmospheric pressure and the other side remains at its rated operating pressure.

2.2 Tube Sheets and Bundles:

Fixed tube sheet exchangers may be used on services meeting all of the following conditions: (1) the maximum temperature of either tube or shell does not exceed 200°F; (2) the maximum difference between the average tube fluid temperature and the average shell fluid temperature is not greater than 100°F; and (3) the shell side fluid is not corrosive. Such exchangers shall have removable channel covers.

3. Concentric Pipe Exchangers

Specifications for concentric pipe exchangers shall conform generally to the specifications for shell and tube exchangers. Return bend connections shall be of the same material and wall thickness as pipe.

GAS PLANT GENERAL SPECIFICATIONS

INSTRUMENTS AND CONTROLS

1. Panel Board

1.1 Pressure Indicators

OICO or Marshalltown liquid filled 6" dial, flush mount, with steel bourdon tube. Range should be twice operating pressure and at least 1½ times MWP. Furnish for all suction pressures and final discharge pressure(s), instrument air supply, jacket water pump discharge, and lube oil header pressure. Bleed valves shall be installed between isolating valves and gages, positioned for installation of test gages.

1.2 Shutdowns

Amot or Fulton Sylphon pneumatic. Furnish for low suction pressure, each inlet stream; high-low discharge pressure, each outlet stream; high discharge temperature, each cylinder; cooler fan vibration; compressor frame vibration; manual emergency shutdown; combustible gas shutdown; and fire alarm system shutdown. A test manifold of two valves shall be provided in the panel on each of the sensing lines so that shut-down devices may be tested and reset without causing actual shut-downs.

1.3 Annunciatures

Provide an Amot or Fulton Sylphon pneumatic annunciator relay for every shut-down and alarm function including compressor and level functions, as specified elsewhere.

1.4 Start-Stop

Means shall be provided for defeat of oil pressure and other functions necessary for starting, and defect shall automatically clear after a timed interval not to exceed five minutes. A test circuit shall be provided for test of individual switches without compressor shutdown.

1.5 Sequencing

Provide remote manual actuation for suction and discharge block valve and equalizing valve operation. Rate of valve operation shall be adjustable for ease of manual loading.

1.6 Piping

All instrument piping shall be ¼" type 316 stainless steel tubing, 0.032" MWT welded and drawn, annealed and pickled, installed with Swagelok, Parker "CPI", or Gyrolok Type 316 stainless steel fittings. Valve actuator piping shall be 3/8" or 1/2" stainless, as required. An exception may be taken within the panel on instrument pressure lines that cannot continue to bleed if ruptured. Such lines shall be Imperial "Impoline" polypropylene, "Nylo-Seal" type SN nylon, or equal, black plastic tubing installed with Imperial "Poly-Flow", or equal, anodized aluminum insert type fittings. Instrument connections to process piping

shall be made through male-female valves, AGCO, H-IVC-24 or -44Q.

2. Local Mounted Pressure Gages

OICO Type 88 chrome case or Marshalltown "Stedigage" liquid filled 4" dial face with steel bourdon tubes and range twice operating pressure.

3. Thermometers

Palmer Type 35A or Ashcroft 60EM mercury filled dial type thermometers shall be mounted in stainless steel wells on discharge lines from each cylinder, compressor suction volume bottles, jacket water and lube oil to and from compressor, fluid to and from each heat exchanger section, and at any other point recommended by equipment manufacturers.

4. Recycle Regulator

Provide to maintain minimum allowable suction pressure(s). limited by rod load, discharge temperature, or increasing horsepower consumption. Fisher type 667D valves sized for 50% compressor capacity, with Fisher 4160 pilot controllers yoke mounted are required. Install pilot with an AGCO male-female valve at sensing point tap.

5. Auxiliary Service Small Regulators

For inlet pressure 150 psi and lower may be steel body, self-contained type, Fisher type 620, 630, 730C, or equal. For higher pressures use Fisher type 4160-667D.

6. Other Pressure Controllers

In general, pressure controllers should be Fisher type 4160. Where an indicating controller is required a Fisher type 43A with proportional and reset action shall be furnished.

7. Temperature Controllers

Jacket water and lube oil may be self-powered, Amot or Fulton Sylphon. Other temperature controllers shall be Foxboro 43A with 1A thermal systems and with proportional and reset modes.

8. Flow Measurement

Orifice flanges with 0.7 Beta ratio plates should be furnished in each inlet gas line to the compressor. Runs need not be AGA, but longest convenient run. If accurate measurement is specified in the "Special Provisions" for any service, furnish Daniel "Senior" fittings in AGA runs.

9. Flow Controllers

Foxboro 43A with T/37 elements and with proportional and reset modes shall be furnished.

10. Control Valves

Fisher "A", "D", or "E" bodies, Fisher "VEE-Ball" or service, shall be used. Characterization should be matched to the process. Topworks should be sized for 3-15 or 6-30 psi uniformly throughout the station. Flow control valves shall be equipped with valve positioners.

11. Safety Relief Valves

Consolidated, Crosby, Farris, or Sage steel pressure relief valves with adjustable set and blowdown shall be furnished on inlet scrubber(s), on compressor discharge piping upstream of each gas cooling section, on final discharge(s), and in fuel, starting and instrument systems downstream of all regulators. Valves shall be sized for full flow considering the imposed back pressure, and balanced bellows sealed valves are acceptable to reduce manifold piping requirements. Relief valves shall be installed with full size full port lock bonnet type valves on the inlet and with a 1/2 inch male-female AGCO H-1 test valve between the inlet block valve and relief valve. Hydraulic relief valves such as that on the glycol filter shall be 3/4" inlet Crosby JMBC.

12. Instrument Air Supply

Except where the instrument air is supplied from the platform control instrument air system, the compressor station equipment shall be equipped with a dissipating desiccant type filter-dehydrator, Dehydration Engineering, LTD. 4DH or 6DH as required and a Poll Trinity Micro "Ultipor 0.9" filter. The dehydrator and filter should be sized for total instrument air flow, including valve actuator air. Air sets for individual instruments shall be Fisher 67 UR.

13. Level Controls

All vessels on offshore platforms which are required to have high-low level shut-downs shall be equipped with "Magnetrol A-1500-J19" liquid level control which will, through the annunciator panel, shutdown the compressor and close the scrubber inlet line. The low level shut-down shall also close the scrubber dump valve.

14. Combustible Gas Detector System

A combustible gas detection system for the total platform will be provided, the measurement-control cabinet for which will be located in the Central Control Room remote from the gas handling facilities. The system will be a General Monitor, Scott-Davis, or equal. Two or three (see Special Provision section and plan drawings) of the remote detector heads will be furnished and installed by Humble in the compressor building in the most critical areas. Building Ventilation fan(s) should not be shut off in case of a gas detector shut-down; however, the compressor suction and discharge valves should be closed and the equalizer and blowdown to flare valves opened in the proper sequence through the panel.

15. **Fire** Detector System

The total platform will be provided with a Central Fire Detector System having a measurement-control panel located in the Central Control Room. Two or four, (see Special Provision Section and Plan Drawings), remote detector heads will be furnished and installed by Humble to scan all of the compressor equipment.

GAS PLANT GENERAL SPECIFICATIONS

PIPING AND FABRICATION

1. Corrosion

See Section on "Construction for Corrosive Fluids" in these General Specifications for exceptions to the following requirements.

2. Piping

2.1 Arrangement

Equipment shall be arranged for easy access for adjustment and maintenance and for neat and orderly piping. Piping shall generally run parallel to the skid axes and be arranged for convenient clamping and bracing to skid members. Pipe clamps and guides should be similar to those shown on drawings GA-101-1 and GA-132, attached. Piping within the building should generally be beneath deck level in trenches or on deck level with a false floor above. Vertical pipe runs for vent stacks and for double deck construction shall be outside the building. Sleeves shall be installed through upper deck (projecting approximately 2" above deck) for passage of risers through deck. Rain shields shall be welded to risers, overlapping sleeves. Shields shall be braced to deck to prevent movement of risers. Equipment located on upper deck must be bolted to WF pad or plates welded to upper deck. There should be no holes through upper deck for anchor bolts. For ease in testing and blowing, 3/4" - 6000# couplings or threadolets shall be installed at high and low points in the piping system.

2.2 Pipe Size Selection:

a. Compressor Process Gas Piping: Pressure drops in gas piping shall be calculated by Weymouth's Formula. An exception to maximums specified may be taken only on the basis of an analog study.

(1) 0-499 psia:
Suction piping: 1/8 psi/100 ft.
Discharge piping: 1/4 psi/100ft.
Total system loss as percent of pressure: 2% to 3% maximum

(2) 500-1499 psia:
Suction piping: 1/4 psi/100 ft.
Discharge piping: 1/2 psi/100 ft.
Total system loss as percent of pressure: 1% to 2% maximum

(3) 1500 psia up:
Suction piping; 1/2 psi/100 ft.
Discharge piping: 1/2 psi/100 ft.
Total system loss as percent of pressure: 1% maximum

b. Other Gas Piping: 1/2 psi/100 ft., computed as above.

c. Liquid Piping:

(1) Pump Suction: 1 ft/100 ft. calculated by the Hazen-Williams Formula with C=100 for water and C=140 for hydrocarbons.

(2) All Other: 1 psi/100 ft. calculated as above.

2.3 Mechanical Design

Manifold, volume bottles and interconnecting gas, water, etc., piping shall be designed and constructed in accordance with the USAS code for Pressure Piping, B31.3, latest edition. Pipe for welding shall be ASTM A53 or A106 Gr. B seamless, and fittings shall be ASTM A234 Gr. WPB.

Piping 2" and larger shall be welded, with flanged connections. Flanges shall be raised face for operating pressures up to 1200 psi. Ring joint face flanges shall be used for operating pressures 1200 psi and above. Flat cut asbestos gaskets shall be used with USAS 150# 300#, and 600# R.F. flanges. Bare Armco Iron oval rings shall be used with ring joint face flanges. All flange bolts shall not be cadmium plated. All connections 2" and larger left for field tie-ins must have weldneck companion flanges complete with gaskets bolted on. Connections smaller than 2" left for field tie-ins must be provided with unions.

All screwed fittings, flanges, and valves in gas piping shall be forged steel, ASTM A-105, Gr. II. Jacket water piping may be screwed galvanized pipe with malleable iron fittings. All screwed piping except jacket water piping shall be minimum Schedule 80, Grade B. Couplings 1-1/2" and smaller shall be 6,000# forged steel and all larger couplings shall be minimum 3,000# forged steel. Glycol piping shall be socket welded to the extent practical, and aluminum jacketed insulation shall be provided to conserve heat where desirable or for burn protection if necessary.

Suction bottles and lead line to suction block valve shall be designed to withstand discharge pressure of the cylinder to which it is attached, or a safety relief provided between the valve and suction bottle. Unit shall be piped as shown on attached typical flow diagrams. Suction, discharge, check, blowdown, and drain valves shown on the typical flow diagrams shall be furnished. Other pipe, valves, and equipment not shown on flow diagrams but required by established good design practice shall also be furnished.

3.0 Valves

Regular Port Ball valves such as Cameron, Grove or Orbit are preferred for all process services. Valves 6" and larger shall be enclosed worm gear operated. Discharge check valves shall be Daniel or Edward piston type. Blowdown valves shall be Edward or Hancock globe type. Valve operators shall be Bettis "Robotarm" or Orbit. Instrument valves shall be AGCO H-1, drain, isolating, blowdown, etc., valves shall be Crane or Walworth of gate or globe design as dictated by the service. Refer to API RP-520 and ASME Section 8, Appendix M for recommended features and design methods for relief valve manifolds.

4.0 Bolting

Alloy cap bolts ASTM A193, Gr. B-7 may be used only for attaching companion flange to compressor cylinder. Machine bolts and nuts, ASTM A-307, GR. B, may be used up through ASA 150# class. All other flanges shall have alloy steel studs, ASTM A-193, Gr. B-7, with heavy Hex nuts, ASTM A-194, Gr. 2H. (See "Construction for Corrosive Fluids" Section of these General Specifications for over-riding requirements for material selections).

5.0 Inspection of Shop Fabrication

5.1 Contractor shall advise Vendors on all purchase orders issued for pipe prefabrication that the following special instructions shall apply:

5.1.1 Piping shall be welded and fabricated as specified in the latest edition of USAS-B31.3 Code for Petroleum Piping. The qualification of welding procedure and welder shall be in accordance with the requirements of Section IX, ASME Boiler and Pressure Vessel Code Welding Qualification. as amended and supplemented in paragraph 6.0, "Welding Procedures and Qualifications" of this Section.

5.1.2 All welding shall be inspected on a Visual and by Random Radiography basis using 2 to 5% spot x-ray. However, Humble reserves the right to require 100% ultrasonic inspection on all welds made by the Fine Wire (MIG) Process and to require additional Radiography up to 100% if, in the Humble Representative's opinion, welds of code quality are not being produced by the manufacturer using any approved welding process. When Random Radiography examination basis is used, the evaluation and repair of imperfections shall include porosity and slag inclusions as well as cracks and incomplete penetration.

5.1.2.1 Radiography - Humble will pay for the costs of Radiography performed in the Vendor's shop except the 2 to 5% spot x-ray referred to above and that done by the Vendor for his own quality control. When a defective weld is discovered, all costs for inspection and repairs shall be borne by the Vendor.

5.1.2.2 Ultrasonic - Where the Vendor elects to use the Fine Wire (MIG) welding process, the Vendor shall employ a Testing Laboratory or Inspection Service Contractor where his own inspection services do not have the ultrasonic equipment or qualified operators. All costs for inspection and repairs shall be borne by the Vendor.

5.1.2.2.1 Approval of Inspection Services - Humble reserves the right to approve the Vendor's selection of a Testing Laboratory or Inspection Service Contractor.

5.1.3 Vendor shall qualify both welding procedure and welders for Humble's projects where the size of such projects warrants such procedure. Humble's inspector shall witness such qualifications.

5.1.4 Welders not qualified for Humble projects shall not be allowed to weld on pipe or vessels purchased by Contractor for Humble's account.

5.1.5 Humble's inspector shall have the right to designate the welds to be inspected by Radiography and all film shall be delivered to Humble's inspector before any repairs are made to welds so inspected. If Random Radiography fails to produce code quality welds as stated above, then such Radiography shall be continued until the welds are acceptable and the procedure or individual operator meets code standards for acceptability and workmanship.

5.1.6 All welding electrode, stick or fine wire, shall be compatible with the grade of steel pipe being used. High strength electrodes for low strength pipe steels shall not be used.

5.1.7 Humble reserves the right to enter Vendor's shop at any time to assure that Humble's requirements are being maintained on a continuing basis.

6.0 Welding Procedures and Qualifications

6.1 General

6.1.1 These specifications shall govern generally the procedures to be use and the qualifying test to be followed for securing competent operators; all for the purpose of securing high quality of workmanship in accordance with the standards prescribed by the applicable codes.

6.1.2 The following specifications have been prepared to cover manual shielded metal-arc welding process using coated stick electrodes.

6.1.3 Other Welding Processes

6.1.3.1 Humble will consider the use of automatic or semiautomatic welding provided the procedure meets the applicable codes, will pass the prescribed tests, and Contractor feels the use or partial use of such equipment will produce a saving. If Contractor desires to utilize welding techniques other than manual shielded-arc, he should so state in his proposal and describe the procedure he plans to employ.

6.1.3.2 All welding shall be inspected on a Visual and by Random Radiography basis using 2 to 5% spot x-ray. However, Humble reserves the right to require 100% ultrasonic inspection on all welds made by the Fine Wire (MIG) Process and to require additional Radiography up to 100% if, in the Humble Representative's opinion, welds of code quality are not being produced by the manufacturer using any approved welding process. When Random Radiography examination basis is used, the evaluation and repair of imperfection shall include porosity and slag inclusions as well as cracks and incomplete penetration.

6.1.3.2.1 Radiography - Humble will employ a Testing Laboratory or Inspection Service Contractor. The costs of such inspection shall be borne by Humble except when a defective weld is discovered. The costs for the inspection and repairs for the defective welds shall be borne by the Contractor. Contractor may at his own election and cost employ Radiography as a quality control tool independent of Humble's inspection.

6.1.3.2.2 Ultrasonic - Where the Contractor elects to use the Fine Wire (MIG) welding process, the Contractor shall employ a Testing Laboratory or Inspection Service Contractor. All costs for such inspection and repairs shall be borne by the Contractor.

6.1.3.2.2.1 Approval of Inspection Services - Humble reserves the right to approve the Contractor's selection of a Testing Laboratory or Inspection Service Contrator.

6.1.4 Unless Humble's written approval prior to fabrication is obtained, all welding of plant piping, whether manual, automatic, or semiautomatic, shall be performed at the jobsite.

6.1.4.1 When permission is granted to prefabricate piping in vendors' shops using fine wire welding, the provisions of 1.3.2 shall be written into the Contractor's purchase orders.

6.1.5 Qualification of Welding Procedure shall be in accordance with Part A, Item Q-10, ASME Boiler and Pressure Vessel Code, Section IX, Welding Qualification.

6.1.6 All piping shall be plumb and square.

6.2 PIPE WELDING PROCEDURE

6.2.1 Piping shall be welded and fabricated as specified in the latest edition of ASA-B31-3 Code for Petroleum Refinery Piping. The qualification of welding procedures and welders shall be in accordance with requirements of Section IX, ASME Boiler and Pressure Vessel Code, amended and supplemented as follows:

6.2.1.1. All prefabricated plant process piping shall be welded as follows:

Bead	Method	Electrode Size
1. First Pass of stringer bead	Downhill	5/32" rod (or 1/8" if req'd)
2. Second pass or hot pass	Downhill)	Uphill or downhill with
3. Filler pass or passes	Uphill)	5/32" rod
4. Final Pass to be a laced cap	Uphill	5/32" rod

6.2.1.1.1 Tie-in welds or in-place plant welds may be made in any plane with the approval of Humble's inspector.

6.2.1.2 "Downhill" as defined herein shall mean vertical down and "uphill" shall mean vertical up.

6.2.1.2 Final pass on water lines or drain lines may be made either uphill or downhill.

6.3 WELDER QUALIFICATION

6.3.1 The following shall constitute the qualification test for electric welding operators with welding performed as outlined in 2.1.1 utilizing a minimum of four passes.

6.3.1.1 Two test nipples each 4-½" long shall be cut from 5.563" OD 3/8" wall thickness or 6-5/8" OD 0.432" wall thickness (Sch. 80), ASTM A-106, Grade B seamless pipe, unless otherwise specified by Humble's welding inspector(s). The welding edges shall be machine beveled.

6.3.1.2 The test nipples shall be placed with their axis in approximately a horizontal plane and with their welding groove in approximately a vertical plane.

6.3.1.3 Electrodes - E-6010 for all beads.

6.3.1.4 The pipe shall not be rolled or turned during welding, thus requiring the operator to deposit the weld metal from a flat, vertical, and overhead position.

6.3.1.5 Four test specimens shall be cut from the welded nipples. The specimens shall be taken 90° apart on the pipe and shall be approximately 1" wide by 9" long. The edges shall be ground smooth to an approximate radius of 1/16" and the weld reinforcement shall be ground flush with the base metal. The four specimens shall be taken one from each side and one from the top and one from the bottom of the pipe.

6.3.1.6 Two face bends and two root bends shall be made using a guided bend test jig. The bends shall be made in accordance with the guided bend procedures outlined in the USAS Code for Pressure Piping. Face bends shall be made from the specimen taken from the top and one side of the pipe. Root (or back) bends shall be made from the specimen taken from the other side and bottom of the pipe.

6.3.1.7 A crack in the weld metal or between the weld and the base material which, during or at the completion of the test, opens up by more than 1/8" in any direction, shall be cause for rejection. Cracks occurring on the corners of the specimen during testing shall not be considered as cause for rejection.

6.3.1.8 Retests. A welder who fails the first test may be allowed to take a second test if, in the mutual opinion of both Humble and Contractor's representatives, he is entitled to do so.

6.3.1.9 Visual Examination. The weld must be free of cracks, inadequate penetration, burn-through, and other obvious defects, and it must present a neat workmanlike appearance. Undercutting adjacent to the final bead on the outside of the pipe shall not exceed 1/32" in depth.

6.3.1.10 Radiographic Examination. In order to assure that the operator can carry out the provisions of the welding procedure, Humble reserves the right to radiograph the joint on a spot radiographic basis as outlined in ASME Section IX, Welding Qualifications, Item Q-21, b, (2).

6.3.2 The following procedure shall constitute the qualification test for oxyacetylene welding of pipe:

6.3.2.1 Two test nipples each 4-½" long shall be cut from 3.500" OD, Sch. 40, 0.216" W.T., ASTM-106, Grade B seamless pipe, unless otherwise specified by Humble's welding inspector(s). The welding edges shall be machine beveled to 30° or 37-½°. The weld shall be made in two passes. The first pass shall be made downhill and the second pass shall be made uphill, using Oxweld #1 or Airco #32, 3/16" rod.

6.3.3 Contractor shall complete, in triplicate, a "Welder Qualification Test Coupon Report" form on each welder tested. Sample form is attached. Original and one copy shall be furnished Humble and one copy retained by Contractor.

6.4. STRUCTURAL WELDING

6.4.1 All structural welding must conform to American Welding Society's "Standard Code for Arc and Gas Welding in Building Construction".

6.4.2 All welders shall pass tests for groove welds in plate in the flat, horizontal, vertical, and overhead positions as prescribed by the American Welding Society.

6.4.2.1 All welders passing the qualification test for pipe welders shall be considered qualified for structural welding.

6.4.3 Tank Interiors

6.4.3.1 All seams in tank interiors where stitch welding provides sufficient structural strength shall be seal welded to provide internal corrosion control.

6.4.4 Outside Structural Steel Exposed to Weather

6.4.4.1 All outdoor seams in structural steel in and between columns, beams, joists, and other members, such as gusset plates, braces, splices, fillers, etc., subject to accumulation of dirt and moisture shall be sealed either by welding or by an approved sealing compound.

6.4.5 Outside Equipment

6.4.5.1 All outside equipment secured from vendors with stitch welding, which is adequate for structural strength, shall be seal welded or sealed using an approved sealing compound to prevent moisture intrusion between plates, structural supports or other members. Items requiring inspection and possible correction are:exposed forced draft duct work between boilers and stacks; structural steel for fired heaters and power plants; hoods for ventilating fans; etc.

6.5 WELDING ON VESSELS

6.5.1 Written approval from Humble shall be obtained before any field welding is done on code vessels. Welding procedure must follow the recommendations of the appropriate code, and welding must be done by a code welder and approved by a code inspector. It shall be Contractor's responsibility to determine and to follow the procedures required to maintain the code status of such vessels, and Contractor shall bear all cost related thereto, including the cost of approved code inspector.

6.6 WELDING EQUIPMENT

6.6.1 Arc welding machines shall be of a standard make equivalent to leading manufacturers such as Lincoln, General Electric, Wilson, and others approved by Humble. Accessories such as ammeters, voltmeters, etc., shall be in good working order and for best results, the governor on machines should maintain the same speed specified on the nameplate of the generator. Capacity shall be such that the machine can operate continuously, using 3/16 to 5/16" rod.

Ground accessories such as cable, electrode holders, etc., shall be of approved manufacture and kept in first-class condition. All welders shall wear equipment approved by safety regulations and helpers shall be supplied with special goggles.

6.6.2 Welding Electrodes

6.6.2.1 Electrodes for electric welding shall be of the shielded type of material equivalent to leading manufacturer's products, such as Lincoln "Fleetweld No. 5," Lincoln "Shield Arc No. 85," Airco "No. 78E," Airco "No. 93," General Electric W-22, General Electric "No. W-5L," A. O. Smith SW-10, A. O. Smith "No. SW-75," and others approved by Humble. Contractor shall refer to Humble for selection of electrodes and procedure for welding high tensile or alloy steels. Electrodes shall be kept dry, stored to prevent moisture loss or moisture absorption, and shall be handled in such a manner as to prevent chemical and/or physical damage to coating. Electrodes which show signs of deterioration or damage shall be rejected.

6.7. WELDING SPECIFICATIONS

6.7.1 Piping and Beveling

6.7.1.1 For electric welding, pipe ends shall be beveled 30° or $37\text{-}\frac{1}{2}^{\circ}$. It will be permissible to make a welded joint where one piece is beveled 30° and the other is beveled $37\text{-}\frac{1}{2}^{\circ}$. Where mating pipe or fittings do not have the same inside bore, the part having the smaller bore shall be beveled so that the weld will have a smooth contour that will merge gradually with the surface of the adjacent part.

6.7.1.2 Steel lines 2" and larger specified to be welded shall be arc welded.

6.7.1.3 Steel lines $1\text{-}\frac{1}{2}$" and smaller specified to be welded shall be acetylene welded.

6.7.1.3.1 Socket weld fittings may be used with shielded metal-arc welding in lieu of the acetylene welding for the steel lines $1\frac{1}{2}$" and smaller if the Contractor so elects.

6.7.1.4 Where slip-on flanges are permitted (in straight runs of pipe only), they shall be welded both inside and outside. The face of the flange shall be set sufficiently far from the end of the pipe to allow a full-fillet inside weld and an additional space of 1/8" to 1/4" between the weld and the flange face.

6.7.2 Aligning

6.7.2.1 Importance of the alignment of pipe and fittings cannot be overemphasized. Special care must be taken so that the ends are accurately aligned and properly spaced between 1/16" and 1/8". A pipe clamp or other devices shall be used as required to obtain accurate alignment and spacing.

6.7.3 Cleaning

6.7.3.1 All scale, rust, dirt, or other foreign matter shall be thoroughly removed from the ends of the pipe before tacking or welding. Wire brushing is generally sufficient for cleaning rusty surfaces, but all torch-cut edges shall be hammered or scraped and wire-brushed to remove oxide scale.

6.7.4 Bell-Hole, Electric Arc

6.7.4.1 Bell-hole or position welds shall consist of not less than three beads, and the electrode shall be of 5/32" size for stringer bead and a maximum of 3/16" size for succeeding beads.

6.7.5 Rolling Welds, Electric Arc

6.7.5.1 The number of passes for rolling welds shall be three for standard wall thickness pipe or less. The first pass shall be applied with no larger than 3/16" electrode, the second pass shall consist of 3/16" to 1/4" rod, and the final pass shall consist of 3/16" to 5/16" rod. For pipe with wall thickness greater than standard grade, the number of passes shall be specified by Humble's welding inspector.

6.7.6 Arc Welding Procedure

6.7.6.1 The entire root bead shall be made with the pipe in a stationary position. It is mandatory that at least two welders be used, operating simultaneously and in opposite quarters, when welding root beads for all sizes of pipe 16" OD or larger. Movement of the pipe during the welding of the root beads shall be held to an absolute minimum. Root bead shall be cleaned by grinding before applying second bead.

6.7.6.2 In addition to the preliminary cleaning, it is necessary to remove all scale and slag deposited on the bead before applying the succeeding bead. All scale, slag or other foreign material shall be removed by chipping and wire brushing or grinding after the application of each bead. When completing a pass, the bead shall be fully completed and then curved slightly, ending on the pipe slowly until the arc is broken.

6.7.6.3 In welding light wall 4-½" OD pipe and smaller which has ¼" WT or under, sufficient cooling time between stringer or root bead, filler beads and final beads shall be allowed in order to make a more sound weld. Humble's welding inspector shall determine the cooling period.

6.7.7 Bead or Deposited Metal

6.7.7.1 Width

6.7.7.1.1 Width of the weld shall be slightly greater than the width of V of the bevel. It is recommended that the bead shall extend a minimum of 1/8" on each side of the bevel.

6.7.7.2 Reinforcement

6.7.7.2.1 For reinforcement, the bead shall extend not less than 1/16" above flush and preferably 1/8" above flush.

6.7.7.3 Penetration

6.7.7.3.1 Penetration or depth of fusion shall extend the full depth of the pipe wall, including both the beveled and straight portions. The interior shall be free from "whiskers" or "icicles."

6.7.7.4 Appearance

6.7.7.4.1 The bead shall be smooth in appearance and shall contain no valleys or indentations on the crest or at the edge. Deposited metal shall be free from folds, cold shuts, gas holes, or other defects. Upon completion of the weld, all oxide and slag on and around the weld shall be removed to allow proper application of coatings.

6.7.8 Identification

6.7.8.1 All welders shall identify their welds with a stencil furnished by Contractor.

6.7.9 Rejections

6.7.9.1 Rejections may be made on a basis of any of the specifications described above. In event of rejections, the expense of installing new welds or repairing, according to direction of Humble's welding inspector, shall be borne by the Contractor.

6.8 FABRICATION

6.8.1 Piping

6.8.1.1 All piping shall be fabricated in accordance with "Approved for Construction" drawings.

6.8.1.2 All piping shall be plumb and square and any misfabricated piping or structures shall be repaired or replaced at Contractor's expense.

6.8.1.3 Threaded nipples shall be of standard lengths. The ends of all threaded pipe shall be reamed so that all burrs are removed.

6.8.1.4 Threaded connections shall not be back welded unless otherwise specified.

6.8.1.5 Piping and structures that are prefabricated shall be held to such a size that they can be handled safely and installed without undue strains being imposed on pipe or fittings.

6.8.1.6 All field fabrication shall be done under the direct inspection of Humble's representative.

6.8.1.7 Any field fabrication that requires stress relieving shall be stress relieved by the electrical resistance, induction heating, or "Exomet Process." Procedures shall be agreed upon by Contractor and Humble. Torch heating will not be accepted.

6.8.1.8 If couplings, branch lines, or nozzles are to be installed in headers, compressor surge bottles, or fabricated piping, such welds shall be completed and the headers, surge bottles, or fabricated piping cleaned of all foreign material before the last welding cap is welded on or the fabricated piping is flanged or welded into the line.

6.8.1.9 A compound or tape approved by Humble shall be used on all threaded connections.

6.9 SEAL WELDING OF THREADED PIPE

9.1 Certain threaded pipe systems may require seal or back welding. If requested by Humble, Contractor shall seal all or a part of the threaded connections using a minimum of two welding passes.

WELDER QUALIFICATION TEST COUPON REPORT

Location of Job: _____

Contractor: _____

Date: _____

Welder's Name: _____ Social Security No. _____

Welder's Address: _____ Phone No. _____

Welder's Mark: _____

Size and Grade of Test Nipple: _____ Wall Thickness _____

Welding Rods: _____

Manufacturer: _____

AWS NO. _____ Size: _____

Remarks on Bend Tests:

1. _____

_____

2. _____

_____

3. _____

_____

4. _____

_____

Remarks on Visual Examination: _____

_____

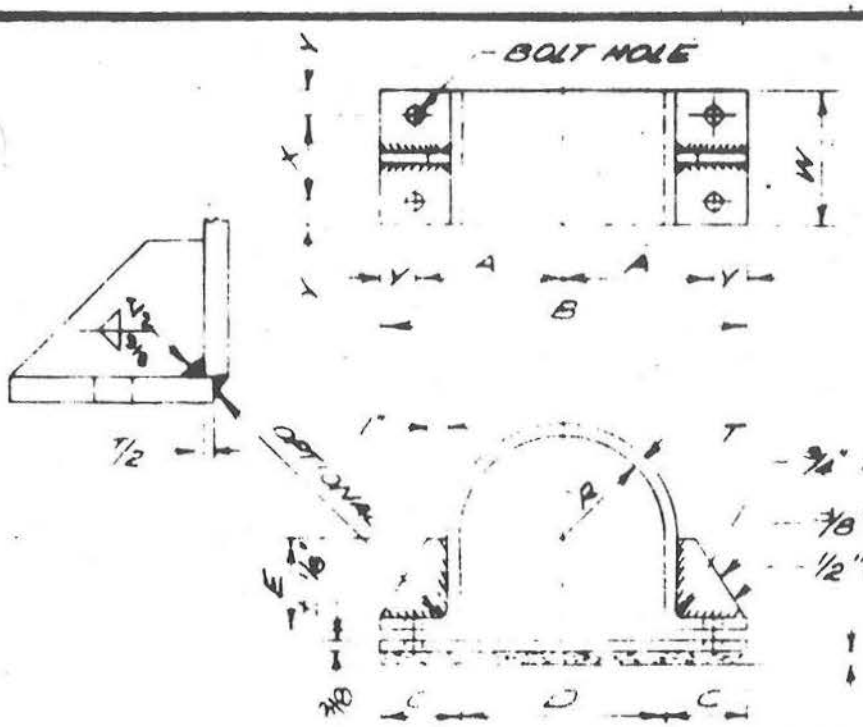
_____

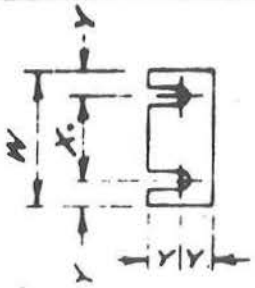
_____

Qualified: _____ Disqualified: _____

_____
Contractor

_____
Humble's Welding Inspector





SHIM DETAIL

2 REQ'D / CLAMP DETERMINE THICKNESS IN FIELD.

PIPE SIZE	BOLT SIZE	BOLT HOLE DIA.	A	B	C	D	E	R	T	W	X	Y
2	3/4	1	3 1/4	8 1/2	3 1/16	2 3/8	1	1 3/16	3/8	5	3	1
2 1/2	3/4	1	3 1/2	9	3 1/16	2 7/8	1 1/4	1 7/16	3/8	5	3	1
3	3/4	1	3 3/4	9 1/2	3	3 1/2	1 1/2	1 3/4	3/8	5	3	1
4	1	1 1/4	4 5/8	11 3/4	3 5/8	4 1/2	2	2 1/4	1/2	6	3 1/2	1 1/4
6	1	1 1/4	5 3/4	14	3 11/16	6 5/8	3 1/8	3 5/16	1/2	6	3 1/2	1 1/4
8	1 1/4	1 1/2	6 7/8	16 3/4	4 1/16	8 5/8	4 1/8	4 9/16	1/2	8	5	1 1/2
10	1 1/4	1 1/2	7 7/8	18 3/4	4	10 3/4	5 1/8	5 5/8	1/2	8	5	1 1/2
12	1 1/2	1 3/4	9 1/4	22	4 3/8	12 3/4	6	6 5/8	5/8	10	6 1/2	1 3/4
14	1 1/2	1 3/4	9 7/8	23 1/4	4 3/8	14	6 5/8	7	5/8	10	6 1/2	1 3/4
16	1 1/2	1 3/4	10 7/8	25 1/4	4 5/8	16	7 5/8	8	5/8	10	6 1/2	1 3/4
18	1 1/2	1 3/4	11 7/8	27 1/4	4 5/8	18	8 5/8	9	5/8	10	6 1/2	1 3/4
20	1 3/4	2	13 1/4	30 1/2	5 1/4	20	9 1/2	10	3/4	10	6	2
24	1 3/4	2	15 1/4	34 1/2	5 1/4	24	11 1/2	12	3/4	10	6	2
26	1 3/4	2	16 1/4	36 1/2	5 1/4	26	12 1/2	13	3/4	10	6	2
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32	2	2 1/4	19 1/2	43 1/2	5 3/4	32	15 1/2	16	3/4	12	7 1/2	2 1/4
34	2	2 1/4	20 1/2	45 1/2	5 3/4	34	16 1/2	17	3/4	12	7 1/2	2 1/4
36	2	2 1/4	21 1/2	47 1/2	5 3/4	36	17 1/2	18	3/4	12	7 1/2	2 1/4

GENERAL NOTES

ALL DIMENSIONS ARE IN INCHES.

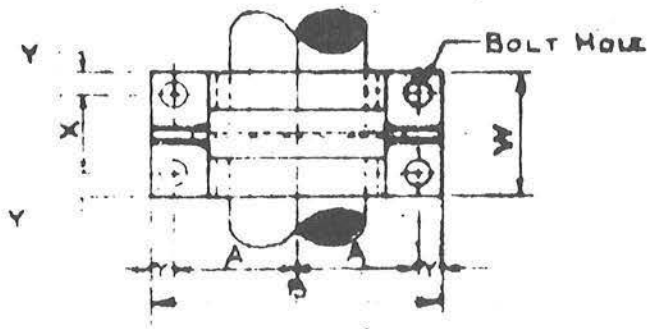
USE TWO NUTS ON EACH BOLT, W/ ONE US STD ROUND WASHER.

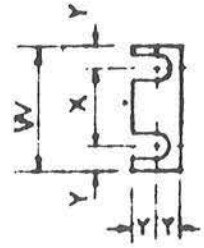
IF CPLG. NUTS ARE USED, STUD BOLTS FOR NUTS SHALL BE A-193 OR B-7 STEEL

FOUR BOLT CLAMP FOR PIPE
2" IN DIA. THROUGH 36"

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
GAS ENGINEERING DIVISION
HOUSTON, TEXAS

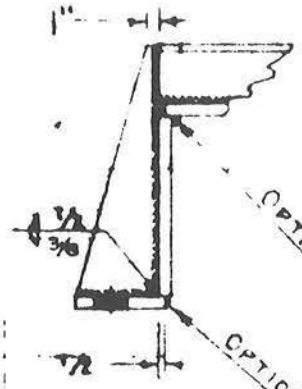
DRAWN BY SCHWARTZ DATE 11-11-1959 SCALE NONE
CHECKED BY A.B. SIMMONS JR
APPROVED BY [illegible]
REVISED 7-1-60, 12-18-62
FILE NO. GA-101-1

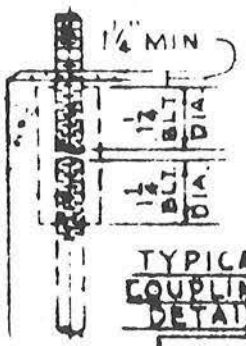




SHIM DETAIL

2 REQUIRED. EACH CLAMP DETERMINE THICKNESS IN FIELD.





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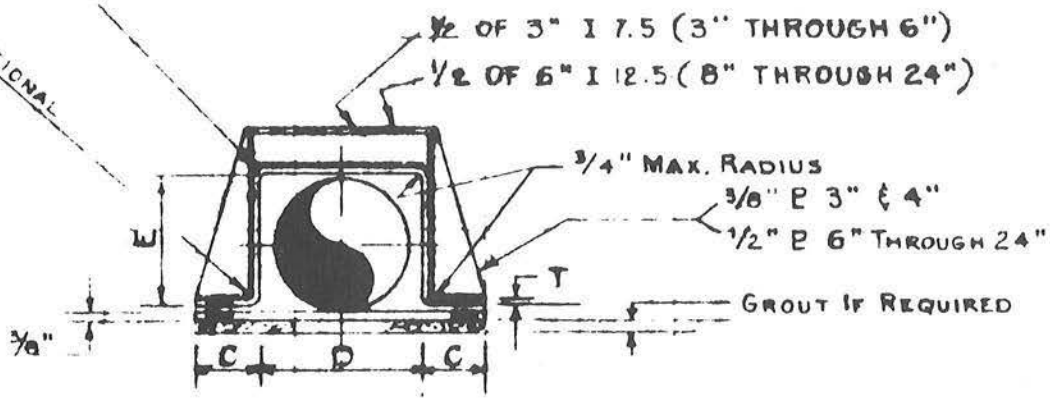


PIPE SIZE	BOLT SIZE	BOLT HOLE DIA.	A	B	C	D	E	T	W	X	Y
3"	1	1 1/16	4 1/4	10 1/2	3"	4 1/2	3 5/8	5/8	5	3	1
4"	1 1/4	1 1/2	5 1/8	12 3/4	3 5/8	5 1/2	4 5/8	1/2	6	3 1/2	1 1/4
6"	1 3/4	1 13/16	6 3/4	15	3 11/16	7 5/8	6 1/2	7/16	6	3 1/2	1 1/4
8"	1 3/4	1 1/2	7 3/4	17 1/2	3 11/16	9 5/8	8 5/8	1/2	8	5	1 1/2
10"	1 3/4	1 1/2	8 3/8	19 3/4	4 1/2	11 3/4	10 7/8	1/2	8	5	1 1/2
12"	1 1/2	1 3/4	9 3/4	23	4 5/8	13 3/4	12 1/2	5/8	10	6 1/2	1 3/4
14"	1 1/2	1 3/4	10 3/8	24 1/4	4 5/8	15	13 3/4	5/8	10	6 1/2	1 3/4
16"	1 1/2	1 3/4	11 3/8	26 1/4	4 5/8	17	15 3/4	5/8	10	6 1/2	1 3/4
18"	1 1/2	1 3/4	12 5/8	28 3/4	4 5/8	19	17 3/4	5/8	10	6 1/2	1 3/4
20"	1 3/4	2	13 3/4	31 1/2	5 3/4	21	19 3/4	3/4	10	6	2
24"	1 3/4	2	15 3/4	38 1/2	5 3/4	25	23 3/4	3/4	10	6	2

GENERAL NOTES

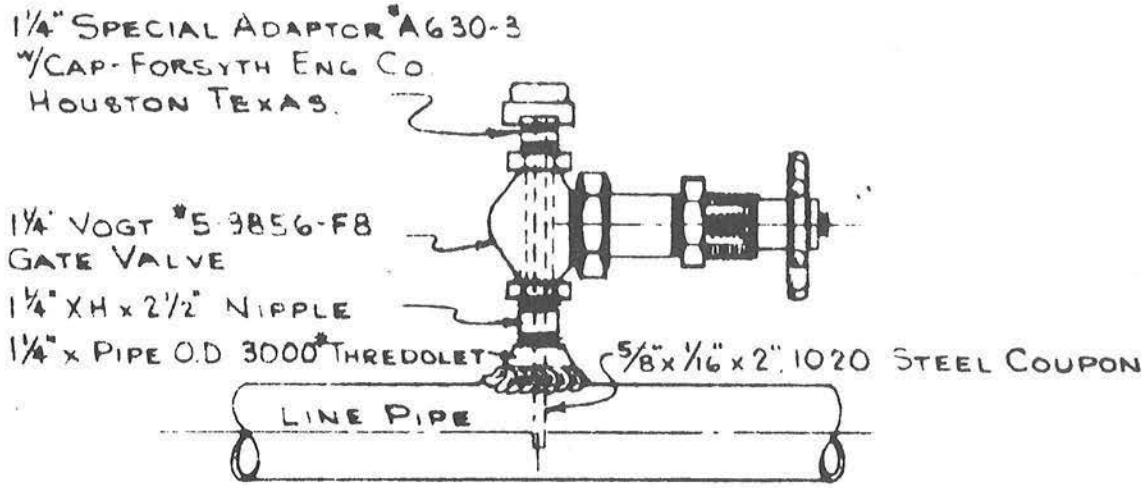
USE TWO NUTS ON EACH STUD BOLT, WITH ONE STANDARD ROUND WASHER. STUD BOLTS FOR COUPLING NUTS SHALL BE A-193 GRADE B-7 STEEL

FOUR BOLT PIPE CLAMP GUIDE FOR COMPRESSOR SUCTION & DISCHARGE PIPING

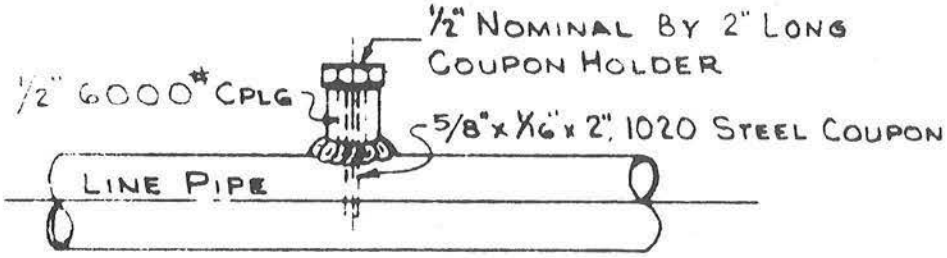
HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
GAS ENGINEERING DIVISION
HOUSTON, TEXAS

DRAWN BY: JIM BYNUM DATE 5-2-61 SCALE NONE
CHECKED BY:
APPROVED BY:
REVISED 7-24-62, 12-18-62

FILE NO. GA-132



RETRACTABLE TYPE

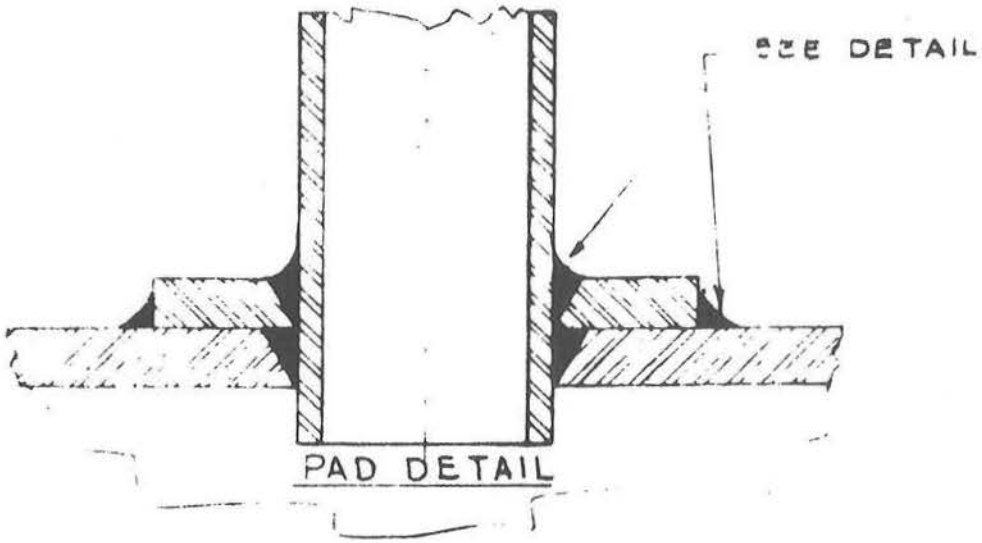


NON-RETRACTABLE TYPE

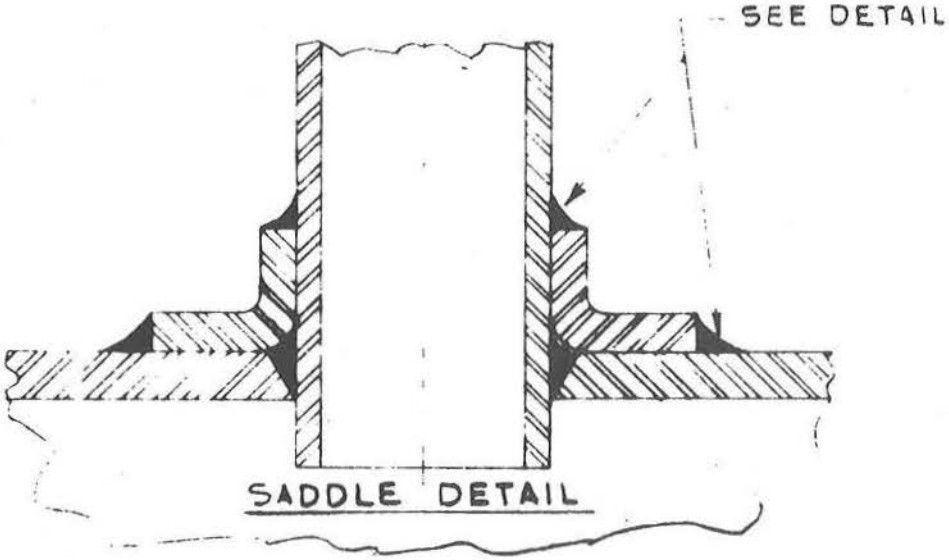
CORROSION TEST CONNECTION
INSTALLATION

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
GAS ENGINEERING DIVISION
HOUSTON, TEXAS

DRAWN BY RG LARSON DATE 9-23-59 SCALE NONE
CHECKED BY J. Biggs W. Lindsley
APPROVED BY H. E. Bell A. G. Buckner
REVISED
FILE NO. GA-105



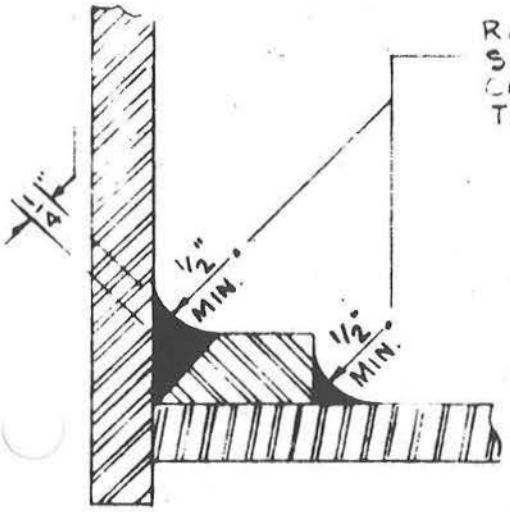
PAD DETAIL



SADDLE DETAIL

MIN. THROAT TO COMPLY WITH CODE

RADIUS REQUIRED TO REDUCE FATIGUE STRESS CONCENTRATION FACTOR. CONCAVE WELD, MAINTAIN MIN. THROAT THICKNESS & GRIND SMOOTH



TYPICAL WELD DETAIL

TYPICAL WELD DETAILS FOR COMPRESSOR BOTTLE NOZZLES

HUMBLE OIL & REFINING COMPANY

PRODUCTION DEPARTMENT

GAS ENGINEERING DIVISION

HOUSTON, TEXAS

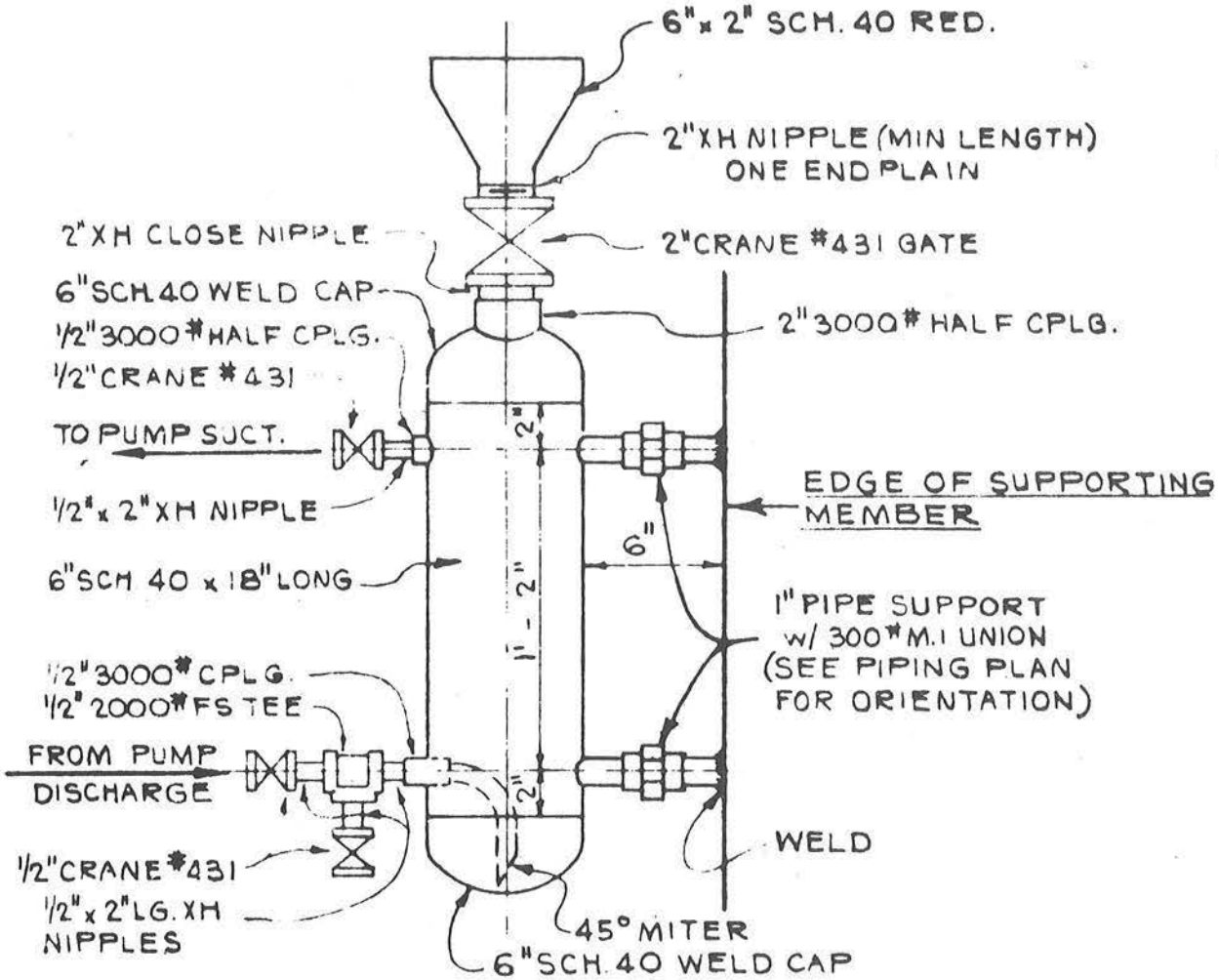
DRAWN BY J. BYNUM DATE 9-20-62 SCALE NONE

CHECKED BY

APPROVED BY

REVISED 7-9-63

FILE NO. GA-146



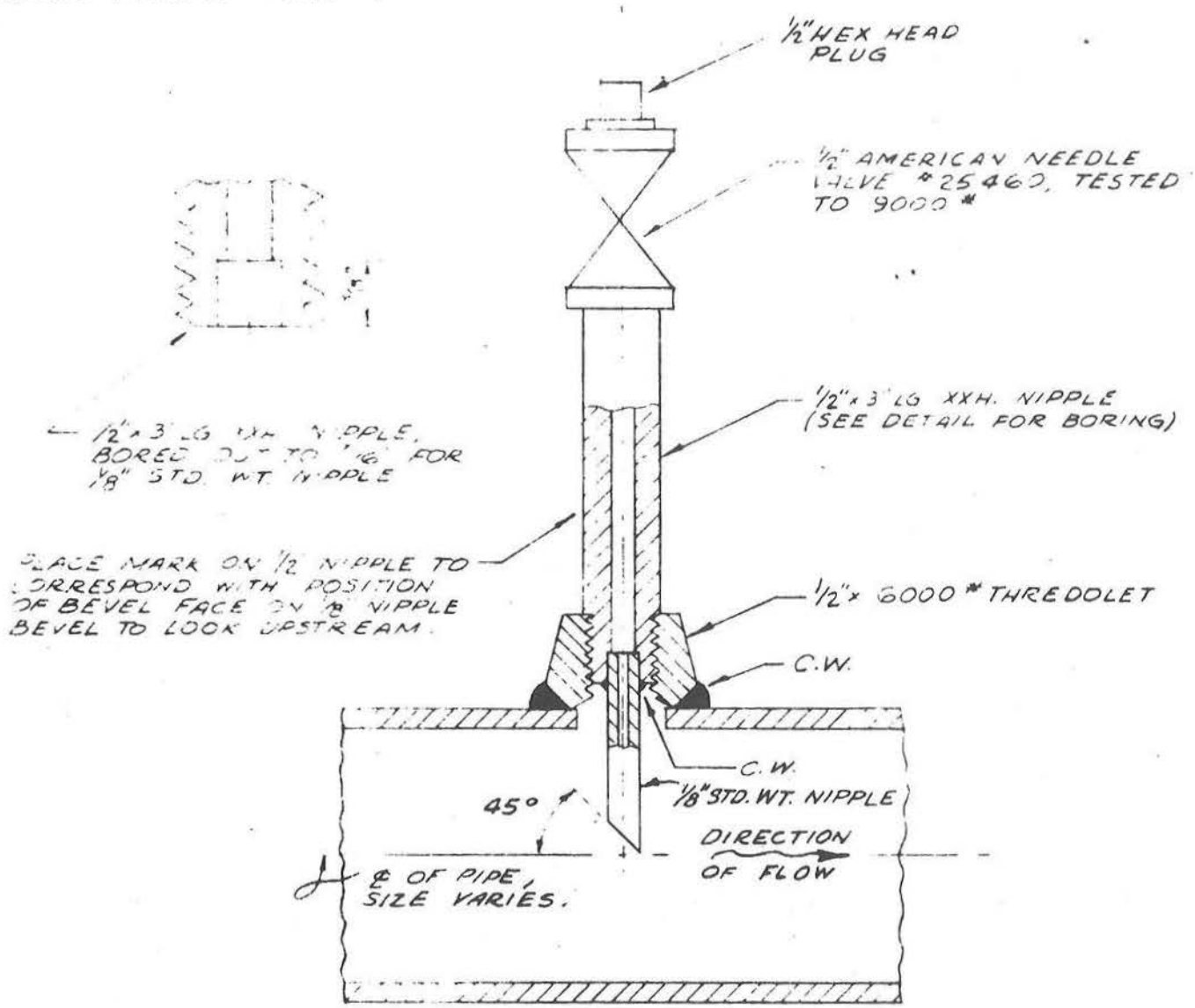
NOTE
SHOP COAT WITH ONE COAT OF HUMBLE'S RUST BAN NO. 274

STANDARD JACKET WATER CHEMICAL INJECTOR FOR COMPRESSOR PLANTS

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
GAS ENGINEERING DIVISION
HOUSTON, TEXAS

DRAWN BY SANCHEZ DATE 10-16-59 SCALE 1½" = 1'-0"
CHECKED BY A.B. SIMMONS, JR.
APPROVED BY H.E. Lott D.C. Bueler
REVISED
FILE NO. GA-112

MWP OF ASSEMBLY
6000 PSIG AT 100° F

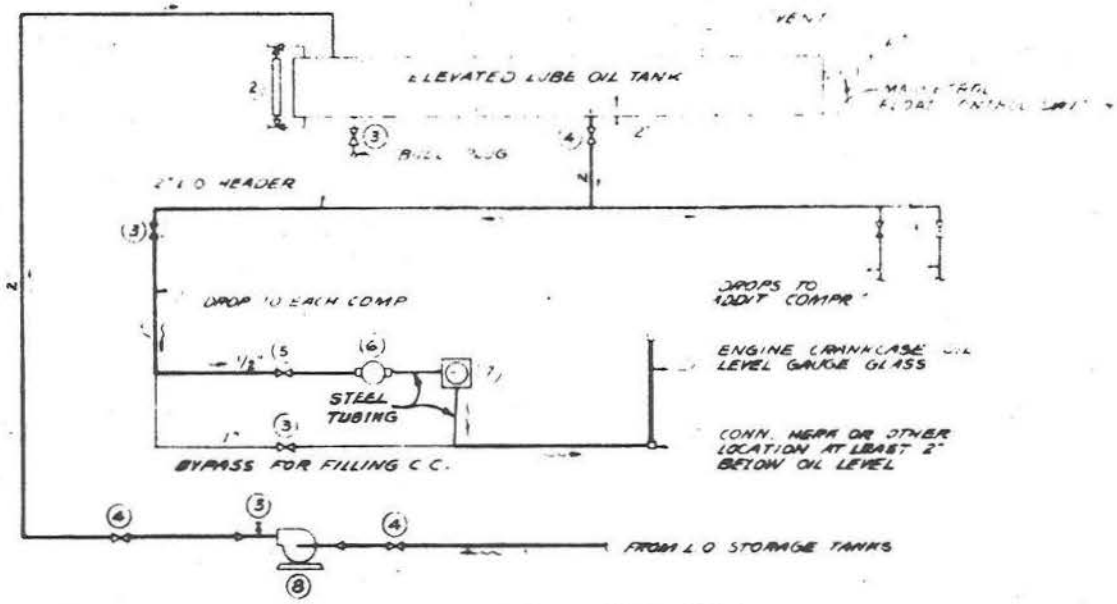


NOTE:

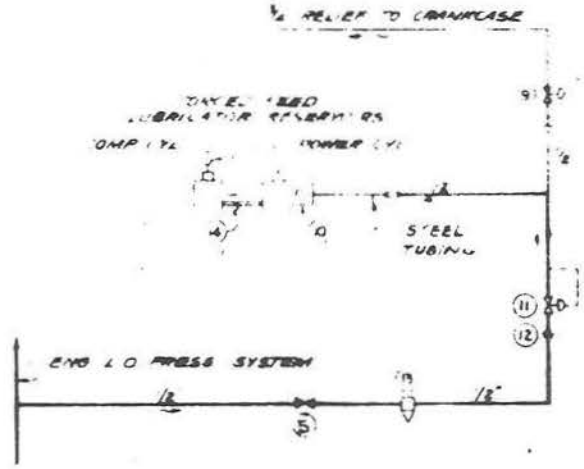
ALL PIPE TO A-106 GR."B"

GAS SAMPLING CONNECTION	HUMBLE OIL & REFINING COMPANY PRODUCTION DEPARTMENT HOUSTON, TEXAS		
DRAWN R.H. SCHWARTZ CHECKED A.B. Summers Jr.	ENGR. SECTION ____ REVISED ____ APPROVED K.E. Katt	SCALE 1/2" = 1'-0" DATE 6-1-60	JOB NO.	FILE NO. GA-120

NOTE: L.O. TANK SHOULD BE SIZED TO CONTAIN A MIN. OF 7 DAYS 'L CONS. MATION AT NORMAL LEVEL



LUBE OIL MAKEUP SYSTEM TO ENGINE CRANKCASE



LUBE OIL MAKEUP SYSTEM TO FORCED FEED LUBRICATOR RESERVOIR

BILL OF MATERIAL

ITEM	NO. REQUIRED	DESCRIPTION
	1	MAGNETROL MODEL [illegible] FLOAT CONTROL SWITCH
2	1	PENBERTHY # GB-4 GAUGE GLASS, FULL RANGE W/ STEEL GAUGE COCKS
3	1 + 2 PER ENG.	1" 125# STEEL GATE VALVE
4	3	2" 125# STEEL GATE VALVE
5	1 + 2 PER ENG.	1/2" 125# STEEL GATE VALVE
6	1 PER ENG.	REN MODEL MRA SLO-FLOW METER
7	1 PER ENG.	REN MODEL RB K OIL LEVEL REGULATOR
8	1	WORTHINGTON MODEL 2 GAU ROTARY PUMP W/ 1/2 HP, 110/220V, 1 PHASE, 60 CYCLE (CLASS 1, GROUP D, IF REQUIRED) ELECTRIC MOTOR OR EQUAL.

ITEM	NO. REQUIRED	DESCRIPTION
9	1 PER ENG	3/16" FISHER # 1805 - RELIEF REGULATOR SET AT 6 PSIG
10	PER ENG	REN MODEL RALUB OIL LEVEL REGULATOR W/ FLEX. HOSE & CLAMPS
11	1 PER ENG	1/4 FISHER # 95L PRESSURE REDUCING REGULATOR SET AT 3 PSIG
12	PER ENG	1/2" x 1/8" ORIFICE UNION
13	1 PER ENG	AIR MAZE MODEL 01 FS-08W OIL FILTER
14	AS REQUIRED	5/8 NEOPRENE HOSE W/ 2 HOSE CLAMPS PER ENGINE
15	1 PER LUB'R DRIVE	MECORD LUBE SENTRY A-29713 FOR ELECTRICAL GROUND SYSTEMS, USE BARRSDALE DIT-AISC ALSO - PANEL MOUNTED TO GROUND MAGNETOS

AUTOMATIC LUBE OIL MAKE UP SYSTEM FOR GAS PLANTS & COMPRESSOR STATIONS

HUMBLE OIL & REFINING COMPANY
PRODUCTION DEPARTMENT
GAS ENGINEERING DIVISION
HOUSTON, TEXAS

DRAWN BY R.H. SCHWARZ DATE 1-20-61 SCALE NONE
CHECKED BY
APPROVED BY
REVISED 1-5 68 LEB
FILE NO. GB-144

GAS PLANT GENERAL SPECIFICATIONS

BUILDINGS AND STRUCTURES

1. Buildings:

1.1 Type

Building shall be a rigid frame shed type with two partial walls and two sides open. The covered portion shall have corrugated or channel formed heavy galvanized or aluminized steel siding. Should space requirements necessitate that the building roof be used as an equipment deck, the upper deck shall be covered with 1/4 inch embossed floor plate. Upper deck beams shall be cambered such that the roof will drain.

1.2 Size

Provide adequate clearance to pull rods or 1-1/2' minimum clearance outside of open clearance pocket, whichever is greater; and adequate height to clear hoist over motor and compressor, etc. A clear space of 18" shall be provided at the flywheel or the end of the hydraulic pump for use of the analyzer motion transducer.

1.3 Design

1.3.1 Building shall be designed, fabricated, and erected in accordance with applicable sections of the latest edition of AISC, AISI, and AWS Specifications.

1.3.2 Buildings shall be designed for loads and combinations thereof as recommended in the "American Standard Building Requirements for Minimum Design Loads in Buildings and Other Structures, A53.1," latest edition, using the resultant wind pressure zone of 45 psf.

1.4 Material

1.4.1 All steel shall be of domestic manufacture.

1.4.2 Structural steel rolled shapes and plate sections shall not be less than 3/16-inch thick. Light gauge cold formed shapes shall not be lighter than 14-gauge.

1.4.3 Hot-rolled steel shapes, plates, and bars shall be as per ASTM A-7 or ASTM A-36, and cold formed shapes shall be ASTM A-245, A-246, or A-303, Grade B or C. Erection and anchor bolts shall be ASTM A-7. Rigid frame splice bolts shall be ASTM A-7 when used in shear, and shall be ASTM A-325 or better when used in tension. All bolts and nuts shall be galvanized per ASTM A-153.

1.4.4 Steel siding shall be 26-gauge corrugated steel, galvanized in accordance with ASTM A-361 specification. Fasteners shall <u>not</u> be cadmium plated or stainless steel.

1.4.5 Gutters and downspouts shall be 26 gage ASTM A-366, and ventilators, louvers, trim cornices, door track hoods and flashing shall be ASTM A-366. All of the above shall be galvanized per ASTM A-361.

1.4.6 Openings where lines pass through walls should be flashed with siding material. The use of flat flashing with caulking compound daubbed in the space between the corrugations will not be allowed.

1.5 Equipment

1.5.1 Crane: The building shall be equipped with a Wright Model B-36 underslung type bridge crane, with a hand operated Wright 600 low headroom trolley hoist or a safeway army type trolley hoist, sized to handle the heaviest removable component of the compressor. Hoists 3 tons and larger shall be gear driven. Crane systems 5 tons and larger shall include a 1 ton safeway clevis connected hoist on the crankdoor end of the bridge beam. The crane system shall be designed to travel outside the building to deliver load for handling by platform cranes to surface transport vehicles.

1.5.2 Doors: If required, the building shall be provided with 3070 single swinging doors and 6070 double sliding doors. All doors shall be hot-dip galvanized industrial type hollow metal, fabricated from 16 gauge steel having stiles and rails not less than 4-7/8" x 1-3/4" with all joints face welded and all welds ground smooth. Doors shall be weatherstripped with an approved interlocking type, hot-dip galvanized material at jambs and astragals. Sliding door trolley rails shall be covered with a hood. Swinging doors shall swing outward and shall be equipped brass anti-panic devices, surface mounted with outside thumb latch (Von Duprin 88 PP, less cylinder) and outside padlock bracket. Automatic closers shall be provided with swinging doors. Screens are not required with any doors.

(1) The upper panel shall include two frames formed by a horizontal mullion and glazed inside with 1/4" wire reinforced clear glass.

(2) Door bottoms shall be flush with the floor line, with a weatherstrip angle extending down and outside the building.

(3) Hardware shall be Richards-Wilcox, or approved equal, galvanized. Doors shall be hung by 4-wheel roller-bearing trolleys, and provided with guides, handles inside and outside, stops, padlock brackets, and center foot bolts. Double doors shall have astragals.

1.5.3 Windows: Each side wall shall be provided with a minimum of one window per 10 ft. of available wall length. Windows shall be Miami Series 565, 3'-6" x 4'-6", inside glazed single hung aluminum 6/6 light windows, factory glazed with 1/4" wire reinforced clear glass. Screens are not required.

1.5.4 Ventilation: Pitched roof buildings shall be provided with type JB American Coolair Corporation power roof vent(s) with 220/440 volt, 3 phase explosion proof motor and static resistant V-belts, inspection ports, and magnetic latches. Finish shall be hot dip galvanized. Flat roof buildings shall be provided with wall mounted American Coolair Corporation type CL fan(s) comparable to the power roof vent, with automatic gravity operated shutters which shall have 12 ga. galvanized steel blades and frames. Fan(s) shall be sized to provide one air change per minute.

1.5.5 Skylight: Each roof panel of pitched roof buildings shall be provided with one sheet of fire resistant skylight green corrulux (2' x 8' minimum length). Should the roof of the building be used as an equipment deck, 5' long sheets of corrulux shall be installed in the walls at the upper deck to the extent that 50% of the wall area within the 5' projection shall be covered with corrulux.

2. Skid:

2.1 Fabrication

A welded skid type base shall be furnished to accommodate all equipment specified herein in a neat and orderly arrangement with all scrubbers, etc., located outside the building either at main skid level or on a second deck above the building. Decks shall be 3/16" minimum multigrip plate continuous welded top and bottom except over skid sections containing pipe below deck level. The floor level inside the building shall be 1" higher than the deck outside the building. Where pipe is below deck level install 1/8" minimum plate pans (trenches) with drains below pipe and removable serrated galvanized steel grating sections above pipe at deck level. Where such trenches intersect building walls no transverse seals shall be constructed in order to insure good ventilation of trench area. Skid shall be designed for a four point-single hook lift and shall be capable of maintaining equipment alignment when supported at four points roughly coinciding with the lifting points. All seams shall be seal welded and equipment grout, if required, shall be Escoweld 7505.

2.2 Skid Drainage Control

2.2.1 Oil Drainage: Whether the decks are concrete or structural steel skids, floor drains must be provided in the compressor building and in other areas where oil, condensate, glycol, etc. can be spilled, and drain lines run to the oil sump header. If equipment outside the compressor building is skid mounted, one drain from each skid to the oil sump header shall be sufficient. Each skid shall have a continuous barrier or curb of 1/4" x 4" steel plate welded continuously (each side) around the perimeter of the skid or that area of the skid subject to spillage. If equipment is not skid mounted, each piece of equipment that is subject to spillage should be provided with a 1/4" x 4" curb around the perimeter of its base plate and a drain to the oil sump header. The sump header will be tied in to the platform oil sump by Humble.

2.2.2 Surface Drainage: Areas not normally subject to spillage shall be provided with floor drains for collecting rain water. The drains shall be manifolded and the drain header brought to the edge of the package for field tie-in by Humble to the platform water sump. If steel plate decks are used, a 1/4" x 4" steel plate curb shall be provided around the perimeter of the steel decked areas separating them from floor grating walkways, so that, in an emergency, if a spillage occurs, it can be contained, and also to insure that rainwater runoff from all areas which may be oily can be collected and purified before disposal.

3. Steel Structures:

3.1 Structural Requirements

3.1.1 Steel structures shall be designed, fabricated, and erected in accordance with the AISC "Specifications for the Design, Fabrication, and Erection of Structural Steel for Buildings," latest edition, using pipe or rolled structural shapes and plates. Members supporting equipment that require removal for servicing repairs, or replacement shall be designed to facilitate removal of the equipment.

3.1.2 Steel structures shall be designed for loads and combinations thereof as recommended in the "American Standard Building Requirements for Minimum Design Loads in Buildings and Other Structures, A58.1," latest edition, using the resultant wind pressure zone of 45 psf. Wind pressures shall be multipled by six-tenths in computing wind loads on cylindrical shapes, such as vessels, tanks, stacks, and piping over one foot in diameter.

3.1.3 Steel structures shall be designed to withstand a 20% seismic force.

3.2 Fabrication and Erection

All outdoor connections subject to accumulation of dirt and moisture shall be seal welded. Holes for bolts, pins, etc., shall be drilled or punched. If brackets, hangers, or clips for conduit, lights, or tubing runs inside the building are to be welded to the structure, they shall be installed so that they can be sandblasted and painted when the structure is painted, before the compressor is installed. Sandblasting within the building after the compressor is installed shall be kept to an absolute minimum and will be permitted only if the compressor is completely covered and sealed.

3.3 Construction Details

3.3.1 Stairways, Ladders, Platforms, Landings, Walkways, Handrails and Steps

Fabricator shall use recognized gas plant construction standards in designing such items in order to provide for safety and efficient operation and maintenance of the plant. Design live load shall be 100 pounds per square foot.

(1) Stairways shall be a minimum of 2'-6" wide and shall be equipped with non-skid treads of galvanized grating.

(2) Ladders over 12 feet in height shall be equipped with safety cages having flared entrance openings and constructed in accordance with the National Safety Code.

(3) Handrails shall be fabricated from 1-1/4" steel pipe. Rails shall be furnished with stairways, platforms, landings, walkways, steps, etc., as needed.

(4) Access to upper deck shall be provided by stairway on one end and ladder on opposite end.

(5) Removable handrails shall be provided around upper deck.

(6) If cooler is a horizontal cooler, a ladder should be provided for access to top of cooler. Handrails should be provided around top of cooler, with sockets welded to cooler structure, not to interfere with removal of cooler sections.

SPECIAL PROVISIONS

ELECTRICAL SPECIFICATIONS

FOR

OFFSHORE PACKAGED COMPRESSOR-DEHYDRATION PACKAGES

1. See "General Specifications" for construction in plants handling corrosive fluids and subject to corrosive atmospheres.

2. PACKAGER shall furnish all electrical control equipment complete with conduit and wiring for all circuits internal to package. Wiring shall be complete to terminal strip in panel for connection of external controls and power supply. Conduit only shall be installed by packager to skid limit for external wiring and wire will be pulled by others. The following conduits shall be installed for each compressor package:

   1 - 3" conduit for 1750 hp motor
   2 - 1" conduit for 15 hp motors
   1 - 1" conduit for 2 hp motor
   1 - 2" conduit for controls
   1 - 3/4" conduit for fractional hp motors

3. Lighting, Combustible Gas Detector Heads and Fire Detector Heads will be furnished and installed by others.

4. Control voltage shall be 120 volts, and control wiring shall be No. 12 AWG aluminum.

5. The circuit breaker for the fractional hp motor circuit will be remote and furnished and installed by others, but the overload heaters shall be provided in the local switches.

6. Except for the large synchrous motors with brushless excitation, all electrical materials and construction shall be for Class I, Group D, Division 1.

7. The following "General Specifications - Electrical" are pertinent to the scope of electrical work outlined above.

GAS PLANT GENERAL SPECIFICATIONS

ELECTRICAL

1. General:

1.1 Design, material, and testing of electrical equipment shall conform to the latest published standards of the AIEEE, NEMA, USAS, and ASTM codes where applicable. Installation of electrical equipment shall be in accordance with the provisions of the National Electrical Code, latest edition.

1.2 Equipment installed shall in all respects be the equivalent of the best manufactured by the leading manufacturers, such as General Electric, Westinghouse, Allis-Chalmers, Louis Allis, Electrical Machinery Mfg. Co., Wagner, Century, U. S. Motors, Crouse-Hinds, Allen-Bradley, Square D, ITE, and other approved by Humble.

2. Classification of Areas:

Classification of areas for compressor stations and gas plants shall be as follows:

Compressor Area	Class I, Group D, Division 2 (Div. 1 in pipe trenches & basements)
Process, Storage, Shipping, and Scrubber and Separator Areas	Class I, Group D, Division 1
Fired Heater, Cooling Tower, and Generator Areas	Nonhazardous

3. Motors:

3.1 Each motor shall have ample capacity to supply the maximum output demanded of its driven member with a speed-torque-current characteristic appropriate to the driven machine.

3.2 The maximum size motor which the Contractor may install shall be limited to a size such that starting of the largest motor while normal plant operating load is being supplied will not drop the voltage at any point in the plant electrical system below 75 percent of the nominal voltage.

3.3 Motors less than 200 HP shall be 440-volt, three-phase, 60-cycle where this power is available, except for fractional horsepower motors which may be 115/230-volt, single-phase.

3.4 Motors shall be suitable for the atmosphere and weather conditions under which they shall operate in addition to being the proper type for a particular area classification such as TEFC of explosion-proof.

3.5 Enclosures for TEFC and explosion-proof motors shall be constructed of cast iron and shall completely enclose the motor. Fan guards and screens over air passages shall be stainless steel, monel, slotted cast iron or bronze. Fans shall also be constructed of corrosion-resistant material.

3.6 All enclosed motors shall be equipped with breathers and drains.

4. Push Button Stations and Remote Control Apparatus:

4.1 Remote control circuits for 4160-volt motors shall be so arranged that they will be disconnected from all sources of supply when the circuit breaker for the controlled circuit is open.

4.2 If this is not practical, such as in auxiliary contact circuits to an annunciator panel or interlocked motor circuits, control wires which will not be deenergized when the circuit breaker is open should be clearly tagged in each cubicle or motor starter enclosure to indicate the external power source. This shall be in addition to the normal wire identification required.

4.3 Each push button station shall be in an enclosure of the proper NEMA rating for the atmosphere and weather conditions under which it shall operate. Explosion-proof push buttons which are exposed to the weather should be C-H OFC, or equal, threaded cover type rather than EFS or similar ground joint type.

4.4 Where motors are controlled with automatic devices, push button stations suitable for "Hand-Off-Automatic" operation shall be provided.

5. Conduit:

5.1 Conduit shall not be installed within 6 inches of insulated aboveground hot lines.

5.2 All electrical circuits shall be run in copper free aluminum (less than 0.4% cu) rigid conduit bearing the label of approval of Underwriters Laboratories. All conduit shall be level, plumb and installed in a neat and workmanlike manner. All conduit connections shall be threaded, and there shall be no conduit in the final installation that is in any way crushed, deformed or otherwise injured. Rigid steel conduit joints shall be tightly made up with at least five full threads engaged, with no running threads used. Threads shall be treated with an approved compound. Wire may not be spliced in conduit under any condition.

5.3 Explosion-proof flexible conduit shall be used to connect all motors to the skid fixed conduit, and shall be long enough and installed in such a manner that the belts on V-belt drives may be either tightened or removed in a practical manner without distorting the flexible conduit, and to provide for stator shift in the large induction motors.

6. Wire and Cable:

6.1 The voltage drop from the source of supply to any point in the electrical system shall not exceed 3 percent of the supply voltage under maximum operating conditions for lighting loads and 4 percent for power loads. The allowable current in any conductor shall not exceed 80 percent of the rated capacity as listed in the National Electrical Code.

6.2 All 600-volt power and control wire in conduit shall be stranded aluminum, Type TW, or better, insulation.

6.3 Control wire shall be No. 12 AWG minimum size, if single conductor.

6.4 Power wire for motors shall be No. 12 AWG minimum size.

7. Explosion-proof Condulets and Fittings:

7.1 Explosion-proof seals shall be suitable for the manner in which they are applied, horizontal seals in horizontal runs and vertical seals in vertical runs.

7.2 Seal covers shall not be used unless it is completely impractical to use conventional seals.

7.3 Conduits leaving or entering a building in a hazardous area or conduit runs from a hazardous are to a nonhazardous area shall be sealed.

Wire or cable splices shall not be made in a sealing condulet.

Only fresh sealing compound from a newly opened can shall be applied. The minimum thickness of compound in a seal shall be the same as the inside diameter of the seal.

7.4 Provisions shall be made to prevent moisture from accumulating in enclosures. Breathers and drains shall be properly applied to all arcing device enclosures.

7.5 All threaded fittings or threaded parts of enclosures shall be treated with Crouse-Hinds STL compound, or Humble equal, before being made up. Ground joints of enclosures shall receive a light film of STL. Before final make-up of all enclosures, the threads or joints shall be thoroughly cleaned and STL reapplied.

7.6 Conduit fittings with threaded covers rather than the ground joint type are preferred.

8. Auxiliary Controls and Alarm and Shutdown System Components:

8.1 Control circuits for motors shall contain only those components necessary for the control of the individual motor. A motor-driven service and its spare shall not have contacts of one relay in both circuits. A single contact of a relay or sequence timer shall not be used to control more than one motor.

8.2 The electrical portion of an alarm and shutdown system shall be normally closed, energized (fail-safe).

8.3 All switches actuating a shutdown system shall be dry contact devices where practical. For individual compressor and engine shutdown the following devices may be used: Barksdale, or equal, diaphragm-actuated pressure switch, Fenwal Series 80016 thermoswitch for cylinder high discharge temperature, and Robertshaw-Fulton vibration switch.

8.4 In general, where a large number of relays are required, the relays shall be grouped in dust-tight enclosures in a nonhazardous area or in a pressurized building rather than in large explosion-proof enclosures in hazardous areas. This does not rule out individual explosion-proof relays as required where more practical.

8.5 Control relays shall be rated 10 amperes, 120 volts AC, Potter Brumfield KRP series or equal.

8.6 Vibration shutdown switches shall be Robertshaw-Fulton Vibraswitch Model 365 for hazardous locations, Model 366 for weatherproof locations. Vibration switches shall be installed on aerial coolers, compressors, and on other major rotating equipment as required. A Robertshaw-Fulton Vibraswitch control unit Model 600, or equal, shall be provided by packager and installed in remote position by others.

8.7 Any time delay relays which may be required shall be Potter Brumfield series CHB.

GAS PLANT GENERAL SPECIFICATIONS

INSULATION, COATINGS, AND MISCELLANEOUS

1. Insulation:

Where required for heat conservation or personnel protection provide hydrous calcium silicate or amosite asbestos insulation. Personnel protection shall be provided in areas of normal operation to surfaces operating over 180°F. Preformed factory fabricated segments in standard lengths and thickness shall be used where possible, and shall be secured with 16 ga. galvanized wire ties on 9" centers. On irregular surfaces, castable insulation cement reinforced with 20 ga. poultry mesh may be used. Aluminum jacketing with epoxy inner coating shall be applied over all insulated surfaces. Jacket shall be secured at seams with aluminum self tapping screws and at sheet centers with 3/4" x 0.020 type 304 stainless steel bands.

2. Protective Coatings:

All material with surface temperature less than 750°F and not subject to damage from sandblasting or pickling shall be coated with Rust-Ban 191 or hot dip galvanized. Material with surface temperature below 400°F subject to damage from the above type coatings shall be hand cleaned and solvent degreased and coated with one coat Rust-Ban AK6272, one coat R-B AK 6273, and one coat R-B AK 6453. The AK 6272 may be omitted on equipment which is delivered with an intact and sound shop coat. For material with surface temperature above 750°F, sandblast and coat with two coats R-B SL 6231. In addition to these protective coatings, color coatings shall be provided as follows:

Panel Board: Black epoxy R-B EX 6679
Emergency Shutdown Station: Yellow epoxy base R-B EE 6598
Fire System Components: Red epoxy base R-B EE 6596

Where touch-up is required for coatings applied to sandblasted surfaces, a pneumatic needle gun may be used in lieu of spot blasting.

All coatings shall be applied in accordance with manufacturers directions. Where doubt exists as to application techniques, etc. contact the Enjay Chemical Company for technical assistance.

3. Miscellaneous:

3.1 All couplings, shafts, belts, pulleys, etc. shall be protected with guards fabricated from sheet or plate, 16 ga. min.

3.2 Start-up screens shall be furnished at each cylinder inlet and at pump suction flanges.

3.3 Flanges outside the building or under the deck shall be protected with 24 mil Plicoflex tape if operating under [illegible] or McEvoy or Rockwell flange protectors if over 150°.

GAS PLANT GENERAL SPECIFICATION

TESTING AND CLEANING

1. General:

Unless specified otherwise, all piping shall be hydrostatically tested after assembly to 1-1/2 times the maximum allowable working pressure of the weakest component in each system. Tests shall be held for one hour or until Humble's inspector is satisfied that leaks do not exist. Test water shall be mixed with Rust-Ban 310 in 9:1 ratio and shall be drained and blown from system by air after successful completion of test.

2. Lubricating Oil and Hydraulic Systems:

After test, lube oil and hydraulic oil systems shall be pickled, flushed, etc. as recommended by the equipment manufacturer. In the absence of specific instructions from the manufacturer and as a minimum, these systems shall be flushed with kerosene or Varsol until clean, then flushed with lube oil until free of cleaning solution. Extreme care should be taken to see that no dirt is carried into engine bearings, etc.

3. Instrument System:

Break connections at instruments and air blow until clean. Pressure with air and test all connections with Snoop bubble forming test solution or an ultrasonic translator detector.

Shop tests and adjustments shall be made to insure that all controls are set at correct operating point and with the proper action. The instrument panel, alarm, shut-down, and annunciator functions shall be completely checked out in the shop on the finished package before shipment.

4. Cleaning and Servicing of Valves:

4.1 Contractor shall service and check for proper operation of all valves before plant start-up.

4.2 All control valves and regulators shall be removed from the system after hydrostatic testing, draining and blowing to clean, for removal of all slag and foreign material. Control valves shall be serviced for proper stroke, stem packing condition, valve position connection and action, etc., before plant start-up.

GAS PLANT GENERAL SPECIFICATIONS

PROPOSAL, DRAWINGS AND OTHER DATA

1. Proposal:

1.1 General

Furnish five (5) copies of proposal.

1.2 Proposal Information

1.2.1 Make and model number of size of each piece of equipment to be furnished including motor/compressor, cooler, scrubber, dehydrator, pulsation snubbers, control valves, and major instruments.

1.2.2 Design pressures, temperatures, capacities, etc. of above equipment.

1.2.3 Compressor data, including cylinder size, MWP, and materials of construction; rod loads, design and maximum operating; unbalanced forced and couples; heat rejection rates; pump circulation rates; and proposed loading equipment.

1.2.4 Proposed mechanical flow diagrams showing line sizes and schedules, valves, controls, etc. Where applicable, data requested above may be shown on flow diagrams rather than tabulated.

1.2.5 Block type preliminary layout drawing.

1.2.6 Estimated delivery date based on date of order, allowing two weeks for preliminary drawing transmittal and approval.

1.2.7 Free service time for field erection and start-up.

1.2.8 Price of complete compressor station loaded and secured to Humble's barge at Fabricator's dock. State location of dock and weight of package. Package must be complete with building when loaded on barge.

1.2.9 Price adjustments for additions or deletions recommended by Fabricator or exceptions taken by Fabricator. A formula for determining the cost of extra work based on cost of material and labor plus percent mark-up should be furnished by Fabricator.

2. Additional Material Required of Successful Bidder:

2.1 Six copies of the proposal revised to show final equipment selection and price of unit including all adjustments made during the progress of the job.

2.2 Four copies of all preliminary drawings, flow, layout, piping, structural, electrical, etc., as many issues as required to resolve all design details.

2.3 Four copies of major equipment rating sheets for Humble approval before award of purchase orders.

2.4 Five sets of "as built" drawings.

2.5 Five "Job Books" including instruction manuals and parts lists for all equipment furnished, manufacturer's drawings of all equipment furnished, pump curves and all similar equipment performance data, and compressor loading information, either curves or tabulated.

8.0 GAS TURBINE GENERATORS

SOLAR

DIVISION OF INTERNATIONAL HARVESTER COMPANY

~~2333 NORTH BROADWAY SUITE 200 SANTA ANA, CALIFORNIA 92706 (714) 543-8407/542-7648 TWX: (910) 595-1579~~
6055 E. Washington Blvd., Room 205, Los Angeles, California 90040

17 March 1971

Humble Oil & Refining Company
Western Division
1800 Avenue of the Stars
Los Angeles, California 90067

Attention: Mr. Lefner

Subject: Sound Attenuation Data for Solar SATURN Gas Turbines;
Solar Reference LA 0-015

Gentlemen:

Recently a question was posed which had to do with the feasibility of attenuating noise emanating from a gas turbine's inlet, exhaust, and casing. Design criteria for Sound Pressure Levels at receiver locations (1) 10 ft. from turbine exhaust and at ear level, (2) 3 ft. from turbine inlet for an inlet at ground level, (3) 3 ft. from turbine casing, were defined as follows:

Octave Band Mid-Frequency (Hz)	63	125	250	500	1000	2000	4000	8000
Sound Pressure Level in Decibels	98	92	87	82	79	78	78	80

In an application where the above S.P.L. design criteria exists, the requirements would be met or exceeded through the use of turbine exhaust silencers, turbine inlet air silencers, and acoustically treated turbine enclosures or turbine housings built of sound metal panels.

Solar's brochure T10S/570/5C, "Sound Attenuation Data for Solar Industrial Gas Turbines", was used in calculating the Sound Pressure Levels at the above specified receiver locations for turbine inlet, exhaust, and casing noise. This S.P.L. data is presented graphically as an attachment to this letter. Solar's

brochure on sound attenuation data has also been enclosed in the event that additional sound pressure level calculations are necessary.

Should you have further questions on this subject, please do not hesitate to contact this office.

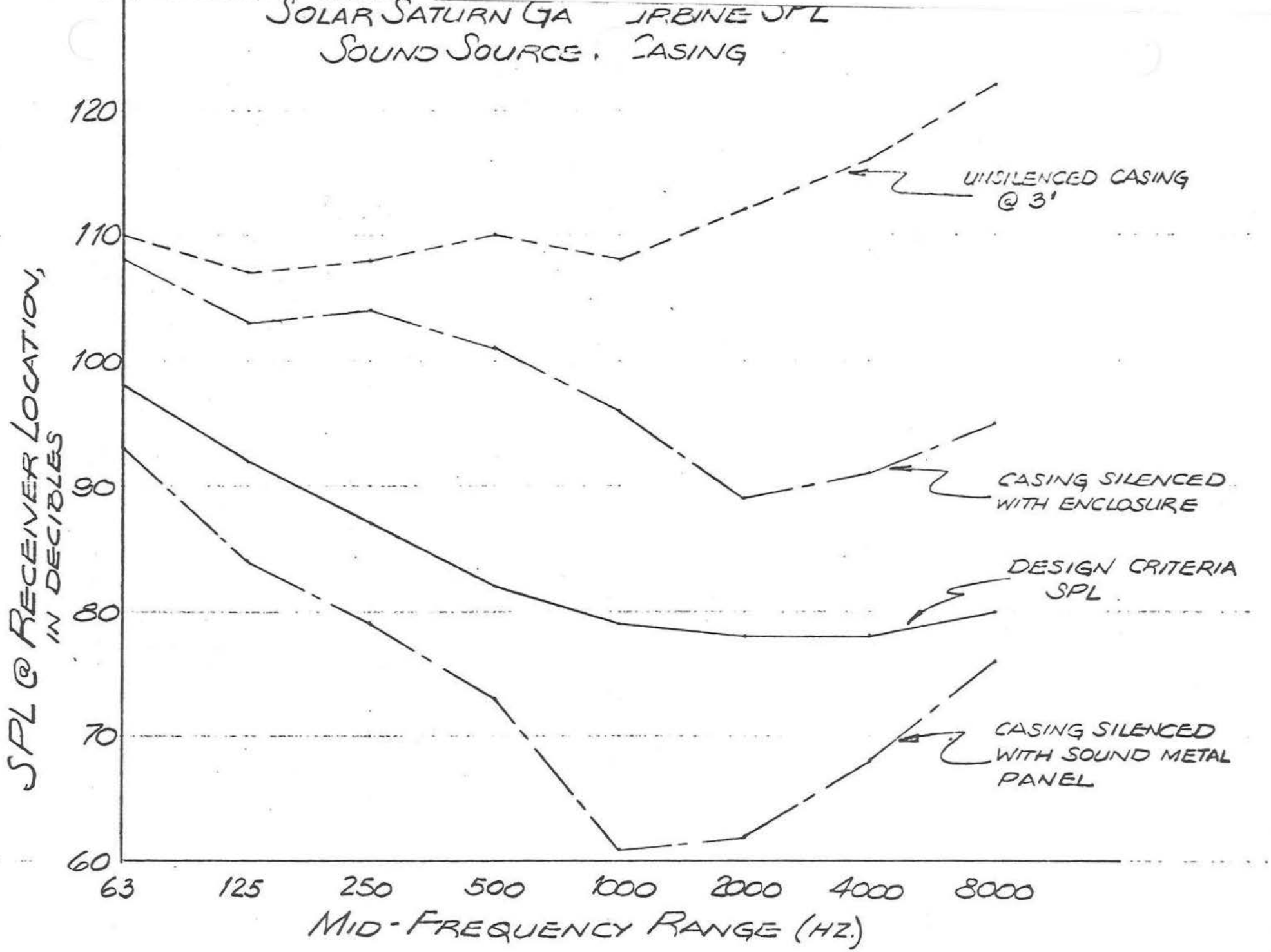
Very truly yours,

Robert C. Hildebran

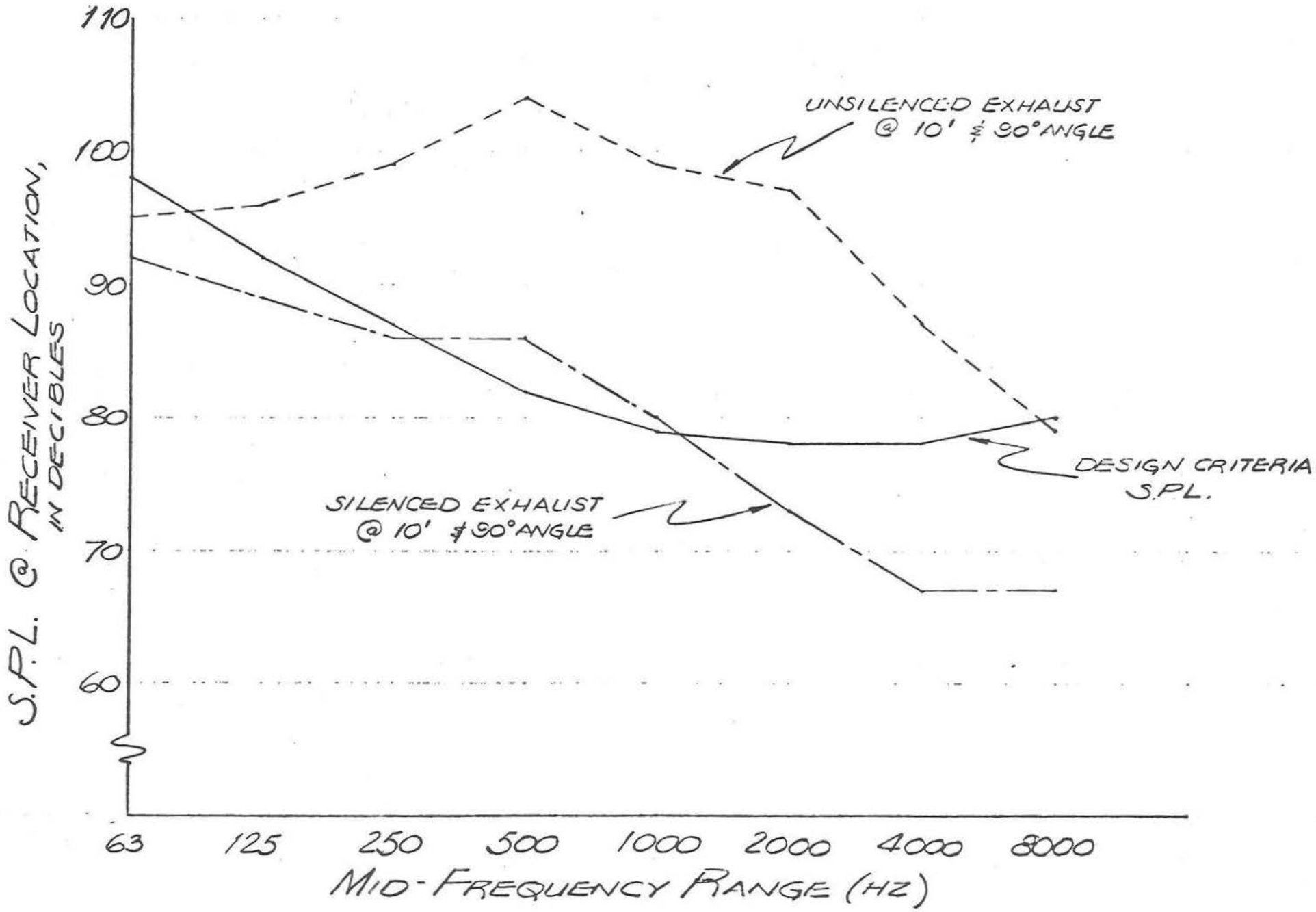
Robert C. Hildebran
Sales Engineer
Turbomachinery Division

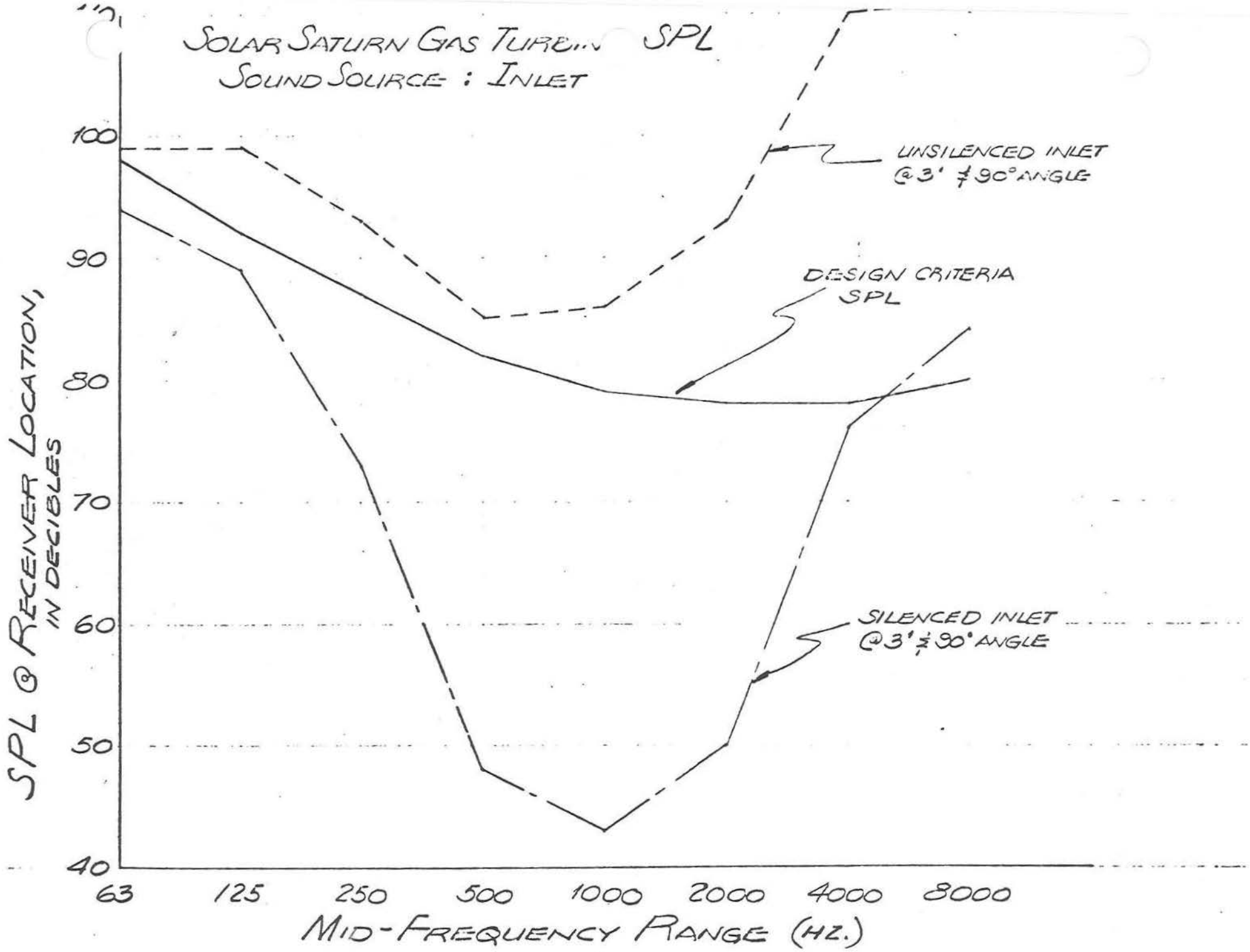
RCH/pl

Enclosures


SOLAR SATURN GA JRBINE SPL
SOUND SOURCE. CASING
120
110
100
90
80
70
60
SPL @ RECEIVER LOCATION, IN DECIBLES
UNSILENCED CASING @ 3'
CASING SILENCED WITH ENCLOSURE
DESIGN CRITERIA SPL
CASING SILENCED WITH SOUND METAL PANEL
63
125
250
500
1000
2000
4000
8000
MID-FREQUENCY RANGE (HZ.)

SOLAR SATURN GAS TURBINE SPL
SOUND SOURCE: EXHAUST




SOLAR SATURN GAS TURBINE SPL
SOUND SOURCE : INLET
UNSILENCED INLET @ 3' & 90° ANGLE
DESIGN CRITERIA SPL
SILENCED INLET @ 3' & 90° ANGLE
SPL @ RECEIVER LOCATION, IN DECIBLES
100
90
80
70
60
50
40
63
125
250
500
1000
2000
4000
8000
MID-FREQUENCY RANGE (HZ.)

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION

FLOW INSTRUMENTS

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	FE 15	FE 16
MAKE OR APPROVED EQUAL	SAME AS FE 14	SAME AS FE 14
TYPE		
MODEL		
MOUNTING		
PRESSURE RATING		
INDICATING OR RECORDING		
DIFFERENTIAL RANGE		
THROTTLING RANGE		
AUTOMATIC RESET		
AIR FILTER & REDUCER		
MANUAL CONTROL BYPASS		
CHART SIZE & NO		
CHART DRIVE REVOLUTIONS		
NUMBER OF PENS		
SPRING RANGE / MATERIAL		
METER MANIFOLD		
MERCURY		
PULSATION DAMPENER		
COMMODITY		
FLOW PRESSURE		
AS FLOW INCREASES CONTROL PRESSURE		
SPECIAL CONSTRUCTION & NOTES		
OPERATES WITH		
SERVICE	GAS TO #2 TURBINE	GAS TO #3 TURBINE

PRIMARY ELEMENT DATA	FE 14	
PLATE — MATERIAL & THICKNESS	1/8" SS	
LSED IN — FITTING SIZE TYPE & RATING	2"-300# RF	
TYPE TAPS	FLG	
PIPE I.D. — ORIFICE I.D.		
PRESSURE — TEMPERATURE	150	80°
SPECIFIC GRAVITY @ 60°	0.70	
SP GR @ FLOW TEMP		
NORMAL RATES — GPM @ 60°		
NORMAL RATES — MSCF DAY	0.33	
NORMAL RATES — # HR		
MAXIMUM RATES — GPM @ 60°		
MAXIMUM RATES — MSCF DAY	0.40	
MAXIMUM RATES — # HR		
CENTIPOISE @ FLOW TEMP		
METER DIFFERENTIAL RANGE	100"	
STATIC SPRING RANGE	0-250	
CHART TYPE — PRESSURE BASE		14.7
SP GR OF SEAL LIQUID		
COEFFICIENT @ STD COND.		
UNITS OF COEFFICIENT		
LINE NO — FLG OR FTG NO		
TYPE OF COEFFICIENT	SQUARE EDGED ORIFICE WITH 0.750" BORE	
SPECIAL CONSTRUCTION & NOTES	FURNISH 2"-300# USAS RF WN ORIFICE FLGS. TUBE TURN #159 WITH B7 STUDS & NUTS	
	GAS TO #1 TURBINE	

DATE

BY

CHECKED

ENGINEER

PROJ ENG

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

8.2 WASTE HEAT EXCHANGERS

SPECIFICATION

GAS TURBINE EXHAUST WASTE HEAT EXCHANGER

(three req'd)

1.0 GENERAL:

This specification applies to the purchase of three waste heat exchangers for use in recovering heat from gas turbine engine exhausts. The units are to be used on an off-shore platform near Santa Barbara. They are continuously exposed to wet salt air atmosphere.

2.0 DESIGN BASIS:

The units are to meet all requirements of the attached Heat Exchanger data sheet.

3.0 CONSTRUCTION:

The heating coils shall be all steel construction with welded joints except the inlet and outlet flanged connection. Pipe used shall be Schedule 40 or heavier. Where tubing is used, it shall be of a minimum thickness equal to the nearest Schedule 40 pipe size.

The quotations shall state the details of any proposed fin tube construction, including fin dimensions, spacing, materials and method of attachment to tube.

The units shall be as manufactured by REPCO Engineering Inc. (or approved equal). The dimensions and arrangement shall be as shown on the attached REPCO Dwg. D-70154-A. The "20" inlet and outlet flanges shall be 125# steel lightweight flanges (Tube Turn Part No. 717 or equal). The diverter valves shall be furnished with spring-return, pneumatic modulating actuators for use with 6-30psig air. Air failure moves diverter valve to the bypass position. Actuator shall have a three-way, normally closed solenoid valve, with explosion-proof and watertight (NEMA 4,7,9) solenoid enclosure, 120VAC single phase 60 Hz operation, 125 psi allowable operating differential (air). The minimum metal thickness of ducts and panels is 24 gauge. Provisions shall be made for 2" thick insulation over all duct and panel surfaces. (Insulation is to be installed by others).

4.0 SHIPMENT:

The units shall be packaged and shipped by the manufacturer. The manufacturer shall be responsible for safe arrival at the destination specified in the Humble Request for Quotation.

6.0 TECHNICAL DATA:

The proposals shall include 3 copies of the following:

(1) Data sheets with all items completed.
(2) Outline drawing showing overall dimensions (if different from the attached drawing).
(3) Cross-sectional drawing showing coils supports and housing construction.
(4) Details of fintube construction.
(5) Data sheets to state
    (1) Total length and size of coils.
    (2) Total fin area
    (3) Effective coil area

The supplier or manufacturer shall furnish 6 copies of all above final data including certified dimensional drawings. Certified drawings shall be furnished within 14 days of order date.

7.0 GUARANTEE:

The supplier and manufacturer shall guarantee that the units meet all requirements of this Specification and to be free of defects in material and workmanship for a period of 12 months from first service date. Defective performance or construction will be corrected at no additional cost to Humble.

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION — HEAT EXCHANGER — 10-084-WHE — REV

JOB NO 10-084

CUSTOMER HUMBLE OIL & REFINING CO.

PLANT LOCATION

SERVICE OF UNIT GAS TURBINE EXHAUST V.S. THERMINOL FR-1

ITEM NO E-5A E5B E5C (3 req'd)

SIZE — TYPE — CONNECTED IN

SURFACE UNIT — SHELLS/UNIT — SURFACE/SHELL — NET SQ FT

PERFORMANCE OF ONE UNIT

	SHELL SIDE		TUBE SIDE	
FLUID CIRCULATED			THERMINOL FR-1	
TOTAL FLUID ENTERING	48,500	# HR	66,000	
TOTAL VAPOR	48,500	# HR		
TOTAL LIQUID		# HR	66,000 (103 GPM)	
TOTAL STEAM		# HR		
TOTAL WATER WITHDRAWN	48,500	# HR		
FLUID VAPORIZED IN CONDENSER		# HR		
STEAM CONDENSED		# HR		
GRAVITY LIQUID SP. GR.		API	1.29 @ 375°F	
VISCOSITY LIQUID			1.16 @ 375°F	
MOLECULAR WEIGHT VAPORS				
SPECIFIC HEAT LIQUIDS	0.251	BTU #	0.312	BTU #
LATENT HEAT VAPORS		BTU #		BTU #
TEMPERATURE IN	800	F	250	F
TEMPERATURE OUT	375	F	500	F
OPERATING PRESSURE	10" W.C.			PSIG
NUMBER OF PASSES	1			
VELOCITY		FT SEC		FT SEC
PRESSURE DROP * MAX.		PROPOSED 8" W.C.		PROPOSED 5 PSI
DESIGN VISCOSITY			0.5 CP @	375 °F

HEAT EXCHANGER SURFACE (EACH EXCHANGER) 5,150,000 BTU/HR CORRECTED

TRANSFER RATE SERVICE — CLEAN — FOULING RESISTANCE .001

CONSTRUCTION

DESIGN PRESSURE	1.0	# SQ IN	150	#/SQ IN
TEST PRESSURE	—	# SQ IN	275	#/SQ IN
DESIGN TEMPERATURE	900	F	600	°F

TUBES — NO — SIZE — LENGTH — PITCH

SHELL — THICKNESS

SHELL COVER — FLOATING HEAD COVER

CHANNEL — CHANNEL COVER

TUBE SHEETS STATIONARY — FLOATING

BAFFLES CROSS — TYPE — THICKNESS — SPACING

BAFFLE LONG — THICKNESS

TUBE SUPPORTS — THICKNESS

GASKETS

CONNECTIONS SHELL IN 20" — OUT 20" — SERIES ROUND DUCTING

CHANNEL IN — OUT — SERIES

CORROSION ALLOWANCE SHELL SIDE — TUBE SIDE

CODE REQUIREMENTS ASME — TEMA CLASS — CUST SPEC

WEIGHTS EACH SHELL — BUNDLE — FULL OF WATER

NOTE: INDICATE AFTER EACH PART WHETHER STRESS RELIEVED (S.R.) AND WHETHER RADIOGRAPHED (X-R)

REMARKS EXCHANGER TO BE MOUNTED OVER TURBINE IN DIRECT LINE WITH ITS VERTICAL EXHAUST

NOTE: THE MAX. FILM TEMP. OF FR-2 IS 600°F FOR DESIGN

* PREFER LOWER ΔP IF PRACTICAL

DATE

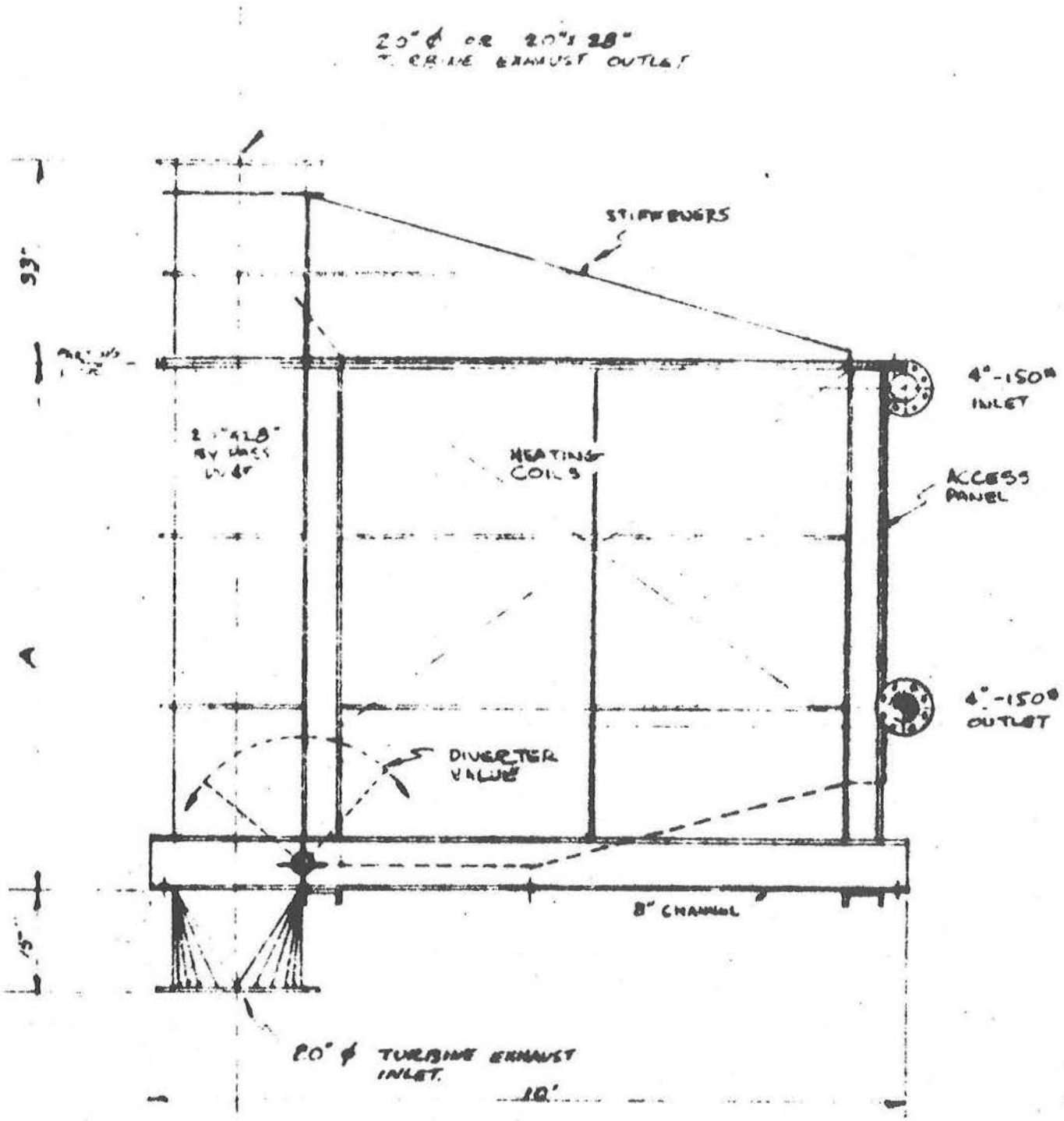
BY

CHECKED

ENGINEER

PROJ. ENG

REPCO ENGINEERING, INC. 1721 SO. BLUFF RD., MONTEBELLO, CALIFORNIA



TOTAL WIDTH 2'-9"

A = 74"

SOLAR SATURN 1100 HP

5.1 x 10⁶ BTU/HR RECOVERY 100 GPM FR-2 250°-500°F

1-5-70	GAS TURBINE EXHAUST HEAT RECOVERY UNIT.	D-70154-A

9.0 WATER CLEANING & OIL RECOVERY SYSTEM

9.1 SURGE TANK &
FLOTATION UNIT

SPECIFICATION

OIL RECOVERY FROM WASTE WATER FLOTATION UNIT

1.0 GENERAL

This specification applies to the design, construction and initial operational supervision of equipment for removal of suspended oil from oil field produced water. The unit is to be installed on an off shore platform near Santa Barbara, California. The location is classified as hazardous Class 1, Division 1, Group D. The unit is continuously exposed to wet salt air atmosphere. The water is very corrosive. The unit is for continuous service and must be dependable since down time of this unit curtails production from the platform.

2.0 DESIGN CONDITIONS

The influent water may contain up to 200 ppm of suspended oil in addition to 50 ppm fine solid particles, sand and grit. The unit shall reduce the non-soluble oil to 10 ppm or less with chemical treatment and to 25 ppm or less without chemical treatment. The required maximum thru put is 25,000 barrels per day.

The unit shall automatically compensate for 100% change in flow rate (at rated capacity) while meeting the above performance on oil removal.

The water contains hydrogen sulphide and carbon dioxide and is very corrosive to carbon steel. All wetted parts shall be protectively coated, made of type 316 ss, or made of rubber or suitable plastic materials.

3.0 EQUIPMENT

The unit shall be a Wemco Depurator (or approved equal) as manufactured by Wemco Division of Envirotech, 721 North B Street, Sacramento, California. The unit is their machine #10 rated at 25,725 B/D. The unit consists of a self supporting steel tank skid mounted. It contains four cells in series; each cell is equipped with a 10 hp explosion proof motor, belt drive, belt housing, neoprene rubber rotor and dispenser. The shafts shall be 316 ss where exposed to the water or gas. The entire assembly is to be gas tight and equipped with a breather valve. Unit is to be connected to the platform vapor recovery system. The unit is to be equipped with a Fisher 2500-249 V liquid level control with reset action and 3-15 psi bourdon tube. Float to be 3" x 14" 316 ss. Trim to be 316 ss.

All internal parts of carbon steel or cast iron shall be coated with Humble Epoxy Mastic Coating in accordance with Specification 10-084-C1. All external metal surfaces shall be coated with Humble Rust Ban in accordance with Specification 10-084-C2.

All equipment items other than those described above shall be as stated in WEMCO Data Sheets F8-D2, F8-D3, F8-D3.1, F8-D302, F8-D302.1, F8-D200, F8-D201, F8-D203, F8-D204; as shown on Dwgs. 52650-3, and as shown on Lithoprint F8-L1.

4.0 TECHNICAL DATA AND SERVICE

The supplier shall furnish technical field service to aid in starting-up and trimming the unit for optimum performance.

The manufacturer shall furnish 6 copies of the following within 14 days of the order date:

(1) Certified dimensional outline drawings.
(2) Cross sectional drawings showing details of internals.
(3) Parts list.
(4) Installation, maintenance and operating instructions.

5.0 SHIPMENT

Supplier shall be responsible for packaging, shipping and safe arrival of all equipment to destination specified by Humble in the "Request for Quotation".

6.0 GUARANTEE

The supplier and manufacturer shall guarantee the equipment to meet all of the requirements of these specifications and the manufacturer's data sheets referenced. They shall guarantee the equipment to be free of defects in material and workmanship for a period of 12 months from first service date. Inadequate performance or defective equipment construction shall be corrected at no cost to Humble.

ADDENDUM #1

The Varec 2000 vapor vent valve shall be special type with flanged pressure vent connection suitable for piping vented gas into the main vent system of the platform.

The supplier shall include, in the bid price, field engineering services for two days as specified in Par. 4.0. State in the quotation basis for charges for additional services requested by Humble.

Humble Job 10240
H-B Job 10-084

10-084-P21A

PRODUCED WATER

PUMPS P21A & P21B

(two req'd)

1.0 GENERAL

This specification applies to the purchase of two pumping units for use in pumping produced water from the flotation unit to the clean water surge tank. The pumps are to be used on an offshore platform in a hazardous location classified as Class 1, Group D. The pumps are exposed continuously to wet salt air atmosphere. The water contains H_2S and CO_2.

2.0 DESIGN & CONSTRUCTION

The pumps shall be capable of pumping at the rate of 750 gpm with a differential head of 65 feet. The motors shall be explosion proof Class 1 Group D with UL label. The motors shall be non-overloading to end of curve. The pump shall be a Worthington 4CNG 84 with all Worthite construction (or approved equal). The pump shall be frame mounted type complete with steel base, motor, coupling, coupling guard and all necessary oil lubrication equipment. The base shall be adequate to maintain the pump alignment when mounted on a relatively flexible steel deck.

3.0 TECHNICAL DATA

Bidders shall submit 3 copies of the following with their quotation:

(1) Head-capacity curves showing efficiency, horsepower and HPSH.
(2) Cross-sectional drawings showing all materials of construction.
(3) Dimensional outline drawings.
(4) Manufacturer catalog number and description of motor, coupling, lubrication equipment and all other accessory items.
(5) Pump data sheet.

Suppliers shall furnish 6 copies of the same final certified data plus operating, installation and maintenance instructions complete with detail parts list.

4.0 SHIPMENT

Supplier shall package and be responsible for safe arrival of the pumping units at the destination specified in the Humble Request for Quotation.

ADDENDUM: All exterior steel and cast iron surfaces shall be coated in accordance with Specification 10-084-C2.

5.0 GUARANTEE

The supplier and the manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for 12 months after the delivery date. Defects or deficiencies shall be corrected at the expense of the supplier.

Humble Job 10240
H-B Job 10-084

Specification T-2

ATMOSPHERIC PRESSURE SURGE TANKS

T21 Potable Water Tank
T22 Diesel Storage and Emergency Surge Tank
T-2 Produced Water Surge Tank
T-2A Clean Water Surge Tank

1.0 GENERAL:

This specification applies to the design and construction of the above tanks. The tanks are to be used on a Humble Oil and Refining Company Offshore Platform near Santa Barbara, California. The tanks are to be all welded construction. Welding and fabrication details are to comply with API Standard 650. Ladders, platforms and handrails to comply with State of California and Federal Safety Regulations.

2.0 CONSTRUCTION:

T2 & T2A shall comply with API 650. Tanks T-21 and T-22 shall comply with API 650 welding and fabrication details. Tanks shall be as shown on Drawings 084-145, 084-146, 084-143 and 084-175.

The tanks are to be furnished completely assembled f.o.b. trucks or barges at the jobsite specified on the Humble Request for Quotation. All exterior and interior seams shall be continuously sealed to provide for proper application of the protective coatings to protect against rusting corrosion and contamination. Each tank shall be tested by filling with water prior to shipment.

3.0 PROTECTIVE COATINGS:

All tank external surfaces including ladders and other appurtenances shall be coated in accordance with the attached Specfication 10-084-C2.

All internal surfaces of tanks T-2, T-22 and T2A shall be coated internally in accordance with Specification 10-084C1. All internal surfaces of tank T-21 shall be coated in accordance with Specification 10-084-C2.

4.0 DRAWINGS:

Supplier shall submit 3 copies of shop drawings for approval prior to starting fabrication. Purchaser reserves the right to change nozzle and appurtenance orientation and location until approval of these drawings.

5.0 GUARANTEE

Supplier shall guarantee the equipment furnished to be free of defects in material and workmanship for 12 months after delivery date. Defects or defeciencies not meeting these specifications are to be corrected at the suppliers expense.

Humble Job 10240
H-B Job 10-084

Specification 10-084-M1100

PRODUCED WATER METER

(One Req'd - Mark M1100)

This specification applies to the purchase of one Halliburton 4" 150# RF flanged turbine meter for metering water at 100 to 1200 gpm. Meter body to be either 316 SS or lined steel. The lining to be Tube-Kote TK21 15 mils thick (or approved equal). The meter is to be for outdoor service in salt air atmosphere in a Class 1 Division 1 Group D hazardous location. A Halliburton Model GOFB flow analyzer shall be furnished to read out the meter output in barrels and tenths. The flow totalizer is to be flush mounted on the main control panel in a non-hazardous location. The power supply is 115 VAC, 60 Hertz. The flow totalizer shall be equipped with a flow rate indicator and D.C. output signal proportional to flow rate. The output signal shall be 4-20MA.

HOBBS-BANNERMAN CORP.

SPECIFICATION — RELIEF VALVES

CUSTOMER HUMBLE OIL & REFINING Co. — 10-084

PLANT LOCATION

	PSV-1001 △	PSV-1002 △	PSV-1003 △	PSV-1004 △
	VAREC	SAME AS PSV-1001	SAME AS PSV-1001	SAME AS PSV-1001
	* FIG 2000			
	ALUM.			
	4" FLG. 125#	4" FLG. 125#		
	STD.			
	—			
	—			
	—	—		
	3 OZ.			
	ATM.			
	3 OZ.			
	1 OZ.			
	** 2 OZ.			
	100°F			
	.85			
	10,000			
	* FURNISH WITH PIPED OUTLET			
	T2 WATER SURGE TANK	T 22 EMERGENCY SURGE TANK	T22 EMERGENCY SURGE TANK	T 2A CLEAN WATER SURGE TANK

** VACUUM SETTING IS 1/2 OZ.

HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

REV

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LSH LC 150 △		LC151 △		LAH152 △		LAL153 △
MAKE OR APPROVED EQUAL		MAGNETROL		FISHER		FISHER		
TYPE		A-103F		2500		2800		
MODEL		TANDEM		249V		252V		
MOUNTING		4"-150#RF		4-150#RF		4"-150#RF		
INDICATING OR RECORDING		—		—		—		
INTERFACE OR LEVEL		LEVEL		LEVEL		LEVEL		
COMMODITY		CRUDE OIL		CRUDE OIL & BRINE		CRUDE OIL & BRINE		
SPECIFIC GRAVITY AT 60°		.80 TO .95		.80 TO 1.02		.80 TO 1.02		
OPERATING PRESS.	TEMP	0	60°F	0	60°F	0	60°F	
MINIMUM DESIGN PRESS.	TEMP	15	120°F	2 oz.	120°F	2 oz.	120°F	
BODY MATERIAL		STL.		STL.		STL.		
CONNECTIONS USAS		4"-150# RF		4"-150# RF		4"-150# RF		
FINS REQUIRED		—				—		
FLOAT MATERIAL	SIZE	PORC	—	316SS	3"x14"	316SS	3"x10"	
PILOT-RIGHT OR LEFT HAND				(LATER)		—		
THROTTLING RANGE				0-10 0-100		—		
AUTOMATIC RESET				NO		—		
AIR FILTER & REDUCER				YES		—		
MANUAL CONTROL BYPASS				NO		—		
CHART NO	SIZE	SPDT	MICRO	3-15 PSI		—	—	
CHART DRIVE	REVOLUTIONS	SWITCHES		BOUR. TUBE		—	—	
AS LEVEL RISES CONTROL PRESSURE		EXPL. PR HOUSING		INCREASES		CONTACTS OPEN		CONTACTS CLOSE
SPECIAL CONSTRUCTION & NOTES		CL. 1 GP. D		COAT ALL STEEL WETTED PARTS PER SPEC. 10-084C1		S.P.D.T. SWITCH WITH EX. PROOF CL. 1 GP. D		
OPERATES WITH				LCV-151				
SERVICE		DISPOSAL TUBE OIL PUMP P-2		WASTE WATER SURGE TANK		WATER SURGE TANK		
VESSEL NO				T-2		T-2		
PLANT NO								
PURCHASE ORDER NO								

SAME AS LAH 152

SAME AS LAH 152

BY DATE

APPROVED

DATE

BY

CHECKED

ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION — FLOW INSTRUMENTS — SHEET ___ OF ___ REV

CUSTOMER	HUMBLE OIL & REFINING CO.		10-084
PLANT LOCATION			
IDENTIFICATION NO.	FC-151A		FE151A △
MAKE (BRAND)	BARTON		316 SS 1/8"
	FLOW CONTROLLER		8"-300# R.F.
	335		FLANGE
	PIPE		SCH. 40 6.25
	500 PSI		2-5 100°F
	IND.		1.02
	20"		
	1-400 %		
	YES		
	.02 TO 70 RPS		
	YES		
	NO		
	— —		750
	— —		
	—		
	— —		
	—		1
	—	METER DIFFERENTIAL RANGE	20"
	—		—
	OILFIELD BRINE H_2S, CO_2	ART TYPE PRESSURE RAGE	— —
	2-5 PSI		NO
	INCREASES		
	316 S.S. BELLOWS & WETTED PARTS		
	6-30 PSI SPRING		
OPERATES W	FCV 151A		
SERVICE	FLOW TO FLOTATION UNIT	SPECIAL CONSTRUCTION & NOTES	BETA RATIO .785 TO KEEP ΔP TO MIN.

CHECKED

ENGINEER

PROJ. ENG

THIS SPECIFICATION CONSTITUTES A BID OF MATERIAL AND WILL BE INCORPORATED INTO THE PURCHASE ORDER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

REV

SPECIFICATION — CONTROL VALVES

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		FCV-151A △	△	△	△
MAKE OR APPROVED EQUAL		FISHER			
TYPE		9110			
MODEL		BFV DOUBLE R/L			
SIZE	TYPE CONNECTIONS	8"	125# RF		
BODY MATERIAL	RATING	CI	125#		
INNER VALVE TRIM MAT'L		316 SS SHAFT BUNA-N-SEAT			
INNER VALVE SIZE	TYPE	8"	BF		
TOP WORKS		* 656-60			
FILTER		—			
POSITIONER	BOOSTER RELAY	—	—		
POSITIONER BYPASS	W/GAGES	—	—		
AIR FILTER & REDUCER		—			
COMMODITY		OILFIELD BRINE, H_2S, CO_2			
FLOW TEMPERATURE °F		100°F			
PRESSURE PSIG	IN / OUT	3	2		
SPEC. GRAVITY	@ 60°F / @ FLOW TEMP				
SPEC. GRAVITY AIR	@ 60°F / @ FLOW TEMP				
GAS LB/HR	NORM FLOW / MAX CAP		750		
SCFM	NORM FLOW / MAX CAP				
[illegible]	NORM FLOW / MAX CAP				
VALVE POSITION ON AIR FAILURE		OPENS			
SPECIAL CONSTRUCTION & NOTES		* 6-30 PSI SPRING			
OPERATOR TAG NO		FC-151A			
SERVICE		WATER TO FLOTATION UNIT			
PO NO					
[illegible]					
PURCHASE ORDER NO					

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HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___ REV

SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PI-21A △	PI-21B △	△	△
MAKE OR APPROVED EQUAL	WIKA	SAME AS PI 21A		
TYPE	PRESS. GA.			
MODEL	233			
MOUNTING / LOCATION	1/2" MPT / LOWER			
INDICATING OR RECORDING	IND.			
NORMAL PRESSURE / TEMP	30 / 100°F			
PRESSURE ELEMENT RANGE	0-60			
PRESSURE ELEMENT TYPE AND MATERIAL	BOURD. / 316SS			
~~REQUIRED SUPPRESSION~~ DIAL SIZE	4"			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REGULATOR				
MANUAL CONTROL BYPASS				
CHART SIZE / NO				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED			
OPERATES WITH SERVICE	P21A WATER PUMP FROM FLOTATION UNIT	P21B WATER PUMP FROM FLOTATION UNIT		
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION — CONTROL VALVES

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO			PCV-350 △		LCV 151 △		ECV 151A △		△
MAKE OR APPROVED EQUAL			FISHER		FISHER				
TYPE			95H		DOUBLE R/L				
MODEL					9110				
SIZE	TYPE CONNECTIONS		1/2"	SCD.	6"	150# RF			
BODY MATERIAL	RATING		STL.	300#	*STL	275#			
INNER VALVE TRIM MAT'L			SS DIAPH.		BUNA-N				
INNER VALVE SIZE	TYPE		3/8"	ORIF.	6"	B.F.			
TOP WORKS			—		656-30				
FINS			—						
POSITIONER	BOOSTER RELAY		—	—					
POSITIONER BYPASS	W/GAGES		—	—					
AIR FILTER & REDUCER			—						
COMMODITY			SWEET GAS		OIL FIELD BRINE				
FLOW TEMPERATURE °F					120°F				
PRESSURE PSIG	IN	OUT	150	20	2#	0			
SPEC GRAVITY H_2O - 1.0	@ 60°F	@ FLOW TEMP		.70		1.02			
SPEC GRAVITY @ 60° AIR 1.0	@ 60°F	@ FLOW-TEMP							
GPM @ 60°	NORM. FLOW	MAX. CAP.				730			
SCF HR	NORM. FLOW	MAX. CAP.	200	400					
# HR	NORM. FLOW	MAX. CAP.							
VALVE POSITION ON AIR FAILURE			—		CLOSES				
Cv					CALC. 5200 ACT. 7800				
SPECIAL CONSTRUCTION & NOTES			STAINLESS STEEL DIAPHRAM		316 SS STEM & BUNA N SEALS				
OPERATES WITH					LC 151				
SERVICE			PRESSURE RED. TO FLOTATION F.I.		WATER SURGE TANK LEVEL				
LINE NO					T-2				
PLANT NO.									
PURCHASE ORDER NO.									

SAME AS LCV 151

*DUCTILE IRON IS ACCEPTABLE

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SPECIFICATION

PRIMARY FLOW DEVICES

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	FI-15 △		△		△			
MAKE OR APPROVED EQUAL	*BROOKS SIZE 7							
FLOW ELEMENT TYPE	ROTAMETER							
BODY MAT'L / RATING	STL.	275						
CONNECTION SIZE / TYPE	1"	FLGD. RF						
PRESSURE TAPS TYPES & SIZE	—							
PLATE MATERIAL & THICKNESS	—							
PIPE I.D. / ORIFICE I.D.								
FLOW PRESS / FLOW TEMP	20	100°F						
COMMODITY	SWEET GAS							
SPECIFIC GRAVITY @ 60°	0.70							
SP GR @ FLOW TEMP								
NORMAL / MAXIMUM: BPD @ 60°								
NORMAL / MAXIMUM: MSCF DAY								
NORMAL / MAXIMUM: # HR								
NORMAL / MAXIMUM: SCFH	200	400						
VISCOSITY IN CENTIPOISE @ FLOW TEMPERATURE								
METER RANGE / STATIC SPRING RANGE								
CHART TYPE / PRESSURE BASE								
TYPE MEASURING ELEMENT								
UNITS OF COEFFICIENT								
NOM COEFF @ STD COND								
ACTUAL COEFF. @ STD COND								
SPECIAL CONSTRUCTION & NOTES	* MODEL 7-3623							
SERVICE	GAS TO FLOTATION UNIT							
LINE NO								
PLANT NO.								
PURCHASE ORDER NO.								

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9.2 OIL & WATER SUMPS

SPECIFICATION
MISCELLANEOUS VESSELS

VENT SURGE TANK V6
WATER SUMP V7
OIL SUMP V8
WELL CLEAN TANK V10

1.0 GENERAL

This specification applies to the design and construction of the above vessels. The vessels are to be used on a Humble Oil and Refining Company Offshore Platform near Santa Barbara, California. The vessels are to be constructed in accordance with ASME Code Section VIII.

2.0 CONSTRUCTION

The vessels shall be constructed as shown on Drawings 084-128, 084-143 and 084-144. The design pressure is 25 psig at 100°F for all vessels V6, V7 and V8 with 1/16" corrosion allowance. V10 is to be designed for 50 PSIG at 100°F and 1/16" corrosion allowance.

All joints and connections both externally and internally shall be continuously seal welded. Welds internally shall be ground smooth prior to coating.

3.0 PROTECTIVE COATING

The vessels and appurtenances shall be coated externally in accordance with the attached Specification 10-084C2 and coated internally in accordance with Specification 10-084-C1.

4.0 DELIVERY

The vessels shall be delivered f.o.b. trucks or barges at the jobsite specified in the Humble request for quotation.

5.0 DRAWINGS

Supplier shall submit three (3) copies of shop drawings for approval prior to fabrication. The purchaser reserves the right to change the location of nozzles and appurtenances until the approval of these drawings.

6.0 GUARANTEE

The supplier shall guarantee the vessels to meet the requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from the delivery date. Defects or deficiencies shall be corrected at no additional cost to Humble.

SPECIFICATION
WATER SUMP PUMPS
P1A and P1B

(Two required)

1.0 GENERAL:

This specification applies to the purchase of two sump pumps for use in a pressurized water sump tank on an offshore platform. The pumps operate in a Class 1, Division 1 hazardous location. The external surfaces are continuously exposed to wet salt air atmosphere. The water is ocean water or oilfield brine containing hydrogen sulphide and carbon dioxide or a mixture of both. Considerable sand and grit is expected in the water. The pumps are to be mounted on a 26" flange provided on top of the tank.

2.0 DESIGN CONDITIONS

The pump shall pump a minimum of 250 gallons per minute of 1.02 specific gravity water at 50°F to 120°F with a total differential head of 100 feet. The pump column length shall be such that the dimension from the mounting flange fore to the bottom of the suction screen is 5'-0". The pump shall be capable of continuous operation with 18" of submersion at the suction screen. The motor shall be non overloading at 1.0 service factor for end of curve condition of pump.

3.0 CONSTRUCTION

The pump shall be a Goulds Model 3171 PR, Group M, 3 X 4 X 11 (or approved equal). The materials shall be as listed in Goulds Catalog for all type 316ss. All pump wetted metal parts are type 316ss, steady bearings are carbon, cover plate is steel. The steel cover plate to be coated in accordance with Specification 10-084C1. External surfaces of pump and motor, except stainless steel surfaces, are to be coated in accordance with Specification 10-084-C2.

The impellers to be open non-clogging type.

The pump to mount on a 26", 125# ASA light weight flange 34¼" od, 31-3/4"BC, 24-1 3/8" bolt holes. The pump mounting is to be vapor tight for an operating pressure of 14.5 psig.

The motor to be 440 volt, 3 phase, 60 hertz squirrel cage induction motor, **explosion proof. The motors shall be 15 HP, 4 pole to drive the pump at 1,750 rpm. The motor shall be suitable for Class 1, Division 1, hazardous location and for outdoor service in continuous wet salt air atmosphere. The motors are in intermittent and standby service.**

4.0 TECHNICAL DATA

Three copies of the following data are to be furnished with the quotations:

1. performance curves.
2. Dimensional outline and cross-sectional drawings showing overall dimensions and all parts and materials of construction.

Six copies of the following data are to be furnished within 14 days of order date:

1. Performance curves and pump data sheet.
2. Certified dimensional outline drawings.
3. Cross sectional drawings with parts list showing all materials of construction.
4. Installation, operating and maintenance instructions.

5.0 SHIPMENT

Manufacturer and supplier are responsible to properly package the pump units for shipment and their safe arrival at the destination specified in the Request for Quotations.

6.0 GUARANTEE

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date. Performance curves furnished with the quotation shall become a part of the guarantee.

OIL SUMP PUMPS

P5A & P5B

(Two Req'd)

1.0 GENERAL

This specification applies to the purchase of two sump pumps for pumping viscous crude oil from an offshore platform oil sump tank. The crude oil is wet and contains some sand and grit. The crude oil also contains H_2S and CO_2. The pumps are located in a hazardous location classified as Class 1, Group D. The exterior of the units is exposed continuously to wet salt air atmosphere.

2.0 DESIGN & CONSTRUCTION

The pumps shall be designed and constructed to pump a minimum of 15 gallons per minute of 100,000 SSU crude oil at 0.93 specific gravity with a differential pressure of 100 psi. The motor shall be a minimum of 5 hp with separate or integral gears to drive the pump at the design speed (approximately 500 RPM). The pump shall be a Worthington 1½ GR with cast iron case and gears, asbestos lead packing, and steel shaft.

The motors to be for 440 volt, 3 phase, 60 Hz power. Motors are to be explosion proof for Class 1, Group D with UL label. The motor and coupling are to be mounted on a steel flange to match a 26" Class 75 mating flange (Tube Turn Part No. 705). The gear motor is to be mounted so that the suction is 48" below the flange face. The arrangement shall be as shown on the attached sketch. The mounting assembly and equipment shall be adequate for operation of the sump tank at 14.5 psig. The pump discharge piping shall be 3" IPS terminated in a 3" 150# ASA RF flange. The pump shaft extension shall be designed for the full gear motor output torque. The pump support column shall be adequate to maintain alignment of the equipment for long bearing life.

3.0 TECHNICAL DATA

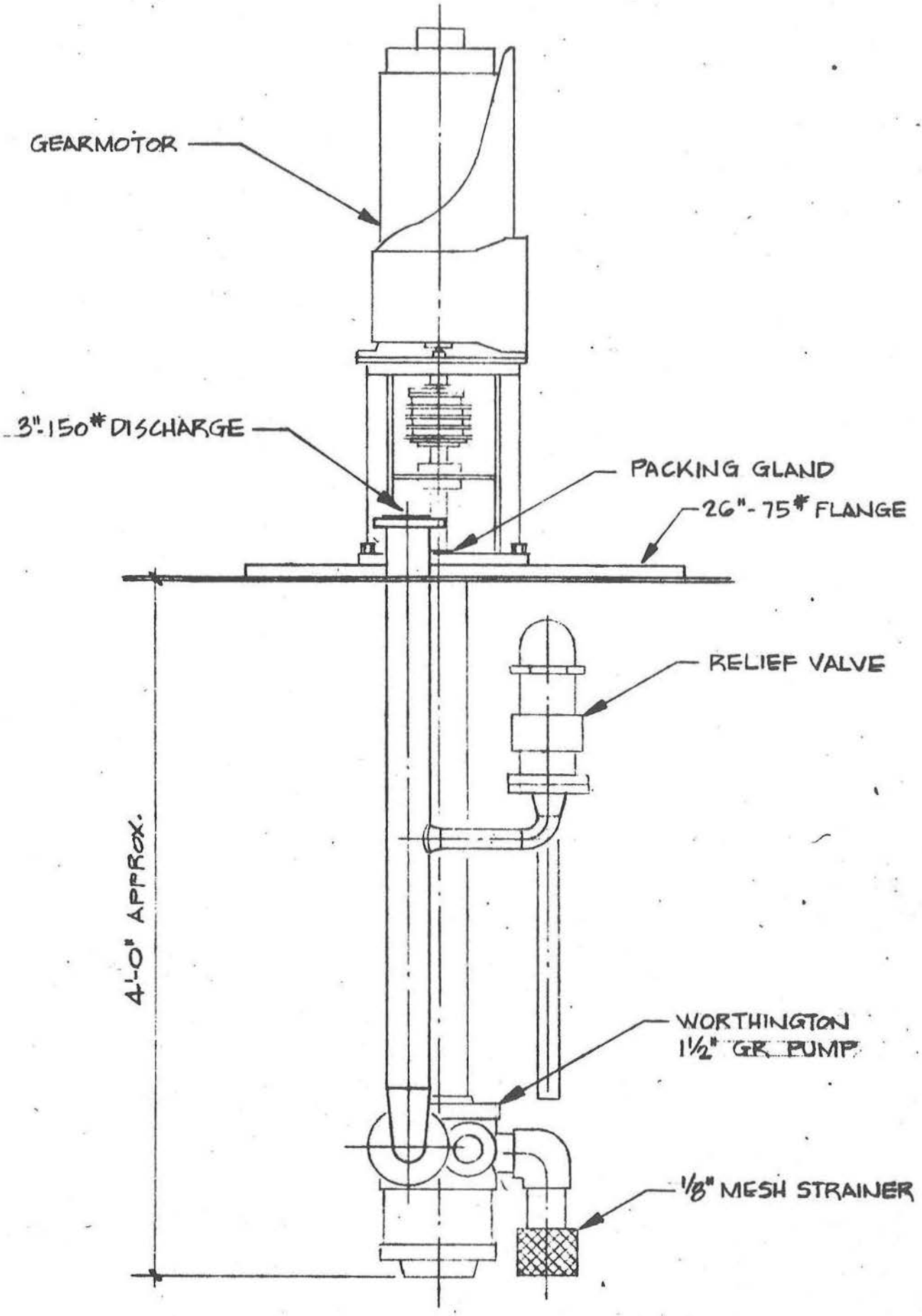
Supplier to submit certified drawings for approval before starting fabrication of the units. Six copies of final drawings, parts list, installation , maintenance and operating instructions shall be furnished upon shipment of units.

4.0 GUARANTEE

Supplier and manufacturer shall guarantee the equipment to meet these specifications and to be free of defects in material and workmanship for 12 months after the delivery date. Deficiencies of defects shall be corrected at the expense of the supplier.

5.0 SHIPMENT

Supplier shall package and ship and be responsible for safe arrival of the units at the destination specified in the Humble Request for Quotation.


GEARMOTOR
3"-150# DISCHARGE
PACKING GLAND
26"-75# FLANGE
RELIEF VALVE
4'-0" APPROX.
WORTHINGTON
1½" GR PUMP
⅛" MESH STRAINER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___ REV.

SPECIFICATION — **PRESSURE INSTRUMENTS**

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.	PI-348	PI-349	PI-350	PI-351
MAKE OR APPROVED EQUAL	WIKA			
TYPE	PRESS. GA.			
MODEL	233			
MOUNTING / LOCATION	½" MPT / BOTTOM			
INDICATING OR RECORDING	—			
NORMAL PRESSURE @ TEMP.	40 / 60°F			
PRESSURE ELEMENT RANGE	0-60°			
PRESSURE ELEMENT TYPE AND MATERIAL	316SS / BOUR			
REQUIRED SUPPRESSION	—	SAME AS PI-348	SAME AS PI-348	
THROTTLING RANGE	—			
AUTOMATIC RESET	—			
RATE ACTION	4" DIAL SIZE			
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE / NO.				
CHART DRIVE / REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER				
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED			
OPERATES WITH		P-1B	P-2	P-5
SERVICE	DISCH. OF DRAIN SUMP PUMP P-1A	DISCH. OF DRAIN SUMP PUMP P-1B	DISCH. OIL PUMP IN DISPOSAL TUBE P-2	DISCH. OIL PUMP P-5
PLANT NO.				
PURCHASE ORDER NO.				

REV	BY	DATE

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SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO.		PI-352 △		△		△		△
MAKE OR APPROVED EQUAL								
TYPE								
MODEL								
MOUNTING	LOCATION							
INDICATING OR RECORDING								
NORMAL PRESSURE @ TEMP.								
PRESSURE ELEMENT RANGE								
PRESSURE ELEMENT TYPE AND MATERIAL								
REQUIRED SUPPRESSION								
THROTTLING RANGE								
AUTOMATIC RESET								
RATE ACTION								
AIR FILTER & REDUCER								
MANUAL CONTROL BYPASS								
CHART SIZE	NO							
CHART DRIVE	REVOLUTION							
INDICATING SCALE RANGE								
AS PRESSURE INCREASES OUTPUT SIGNAL								
LOCATION OF PRESSURE TAP								
PULSATION DAMPENER								
SPECIAL CONSTRUCTION & NOTES								
OPERATES WITH								
SERVICE		DISCHARGE OIL PUMP OIL SUMP (P-BB)						
PLANT NO.								
PURCHASE ORDER NO								

SAME AS PI-348

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<&&&O>WD			

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HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

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REV

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LAH LC 146 △		LAH LC 147 △	LAH LC 148 △	LAH LC 149 △
MAKE OR APPROVED EQUAL		MAGNETROL		SAME AS LAH/LC 146	MAGNETROL	SAME AS LAH/LC 148
TYPE		A-103F			A-103F	
MODEL		TANDEM			TANDEM	
MOUNTING FLANGE		4"-150# RF			4"-150# RF	
INDICATING OR RECORDING		—			—	
INTERFACE OR LEVEL		LEVEL			LEVEL	
COMMODITY		OIL FIELD BRINE			CRUDE OIL	
SPECIFIC GRAVITY AT 60°		1.02			.80 TO .95	
OPERATING PRESS.	F° TEMP	0	60°			
MINIMUM DESIGN PRESS.	TEMP	15	120°			
BODY MATERIAL		STL.				
CONNECTIONS USAS		4"-150# RF				
FINS REQUIRED		—				
FLOAT MATERIAL	SIZE	PORC.	$2\frac{9}{16}$" x $3\frac{3}{4}$"			
PILOT-RIGHT OR LEFT HAND		—				
THROTTLING RANGE		—				
AUTOMATIC RESET		—				
AIR FILTER & REDUCER		—				
MANUAL CONTROL BYPASS		—				
CHART NO	SIZE	SPDT MICRO SWITCHES				
CHART DRIVE	REVOLUTIONS					
AS LEVEL RISES CONTROL PRESSURE						
SPECIAL CONSTRUCTION & NOTES		EXPL. PROOF HOUSING CL. 1 GR. D.				
OPERATES WITH		PIA		PIB	P-5A	P-5B
SERVICE COAT WETTED STL. PARTS PER SPEC. 10-084C1						
VESSEL NO		WATER SUMP		WATER SUMP	OIL SUMP	OIL SUMP
PLANT NO						
PURCHASE ORDER NO						

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9.3 DISPOSAL TUBE

OIL DISPOSAL TUBE PUMP

P2

(One Req'd)

1.0 GENERAL

This specification applies to the purchase of one sump pump for pumping viscous crude oil from an offshore platform oil sump. The crude oil is wet and contains some sand and grit. The crude oil also contains H_2S and CO_2. The pump is located in a hazardous location classified as Class 1, Group D. The exterior of the unit is exposed continuously to wet salt air atmosphere.

2.0 DESIGN & CONSTRUCTION

The pump shall be designed and constructed to pump a minimum of 30 gallons per minute of 100,000 SSU crude oil at 0.93 specific gravity with a differential pressure of 100 psi. The meter shall be a minimum of 10 hp with separate or integral gears to drive the pump at the design speed (approximately 500 RPM). The pump shall be a Worthington GR with cast iron case and gears, asbestos lead packing and steel shafts.

The motor to be for 440 volt, 3 phase, 60 Hz power. Motor is to be explosion proof for Class 1, Group D with UL label. The motor and coupling are to be mounted on a steel flange to match a 26" Class 75 mating flange (Tube Turn Part No. 705). The gear motor is to be mounted so that the suction is *28'-0" below the flange face. The arrangement shall be as shown on the attached sketch. The mounting assembly and equipment shall be adequate for operation of the sump tank at 14.5 psig. The pump discharge piping shall be 3" IPS terminated in a 3" 150# ASA RF flange. The pump shaft extension shall be designed for the full gear motor output torque. The pump support column shall be adequate to maintain alignment of the equipment for long bearing life.

3.0 TECHINICAL DATA

Supplier to submit certified drawings for approval before starting fabrication of the units. Six copies of final drawings, parts list, installation, maintenance and operating instructions shall be furnished upon shipment of units.

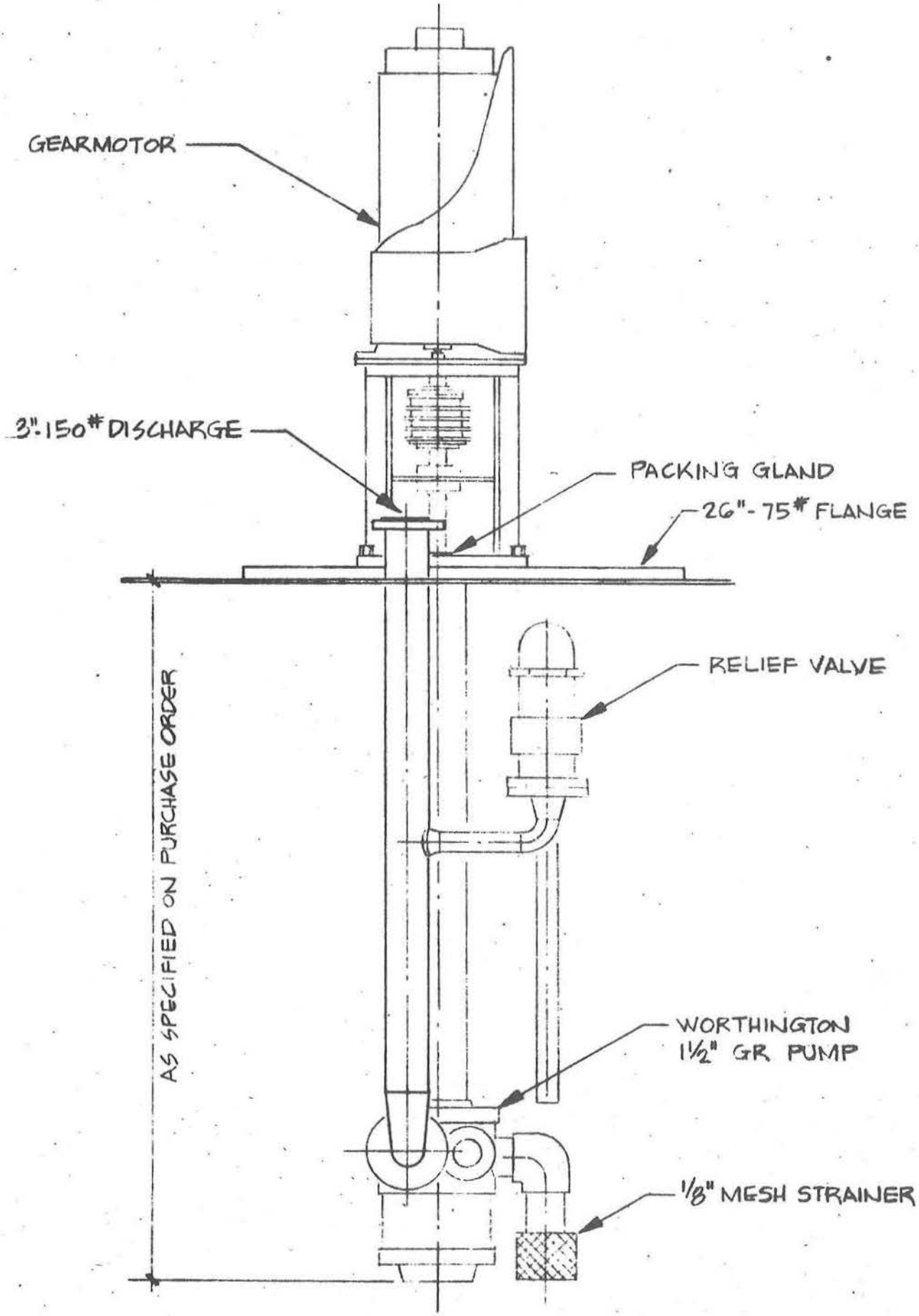
* Also quoate price for 24'-0" and 32'-0"

4.0 GUARANTEE

Supplier and manufacturer shall guarantee the equipment to meet these specifications and to be free of defects in material and workmanship for 12 months after the delivery date. Deficiencies of defects shall be corrected at the expense of the supplier.

5.0 SHIPMENT

Supplier shall package and ship and be responsible for safe arrival of the units at the destination specified in the Humble Request for Quotation.


GEARMOTOR
3"-150# DISCHARGE
PACKING GLAND
26"-75# FLANGE
RELIEF VALVE
AS SPECIFIED ON PURCHASE ORDER
WORTHINGTON
1½" GR PUMP
1/8" MESH STRAINER

10.0 ELECTRICAL SYSTEM

Humble Job 10240
H-B Job 10-084

ELECTRICAL POWER SYSTEM

1.0 GENERAL

This description applies to the electrical power system supplying power to the platform and consists of two parts, one the onshore facilities, and two the platform facilities.

2.0 ONSHORE FACILITIES

The onshore facilities consist of a 34.5KV metering section and main breaker totally enclosed in an outdoor metal-clad switchgear line-up. The serving utility would provide power at 34.5KV to the onshore site where it would be metered and taken to the platform via approximately 8 miles of submarine power cable. In addition to the supply conductors the submarine cable would carry all necessary communication and telemetry conductors.

3.0 PLATFORM FACILITIES

The submarine power cable from shore would terminate on the platform in a 34.5KV loadbreak disconnect switch located in a pressurized switchgear room on the production deck. Provisions would be made to separate out the communications conductors before the disconnect switch.

From the disconnect switch the 34.5KV power is transformed to 4.16KV via a 20,000KVA transformer and is fed to the platform main power circuit breaker which provides short-circuit and overcurrent protection for the platform electrical system.

The 4.16KV power is used to supply energy to all large power loads including the gas compressors, the two drilling rigs and the future submersible pumps.

In addition to the primary 4.16KV power bus the platform is designed to have a secondary 4.16KV bus, separate from the primary bus, supplied from three 1,000KVA gas turbine generators. This arrangement of shoreside power and platform generated power provides for an economical reduction of purchased power by enabling part of the load to be supplied from the secondary bus. A fused disconnect switch, electrically interlocked with the main power circuit breaker, would allow connection of the secondary bus with the primary bus in the case of a shoreside power failure.

A 1500 KVA 4.16KV to 480V transformer would be provided to supply most small motors, the crew quarters, and the lighting and control power transformer. Provisions would be made for switching the primary of the 1500 KVA transformer to either 4.16KV bus.

An emergency lighting transformer connected to the secondary bus would be furnished to supply emergency lighting and communications in the case of a shore side power failure. A voltage sensitive relay connected to the primary bus would actuate an electrically operated transfer switch energizing emergency lighting.

3.0 PLATFORM FACILITIES (cont'd)

Adequate power has been provided for an impressed current type cathodic protection system with a total current capacity of 10,000 amperes P.C. using pb-6% SB-1% Ag alloy anodes with 15 year nominal life should this type system be elected to be installed for corrosion control on the underwater steel surfaces of the platform. This system would provide an apparent current density of 10MA./sq. ft. for all surfaces in the water zone and 1MA/sq. ft. for mud zone areas, plus 3 amperes additional per well casing.

The platform electrical system is shown on drawings 084-301 and 084-302.

The ellaborate load sharing scheme with the necessary electrical interlocks and fused switches was necessary so that the 1000KVA turbine generators would be able to be run reasonably loaded thereby enabling the turbine exhaust heat to be used effectively for the oil treating process.

1.0 GENERAL

This specification covers the design requirements for a circuit breaker to be used as the primary overcurrent protective device for a submarine power cable supplying electrical power to an offshore drilling platform. The circuit breaker assembly shall include provisions for utility company metering and shall be designed for outdoor service in a corrosive atmosphere near the ocean. The unit shall consist of totally enclosed, dead front metal-clad vertical sections and shall have supply and load conductors entering and leaving underground.

2.0 CODES

The assembly shall conform to the "State of California Electrical Safety Orders" latest edition and the "National Electric Code" latest edition.

3.0 DESIGN BASIS

3.1 Circuit Breaker

The circuit breaker shall be designed to operate at 34,500 volts and shall have a continuous current rating of 1200 amperes. The unit is to be for three phase, 60 hertz electrical power and shall have an interrupting capacity of 1500 MVA symmetrical.

All insulators shall be rated at a minimum of 34.5KV and shall have additional allowances to 60KV to prevent 34.5KV flashover due to an exposure in a salt air atmosphere.

The circuit breaker shall be the drawout type capable of mechanical and electrical operation. The breaker shall use a stored energy type closing mechanism and shall derive its power from the supply side of the breaker. The breaker shall have a position indicator, an operation counter, primary and secondary disconnecting devices, and a mechanical interlock to prevent making or breaking load current on the disconnects.

The circuit breaker shall have internally mounted any transformer or battery necessary to furnish control power. If a battery is provided, suitable means for charging shall be furnished. All power is to be derived from the 34.5KV supply and no separate low voltage, either AC or DC, will be provided externally. SPDT dry electrical contacts rated 5 amps at 120 volts shall be provided to indicate control power failure.

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The circuit breaker shall include a semi-flush mounted voltmeter with selector switch to indicate the phase voltage. The selector switch shall have an "off" position and three additional positions to switch between phases.

The circuit breaker shall include a ground detection system with indicating lights and a ground current detector relay with alarm contacts set to open the breaker at 5 to 10 amperes ground current.

The circuit breaker shall include provisions for terminating the purchasers submarine cable, both supply and communication conductors. The communication conductors are to be separated from the supply conductors in the breaker load compartment. Space shall be provided for mounting and connecting the purchaser's pot head (complete with insulators) for separating the communication conductors. A sketch of the desired arrangement is provided with the specification.

3.2 Metering Section

A 34.5KV metering section shall be provided. Provisions shall be made for mounting the utility company's (Southern California Edison Company) potential and current transformers. The vendor shall coordinate the design of the metering section with the utility company. Supply conductors will be from underground by the utility company.

3.3 Area Lighting

A 5 KVA Transformer 34.5 KV primary and 120V secondary, single phase shall be provided complete with fused disconnects on the primary and with an 8 circuit "Lighting type" panel for outside service on the secondary. The panel main circuit breaker shall be set to prevent overload of the transformer and the circuit breaker shall be coordinated with the fuses to prevent blowing the fuses in case of a fault on the secondary. All circuit breakers except the main shall be 15 amp.

4.0 FABRICATION

4.1 The circuit breaker and metering section shall be housed in a weatherproof steel enclosure having an aisle space of sufficient size to permit withdrawal of the circuit breaker for inspection, test or maintenance. Each access door will have provisions for outside padlocking, but also arranged so that it can be opened

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from the inside regardless of whether or not it has been locked from the outside. Adequate incandescent lighting, controlled by a switch near each access door will be provided. Louvers, equipped with standard aluminum mesh filters, will be appropriately located to permit proper air circulation but to exclude dust, dirt and rodents. The complete enclosure will set on a concrete slab and shall have provisions for bolting to the foundation.

4.2 Painting

All surfaces of the enclosure shall be primed with Subox No. 11 red primer applied per the manufacturer's specification. Two finish coats of Subox heavy duty finish No. 1165 shall be applied per the manufacturer's recommendation.

5.0 PROPOSAL

The vendor shall supply complete descriptive literature including dimensional data and electrical single line schematics. The proposal shall include an estimate of the freight charges from the factory to Santa Barbara, California.

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HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS
SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION 34.5KV POLYETHYLENE INSULATED SUBMARINE CABLE

10-084SC | REV

CUSTOMER HUMBLE OIL AND REFINING COMPANY

JOB NO. 10-084

PLANT LOCATION PACIFIC COAST OFF-SHORE

GENERAL

This specification covers the design requirements for a 34,500 volt submarine cable to be used for supplying electric power to an offshore drilling platform. The platform is to be located in approximately eight hundred (800) feet of water off the California Coast near Santa Barbara. The cable will extend from the onshore substation to the platform disconnect switch located at approximately fifty-four (54) feet above the ocean surface.

DESIGN REQUIREMENTS

The power cable shall be designed for use on 34,500 volts and shall have a continuous full load current rating of 340 amperes. The power cable shall be designed for a maximum voltage drop of 5% at a length of 40,000 feet. The power cable shall have the following short circuit current characteristics.

39,000 amps, 2 cycles
27,500 amps, 4 cycles
20,000 amps, 8 cycles

The power cable shall have a basic impulse level (BIL) of 200,000 volts. The power cable shall have a minimum conductor size of no. 4/0 AWG.
The submarine cable shall include six pairs of #16AWG copper wire for communication and signaling circuits. The #16AWG wire shall have insulation good for 600 volts.

CONSTRUCTION

The submarine cable shall be constructed in accordance with all applicable IPCEA and NEMA standards. The cable shall use polyethylene as the insulating material. The power conductors shall be individually shielded and arranged in such a manner as to have their centerlines 120° apart. The communication cables shall be arranged in sets (two pairs to a set) and located so each set is in each interstice. The entire cable shall be filled with a waterproof jute so as to make a round and compact core. A protective coating of galvanized steel armor wires, individually coated with a thermoplastic jacket, shall be provided around the entire cable. The size of the galvanized steel armor wires shall be a minimum #8 AWG.

PROPOSAL

The bidder shall base his quotation on the basis of 40,000 feet of cable. Additional quotations based on the following will be required.

(1) The addition of 1000 ft. of cable.
(2) The deletion of 1000 ft. of cable.
(3) The deletion of 2000 ft. of cable.

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(4) The deletion of 3000 ft. of cable.
(5) The deletion of 4000 ft. of cable.
(6) The deletion of 5000 ft. of cable.

The bidder shall furnish with the quotation complete technical data including a detailed arrangement sketch showing all material of construction.

The bidder shall base his quotation on the delivery of the submarine cable, in one piece, to the Port of Los Angeles or similar port. He shall be responsible for loading the cable on a lay barge, furnished by Humble, and shall provide an Engineer, for approximately one week, to supervise the installation of the cable.

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SUBMARINE POWER CABLE

TERMINATIONS AND INSTALLATION

Although there may be slight variations in the technique of laying and installing the 34.5KV polyethylene coated #4/0 submarine power cable the following discussion is intended to encompass the general procedure that should be followed to bring shoreside power to the platform.

After the cable is loaded on the barge and the barge brought into position near the shore site, the cable should be pulled ashore and placed in the previously dug trench through the beach. The trench should be a minimum of 6 ft. in depth extending from the shore cliff to a point beyond the surf at mean low tide.

The cable should be buried a minimum of 6 ft. up the side of the cliff and brought into the cable pothead adapter underground as shown on Drawing 084-318. The communication and control conductors should be brought out the side of the adapter through the fitting equipped with seals to prevent the entrance of moisture. Stress cone terminations should be made on the 34.5KV conductors by building the core up with varnished cambric and applying a semiconductor tape and a copper braid from the conductor shield to the peak of the stress cone. All shields shall be connected to ground by a copper ground strap.

The cable should be laid on the ocean floor from the trench to the platform. Constant tension should be maintained on the cable as it is laid off the barge to prevent any unnecessary strain.

Once the barge reaches the platform the pulling cable should be attached to a previously installed monel line looped through the 8" conductor pipe and terminated on the production deck. The cable should then be thrown over the side and pulled through the conductor with a power winch. Once the pulling cable is on the production deck the submarine power cable can be pulled through the conductor and fastened to the support on the production deck as shown on 084-319. The cable can then be routed to the oil switch and connected in a similar manner as on the shore side. A Kellems conduit riser grip should be used to support the cable underneath the oil switch.

A high voltage D.C. field test (conductor to shield) should be made on the 34.5 KV conductors, and a megger and conductor continuity tests on the communication and control conductors to determine if any electrical damage has occurred during installation before energization.

SPECIFICATION 34.5 KV LOAD BREAK OIL SWITCH | 10-0840S | REV

CUSTOMER HUMBLE OIL AND REFINING COMPANY JOB NO. 10-084

PLANT LOCATION PACIFIC COAST OFF-SHORE

1.0 GENERAL

This specification covers the design requirements for a 34,500 volt load break oil switch to be used as the primary disconnecting means for electric power to an off-shore drilling platform. The oil switch will be installed on the primary side of the main power transformer and shall disconnect same from the submarine power cable.

2.0 DESIGN REQUIREMENTS

Load break oil switch, rated 34.5KV, 200,000 amperes basic impulse level (BIL), 600 amperes continuous and load break, 40,000 amperes RMS asymmetrical momentary withstand and close and hold.

Each switching way of the load break oil switch is to be equipped with an internally mounted operating mechanism capable of providing quick-make, quick-break operation for each switching action in either switching direction. The operating mechanism is to be actuated from outside of the switch by means of a removable level and it shall be adaptable for remote actuation. lever

The switch shall be two-way, three pole: one way bottom for incoming feeder with 3/c shape C cableheads including stuffing box type accessories and splice housing necessary to terminate submarine cable. The cable will contain communication conductors which must be separated from the power conductors in the splice box, the load side shall be out the side and will include a transition housing with removable lid and connector leads to enable connection to the primary side of the main power transformer. The manufacture shall furnish all necessary cable potting compounds.
The unit shall include viewing windows and shall be mounted on an angle iron frame, panel enclosed and removable on all sides. Height, width and depth as required.

The unit shall be coated with an epoxy coating for protection against a corrosive sea environment.

The unit shall in all respects be similar to the G & W load break oil switch cat. no. GRA21-396TB-40M.

3.0 PROPOSAL

The bidder shall furnish with the quotation complete technical data including a detailed arrangement sketch showing all material of construction.

Humble Oil & Refining will furnish with the order complete descriptive

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SPECIFICATION 34.5 KV LOAD BREAK OIL SWITCH | 10-0840S | REV

CUSTOMER HUMBLE OIL AND REFINING COMPANY | JOB NO. 10-084

PLANT LOCATION PACIFIC COAST OFF-SHORE

and dimensional data on the submarine cable and the main power transformer.

The manufacture shall furnish certified drawings for approval within one week of the order date.

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1.0 GENERAL

This specification applies to the design and fabrication of an integrated lineup of indoor, three phase, 60 Hz, electrical power equipment consisting of a 34.5KV/4.16KV main power transformer, 4.16KV power switchgear, 4.16KV squirrel cage motor starters, 4.16KV contactors for turbine generator units, 4.16KV synchronous motor starters, 4.16KV/2.3KV power transformer, 2.3KV submersible pump starters, 4.16KV/480V power transformer and 480V motor starters, as shown on the attached single-line diagram and as specified below.

2.0 LOCATION

The equipment will be installed in a pressurized room on an off-shore drilling platform off the coast of California.

3.0 CODES AND ORDINANCES

The entire electrical assembly shall comply with the requirements of the State of California Electrical Safety Orders and the National Electric Code. Where a conflict occurs, the more stringent code applies.

4.0 MAIN POWER TRANSFORMER

Furnish one 20,000 KVA, oil immersed, power transformer, Class OA/FA, 55°C rise with 34.5KV delta primary and 4.16KV wye connected secondary. The unit shall be satisfactory for and rated at a minimum of 20,000KVA continuous duty at 55°C rise and 22,400KVA (112%) at 65°C rise with 30°C average, 40°C maximum ambient temperature.

Furnish fully rated high voltage taps for 36,200, 35,300, 33,500 and 32,600 volts. Tap changer to be no-load type, hand operated from outside of tank.

The primary and secondary terminals shall be side throat mounted. Top of throat to be equipped with bolted access plate for making terminal connections. The primary throat shall contain oil and shall be adaptable to a G & W load break oil switch cat. no. GRA21-396TB-40M

The following NEMA-ASA accessories shall be furnished with the transformer:

(1) Tap changer.
(2) Liquid level indicator.
(3) Temperature indicator for transformer liquid.

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(4) Pressure-vacuum indicator for tank.
(5) Pressure-vacuum bleeder.
(6) Relief diaphram.
(7) Sample, drain and filter connections with valves.
(8) Lifting lugs.
(9) All steel base.
(10) Grounding pads.
(11) ASA nameplate.

5.0 4.16KV POWER SWITCHGEAR

The switchgear shall be designed and tested in accordance with all applicable USA and NEMA standards. The housing shall consist of rigid, free standing, steel clad welded vertical sections bolted together to form the complete assembly. Buses, circuit breaker units and instrument transformers shall be isolated in individual compartments separated by sheet steel barriers. Each compartment shall have an individual cover or door. Equipment will be front accessible. Rear access will be permitted.

The main breaker shall be a horizontal drawout type, electrically operated air circuit breaker with D.C. solenoid operating mechanism. Breaker shall be rated at 3,000 amps continuous duty and 250 MVA interrupting capacity at 4.16KV. The breaker frame shall be grounded directly to the ground bus until the primary contacts are disengaged and separated a safe distance. The drawout mechanism shall include interlocks to prevent engaging or disengaging the breaker when closed. Breaker control circuits shall be disengaged through a multiple plug and socket contact when the breaker is withdrawn from the operating position with provision for manually re-engaging the control contacts when in the test position. High voltage parts shall be separated from the control mechanism by a steel plate barrier. The stationary primary contacts shall be automatically covered by a steel plate barrier when the breaker is disconnected.

The breaker for the 7500KVA transformer shall be a horizontal drawout type, electrically operated air circuit breaker with D.C. solenoid operating mechanism. Breaker shall be rated at 1200 amps continuous duty and 250 MVA interrupting capacity at 4.16KV. All breaker operating mechanisms and control circuit interlocks shall be as specified for the main breaker.

The main bus shall be rated at 3000 amps continuous at 65°C rise and 40°C ambient temperature. The bus shall be braced to withstand 60,000 amps RMS symmetrical fault current. The bus and connections shall be completely insulated. The bus shall include a barriered throat connection from the main power transformer.

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A ground bus shall be furnished and rated at 200 amps continuous duty. The ground bus shall be braced to withstand a momentary fault current equal to the highest momentary rating of any circuit breaker in the lineup. The ground bus shall have provisions for connecting to the ground bus of adjacent motor starters. All stationary structures shall be grounded directly to the ground bus.

Potential transformers shall be of the current-limiting fused, drawout type, which are automatically disengaged from the line when the compartment door is open. The transformer primary shall be grounded whenever the line contacts are disengaged.

All instruments, meters, indicating lights, control switches and relays will be mounted on a hinged instrument panel. All devices shall be completely wired and connected. All external control connections shall be brought to a terminal strip accessible to top conduit entry.

6.0 4.16KV SQUIRREL CAGE MOTOR STARTERS

The starters shall be designed, fabricated and tested in accordance with all applicable NEMA and IEEE standards. Starters shall be NEMA Class E-2, non-reversing squirrel cage full voltage type, with current-limiting power fuses and isolating switch, and magnetic air-break contactors providing three-phase thermal overload protection. Time-current tripping characteristics of overloads and current-limiting fuses shall be coordinated to provide 250 MVA (minimum) symmetrical interrupting capacity, at 5KV.

The continuous current rating shall be 700 amps for the 3000HP starters, 700 amps for the secondary bus switch-over starter, 400 amps for the vapor compressor and transformer switchover starter, and 200 amps for all other 4.16KV starters and contactors.

Starters shall be mounted in rigid, free standing, steel clad, welded vertical sections, similar to enclosures specified above for switchgear except front access only will be permitted. Conduit entry will be from the top.

The isolating switch shall be the manually-operated drawout type, with provisions for padlocking operating in the "OFF" position. Interlocks shall be provided to prevent opening of the access door to any high voltage parts unless the switch handle is in the "UNLOCKED" position, and to prevent returning the handle to the "ON" position with the door open. When the handle is moved to the "OFF" position, the starter shall be positively grounded and a barrier shutter shall cover the line connections.

Contactors shall be the drawout type, D.C. magnetic operation. D.C. coil power shall be rectified 120 volt A.C. single phase power supplied by an integral fused control power transformer and silicon rectifiers. Stop-start controls, with interposing relay, shall be for 115 volt AC single phase control from the outside.

Low voltage components shall be housed within a separate compartment of the starter, barriered from the high voltage section and accessible by a separate door. Switches, meters and indicating lights shall be mounted on the front panel of this section. All external control connections shall be brought to a terminal strip in this section, accessible to top conduit entry. All internal wiring shall be complete. Two N.O. and two N.C. extra starter auxiliary contacts shall be wired to the terminal strip.

The starter assembly shall include a horizontal bus braced and insulated as specified above for switchgear. Each vertical starter section shall have vertical bus to connect tiered starter units. Vertical bus shall be sized to correspond to starter size. There shall be a continuous horizontal ground bus rated and as specified above for switchgear. Starter load connections shall be located for top conduit entry.

Each starter cubicle shall be provided with a 115 volt A.C. single phase space heater, arranged to be automatically energized when the contactor is open.

7.0 4.16 KV CONTACTORS FOR TURBINE GENERATORS

The contactor shall be designed, fabricated and tested in accordance with all applicable NEMA and IEEE standards. The contactor shall be NEMA Class E-2 with current-limiting power fuses and isolating switch providing three-phase thermal overload protection. Time-current tripping characteristics of overloads and current-limiting fuses shall be coordinated to provide 250 MVA (minimum) symmetrical interrupting capacity at 5KV.

The continuous current rating of the contactor shall be 200 amps.

Each contactor shall be mounted in rigid free standing, steel clad, welded steel vertical sections, similar to enclosures specified above for starters.

The isolating switch shall be the manually operated drawout type, with provisions for padlocking operating in the "OFF" position. Interlocks shall be provided to prevent opening of the access door to any high voltage parts unless the switch handle is in the "UN-LOCKED" position, and to prevent returning the handle to the "ON" position with the door open. When the handle is moved to the "OFF"

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position, the starter shall be positively grounded and a barrier shutter shall cover the line connections.

Contactors shall be the drawout type, D.C. magnetic operation. D.C. coil power shall be rectified 120 volt A.C. single phase power supplied by an integral fused control power transformer and silicon rectifiers. Stop-start controls, with interposing relay, shall be for 115 volt A.C. single phase control from the outside.

The contractors shall include, in addition to the overload CT's, three 5KV class current transformers for relaying and remote metering. Accuracy class .3B2. Secondaries to be Y connected and common grounded to the ground bus.

The contactors shall include three potential transformers, 5KV class, with primary and secondary fuses for relaying and remote metering. The accuracy class shall be 0.3Y when operating at rated 120 volts secondary. The P.T.'s shall be connected wye-wye with secondary common grounded to the ground bus.

The contactor shall include a reverse power relay, single phase drawout type semi-flush mounted.

The low voltage components shall be housed within a separate compartment of the starter, barriered from the high voltage section and accessible by a separate door. Switches, meters and indicating lights shall be mounted on the front panel of this section. All external control connections shall be brought to a terminal strip in this section, accessible to top conduit entry. All internal wiring shall be complete. Two N.O. and two N.C. extra starter auxiliary contacts shall be wired to the terminal strip.

Each controller cubicle shall be provided with a 115 volt A.C. single phase space heater, arranged to be automatically energized when the contactor is open.

8.0 4.16 KV SYNCHRONOUS MOTOR STARTERS

The synchronous motor starters shall be designed, fabricated and tested in accordance with all applicable NEMA and IEEE standards. The contactor shall have current-limiting power fuses and an isolating switch providing three phase thermal overload protection. Time current tripping characteristics of overloads and current limiting fuses shall be coordinated to provide 250 MVA (minimum) symmetrical interrupting capacity at 5KV.

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The continuous current rating of the contactor shall be 400 amps.

Each controller shall be mounted in rigid free standing, steel clad, welded steel vertical sections, similar to enclosures specified above for starters.

The isolating switch shall be the manually operated drawout type, with provisions for padlocking operating in the "OFF" position. Interlocks shall be provided to prevent opening of the access door to any high voltage parts unless the switch handle is in the "UN-LOCKED" position, and to prevent returning the handle to the "ON" position with the door open. When the handle is moved to the "OFF" position, the starter shall be positively grounded and a barrier shutter shall cover the line connections.

Contactors shall be the drawout type, D.C. magnetic operation. D.C. coil power shall be rectified 120 volt A.C. single phase power supplied by an integral fused control power transformer and silicon rectifiers. Stop-start controls, with interposing relay, shall be for 115 volt as single phase control from the outside.

The controllers will be used on 1750HP synchronous motors with brush-less field excitation. The controllers shall protect the squirrel-cage winding of the motors in case of a stall in starting. This protection shall consist of stall-protective relays responsive to extended time locked rotor current which will remove power before damage to the squirrel-cage winding can occur. The controllers shall protect the motor from running out-of-step. This protection shall consist of a relay which senses a lagging power factor and operates to remove field excitation. This relay must operate within the first half of the slip cycle before reversing torque has a chance to develop. The controller shall provide for resynchronization of the motor if a heavy overload or line voltage drop causes the motor to pull-out of synchronism. The motor will be ordered with 100% pull-in torque because the driven machine cannot be unloaded. After pull-out, if the motor again reaches the proper speed for synchron-izing, the control elements shall again reapply D.C. to the field. The controller shall furnish the direct current supply for the A.C. exciter field. A silicon rectifier bridge supplied from a constant voltage transformer shall be used to prevent field current from fluctuating with voltage dips in the A.C. supply line and to provide control of the exciter field current. Field excitation will be required for a 25KW exciter maximum, and shall be for 125 volts.

Low voltage components shall be housed within a separate compartment of the starter, barriered from the high voltage section and acces-sible by a separate door. Switches, meters, rheostats and indicat-ing lights shall be mounted on the front panel of this section. All

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external control connections shall be brought to a terminal strip in this section, accessible to top conduit entry. All internal wiring shall be complete. Two N.O. and two N.C. extra starter auxillary contacts shall be wired to the terminal strip.

Each controller cubicle shall be provided with a 115 volt A.C. single phase space heater, arranged to be automatically energized when the contactor is open.

An A.C. line ammeter and D.C. exciter field ammeter shall be provided for each controller

9.0 4.16KV/2.3KV POWER TRANSFORMER

Furnish one 7500KVA, askarel immersed, power transformer, Class OA/FA, 55°C rise with a 4.16KV wye connected primary and 2.3KV delta connected secondary. The unit shall be satisfactory for and rated at a minimum of 7500KVA continuous duty at 55°C rise and 8400KVA (112%) at 65°C rise with 30°C average, 40°C maximum ambient temperature.

Furnish fully rated high voltage taps for 5% and 2½% above and below the nominal voltage. Tap changer to be no-load type, hand operated from outside of tank.

The primary and secondary terminals shall be side throat mounted. The bus connections shall enter and exit the top of the throat. The throat is to be equipped with side access plates for making terminal connections.

The following NEMA-ASA accessories shall be furnished with the transformer:

(1) Tap changer.
(2) Liquid level indicator.
(3) Temperature indicator for transformer liquid.
(4) Pressure-vacuum indicator for tank.
(5) Pressure-vacuum bleeder.
(6) Relief diaphram.
(7) Sample, drain and filter connections with valves.
(8) Lifting lugs.
(9) All steel base.
(10) Grounding pads.
(11) ASA name plate.

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10.0 2.3KV SUBMERSIBLE PUMP STARTERS

The starters shall be designed, fabricated and tested in accordance with all applicable NEMA and IEEE standards. Starters shall be NEMA Class E-2, non-reversing squirrel cage full voltage type, with current-limiting power fuses and isolating switch and magnetic air-break contactors providing three-phase thermal overload protection. Time-current tripping characteristics of overloads and current-limiting fuses shall be coordinated to provide 250 MVA (minimum) symmetrical interrupting capacity at 2.3KV.

The continuous current rating shall be 200 amps for all starters.

Starters shall be mounted in rigid, free standing, steel clad, welded vertical sections, similar to enclosures specified above for switchgear except front access only will be permitted. Conduit entry will be from the top.

The isolating switch shall be the manually-operated drawout type, with provisions for padlocking operating in the "OFF" position. Interlocks shall be provided to prevent opening of the access door to any high voltage parts unless the switch handle is in the "UNLOCKED" position, and to prevent returning the handle to the "ON" position with the door open. When the handle is moved to the "OFF" position, the starter shall be positively grounded and a barrier shutter shall cover the line connections.

Contactors shall be the drawout type, D.C. magnetic operation. D.C. coil power shall be rectified 120 volt A.C. single phase power supplied by an integral fused control power transformer and silicon rectifiers. Stop-start controls, with interposing relay, shall be for 115 volt A.C. single phase control from the outside.

The starters shall include an underload relay with provisions for shutting down the pump in case of a loss of load. An indicating ammeter shall be included. A hand-off-auto selector switch and start push-button shall be included and shall function as follows:

With the hand-off-auto selector switch in the hand position depressing the start push-button will immediately start the pump.

With the hand-off-auto in the "OFF" position depressing the start push-button will not start the pump.

With the hand-off-auto selector switch in the auto position an on delay timer shall start the pump after a certain time delay. The time delay shall be adjustable from 0-2 hr. in the five minute intervals.

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Provisions shall be made for installation of a flow switch at a future date.

A green indicating light shall be furnished and installed and connected to be "ON" when the motor is running.

Low voltage components shall be housed within a separate compartment of the starter, barriered from the high voltage section and accessible by a separate door. Switches, meters and indicating lights shall be mounted on the front panel of this section. All external control connections shall be brought to a terminal strip in this section, accessible to top conduit entry. All internal wiring shall be complete. Two N.O. and two N.C. extra starter auxiliary contacts shall be wired to the terminal strip.

The starter assembly shall include a horizontal bus braced and insulated as specified above for switchgear. Each vertical starter section shall have vertical bus to connect tiered starter units. Vertical bus shall be sized to correspond to starter size. There shall be a continuous horizontal ground bus rated and as specified above for switchgear. Starter load connections shall be located for top conduit entry.

Each starter cubicle shall be provided with a 115 volt A.C. single phase space heater, arranged to be automatically energized when the contactor is open.

11.0 4.16KV/480 V POWER TRANSFORMER

Furnish one 1500KVA, askarel immersed, power transformer, Class OA/FA, 55°C rise with a 4.16KV wye connected primary and a 480 volt delta connected secondary. The unit shall be satisfactory for and rated at a minimum of 1500KVA continuous duty at 55°C rise and 1680KVA (112%) at 65°C rise with 30°C average, 40°C maximum ambient temperature.

Furnish fully rated high voltage taps for 5% and 2½% above and below the nominal voltage. Tap changer to be no-load type, hand operated from outside of tank.

The primary and secondary terminals shall be side throat mounted. The bus connections shall enter and exit the top of the throat. The secondary throat is to be equipped with side access plates for making terminal connections.

The following NEMA-ASA accessories shall be furnished with the transformer:

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(1) Tap changer.
(2) Liquid level indicator.
(3) Temperature indicator for transformer liquid.
(4) Pressure vacuum indicator for tank.
(5) Pressure vacuum bleeder.
(6) Relief diaphram.
(7) Sample, drain and filter connections with valves.
(8) Lifting lugs.
(9) All steel base.
(10) Grounding pads.
(11) ASA nameplate.

12.0 480 VOLT MOTOR STARTERS

12.1 This specification covers the design and fabrication requirements for a low voltage motor control center assembly. The assembly shall be complete and ready for operation and shall comply with this specification and attached sketches. Assemblies shall consist of rigid, free standing, metal enclosed, dead-front vertical sections. All equipment shall be installed, maintained and operated from the front.

12.2 Design and Ratings

12.2.1 Motor Control Centers: For 480 volt, three phase, 60 cycle, three wire power system. Design shall be NEMA Type B. The MCC shall include the main power service breaker, the feeder breaker for the lighting and control transformer and the combination motor starters as shown on the attached single-line drawing and as follows:

12.2.11 Main power service breaker shall be fixed-mount type, 2000 ampere frame size, 600 volt rated, three pole, moulded case circuit breaker with interchangeable three phase overcurrent trip device providing inverse time delay trip on overload and instantaneous trip with major fault currents. The breaker shall have a minimum interrupting capacity of 22,000 amperes symmetrical. The breaker shall have an external front mounted operating handle and trip button. Operating handle shall have a position indicator and provision for locking in "off" position. The breaker shall be Westinghouse type PB, or equal.

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12.2.12 Feeder breaker for the lighting and control power transformer shall be 225 ampere frame, 22,000 amperes interrupting capacity, Westinghouse type JA, or equal.

12.2.13 Combination motor starters for 480 volt, three phase motors shall be the circuit breaker type with 600 volt rated, three pole, moulded case circuit breakers having a minimum interrupting capacity as indicated, with adjustable three phase overcurrent trip devices.

All motor starters shall be magnetic, full voltage, single direction type with three (one per phase) thermal overloads. Minimum starter size shall be NEMA Size 0. One SPDT auxiliary contact in addition to the motor coil holding contact shall be provided. Starters shall have a front operated overload reset button and front mounted green indicating light connected to be "on" when the starter is energized. Starter coils to be for 120V 60Hz electrical power.

All combination starters shall have a breaker external mounted operating handle with position indicator and provisions for locking in the "off" position. A "stop" push button shall be included on all starters.

All starters shall be the plug-in type, capable of installation or removal with buses energized.

12.2.14 Main bus continuous rating shall be 1800 amperes and shall be braced to withstand 22,000 amperes interrupting capacity.

12.2.15 All breakers shall have an interrupting capacity of 22,000 amperes symmetrical minimum.

12.2.16 120 volt control power shall be furnished internally. The exact arrangement is shown on the single line diagram.

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12.3 General Construction

12.3.1 Enclosures: All enclosures shall be NEMA, Type 1 construction with all compartment doors gasketed with neoprene sponge rubber.

12.3.2 Equipment Identification: All equipment shall be identified with engraved plastic name plates (black with white letters) attached to door. Terminal blocks shall be clearly labeled. See attached single line diagram for engraving data.

12.3.3 Equipment Arrangements: The general arrangement desired is shown on the attached layout. The vendor shall determine the best arrangement for this design, within the space limitations shown, and shall include a sketch of his proposed arrangement with his proposal.

12.3.4 Standards: All equipment and assemblies shall be designed and fabricated in accordance with the latest NEMA, IEEE and ASA Standards. All standard NEMA items not specifically called out shall nevertheless be included.

13.0 BUS

The selected vendor will be responsible for the design of all bussing and transitions between the various pieces of equipment.

14.0 SPECIFICATIONS AND DRAWINGS

These specifications are intended to cover all equipment, material and standards of workmanship to be employed in the work shown on the Drawings, called for in the specifications, or reasonably implied by the terms thereof. The drawings and specifications are intended to supplement one another and any part of the work that may be mentioned in the one and not represented in the other shall be alone the same as if it had been mentioned or represented in both. Work or material of a minor nature which may not be specifically mentioned but which may reasonably be assumed as necessary for completion of the work, shall be performed, or furnished the same as if shown or mentioned.

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15.0 INFORMATION TO BE SUPPLIED BY BIDDER/VENDOR

Bidders shall supply with the quotation three copies of outline dimensional drawings and complete descriptive literature with the necessary information to completely evaluate the quotation. It is intended that this data will be used to prepare final installation drawings while the equipment is being manufactured. Physical dimensions, conduit stubup space and an equipment layout will be necessary to make the quotation acceptable. The selected vendor shall supply ten copies of the wiring diagrams, parts lists, installation instructions and operating and maintenance instructions within three weeks of receipt of order.

16.0 The following drawings must be included with this specification:

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084-302

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Humble Job 10240
H-B Job 10-084

Specification 10-084LABBC

HUMBLE OIL AND REFINING COMPANY
DEEPWATER OFFSHORE PLATFORM
LEAD-ACID BATTERIES AND BATTERY CHARGER

1.0 GENERAL

This specification covers the design and fabrication requirements for a 24-volt D.C. power system including batteries and battery charger. The system will be installed in a pressurized room on an offshore drilling platform in an area classified as non-hazardous.

2.0 BATTERY CHARGER, DESIGN AND RATING

The charger shall be the full wave rectifier type and shall use silicon controlled rectifiers as the power-control elements. Sensing, control and firing modules shall be the plug-in type.

The charger shall be the floor mounted type. Over-all dimensions shall not exceed 24" wide, 16" deep and 60" high. All components shall be readily accessible from the front.

The charger shall maintain a float charge of between 23.6 and 29.3 volts and an equalizing charge of between 25.6 and 30.3 volts. It shall operate from 480 volts, single phase, 60 cycle A.C. supply.

The charger shall automatically recharge four (4), three (3) cell 80 amp-hr (8 Hr. rating) batteries in 8 hours when the batteries are 50% discharged. The charger shall simultaneously supply a continuous load of 30 amps. Charger voltage shall be maintained at ± ½% from 0 to 100% of charger capacity rating, with an A.C. line voltage variation of ± 10% and a frequency variation of ± 5% at 60 cycles.

The charger shall be capable of continuous operation at rated current at an ambient temperature of 40°C.

The charger shall be convection cooled and housed in a NEMA type 1, ventilated steel enclosure painted with ASA 61 gray paint.

D.C. output, 3½-inch scale, 2 per cent, full scale ammeter and voltmeter shall be provided. The charger shall incorporate adjustable float and equalizing voltage potentiometers and a 0-72 hr. equalizing automatic timer. The A.C. and D.C. circuit breakers and the on pilot lamp shall be mounted on the front of the hinged door.

The solid state electronic circuit shall have A.C. and D.C. transient voltage protection. It shall be designed to recharge a fully discharged battery without overloading or tripping the D.C. or A.C. circuit breakers.

A ground-detection relay capable of detecting a ground current of 15 MA shall be provided.

The charger shall also be equipped with a low-voltage alarm relay, actuated when battery voltage falls to 20 volts. This low-voltage relay shall not respond to a voltage dip of 1/2 sec. or less.

Installation and operating instructions with wiring diagrams and a service manual shall be provided.

The charger shall be an Excide model USF Cat. No. USF 25-3-75 or approved equal.

3.0 BATTERIES

The battery system shall contain four (4) three (3) cell lead-acid batteries rated 80 ampere-hours for 8 hrs at 1.210 specific gravity at 77°F. The batteries shall be assembled in heat-resistant, polystyrene containers and covers. Explosion resistant ¼ turn vent plugs shall be provided for each battery. Pilot balls shall also be provided for each battery.

The batteries shall be Excide type 3-EMP-5 Cat. No. 74419 or approved equal.

4.0 BATTERY MOUNTING

A single row - 2 tier battery rack for the above specified batteries shall be provided. The rack shall have stops to prevent the batteries from sliding during an earthquake.

The rack shall be an Excide rack Cat. No. 54345 or approved equal.

5.0 GUARANTEE

The manufacture shall guarantee the materials and workmanship to be free of defects for a period of one year after date of acceptance.

NAVIGATION WARNING EQUIPMENT

The platform facilities are equipped with the necessary nagivation warning equipment prescribed by the U. S. Coast Guard and the Federal Aviation Administration as shown on Drawing 084-147A.

Four Wallace & Tiernan 250 mm. lanterns, Type FA-250, are to be installed on the drilling deck, one in each corner.

Each drilling rig is to have a Crouse-Hinds 300 mm. hazard beacon mounted on top to be used as a warning to aircraft.

A two mile Wallace & Tiernan 1000 watt fog horn will be installed on the drilling deck to be used as a warning to ships.

11.0 VENT & FLARE SYSTEM

SPECIFICATION
MISCELLANEOUS VESSELS

VENT SURGE TANK V6
WATER SUMP V7
OIL SUMP V8
WELL CLEAN TANK V10

1.0 GENERAL

This specification applies to the design and construction of the above vessels. The vessels are to be used on a Humble Oil and Refining Company Offshore Platform near Santa Barbara, California. The vessels are to be constructed in accordance with ASME Code Section VIII.

2.0 CONSTRUCTION

The vessels shall be constructed as shown on Drawings 084-128, 084-143 and 084-144. The design pressure is 25 psig at 100°F for all vessels V6, V7 and V8 with 1/16" corrosion allowance. V10 is to be designed for 50 PSIG at 100°F and 1/16" corrosion allowance.

All joints and connections both externally and internally shall be continuously seal welded. Welds internally shall be ground smooth prior to coating.

3.0 PROTECTIVE COATING

The vessels and appurtenances shall be coated externally in accordance with the attached Specification 10-084C2 and coated internally in accordance with Specification 10-084-C1.

4.0 DELIVERY

The vessels shall be delivered f.o.b. trucks or barges at the jobsite specified in the Humble request for quotation.

5.0 DRAWINGS

Supplier shall submit three (3) copies of shop drawings for approval prior to fabrication. The purchaser reserves the right to change the location of nozzles and appurtenances until the approval of these drawings.

6.0 GUARANTEE

The supplier shall guarantee the vessels to meet the requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from the delivery date. Defects or deficiencies shall be corrected at no additional cost to Humble.

VENT STACK SEAL

This specification applies to the purchase of one John Zink Molecular seal for use on a 14" OD vent stack. The vent stack is on an off-shore platform near Santa Barbara, California. The stack is designed to handle up to 28 MMSCFD of 0.70 specific gravity gas at ambient pressure and 100°F. The gas contains H_2S and CO_2. The vent stack is to be equipped with a flare on which pilots are continuously burning. The purpose of the seal is to prevent air getting into the vent system and to prevent flame propogation from the flare to the vent scrubber and vent piping.

Sweet purge gas will be continuously injected into the vent system. The molecular seal shall be designed to give adequate protection against flame propogation thru the seal without the purging of the vent system. This requirement is to prevent severe damage of the platform and equipment due to explosion in the event of the purge gas being inadvertently shut-off.

The molecular seal shall function satisfactorily when installed with its axis on a 45° angle with the vertical.

The unit shall be 16 feet overall length with 30 inch diameter main section. The ends shall be for welding to 14" outside diameter 0.250" wall pipe.

The external surfaces shall be coated in accordance with attached Specification 10-084-C2.

VENT STACK FLOW SWITCH

(Mark FAH-1)

This specification applies to the purchase of one heat actuated solid state flow switch for use as a flow alarm in the main vent stack of an offshore production platform. The unit shall be a Whittaker Corporation Model DF-64 (or approved equal) with sensitivity to actuate the switch at 10 feet per second velocity in 0.70 specific gravity gas at 100°F (mostly methane gas). The unit shall be explosion proof for Class I Group D location. It shall be suitable for mounting outside in wet salt air atmosphere. All wetted parts to be stainless steel. Mounting shall be for 1¼" threaded boss. Power supply is 115 VAC.

HOBBS–BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___ REV.

SPECIFICATION — CONTROL VALVES

CUSTOMER: HUMBLE OIL & REFINING CO. — JOB NO: 10-084

PLANT LOCATION

DESIGNATION TAG NO		LCV 162A △		△		△		△
MANUF & APPROVED EQUAL		FISHER						
TYPE		9110						
MODE		DOUBLE R/L						
SIZE	TYPE CONNECTIONS	10"	150# R.F.					
BODY MATERIAL	RATING	STL.	150#					
INNER VALVE & TRIM MATL		316 SS STEM BUNA-N-SEAT						
INNER VALVE SIZE	TYPE	10"	BF					
TOP WORKS		656-60						
FANS								
POSITIONER	BOOSTER RELAY							
POSITIONER BYPASS	W GAGES							
AIR FILTER & REDUCER								
FLUID		CRUDE OIL						
FLUID TEMPERATURE °F								
PRESSURE PSIG	IN	OUT						
SPEC GRAVITY	@ 60°F	@ FLOW TEMP						
SPEC GRAVITY	@ 60°F	@ FLOW TEMP						
GPM @ 60°	NORM FLOW	MAX CAP.						
SCFH	NORM FLOW	MAX CAP						
LB/HR	NORM FLOW	MAX CAP						
VALVE POSITION ON AIR FAILURE		CLOSES						
DP								
SPECIAL CONSTRUCTION & NOTES		OPERATES AGAINST 25 PSI @ 90°						
OPERATING DATA								
SERVICE		LIQUID DUMP FROM VENT SCRUBBER V-6						
LINE NO								
PLANT NO								
PURCHASE ORDER NO								

DATE ___ BY ___ CHECKED ___ ENGINEER ___ PROJ. ENG. ___

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS · CALIFORNIA

SHEET ___ OF ___

REV

SPECIFICATION

CONTROL VALVES

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		PCV 380 △		LCV 162 △		PCV 380A △		PSV-380B △
MAKE OR APPROVED EQUAL		FISHER		FISHER		FISHER		FISHER
TYPE		95H		BUTTERFLY 9110		Y600-2		98H
MODEL				DOUBLE R/L				
SIZE	TYPE CONNECTIONS	1/2"	SCRD.	6"	FLG.	3/4"	SCRD.	1/2" SCRD.
BODY MATERIAL	RATING	STL	350#	STL.	150# RF	MI	150#	STL 350#
INNER VALVE TRIM MAT'L		S.S. DIA		316 SS STEM BUNA-N SEAT		—		S.S. DIA.
INNER VALVE SIZE	TYPE	3/8"	QO	6"	CI BF	1/8"	QO	3/8" QO
TOP WORKS		—		656-40		—		—
FINS		—		—		—		—
POSITIONER	BOOSTER RELAY	—	—	—	—	—	—	— —
POSITIONER BYPASS	W/GAGES	—	—	—	—	—	—	— —
AIR FILTER & REDUCER		—		NO		—		—
COMMODITY		FUEL GAS		CRUDE OIL		FUEL GAS		
FLOW TEMPERATURE, °F		100° F						
PRESSURE PSIG	IN	OUT						
SPEC GRAVITY H_2O = 1.0	@ 60°F	@ FLOW TEMP						
SPEC GRAVITY @ 60° AIR = 1.0	@ 60°F	@ FLOW TEMP						
GPM @ 60°	NORM FLOW	MAX CAP.						
SCF HR	NORM FLOW	MAX CAP						
# HR	NORM FLOW	MAX CAP						
VALVE POSITION ON AIR FAILURE				CLOSES				
Cv								
SPECIAL CONSTRUCTION & NOTES						3" TO 8" WC RED. PRESS.		SET @ 100 PSIG
OPERATES WITH		PCV 380A		LC 162		PCV 380		PCV 380A
SERVICE		FUEL GAS TO FLARE PRESSURE REDUCER		VENT SCRUBBER V.6 LEVEL		FUEL GAS TO FLARE PILOT		RELIEF TO PROTECT PCV 380A
LINE NO								
PLANT NO								
PURCHASE ORDER NO								

REV	DATE	BY

DATE

BY

CHECKED

ENGINEER

PROJ. ENG

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HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

REV

SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LC 162 △		LC 163 △		△		△
MAKE OR APPROVED EQUAL		FISHER		FISHER				
TYPE		2500		2800				
MODEL		249V		252V				
MOUNTING		FLG.		FLG.				
INDICATING OR RECORDING								
INTERFACE OR LEVEL		LEVEL		LEVEL				
COMMODITY		CRUDE OIL		CRUDE OIL				
SPECIFIC GRAVITY AT 60°		.80-.95		.80-.95				
OPERATING PRESS.	TEMP	0	110°F	0	110°F			
MINIMUM DESIGN PRESS.	TEMP	50	150°F	50	150°F			
BODY MATERIAL		STL.		STL.				
CONNECTIONS		4"-150# R.F.		4"-150# R.F.				
FINS REQUIRED		NO		NO				
FLOAT MATERIAL	SIZE	316 SS	3"X14"	316 SS	3"X10"			
PILOT-RIGHT OR LEFT HAND		(LATER)		—				
THROTTLING RANGE		0-10 0-100%		—				
AUTOMATIC RESET		NO		—				
AIR FILTER & REDUCER		YES		—				
MANUAL CONTROL BYPASS		NO		—				
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE		INCREASES		CONTACTS OPEN				
SPECIAL CONSTRUCTION & NOTES		3-15 PSI SPRING		SPDT SWITCH EXPL. PROOF CL.1 GR.D				
OPERATES WITH		LCV 162						
SERVICE		VENT SCRUBBER V.6 LEVEL		VENT SCRUBBER V6 HIGH LEVEL SHUTDOWN				
VESSEL NO		V-6		V-6				
PLANT NO								
PURCHASE ORDER NO								

APPROVED

BY DATE

DATE

BY

CHECKED

ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

REV.

SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		PI-381 △		△		△		△	
MAKE OR APPROVED EQUAL		WIKA							
TYPE		PRESS. GAUGE							
MODEL		233							
MOUNTING	LOCATION	1/2 MPT	LOWER						
INDICATING OR RECORDING		IND.							
NORMAL PRESSURE @ TEMP		0	110°F						
PRESSURE ELEMENT RANGE		0-30 PSI							
PRESSURE ELEMENT TYPE AND MATERIAL		BOURD.	316SS						
REQUIRED SUPPRESSION		—							
THROTTLING RANGE	DIAL SIZE	4"							
AUTOMATIC RESET									
RATE ACTION									
AIR FILTER & REDUCER									
MANUAL CONTROL BYPASS									
CHART SIZE	NO								
CHART DRIVE	REVOLUTION								
INDICATING SCALE RANGE									
AS PRESSURE INCREASES OUTPUT SIGNAL									
LOCATION OF PRESSURE TAP									
PULSATION DAMPENER		NO							
SPECIAL CONSTRUCTION & NOTES		GLYCERIN FILLED							
OPERATES WITH									
SERVICE		VENT SCRUBBER V-6							
PLANT NO									
PURCHASE ORDER NO.									

REVISIONS — DATE — BY

DATE

BY

CHECKED

ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY

12.0 FIRE PROTECTION & GAS
DETECTION SYSTEMS

12.1 FIRE PROTECTION
WATER SYSTEM

SPECIFICATION

ELECTRIC MOTOR DRIVEN WASH DOWN & FIREWATER PROTECTION PUMP P 9
(1 Req'd.)

1.0 GENERAL

This specification describes one (1) electric-driven firewater and washdown pump. The firewater pump shall be suitable for use in conjunction with a water fog fire protection system on an offshore platform in Santa Barbara Channel, California. The units are to be located in a Class 1, Division 1, hazardous location and must comply with the State of California Safety Codes.

The firewater pumps shall conform to the applicable provisions of the most current issues of National Fire Protection Association Pamphlet No. 20, unless otherwise specified, and shall conform to all applicable provisions of local and state regulatory codes.

The pump driver and pump discharge head shall be furnished as a completely integrated, skid-mounted assembly, ready for operation. Pump column shall be furnished in maximum 10'-0" flanged sections for assembly in the field.

Pump shall extend from the platform deck into a stilling well and into the water. Pump shall be automatically started by a pressure switch (by others).

2.0 DESIGN BASIS AND CONSTRUCTION

2.1 PUMP

Capacity	300 GPM
Length Including Pump Stages & Column	55'-0" Minimum
Column Submersion	20' below M.L.L.W.
Discharge Pressure (At discharge platform level)	150 PSI
Efficiency	70 Minimum at design conditions
BHP	As required by pump at end of curve condition
Speed	1760
Fluid Pumped	Sea Water - Spec. Grav. 1.03
Design Pumping Temp.	40°F.

Pump shall be a vertical shaft turbine-type. Pump shall comply with the hydraulic requirements of NFPA Pamphlet No. 20. Shutoff total head shall not be greater than 140% of total rated head.

Pump shall consist of the following:

1. Discharge Head

   Head shall be fabricated steel with Epoxy coating inside in accordance with Specification 10-084-C1.
   The stuffing box and gland shall be zincless bronze with K-Monel bolts and nuts. The discharge flange shall be 6", 150# USAS RF. Furnish ½" NPT for pressure indicator.

2. Column

   Column shall consist of maximum 10'-0" flanged sections. Line shaft and coupling shall be type 316 ss. Bearing retainers to be type 316 ss. and cutless rubber bearings, water lubricated. Flanged sections shall be bolted with 316 ss. bolts and nuts.

   Column Material shall be :

   Carbon steel Epoxy coated inside and outside. Coating shall be in accordance with Specification 10-084-C1.

3. Bowls

   Bowls shall be cast iron coated internally and externally per Specification 10-084-C1. Impellers, wear rings, cone-type strainer, lock collets, bolting and shaft shall be type 316 ss.

2.2 Motor

Motor shall be directly connected, of the vertical, hollow shaft type, squirrel cage induction type, explosion proof with UL label, for outdoor service. The power supply is 440 volt, 3-phase, 60 cycles.

2.3 Protective Coatings

In addition to internal and external coatings specified above the remainder of the entire motor pump unit shall be coated externally in accordance with Specification 10-084-C2.

3.0 TECHNICAL DATA

3.1 Information Required with Bid (3 copies)

Each proposal shall include three copies of each of the following:

a. Pump design data sheet.

b. Preliminary dimensional outline drawing.

c. Typical pump cross-section drawing showing details of construction.

d. List of equipment items furnished as accessories with the pump and driver showing manufacturer, model or catalog number and description of the item.

e. Guaranteed pump performance curves.

3.2 Information Required with Purchase (6 copies)

Within one week of date of order vendor shall submit approval drawings. Within three weeks of date of order vendor shall submit the following final data:

Promptly after approval of dimensional drawings the vendor shall furnish six (6) copies of the following data.

a. Final dimensional outline drawings, including driver.
b. Installation, operation and maintenance instruction manual.
c. Manufacturer's pump data sheet.
d. Pump sectional drawing including parts list with materials of construction.
e. Driver data as required by this specification including that on the manufacturer's Pump Data Sheet.

4.0 GUARANTEE

The supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification. The bid data listed in Par. 3.1, a thru e, and furnished by the successful bidder shall become part of this specification and therefore become a part of the suppliers guarantee. He shall guarantee the equipment to be free of defects in workmanship and material for 12 months after the first service date. Deficiencies shall be corrected and paid for by the supplier.

5.0 SHIPMENT

All items shall be packaged and shipped to location designated by Humble on the Request for Quotation. The supplier shall be responsible for safe arrival of the equipment.

Humble Job 10240
H-B Job 10-084

Specification 10-084-EDFP

SPECIFICATION

DIESEL ENGINE DRIVEN
FIREWATER PROTECTION PUMP P-8
(One Req'd.)

1.0 GENERAL

This specification describes one (1) diesel-driven firewater pump, which shall be suitable for use in conjunction with a water fog fire protection system on an offshore platform in Santa Barbara Channel, California. The unit is to be located in a Class 1, Division 1 hazardous location and must comply with the State of California safety orders.

The unit shall be on standby service, operated only in case of fire.

The firewater pump shall conform to the applicable provisions of the most current issues of National Fire Protection Association Pamphlet No. 20 unless otherwise specified, and shall conform to all applicable provisions of local and state regulatory codes.

The pump driver, pump discharge head, and fuel tank shall be furnished as a completely integrated, skid-mounted assembly, ready for operation. Pump column shall be furnished in maximum 10'-0" flanged sections for assembly in the field.

Pump shall extend from the platform deck into a stilling well and into the water. Pump engine shall be manually started at the engine and remotely started thru electrical contacts.

2.0 DESIGN BASIS AND CONSTRUCTION

2.1 PUMP

Capacity	800 GPM
Length Including Pump Stages and Column	55'-0" Minimum
Column Submersion	20' below M.L.L.W.
Discharge Pressure (at discharge flange, platform level)	150 PSI
Efficiency	70% Minimum at design condition
BHP	As required by pump at end of curve conditions

Speed	1760 RPM
Design Pumping Temp.	40°F

Pump shall be a vertical shaft turbine-type. Pump shall comply with the hydraulic requirements of NFPA Pamphlet No. 20. Shutoff total head shall not be greater than 140% of total rated head.

Pump shall consist of the following:

1. Discharge Head

   Head shall be fabricated steel with Epoxy coating inside, in accordance with Specification 10-084-C1. It shall be externally coated in accordance with Specification 10-084-C2. The stuffing box and gland shall be zincless bronze and K-Monel bolts and nuts. The discharge flange shall be 150# USAS RF. Furnish ½" NPT for pressure indicator.

2. Column

   Column shall consist of maximum 10'-0" flanged sections. Line shaft and coupling shall be type 316 stainless steel. Bearing retainers to be type 316 ss, and cutless rubber bearings, water lubricated. Flanged sections shall be bolted with 316 ss bolts and nuts.

   Column material shall be carbon steel epoxy coated inside and outside. Coating shall be in accordance with Specification 10-084-C1.

3. Bowls

   Bowls shall be cast iron coated internally and externally per Specification 10-084-C1. Impellers, wear rings, cone-type strainer, lock collets, bolting and shaft shall be Type 316 SS.

2.2 ENGINE

The engine shall be a six or eight cylinder, manual start and stop, compression ignition, diesel type. The engine shall have a bare engine continuous brake horsepower rating at least 20% greater than required to drive the fire pump at 1760 RPM.

Engine shall be equipped with the following:

1. Overriding clutch

2. Fuel filters

3. Dry air cleaner

4. Crankcase breather

5. Governor control shall regulate speed within 10% between shut-off and maximum load conditions and shall shut down the engine at approximately 20% above rated speed. Auxiliary hand throttle speed control shall be provided.

6. Chromolox electric heaters, or equal, for jacket water, to insure starting up to 20°F and maintain water temperature at a minimum of 120°F. Electrical connections to be made by others.

7. Fuel injection system with full flow filter.

8. Seamless, convoluted flexible connection between engine exhaust and exhaust piping.

9. Silencer with spark arrestor and exhaust piping.

10. Cooling System

    The engine shall be fresh water cooled, capable of operating at 100°F ambient temperature with mounted radiator, fan, water pump, and engine jacket thermostat. A fresh water jacketed exhaust manifold shall be provided.

11. Flywheel and housing

12. Instrument Panel

    Instrumentation shall include totalizing type tachometer, oil pressure gauge, engine cooling water temperature gauge, and fuel pressure gauge. An oil temperature control system shall be provided. High water temperature and low oil pressure shutdown shall not be provided; alarm contacts shall however be provided for utilization in the facility main control panel.

13. Engine Generator

14. Battery Starter

15. Battery Charger

16. Engine Starting and Controls

    Connecting wires for the controls shall be harnessed or flexibly enclosed, mounted on the engine, and connected in an engine junction box to terminals numbered to correspond with numbered terminals in

the controls. Main battery contactors shall be manually operable in case of control circuit failures. The starter shall be air driven type suitable for use on 100 psig air. The unit shall be equipped with 115V AC explosion proof solenoid valve to operate the starter, in addition to the electrical starting control. Starting shall be both remote and at the unit both electrically and manually (at the vent).

Air piping to terminate for air supply connection only. Electrical connections to terminate in one J-box. The electrical equipment associated with the diesel drive shall be approved for the hazard classification of the area in which it is located which is Class 1, Division 1, Group D.

17. Fuel Tank

The diesel fuel supply tank shall have minimum capacity sufficient to operate the engine for eight (8) hours. A fuel level indicator shall be provided. The tank shall be vented. Fuel piping shall comply with NFPA Standard No. 31. No shut-off valve shall be installed in the fuel return line to tank. Relief venting for fire exposure shall be provided as specified by NFPA Pamphlet No. 30.

2.3 GEAR

Unit shall have right-angle gear drive, hollow shaft type with high-thrust bearings, non-reverse ratchet, oil cooling system, oil pump, and weather-protected housing. Ratio shall be 1:1.

2.3 COUPLINGS

Engine shall be directly connected to gear through an approved universal-type drive shaft or flexible coupling. Coupling guard shall be provided.

2.4 ASSEMBLY

Engine, fuel tank, and gear shall be mounted on a common structural steel skid. Skid shall be provided with suitable lifting eyes for lift with four (4) 10-foot long cable slings without spreader bar. The slings shall not contact any part of the engine or gear when skid is lifted. Jacking screws 90 degrees apart at each foot on engine and gear shall be provided so that units may be easily aligned. Skids, pumps, and gear shall be coated in accordance with Specification 10-10-084-C2.

3.0 TECHNICAL DATA

The following shall be furnished with the proposal (in triplicate):

(1) Pump performance curves showing guaranteed performance along with manufacturer's pump data sheet with all items filled in.

(2) Crossectional drawings of pump showing details of construction and materials.

(3) Dimensional outline drawings.

(4) List of all items and accessories showing manufacturer and identification numbers.

(5) Engine performance data including continuous and short-time horsepower ratings, fuel consumptions, starting air requirements, etc.

(6) Weights of pump, engine and total assembly.

Final data shall be furnished within 14 days of order date including all above data in addition to dimensional outline drawings and detailed electrical schematic and hook up drawings. All these data shall be furnished in 6 copies. Six copies of installation, operation and maintenance instructions including detailed parts list.

4.0 GUARANTEE

The supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification. The bid data listed in Par. 3.0 1 thru 6 and furnished by the successful bidder shall become part of this specification and therefore become a part of the suppliers guarantee. He shall guarantee the equipment to be free of defects in workmanship and material for 12 months after the first service date. Deficiencies shall be corrected and paid for by the supplier.

5.0 SHIPMENT

All items shall be packaged and shipped to location designated by Humble on request for quotation. The supplier shall be responsible for safe arrival of the equipment.

SPECIFICATION

ELECTRIC MOTOR DRIVEN
FIREWATER PROTECTION PUMPS P7A, P7B & P7C (FUTURE)
(2 Req'd.)

1.0 GENERAL

This specification describes two (2) electric-driven firewater pumps. The firewater pumps shall be suitable for use in conjunction with a water fog fire protection system on an offshore platform in Santa Barbara Channel, California. The units are to be located in a Class 1, Division 1, hazardous location and must comply with the State of California Safety Codes.

The firewater pumps shall conform to the applicable provisions of the most current issues of National Fire Protection Association Pamphlet No. 20, unless otherwise specified, and shall conform to all applicable provisions of local and state regulatory codes.

The pump dirver and pump discharge head shall be furnished as a completely integrated, skid-mounted assembly, ready for operation. Pump column shall be furnished in maximum 10'-0" flanged sections for assembly in the field.

Pumps shall extend from the platform deck into a stilling well and into the water. Pumps shall be automatically started by a pressure switch (by others).

2.0 DESIGN BASIS AND CONSTRUCTION

2.1 PUMP

Capacity	800 GPM
Length Including Pump Stages & Column	55'-0" Minimum
Column Submersion	20' below M.L.L.W.
Discharge Pressure (At discharge platform level)	150 PSI
Efficiency	70 Minimum at design conditions
BHP	As required by pump at end of curve condition
Speed	1760
Fluid Pumped	Sea Water - Spec. Grav. 1.03
Design Pumping Temp.	40°F.

Pump shall be a vertical shaft turbine-type. Pump shall comply with the hydraulic requirements of NFPA Pamphlet No. 20. Shutoff total head shall not be greater than 140% of total rated head.

Pump shall consist of the following:

1. Discharge Head

   Head shall be fabricated steel with Epoxy coating inside in accordance with Specification 10-084-C1.
   The stuffing box and gland shall be zincless bronze with K-Monel bolts and nuts. The discharge flange shall be 6", 150# USAS RF. Furnish ½" NPT for pressure indicator.

2. Column

   Column shall consist of maximum 10'-0" flanged sections. Line shaft and coupling shall be type 316 ss. Bearing retainers to be type 316 ss. and cutless rubber bearings, water lubricated. Flanged sections shall be bolted with 316 ss. bolts and nuts.

   Column Material shall be :

   Carbon steel Epoxy coated inside and outside. Coating shall be in accordance with Specification 10-084-C1.

3. Bowls

   Bowls shall be cast iron coated internally and externally per Specification 10-084-C1. Impellers, wear rings, cone-type strainer, lock collets, bolting and shaft shall be type 316 ss.

2.2 Motor

Motor shall be directly connected, of the vertical, hollow shaft type, squirrel cage induction type, explosion proof with UL label, for outdoor service. The power supply is 440 volt, 3-phase, 60 cycles.

2.3 Protective Coatings

In addition to internal and external coatings specified above the remainder of the entire motor pump unit shall be coated externally in accordance with Specification 10-084-C2.

3.0 TECHNICAL DATA

3.1 Information Required with Bid (3 copies)

Each proposal shall include three copies of each of the following:

a. Pump design data sheet.

b. Preliminary dimensional outline drawing.

c. Typical pump cross-section drawing showing details of construction.

d. List of equipment items furnished as accessories with the pump and driver showing manufacturer, model or catalog number and description of the item.

e. Guaranteed pump performance curves.

3.2 Information Required with Purchase (6 copies)

Within one week of date of order vendor shall submit approval drawings. Within three weeks of date of order vendor shall submit the following final data:

Promptly after approval of dimensional drawings the vendor shall furnish six (6) copies of the following data.

a. Final dimensional outline drawings, including driver.
b. Installation, operation and maintenance instruction manual.
c. Manufacturer's pump data sheet.
d. Pump sectional drawing including parts list with materials of construction.
e. Driver data as required by this specification including that on the manufacturer's Pump Data Sheet.

4.0 GUARANTEES

The supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification. The bid data listed in Par. 3.1, a thru e, and furnished by the successful bidder shall become part of this specification and therefore become a part of the suppliers guarantee. He shall guarantee the equipment to be free of defects in workmanship and material for 12 months after the first service date. Deficiencies shall be corrected and paid for by the supplier.

5.0 SHIPMENT

All items shall be packaged and shipped to location designated by Humble on the Request for Quotation. The supplier shall be responsible for safe arrival of the equipment.

FIRE PROTECTION EQUIPMENT ITEMS

The following provides a description of fire protection equipment items shown on Drawing 084-124:

Item 1. 3/4" Elkhart Fog Nozzle NTS-C with ball swivel and male connection. Ball swivel to have lock screw for locking nozzle in proper aiming position. Factory set nozzles for 13 GPM. All items to be chrome plated brass.

Item 2. 3/4" Spraying Systems Company, full jet stainless steel spray nozzles Cat. No. 3/4 HH6W.
Production equipment automatic sprinklers.

Item 3. Hose Reel Stations with Sierra Type A W300 drum reels, 100 feet Sierra HV6 neoprene hose and adapters, with 1½" Elkhart V891 brass drop out valve and 1" Sierra N250A chrome plated nozzle.

Item 4. Fire Protection Monitor 2½" NST, 600 GPM Elkhart 292-6 chrome plated brass with Elkhart CJ Jumbo Select-O-Stream nozzle. All items chrome plated brass.

Item 5. Drill Deck Monitors. Same as Item 4 except nozzle is 170 GPM Elkhart D-200.

Item 6. 4" & 6" Automatic Sprinkler Valves. Clayton, cast bronze, 150# ASA RF flanged Figure 100 Globe Valve, with Naval Brass Trim. Valves to be equipped with all items normally furnished with Clayton 132E solenoid controlled valves except all tubing valves, strainer and solenoid wetted parts to be type 304 or 316 stainless steel. The solenoid valve to be Class 1, Group D, explosion proof and for outside service. Voltage is 115VAC. Energization opens the valves.

Item 7. 3/4" & 1/2" Gate Valves. 1½" and smaller to be 200# bronze gate valves, Lunkenheimer Fig. 831 screwed and, OS & Y.

Item 8 Gate Valves. 2" thru 6" to be Lunkenheimer Fig. 1436, 250# flanged end OS & Y bronze trim, cast iron body with all wetted parts of cast iron coated with 12-15 mils of Tube-Kote TK 21 (or approved equal).

Item 9 Check Valves. 2" thru 6" to be Lunkenheimer Fig. 323, 250# flanged end, bolted bonnet cast iron body, bronze trim with all cast iron parts coated internally with 12-15 mils of Tube-Kote TK21 (or approved equal).

Item 10. Strainers. Strainers to be 4" or 6" (as shown on drawing) Zurn Y strainer series 540, 250# C.I. body with type 316 SS 20 mesh strainer. Coat internals of cast iron surfaces with 15 mils of Tube-Kote TK-21.

FIRE EXTINGUISHER EQUIPMENT

The following is a description of fire extinguishers to be located as shown on Drawing 084-147.

Item 1	Description
(1)	100# CO_2 extinguisher Cart Sierra Co-1000 with 50 feet of hose, horn and shutoff valve at horn. Furnish complete with hose rack and mounting brackets for storage (or approved equal).
(2)	150# wheel-type dry chemical extinguisher Cart Sierra No. CD1500 with 50 feet of hose and shut off valve (or approved equal).
(3)	20# dry chemical extinguishers Sierra SP 200 (or approved equal).

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

REV.

SPECIFICATION — PRESSURE INSTRUMENTS

CUSTOMER

JOB NO

PLANT LOCATION

IDENTIFICATION TAG NO	PI 370 △	PI 371 △	PI 372 △	PI 373 △
MAKE OR APPROVED EQUAL	WIKA	SAME AS PI 370	SAME AS PI 370	SAME AS PI 370
TYPE	PRESS. GAGE			
MODEL	233			
MOUNTING LOCATION	1/2" MPT LOWER			
INDICATING OR RECORDING	INDICATING			
NORMAL PRESSURE / TEMP	150 psi 40°F			
PRESSURE ELEMENT RANGE	0-300 psi			
PRESSURE ELEMENT TYPE AND MATERIAL	BOUR. 316 S.S.			
DIAL SIZE	4"			
THROTTLING RANGE				
AUTOMATIC RESET				
RATE ACTION				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART SIZE NO				
CHART DRIVE REVOLUTION				
INDICATING SCALE RANGE				
AS PRESSURE INCREASES OUTPUT SIGNAL				
LOCATION OF PRESSURE TAP				
PULSATION DAMPENER	NO			
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED			
OPERATES WITH SERVICE	FIREWATER PROTECTION PUMP P-8	FIREWATER PROTECTION PUMP P-7A	FIREWATER PROTECTION PUMP P-7B	WASHDOWN PUMP P-9
PLANT NO				
PURCHASE ORDER NO				

DATE

BY

CHECKED

ENGINEER

PROJ. ENG.

THIS SPECIFICATION CONSTITUTES A BILL OF MATERIALS

12.2 FIRE DETECTION SYSTEM

Humble Job 10240
H-B Job 10-084

Specification
10-084-FDU

SPECIFICATION
FIRE DETECTOR UNITS

1.0 GENERAL

This specification applies to the purchase of three Thomas A. Edison Industries Type 613 U/V fire detector signaling systems complete with 8 explosion proof fire detector heads each for Class 1, Group D location. The units are to be equipped with continuous automatic test equipment and malfunction alarms. One contact for remote malfunction alarm shall be furnished for each cabinet. Contacts for these remote alarms shall be normally closed and open on the alarm condition. The extinguisher circuits on two systems shall be furnished with 4 heads on each circuit for separate zone control. The third unit shall have two heads on each circuit for separate zone control.

The extinguisher circuit contacts shall be normally open and closed on the alarm conditions after 2 to 6 seconds delay (adjustable). All items shall be in accordance with Edison Publication No. 1109 Specification for Fire Protective Signaling System, Types 612 and 613 (8 pages)

2.0 GUARANTEE

The supplier and manufacturer shall guarantee the units to meet all requirements of these specifications and that the equipment is free of defects in design, material, and workmanship for 12 months after the delivery date.

3.0 SHIPMENT

The supplier shall package, ship and be responsible for safe arrival of all items at the destination stated in Humble's Request for Quotation.

12.3 GAS DETECTION SYSTEM

SPECIFICATION

GAS DETECTOR SYSTEM

1.0 GENERAL

This specification applies to the purchase of combustable gas detector units for use on an offshore platform near Santa Barbara. The units are to comply with the latest edition of Federal OCS Order No. 8 in addition to all other Federal and State of California Safety laws and safety orders. The units are to be used to monitor accidental gas leaks on the platform and provide warnings and safety shutdown of equipment as required for safety. The units are continuously exposed to wet salt air atmosphere. The sensing heads are to be located in a Class 1, Division 1, Group D, hazardous location. The control panels are to be located inside a control room classified as non-hazardous.

2.0 BASIC REQUIREMENTS

2.1 Sensors

Twenty two sensors are req'd. The sensors shall be explosion proof, Class 1, Group D. Underwriters Laboratory labels are desired if available. Equipment bearing the UL label shall be given preference in the selection. The sensors shall be satisfactory for operation in atmosphere containing hydrogen sulphide gas in concentrations of 10,000 ppm or more without lowering the sensitivity and accuracy of the units. The sensors shall be equipped with stainless steel internal metal diffusers (or approved equal) since brass and similar materials are not suitable for the type of exposure. The sensors shall be for methane gas, however, the sensors shall be the type that are safe to operate in hydrogen atmosphere.

2.2 The control cabinet shall be for mounting in standard 19 inch rack. Each cabinet shall contain 12 or less channels.

Each cabinet shall have a meter to indicate the highest LEL reading of the channels in the cabinet. Each channel will be for one sensor. They shall be two stage units adjustable to alarm at or less than 20% LEL and alarm and actuate shutdown contacts at or below 50% LEL. The detecting units shall continuously monitor the presence of combustable gas. Each channel shall have alarm and malfunction lights. One malfunction alarm contact shall be furnished in each cabinet for the remote alarm. Each cabinet shall have a selector switch to manually select the Channel to read out on the meter. The LEL settings shall be adjustable from the control panel. Alarms and shutdowns shall be active on all channels during the adjustment of one. All alarm and shutdown lights shall remain on until manually reset at the cabinet. The cabinet shall have a low alarm light and reset buttons and a high alarm (shutdown) light and reset button.

Each cabinet shall have its own DC power supply for use with 115 VAC, 60 hertz power. A "power on" light and "system ready" light shall be in the cabinet. The circuits shall be all solid state with plug-in circuit boards.

Each cabinet shall have one set of dry contacts for remote alarm for the following: (1) low alarm on any channel in the cabinet, (2) high alarm on any channel in the cabinet and (3) malfunction of any channel or power supply on the readout module. High LEL shutdown dry contacts for each channel shall be furnished in both cabinets. These contacts shall be for 5A, 115V, 60 hertz and contacts in (1) and (2) shall be closed under normal conditions and open on alarm conditions.

The cabinets shall be designed to automatically take 24V DC power supply from purchaser's battery upon failure of cabinet power supply. The power supply failure shall actuate the malfunction alarm.

2.3 Calibration Equipment. Furnish all necessary adapters, connectors, standard gas samples with regulation mixing and control equipment to field calibrate the gas detector units.

3.0 TECHNICAL DATA

The following data shall be supplied in 3 copies with the quotation:

(1) Cabinet picture front, side and rear views.

(2) Dimensional drawings of cabinet and sensors.

(3) Circuit and connection diagrams.

(4) Complete description of the functioning of the unit with confirmation that all items specified herein are included.

(5) Additional optional equipment with price.

(6) Manufacturer's complete specification for the sensors, the cabinet, and the test equipment.

(7) All necessary data for OCS Order No. 8 application for Installation of the detectors.

Six copies of above final data in addition to installation, operating and maintenance instructions and parts lists shall be provided by the supplier.

4.0 GUARANTEE

The supplier and manufacturer shall guarantee the units to meet all requirements of these specifications and that the equipment is free of defects in design, material and workmanship for 12 months after the delivery date.

5.0 SHIPMENT

The supplier shall package, ship and be responsible for safe arrival of all items at the destination stated in Humble's Request for Quotation.

13.0 CONTROL & INSTRUMENTS

Humble Job 10240
H-B Job 10-084

WELL AND PIPELINE SHUT-IN
ELECTRICAL SYSTEM
Drawing 084-303

The platform shut-in system is a 24-volt D.C. system supplied from four six volt lead-acid batteires with a floating charger. This system eliminates needless platform shut-ins due to power loss or voltage dips. If an actual shut in condition exists the system will shut in the appropriate wells and/or pipeline and will remain shut in until manually reset by the operator. The system as designed is "fail-safe"; that is if a particular component fails, a relay, a pressure switch, etc., the system will automatically go to the safe condition.

Production separators V-1A and V-1B operate in exactly the same way. Under normal operating conditions relays R1, R2, TDR3, TDR4 and RA of V-1A would be energized. On high pressure, PSH-307 would open, de-energizing relay R1 and RA and in turn de-energize relay RS shutting in the Monterey Chert wells at the wellhead. The contact of RS that shuts-in the individual wells is part of the well test panel and is shown in line 808 of drawing 084-308. At the same time the b contact of R1 would give an alarm on the annunciator to let the operator know what had shut-in the wells. The same exact procedure would be followed for a low pressure shutdown. The low or high level shutdowns would also follow the same procedure except that there is a 30 second delay before actuation of the shutdown to eliminate needless shutdowns due to contact bounce due to foaming or surging.

Production separator V-1C operates the same as V1A and V1B except that relay RT shutins the sandstone wells. The contact of RT that shuts-in the wells is part of the well test panel and is shown on line 854 of drawing 084-308.

Sweet gas scrubber V-5 operates in exactly the same way as production separator V-1C.

Test separator V-2A operates the same as production separators V-1A and V-1B except that relay RE does not shut-in the wells but suspends the test and switches the well back into production. The contact of RE that actually switches the well is part of the well test panel and is shown on line 801 of Drawing 084-308.

Test separator V-2B operates the same as test separator V-2A except the contact of RF that switches the well back into production is shown on 841 of Drawing 084-308.

Well clean separator V-1D operates the same as V-1A except that relay RG shuts-in both the Monterey Chert and the sandstone wells by de-energizing relays RS and RT.

The well clean tank has a high level shutdown only which shuts-in the Monterey Chert and sandstone wells by de-energizing relays RS and RT. LC155 and LAH 155 are part of the same switch as LSH 155 and therefore, to facilitate field wiring are included in the 24 volt D.C. system.

A high level or a high pressure in crude surge tanks V4A and V4B or a high pressure in crude surge tank V-4C would deenergize relays RS and RT and shut-in the Monterey Chert and Sandstone wells.

The oil pipeline to shore and shipping pumps P-4B, P-4D and P-4F are equipped with high and low pressure shutdowns which deenergize EOV A and shutdown the pipeline. TDRAA, TDRBB and TDRCC enable the shipping pumps to be started with a low pressure. After a time delay if the low pressure had not come up the oil pipeline valve would be closed.

The gas, fire and leak detectors are also tied into the pipeline shutdown through relay RL. If any of these items go to an alarm state RL would deenergize and would in turn deenergize EOV A. A test switch is provided to test the items without causing a pipeline shutdown.

A high level in the emergency surge tank would deenergize relay TDR 869 and deenergize relay RM which would deenergize relays RS and RT shutting in the Monterey Chert and Sandstone wells. LAH 1004 and LAH 1005 were included in the 24 volt DC system to facilitate field wiring.

A high or low pressure in the main gas scrubber or a high or low level would deenergize relay RM which in turn deenergizes relay RS and RT shutting in the Monterey Chert and Sandstone wells.

Test override switches are provided on relays RS and RT and solenoid valve EOV A to enable the shutdown circuits to be tested without actually shutting in the wells or pipeline.

SHIPPING PUMPS ELECTRICAL
CONTROL SCHEMATICS

Drawings 084-304 and 084-305

The crude shipping and booster pumps are designed to allow a booster and shipping pump combination to operate between the high or low set of levels in either crude surge tanks V4A or V4B.

Before starting the pumps the operator should select whether he would like to operate on the high or low set of levels. He does this by aligning the following switches: SW-10, SW-15, SW-20 and SW-25. He then selects the particular tank by aligning the following switches: SW-11, SW-16, SW-21 and SW-26.

Let's assume that he has selected the low set of levels on Tank V4A for pumps P4A and P4B. When the level in tank V4A starts to rise it will close LSL-140. On increasing level switch LS134 will close and a further increase in level will close LS-130 energizing relay R2 and locking it in through its own contact and LS-134. Immediately TDR10 will start timing and 10 seconds later will energize relay R11. TDR10, TDR15, TDR20 and TDR25 prevent all booster shipping pump combinations from starting at the same time.

The matrix for each booster shipping pump combination, for P4A and P4B shown on lines 10 through 14 allow for other pumps to start if P4A and P4B fail to start for some reason. For example, before TDR15A on line 10 opens R204b on line 11 would close if pumps P4C and P4D had a run signal keeping R11 energized. If P4C and P4D had a run signal but the booster pump P4C failed to start R210 on line 12 would close keeping R11 energized. If the P4C and P4D had a run signal but the shipping pump failed to start R213 on line 13 would close keeping R11 energized. If P4C and P4D did not have a run signal and the shutdowns were in the normal condition R233 on line 14 would be energized thereby keeping R11 energized.

If R11 is energized it will immediately energize TDR100, TDR101 and TDR103 as well as the booster pump if the shutdown relay R134 is energized. If R134 is not energized the pumps will not start and reason they will not will be displayed on the panel. Pushing the reset button will clear the board for another attempt. If R134 is energized and booster pump P4A fails to start TDR101 will time out deenergizing TDR103 and energizing relays R110 and R111 and light L112. This light gives an indication that booster pump P4A failed to start. If the booster pump starts but the shipping pump fails to start relay TDR103 would energize R113 and R114 and light 115 indicating that the shipping pump P4B failed to start. Since relay R104 had not energized and relay TDR100 had timed out the booster pump P4A would shutdown. If the booster pump had started the M4A aux contact on line 101 and 102 would transfer and start the shipping pump and deenergize TDR101 before it had timed out. If the shipping pump starts M4B aux contact on lines 103 and 104 would transfer deenergizing TDR103 and energize R104 locking in the booster pump. Relay TDR100

on line 119 would keep R116 energized during start-up to prevent getting shutdown on low suction pressure. Likewise if the booster or shipping pumps had failed to start they would override the low suction pressure, with contacts R111 and R114 on line 117 and 118 respectively, thereby giving a true indication of what had happened when PSL-325 had energized it would keep relay 116 energized through its own contact on line 121. A high or low pressure on the shipping pump discharge would deenergize relay R500 deenergizing relay R126 and shutting of the pumps through relay R134. A high discharge temperature on P4B would deenergize relay R123 and shutdown the pumps through relay R134. A high discharge temperature on P4B would deenergize relay R123 and shutdown the pumps through relay R134. A high winding temperature in P4B motor would deenergize relay R130 and shut the pumps down through relay R134.

Relay R135 overrides PSL-325 in the case of a shutdown due to high discharge temperature P4B, high low discharge pressures, or high motor winding temperature pump P4B.

If the shipping or booster pump failed to start relay R510 would be energized giving an alarm on the main control panel. If the shipping pump was shutdown it would deenergize relay R502 giving an alarm on the main control panel.

Pump combinations P4C and P4D; and P4E and P4F; and P4G and P4H; operate in a similar manner to pumps P4A and P4B and will not be discussed.

Lines 511 to 534 on 084-305 show the hookup of the illuminated switches for pump control.

FIRE AND GAS DETECTOR SYSTEMS AND MISCELLANEOUS SYSTEMS DRAWING 084-306

There are three Edison fire detector control units mounted in the panel labeled Unit "A", Unit "B" and Unit "C" on the schematic. These units control two zones each. For example, Unit "A" controls zones "A1 and A2". Internal to the control unit are circuits which continueouly check each fire detector head by exposing it to a small source of ultra violet light. If a detector head does not respond the unit energizes a relay which gives a malfunction alarm. The malfunction alarms for the three control units are tied together to relay R626 which when energized sounds an alarm on the main annunciators. If a detector head picks up a fire relay R627 is energized sounding an alarm on the annunciator. If the fire does not go out within 8 seconds relay R629 is energized shutting in the wells at the wellhead and at the subsurface safety valves. Simultaneously, relay R633 is energized starting firewater pumps P7A and P7B and the solenoid valve for the affected area is energized (SOV603 for zone A1, SOV604 for zone A2, etc.). If a pump fails to start relay TDR652 or TDR664, depending on which pump malfunctioned, is energized starting diesel firewater pump P-8. The pumps continue to run until the "Fire Reset" button is pushed. A "Fire Test" switch is provided to allow testing of the fire system without shutting in the platform. The fire water pumps can also be started manually from the panel and at various locations around the platform. The diesel fire pump additional start-stop stations are shown on Drawing 084-315.

Three gas detector control units are included in the panel. If a detector head senses a low "LEL" relay R675 is deenergized sounding an alarm on the main annunciators. If a high "LEL" is sensed TDR676 and R677 are deenergized and an alarm sounded immediately on the annunciators. 30 seconds later the wells are shutin at the wellhead and EOVA is deenergized closing the oil pipeline valve. If any control unit malfunctions relay R674 is deenergized sounding an alarm on the main annunciators.

Lines 682 to 700 contain miscellaneous alarm conditions. An opening of any alarm device would deenergize the appropriate relay and sound an alarm on the main annunciators.

MISCELLANEOUS ELECTRICAL

CONTROL SCHEMATIC DIAGRAM

DRAWING 084-307

The drain system is shown in detail on lines 701 to 730. LAH152 would open on high level and deenergize relay R701 and sound an alarm on the annunciators. LAL-153, LAH146, LAH147, LAH148, LAH149 and LAH150 would operate in a similar way.

The flotation unit motors all operate start-stop. Depressing the start button would energize the motor coil and lock itself in around the start button. Depressing the stop button would deenergize the coil.

When the level rises in the water sump, level control LC-146 would energize starting water sump pump P1A. When the level had dropped to the stop level the pump would stop. Level controls LC-147, LC-150, LC-148 and LC-149 operate in a similar manner.

The crude oil heating system is shown on lines 731 to 749. Exchanger E5A is equipped with a high temperature and low flow switches. If either switch opens, TSH-221 and FSL401, relay R731 is deenergized and the divert valve opened. The divert valve diverts the turbine exhaust gases around the exchanger. A low level in the therminol expansion tank, LSL165, would also divert the gases around the exchanger by energizing relay R744-exchangers E5B and E5C operate in a similar manner.

A low level in the therminol expansion tank, LSL165, also shuts off therminol pumps P20A and P20B. A low flow, FSL-746, on the jacket water for the therminol pumps also shuts down P20A and P20B by deenergizing relay R746. There is also a low temperature alarm on the discharge of the crude oil heaters. This would deenergize relay R749 and sound an alarm on the annunciators.

Lines 750 to 755 show the hookup for the interface controllers on tanks V4A and V4B, and also the high level alarms on V4A and V4B. Opening of the level switch would deenergize the relay and sound an alarm on the annunciators.

Lines 756 to 760B show the hookup of the controls on the well clean separator and well clean surge tank. LAH161 deenergizes relay R756 and sounds an alarm on the annunciators. LC154a and LC154b maintain a level in the well clean separator. On increasing level, control LC-154b closes. On a further increase LC-154a closes, energizing relay R757 and opening the dump valve.

A high level in the well clean surge tank would override LC154a and LC154b and close the dump valve on the well clean separator by energizing EOV 760C. A further increase in the well clean surge tank would energize EOV 155 and shut off the gas to the vapor compressor and open the dump valve to the emergency surge tank.

The diesel fuel system is shown on line 761 to 773. A high level in diesel tank #1 or #2 would shutoff the inlet valve by energizing SOV156 or SOV157. An

alarm would also be sounded on the main annunciators. The tanks are also equipped with high level alarms, LAH 156 and LAH 157. The diesel day tank is equipped with a high and low level alarm, LAH 158 and LAL 158 which sounds an alarm on the annunciators. The diesel day tank is equipped with a two position level control which is used to start and stop the diesel fuel transfer pumps P101A and P101B. A selector switch is provided to select which level starts which pump.

Drawing 084-307 also shows two miscellaneous alarms and the start-stop stations for the washdown pumps.

WELLHEAD AND MANIFOLD SWITCHING AND MISCELLANEOUS SYSTEMS ELECTRICAL CONTROL SCHEMATICS DRAWING 084-308

Assuming that there are no shutdowns in the test separator or in any other device that might have closed the Monterey Chert well contacts RE on Line 801 and R5a on 808 would be closed. Then depending on whether the "Test Mode" switch was in the manual or automatic position the test programmer or the manual test switch could put a well in test by energizing for well No. 1 relay R1A. R1A contacts would transfer energizing EOVIA and EOVIB and deenergizing either EOVIC and EOVID or EOVIE and EOVIF depending on what production separator had been chosen for the well. The well can be shutin at the wellhead by (1) a Monterey Chert well shutdown contact (2) compressor shutdown contacts "A" or "B" (3) or the well number illuminated pushbutton. The wellhead valve position and the test valve position are picked up by limit switches on the valves and energize relays R1B and R1C respectively. EOVIH is the well start up solenoid and is energized by depressing the wellhead valve position pushbutton.

Wells 2 through 35 are identical in operation to Well #1.

Wells 40 through 45 are similar in operation to Well No. 1 except there is no choice in production separators and there is no compressor shutdown contacts.

Lines 874 to 896 show the hookup of the sand drawoff valves on the water surge tank. The stepping rate is controlled by TDR880 and the Agastat programmer #2962.

A few miscellanious alarms and controls are also shown but are self explanatory.

The well test procedure is also discussed in the functional description of the main control panel.

WELLHEAD MANIFOLD SWITCHING

ELECTRICAL CONTROL SCHEMATIC

DRAWING 084-309

This drawing basically details the illuminated pushbutton hookups for the well test panel. The schematic is self explanatory.

The well manual shutdown alarm schematic is also shown. If a well is manually shutdown from the panel the well number illuminated pushbutton will close sounding an alarm on the annunciator. When the valve closes the limit switch on the valve will open allowing the annunciator to be cleared for the next manual shutdown.

MISCELLANEOUS SYSTEMS

ELECTRICAL CONTROL SCHEMATIC DIAGRAMS

DRAWINGS 084-314 and 084-315

These drawings detail the field and panel wiring for all the readout devices included in the panel. The hookup is self-explanatory.

084-315 also shows the start-stop stations for the diesel fire pump and the two effluent pumps P21A and P21B. A few miscellaneous alarms are also shown.

13.1 AIR SUPPLY SYSTEM

SPECIFICATION

AIR COMPRESSOR UNITS

1.0 GENERAL:

This specification applies to the purchase of one complete air compressor unit. The unit includes a utility air compressor and surge tank, an instrument air compressor and surge tank, piping, valves, controls, instruments, coolers and electric motors, all mounted on one steel skid base. The unit is to be utilized on an offshore platform in an area classified as hazardous Class 1, Division 1, Group D. The equipment is exposed continuously to wet salt air atmosphere. The unit is to be for continuous operation. Dependability and long life are desirable and will be given preference in considering the proposals.

2.0 DESIGN CONDITIONS:

2.1 Utility Air Compressor Unit

The compressor shall be capable of delivering a minimum of 120 SCFM of air at 150 psig and 110°F maximum temperature. The maximum ambient air temp. is 80°F. The air receiver shall have a minimum volume of 300 gallons. It shall be designed and certified in accordance with the ASME Code Section VIII for 200 psig with 1/16" corrosion allowance. Compressor controls automatically starts and stops compressor to control receiver pressure. A pressure control takes air from this unit into the instrument air unit when the instrument air system pressure drops to 80 psig. Intercolling (if required) and aftercooling shall be through air cooled exchangers with fans driven off the compressor unit.

2.2 Instrument Air Compressor Unit

The compressor shall deliver 35 s.c.f.m. of air at 125 psig and 110°F maximum temperature. The air receiver volume shall be a minimum of 100 gallons. The receiver shall be designed for 200 psig with 1/16" C/A as specified in Par. 2.1. The compressor controls automatically start and stops to control the receiver pressure between 100 and 125 psig.

2.3 The units shall incorporate all items shown on the P & I Diagram Dwg. 084119.

3.0 CONSTRUCTION:

3.1 The compressor units are to be arranged on one compact steel skid base. The equipment shall be arranged to occupy a minimum of floor space consistent with good access for operating and maintaining the equipment. No running equipment shall be mounted on or supported off the air receivers. The maximum floor space for the skid shall be a rectangle of 8 feet x 4 feet.

3.2 The base proposals shall be for direct coupled motors and compressors with an alternate quote for anti static V-belt drives. All drives shall have State of California approved guards.

3.3 All gate and block valves shall be Powell Fig. 2375 (or approved equal) 200 pound bronze double wedge gate valves.

3.4 Pressure gauges shall be Ashcroft 1279J 4½" dial size (or approved equal).

3.5 Relief valves shall be Crosby Style AC.

3.6 Pressure switches for starting and stopping the motors shall be Square D Class 9013 ASR-8 in explosion proof enclosure. Pressure switch for low pressure alarm shall be Custom Components Dual Snap 606-GR-11 (or approved equal).

3.7 Pressure control valve shall be 1/2" Fisher 95H (or approved equal).

3.8 The drain traps shall be 3/4" Armstrong Series 22.

3.9 The intake air filters shall be dry type with replaceable elements.

3.91 Intercoolers (if any) and aftercoolers shall be air cooled type with fan driven by compressor. The fins shall be copper free aluminum.

3.92 The skid base shall be fabricated steel. It shall be adequate for marine handling of the unit.

3.93 All piping shall be in accordance with ANSI Code for Pressure Piping B31.1. All pipe shall be A53 GR B seamless. All fittings shall be 250# malleable iron. Unions to be 250# malleable iron with brass seats.

3.94 All external surfaces of the compressors, motors, skid base, piping and other metallic items (except brass stainless steel and aluminum) are to be protectively coated in accordance with Specification 10-084-C2.

3.95 The electric motors shall be 480V, 3 phase, 60 Hertz. The motors shall have epoxy encapsulated windings. Motor manufacturer is subject to approval by Humble. The motors shall be sized to start and run the compressors under full load with 1.0 service factor. The motors shall have a 1.15 service factor. The compressors shall be equipped with automatic unloaders if required to properly start the units.

3.96 The electrical work shall comply with the National Electric Code and with the State of California Title 24. The location is classified as Class 1, Division 1, Group D. All controls shall be fully piped and wired. External connections shall be provided at one junction box for both units. Others will furnish the motor starters and run the 480V feeders to the motors. The supplier shall furnish wire Hand-Off-Automatic switches for each compressor unit.

All conduit fittings and junction boxes shall be copper free aluminum as manufactured by Crouse Hinds. All junction boxes shall be screw cover type (Crouse Hinds GUA type). All wiring shall be copper stranded. All wires shall be labeled at both ends and in all j-boxes.

3.97 The completed unit shall be run in and the controls tested at all conditions of operation. The air delivery for each unit shall be measured and certified.

4.0 TECHNICAL DATA:

4.1 The following shall be submitted in triplicate with the quotation:

(1) Overall layout of skid and equipment.
(2) Manufacturers and catalog numbers for all equipment. Data on compressors shall show guaranteed delivery and running speed; type of unloaders (if any). Both direct coupled and belt-drive units shall be quoted.
(3) List any exceptions or deviations from this Specification.

4.2 Six copies of the following shall be furnished within two weeks of order date.

(1) Electrical wiring schematic.
(2) Certified dimensional showing overall dimensions and all piping and electrical connections points by accurate dimensional location.
(3) List of all equipment items with manufacturer's catalog number.

(4) Piping layout including materials and sizes.
(5) Instrument details.
(6) Skid base construction.
(7) Installation, operating and maintenance instructions.

5.0 SHIPMENT:

Manufacturer and supplier are responsible to properly package the pump units for shipment and their safe arrival at the destination specified in the Request for Quotations.

6.0 GUARANTEE:

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from first service date. Performance curves furnished with the quotation shall become a part of the guarantee.

7.0 ALTERNATE QUOTATION:

Quote price addition to make both compressors suitable for use with non-flammable lubricating oil.

SPECIFICATION

INSTRUMENT AIR DRIER

1.0 GENERAL

This specification applies to the purchase of one refrigeration type instrument air drier. The unit is to be used on an offshore oil production platform near Santa Barbara, California. It is to operate inside an equipment room classified as non-hazardous. The unit is for continuous operation in a critical instrument air system where long life and dependability are very important.

2.0 DESIGN CONDITIONS

The unit shall have a capacity of 100 SCFM of saturated air at 100 psig and 100°F inlet temperature. The ambient air temperature for design is 90°F. The unit shall have a safe operating pressure of 200 psig. The outlet air from the unit shall be free of all entrained water and shall have a dew point of 35°F at the outlet pressure.

3.0 CONSTRUCTION

The unit shall be a Hankison Refrigifilter F-100 or approved equal with 115V single phase 60 hertz electric motor. It shall be equipped with a Hankison Trip-L-Trap water trap. Furnish with two spare Hankison 0702-1 filter cartridges. (Other equipment of equal construction and features will be considered).

4.0 GUARANTEE

Supplier and manufacturer shall guarantee the equipment to meet all requirements of this Specification and to be free of defects in workmanship and material for a period of 12 months after first service date. Deficiencies or defects will be repaired or the unit replaced with one meeting these requirements at no additional cost to Humble.

5.0 SHIPMENT

The manufacturer shall be responsible to package and ship the unit to the destination specified in the Humble "Request for Quotation". Manufacturer is responsible for the safe arrival of the unit.

13.2 MAIN CONTROL PANEL

13.3 MISCELLANEOUS INSTRUMENTS

Humble Job 10240
H-B Job 10-084

Spec. 10-084-RTU

RTU SPECIFICATION

A remote terminal unit shall be provided by TRW International Controls Corporation and shall be their Model S-70 as per their purchase agreement with Humble Oil Company dated August 8, 1969 with the following modifications and specifications:

1. No power supply will be required. The RTU shall take power from the platform 24 volt D.C. battery system which has adequate filtering to reduce A.C. ripple to a tolerable level.

2. The RTU shall be capable of monitoring 93 dry contact closures.

3. The RTU shall be capable of monitoring 8 analog inputs.

4. The RTU shall be capable of monitoring 13 digital inputs.

5. The RTU shall be capable of providing 39 contact closures for controlling purposes.

All inputs will be compatible with the RTU input requirements as outlined in the purchase agreement.

Humble Job 10240
H-B Job 10-084

Specification 10-084-EOV

SOLENOID VALVES

All electrically operated valves marked EOV or solenoid operated valves marked SOV on the drawings shall be 1/4" stainless steel body, soft seat, explosion proof, water tight, for universal operation, ASCO Catalog No. 8320114 with 115VAC or 24VDC coils as required for the circuit application.

Humble Job 10240
H-B Job 10-084

10-0840PURGE-PS2

PURGE PRESSURE ALARM SWITCHES
CONTROL & SWITCHGEAR ROOM AND WELDING ROOM
PSL 692 and PSL 699
(2 req'd.)

This specification applies to the purchase of two Mercoid PQ-X2 diaphragm pressure switches for 0.1" WC to 1.0" WC pressure with 0.3" WC differential, general purpose enclosure. Furnish with each switch a Mercoid V2-3A relay.

Humble Job 10240
H-B Job 10-084

Specification 10-084TM

TURBIDIMETER METER

1.0 GENERAL

This specification applies to the purchase of one Continuous Flow "Surface Scatter" Turbidimeter to be used to measure turbidity of process water effluent from the discharge of a flotation unit on an off shore drilling platform. The unit will be surface mounted in a pressurized control room classified as non-hazardous.

2.0 DESIGN AND RATING

The unit shall adhere to the following specifications:

(1) Range - Manual switching shall permit the following range selections: 0-1, 1-10, 0-100 and 1-1000 FTU's (Formazin Turbidity Units).

(2) Response time - 30 seconds to detect a change in turbidity

(3) Calibration - Formazin

(4) Method of standardization - A standard reflectance plate is to be placed in the light beam and a standardization control adjusted to a fixed FTU value.

(5) Sample required - 1/4 to 1/2 gallon per minute.

(6) Construction - case to be cast aluminum-all wetted parts to be PVC

(7) Photocell - Silicon

(8) Recorder output - 0-1 volt

(9) Indicator - 4½" meter mounted on the turbidimeter

(10) Alarm contacts - High and low alarm contacts are to be proivded adjustable from the meter face. Contact rating is 3 amperes at 120 volt

(11) Temperature of sample - 100°F Max.

(12) Power available - 120 volt, 60 Hz

The unit to be a Hach Chemical Company Model 2426 or approved equal.

3.0 GUARANTEE

The manufacturer shall guarantee all material and workmanship for a period of one year from date of purchase.

13.4 PUBLIC ADDRESS &
ALARM SYSTEM

PUBLIC ADDRESS SYSTEM

1.0 GENERAL

This specification covers the design requirements for a single channel page/reply system to be used on an off shore drilling and production platform. All equipment located outside of the pressurized rooms and living quarters shall be suitable for use in a Class 1, Division 1 hazardous area and shall carry the U.L. label for this service.

2.0 DESIGN AND RATINGS

The page/reply system shall contain the type of hansets and reproducers as specified below:

2.1 Explosion proof trumpet reproducer shall consist of a trumpet type speaker with a frequency range of 250-10,000 Hz. The speaker shall be suitable for a continuous input power of 40 watts; 60 watts peak. The axial sensitivity shall be 90 db. at four feet with rated power input. The dispersion shall be 100 degrees. The horn shall be spun aluminum with a bell diameter of 13 inches. The housing driver shall be heavy gauge cast metal and shall contain a 3/4" conduit entrance. The trumpet shall have a built in impedance transformer. The unit shall be an Executone Model C23X(02) or approved equal.

2.2 Explosion-proof handset station shall consist of a single channel industrial paging handset with control and lamp assembly suitable for surface mounting in a hazardous area. The receiver shall be magnetic with the transmitter high quality carbon button. The handset shall be constructed of tough moulded plastic and shall have a heavy cast aluminum cradle. A factory sealed press-to-page button with heavy duty jewel "in-use" lamp housing shall be provided. The aluminum housings shall be copper free, less than .4%. The housings shall be provided with 3/4" conduit engrance hubs. The unit shall be a Executone Model IPTH154LX or approved equal.

2.3 Surface mounted handset stations shall consist of a single channel page/reply handset station with built-in speaker and volume control for receiving page. The unit shall include a "press-to-page" button and "busy" red lamp indicator. The receiver shall be magnetic and the transmitter high quality carbon button. The speaker shall be the 4" cone type with 93 db. sensitivity at 4 feet with 1 watt input. The speaker will be "cutoff" when paging. The unit shall be an executone Model IPTH 1581S2, or approved equal.

2.4 Desk type handset station shall consist of a single channel page/reply handset station with built-in speaker and volume control for receiving page. The unit shall include a "press-to-page" button and "busy" red lamp indicator. The receiver shall be magnetic and the transmitter high quality carbon button. The speaker shall be the 4" cone type with 93 db sensitivity at 4 feet with 1 watt input. The unit shall have a switch for connecting the reply system to the commercial telephone line. The appropriate coupling equipment will be provided.

2.0 AUXILIARY EQUIPMENT

The following additional equipment will be provided to make the system operational.

3.1 A central control unit to handle up to 30 handset stations.

3.2 A relay controlled power booster (amplifier) to provide output power to all reproducers.

3.3 A power supply adequate to handle the entire system shall be provided.

4.0 SYSTEM OPERATION

4.1 To Page - walk to the nearest handset station. If busy light is illuminated, channel is in use. If busy light is not illuminated lift the handset from its cradle. The busy light shall automatically illuminate on all handset stations. Depress the button near the handset station and talk into the handset. Page the person you want. The page shall be heard over all sound system reproducers and handset stations equipped with speakers.

4.2 To reply to page message - walk to the nearest handset station and lift the handset from its cradle. With the handset lifted, instant voice contact shall be completed between the paged party and the person calling. Handset conferences shall be possible between more than two people.

4.3 Provisions shall be made in the control room for two auxiliary inputs.
(1) A horn sound for platform trouble indication.
(2) A bell sound for fire alarm.

These inputs shall automatically cutoff all paging from all handset stations. However, communications shall continue between all handset stations.

5.0 GUARANTEE

The supplier shall guarantee his equipment for a period of one year from date of installation to be free of defects in manufacture or faulty operation.

14.0 DIESEL FUEL SYSTEM

SPECIFICATION
THERMINOL EXPANSION TANK T-20
DIESEL FUEL DAY TANK T-23

1.0 GENERAL

This specification applies to the design and construction of the above vessels for use on a Humble Oil and Refining Company offshore platform near Santa Barbara. The vessels are to be non-code, however, they are to be constructed in accordance with the ASME Section VIII but not stamped.

2.0 CONSTRUCTION

The vessels shall have a minimum metal thickness of 3/16". They shall be tested at 30 psig. The ASME code shall be followed as to construction details including welding and welder qualification.

The vessels shall be constructed as shown on Drawing 084-132.

3.0 PROTECTIVE COATING

The vessels and appurtenances shall be coated externally in accordance with the attached Specification 10-084-C2. The vessels shall be sandblasted internally as described in 10-084-C2 and dried for shipment. They shall be sealed with adequate desiccant to prevent rusting during delivery.

4.0 DELIVERY

The vessels shall be delivered f.o.b. trucks or barges at the jobsite specified in the Humble request for quotation.

5.0 DRAWINGS

Supplier shall submit three (3) copies of shop drawings for approval prior to fabrication. Thr purchaser reserves the right to change the location of nozzles and appurtenances until the approval of these drawings.

6.0 GUARANTEE

The supplier shall guarantee the vessels to meet the requirements of this specification and to be free of defects in material and workmanship for a period of 12 months from the delivery date. Defects or deficiencies shall be corrected at no additional cost to Humble.

SPECIFICATION

DIESEL FUEL TRANSFER PUMPS
P101A & P101B
(Two Req'd)

1.0 GENERAL

This specification applies to the purchase of two diesel fuel transfer pumping units for use on an off-shore platform near Santa Barbara. The units supply fuel to critical platform equipment. Dependability and low maintenance are desired features in these pumps. The units are continuously exposed to wet salt air atmosphere. The pump is located in a Class 1, Division 1, Group D location.

2.0 DESIGN & CONSTRUCTION

The attached Centrifugal Pump data sheet gives the design basis. In addition the motor shall be sized to be non-overloading with 1.0 service factor at end of curve conditions. Pump selection shall allow for future impeller installation that would provide for 20% additional head over that specified as design.

The pump, motor, base, coupling oilers, coupling guard and all other necessary equipment to make the unit complete shall be furnished and shipped fully assembled.

3.0 TECHNICAL DATA

The proposals shall contain the following in triplicate:

(1) Pump data sheets completely filled in.
(2) Performance curves including NPSH requirements and horsepower.
(3) Cross sectional drawings showing details of construction and materials.
(4) Dimensional outline drawings.
(5) Motor description.
(6) Total weight.

The manufacturer shall furnish 6 copies of all above final data in addition to certified dimensional drawings within 14 days of purchase order.

4.0 SHIPMENT

Manufacturer shall package and ship the units to destination stated in the Request for Quotation. Supplier and manufacturer shall be responsible for safe arrival of the units.

5.0 GUARANTEE

The supplier and manufacturer shall guarantee the units to meet all requirements of these specifications and to be free from defects in material and workmanship for a period of 12 months from first service date. Defects will be corrected at no additional expense to Humble.

HOBBS—BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SPECIFICATION — CENTRIFUGAL PUMP

CUSTOMER — HUMBLE OIL & REFINING COMPANY — JOB NO. 10-084

PLANT LOCATION

SERVICE OF UNIT — ITEM NO. P101A, P101B

DESIGN DATA

LIQUID CHARACTERISTICS		WORK MATERIALS	RECIPROCATING
LIQUID	DIESEL OIL		
API GRAVITY	30		
SPECIFIC GRAVITY	0.90		
TEMPERATURE	70°		
VISCOSITY	70 SSU MAX.		
VAP PRESS FLOW EMP			
PRESSURE			
SUCTION PRESS	10		
SUCTION PRESS	0		
DISCHARGE PRESS	40		
DISCHARGE PRESS	40		
DIFFERENTIAL HEAD	102		
MAX. WORK PRESS	100 PSIG		
HYDROTEST	150 PSIG		

CONSTRUCTION & MATERIAL

NO. OF STAGES	1		
CASING	** VERT		
BASE	STL OR DUCT IR.		
CASING WEAR RINGS	C.I.		
IMPELLER	C.I.		
IMPELLER WEAR RINGS	C.I.		SQ. CAGE INDUCTION
SHAFT			
SHAFT SLEEVES	304 S.S.		
COUPLING	SPACER TYPE, THOMAS DBZ		440
BASE PLATE	STL.		3 ϕ
	* MECHANICAL SEAL		60
THRUST BEARINGS	BALL		
RADIAL BEARINGS	BALL		CLASS 1 GR. D
LUBRICATION	OIL		EXPL. PROOF
NO. OF THRUST BEARINGS			WITH U/L LABEL
LUBRICATOR	RING		
			STATE OF CALIF.
			SAFETY ORDERS

REMARKS

* MECH. SEAL TO BE JOHN CRANE, BORG WARNER OR APPROVED EQUAL

MOTOR TO BE GE, WESTINGHOUSE OR U.S. MOTORS

** END SUCTION, VERTICAL DISCHARGE

REVISIONS

HOBBS-BANNERMAN CORP.

[illegible] SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION

RELIEF VALVES

REV

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PSV-29 △	PSV-25 △	△	△
MAKE OR APPROVED EQUAL	CROSBY	SAME AS PSV 24		
TYPE	JO-25			
MODEL	3L4			
BODY MATERIAL	STL.			
PIPE SIZE IN	3" 4"			
CONNECTIONS IN	150# RF 150# RF			
TRIM MATERIAL SPRING	SS STL			
LIFTING GEAR GAS				
CALCULATED ORIFICE AREA SQ IN	2.75			
SELECTED ORIFICE AREA & LETTER	2.85 L			
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG	14.5			
OPERATING PRESSURE OF ASSOCIATED EQUIP	0			
RELIEVING PRESSURE PSIG	14.5			
BACK PRESSURE PSIG				
DIFFERENTIAL OPERATIONS SET PRESSURE PSI	14.5			
FLOW TEMPERATURE °F	70°F			
MW OR SG AT FLOW TEMP	.85			
DESIGN OR MAX FLOW GPH	300			
GPM				
LB/HR				
BASIS OF SELECTION	IN FLOW			
VESSEL AREA EXP SEC TO FIRE	—			
COMMODITY	DIESEL OIL			
OVER PRESSURE	25%			
SPECIAL CONSTRUCTION & NOTES				
LOCATION	RELIEF CRANE PEDESTAL TANK #1	RELIEF CRANE PEDESTAL TANK #2		
UNIT OR VESSEL NO				
PLANT NO				
PURCHASE ORDER NO				

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LAH LSH L1 - 156 △		LAH LSH L1 - 157 △	LAL LAH - 158 △		LC-159
MAKE OR APPROVED EQUAL		VAREC			MAGNETROL		
TYPE		2500			A-153F		
MODEL		B			TANDEM		
MOUNTING					4"-150# R.F.		
INDICATING OR RECORDING		IND.			—		
INTERFACE OR LEVEL		LEVEL			LEVEL		
COMMODITY		DIESEL OIL			DIESEL OIL		
SPECIFIC GRAVITY AT 60°		.85			.85		
OPERATING PRESS.	TEMP	0	70°F		0	70°F	
MINIMUM DESIGN PRESS.	TEMP	50	100°F		50	100°F	
BODY MATERIAL		ALUM.		SAME AS 156	STL.		
CONNECTIONS		MFGR. STD.			4"-150# R.F.		
FINS REQUIRED		—			—		
FLOAT MATERIAL	SIZE	MATERIALS			3"x11" 3"x6"	S.S.	
PILOT-RIGHT OR LEFT HAND		TO BE STD.					
THROTTLING RANGE		AS SHOWN					
AUTOMATIC RESET		IN VAREC					
AIR FILTER & REDUCER		CATALOG					
MANUAL CONTROL BYPASS							
CHART NO	SIZE	FURNISH WITH					
CHART DRIVE	REVOLUTIONS	FIG. 2557					
AS LEVEL RISES CONTROL PRESSURE		PROGRAMMER			LAL - CLOSE LAH - OPEN		CLOSE OPEN
SPECIAL CONSTRUCTION & NOTES		& 3 SPDT SWITCHES			TWO SPDT SWITCHES CLASS I, DIV. 1		TWO SPDT SWITCHES CLASS I, DIV
OPERATES WITH		LCV-156		LCV-157	GROUP D EXPL. PROOF		GROUP D EXPL. PROO
SERVICE		CRANE PEDESTAL DIESEL TANK #1		CRANE PEDESTAL DIESEL TANK #2	DIESEL DAY TANK TURB. GEN.		STARTS & STOPS DIESEL PUM
VESSEL NO							
PLANT NO							
PURCHASE ORDER NO							

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING COMPANY JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LC-160 △		△		△		
MAKE OR APPROVED EQUAL		FISHER						
TYPE		2900						
MODEL		244 V						
MOUNTING		FLG'D						
INDICATING OR RECORDING		IND.						
INTERFACE OR LEVEL		LEVEL						
COMMODITY		DIESEL OIL						
SPECIFIC GRAVITY AT 60°		.85						
OPERATING PRESS.	TEMP	0	70°					
MINIMUM DESIGN PRESS.	TEMP	50	100°F					
BODY MATERIAL		STL.						
CONNECTIONS		4"-150# R.F.						
FINS REQUIRED		—						
FLOAT MATERIAL	SIZE	PLASTIC	2¾"x8"					
PILOT-RIGHT OR LEFT HAND		—						
THROTTLING RANGE		—						
AUTOMATIC RESET		—						
AIR FILTER & REDUCER		YES						
MANUAL CONTROL BYPASS								
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE		DECREASES						
SPECIAL CONSTRUCTION & NOTES		SNAP ACTING 3-15 PSI OUT.						
OPERATES WITH								
SERVICE		HIGH LEVEL CUT OFF DIESEL DAY TANK TURBINE GENERATOR						
VESSEL NO								
PLANT NO								
PURCHASE ORDER NO								

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HUMBLE OIL & REFINING CO.

JOB NO. 10-084

	LCV-160	LCV-156	LCV-157	
	FISHER 125 P 2" FLG STL. 150# R.F. S.S. 1" TAPER SIZE 4 ___ ___ ___ ___ ___ ___	USE 3" STL. FLANGED 150# R.F. BALL VALVE WITH SPRING TO CLOSE BETTIS OPERATOR AIR FAILURE CLOSES 100 PSI AIR AVAILABLE FURNISH, MOUNT & PIPE ASCO	SAME AS LCV-156	
	DIESEL OIL 70° F 10 0 .85 20 CLOSES	EXPL. PROOF 3 WAY SOL'N VALVE 115 V 60 ~ EXPL. PROOF TO OPEN VALVE ON DE-ENERGIZATION PIPE WITH 304 S.S. TUBING & FITTINGS		
	LC-160 OIL SHUTOFF TO DIESEL DAY TANK, TURBINE GENERATOR	LAH LSH 156 LI DIESEL TO #1 STORAGE TANK SHUT-OFF	LAH LSH 157 LI DIESEL TO #2 STORAGE TANK SHUT-OFF	

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SANTA FE SPRINGS CALIFORNIA

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SPECIFICATION PRESSURE INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	PI-353 △	PI-354 △	△	△	
MAKE OR APPROVED EQUAL	WIKA	SAME AS PI-353			
TYPE	PRESS. GA.				
MODEL	233				
MOUNTING LOCATION	½"MPT BOTTOM				
INDICATING OR RECORDING	—				
NORMAL PRESSURE & TEMP	35 70°				
PRESSURE ELEMENT RANGE	0-60				
PRESSURE ELEMENT TYPE AND MATERIAL	316 SS BOUR.				
SEC RED SUPPRESSION					
THROTTLING RANGE					
AUTOMATIC RESET					
RATE ACTION	4" DIAL SIZE				
AIR FILTER & REDUCER					
MANUAL CONTROL BYPASS					
CHART SIZE NO					
CHART DRIVE REVOLUTION					
INDICATING SCALE RANGE					
AS PRESSURE INCREASES OUTPUT SIGNAL					
LOCATION OF PRESSURE TAP					
PULSATION DAMPENER					
SPECIAL CONSTRUCTION & NOTES	GLYCERIN FILLED				
OPERATES WITH SERVICE	DIESEL PUMP P-101A	DIESEL PUMP P-101B			
PLANT NO					
PURCHASE ORDER NO					

DATE

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ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

REV

SPECIFICATION LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO	LI-LAH-LSH- 1004 △	LI-LAH- 1005 △	△	△
MAKE OR APPROVED EQUAL	VAREC	SAME AS 1004		
TYPE	2500			
MODEL	B			
MOUNTING				
INDICATING OR RECORDING	INDICATING			
INTERFACE OR LEVEL	LEVEL			
COMMODITY	CRUDE OIL			
SPECIFIC GRAVITY AT 60°	.80 TO .95			
OPERATING PRESS. / TEMP	ATM /			
MINIMUM DESIGN PRESS. / TEMP				
BODY MATERIAL	ALUM.			
CONNECTIONS	MFG. STD.			
FINS REQUIRED				
FLOAT MATERIAL / SIZE				
PILOT-RIGHT OR LEFT HAND	MATERIAL TO BE STD. AS SHOWN IN VAREC CATALOG			
THROTTLING RANGE				
AUTOMATIC RESET				
AIR FILTER & REDUCER				
MANUAL CONTROL BYPASS				
CHART NO / SIZE				
CHART DRIVE / REVOLUTIONS				
AS LEVEL RISES CONTROL PRESSURE				
SPECIAL CONSTRUCTION & NOTES	FURNISH WITH FIG. 2557 PROGRAMMER ~~& 3 SPDT~~ SWITCHES			
OPERATES WITH				
SERVICE	T-22 EMERGENCY TANK (CRUDE)	T-22 EMERGENCY TANK (DIESEL)		
VESSEL NO				
PLANT NO				
PURCHASE ORDER NO				

BY DATE

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15.0 POTABLE WATER SYSTEM

Humble Job 10240
H-B Job 10-084

Specification T-2

ATMOSPHERIC PRESSURE SURGE TANKS

T21 Potable Water Tank
T22 Diesel Storage and Emergency Surge Tank
T-2 Produced Water Surge Tank

1.0 GENERAL:

This specification applies to the design and construction of the above tanks. The tanks are to be used on a Humble Oil and Refining Company Offshore Platform near Santa Barbara, California. The tanks are to be all welded construction. Welding and fabrication details are to comply with API Standard 650. Ladders, platforms and handrails to comply with State of California and Federal Safety Regulations.

2.0 CONSTRUCTION:

T2 tank shall comply with API 650. Tanks T-21 and T-22 shall comply with API 650 welding and fabrication details. Tanks shall be as shown on Drawings 084-145, 084-146 and 084-143.

The tanks are to be furnished completely assembled f.o.b. trucks or barges at the jobsite specified on the Humble Request for Quotation. All exterior and interior seams shall be continuously sealed to provide for proper application of the protective coatings to protect against rusting corrosion and contamination. Each tank shall be tested by filling with water prior to shipment.

3.0 PROTECTIVE COATINGS:

All tank external surfaces including ladders and other appurtenances shall be coated in accordance with the attached Specfication 10-084-C2.

All internal surfaces of tanks T-2 and T-22 shall be coated internally in accordance with Specification 10-084C1. All internal surfaces of tank T-21 shall be coated in accordance with Specification 10-084-C2.

4.0 DRAWINGS:

Supplier shall submit 3 copies of shop drawings for approval prior to starting fabrication. Purchaser reserves the right to change nozzle and appurtenance orientation and location until approval of these drawings.

5.0 GUARANTEE

Supplier shall guarantee the equipment furnished to be free of defects in material and workmanship for 12 months after delivery date. Defects or defeciencies not meeting these specifications are to be corrected at the suppliers expense.

SPECIFICATION

POTABLE WATER PUMP

P-22

1.0 GENERAL

This specification applies to the purchase of one potable water pump for use on an offshore platform near Santa Barbara. The pump is located in a hazardous location classified as Division 1 Group D. The external parts are exposed to wet salt air atmosphere. The pump is used to pump potable water from a storage tank to supply the potable water system.

2.0 DESIGN AND CONSTRUCTION

The pump shall deliver 40 gpm water at 60°F and 50 psig (120 feet head). The motor shall be explosion proof, Class 1, Group D with UL label. The power is 440V, 60 Hz, 3 phase. The motor shall be 5 horsepower at 3500 RPM. The unit shall be a Goulds Vertical Centrifugal Process Pump 3171-PR Group S. The materials shall be as listed for all bronze in Goulds catalog except the steady bearing to be cutless rubber. The tank depth is 8'-6". The pump suction shall clear the bottom of the tank by 6" making the length from mounting plate to bottom of the pump 8'-6". The mounting plate shall be 8'-0" made to fit a 26", 75 pound flange (Tube Turn Part No. 705).

Motor frame and mounting plate of the unit to be coated in accordance with Specification 10-084-C2.

3.0 TECHNICAL DATA

Bidders shall submit 3 copies of the following with their quotation:

(1) Head-capacity curves showing efficiency, horsepower and NPSH
(2) Cross-sectional drawings showing all materials of construction.
(3) Dimensional outline drawings.
(4) Manufacturer catalog number and description of motor, coupling, lubrication equipment and all other accessory items.
(5) Pump data sheet.

Suppliers shall furnish 6 copies of the same final certified data plus operating, installation and maintenance instructions complete with detail parts list.

4.0 SHIPMENT

Supplier shall package and be responsible for safe arrival of the pumping units at the destination specified in the Humble Request for Quotation.

Humble Job 10240
H-B Job 10-084

Specification 10-084-PWPT

POTABLE WATER SUPPLY PRESSURE TANK

This specification applies to the purchase of one 526 gallon 36" X 120" vertical hydro-pneumatic tank complete with air seal, pressure switch and relief valve. The tank shall be ASME Code Section VIII construction and certified for 75 psig working pressure. The tank shall be as manufactured by National Steel Company with Coro-Clad protective coating internally and externally. The relief valve shall be Crosby Sage Series 400, 0.210 orifice, 304.s.s. body, set at 75 psig with Type C lifting lever. The pressure switch shall be Square D Class 9012-ACR-5 in NEMA 7 enclosure. Set switch to close at 35 psig and open at 50 psig. Mount and pipe valve and switch, ship as one assembly.

16.0 MISC. POLLUTION CONTROL

SPECIFICATION

PACKAGED SEWAGE TREATMENT UNIT

1.0 GENERAL:

This specification applies to the design, fabrication and purchase of one packaged, skid mounted, automatic sewage treatment unit to be installed in an outdoor, marine exposure on an offshore platform near Santa Barbara, California. The unit shall be suitable for use in a class 1, Division 1, Group "D" hazardous area. The unit shall be an Aquanox, Inc., model 402, or approved equal.

2.0 DESIGN BASIS

The unit shall be designed to process human body wastes, and the effluent from toilets and similar receptacles intended to receive or retain body wastes, for a maximum of fifty (50) persons. The unit shall utilize atmospheric air as the oxidizing agent in an accelerated aeration process, and shall not depend on bacterial action, chemicals or heat for the degradation of waste material. No odor shall be emitted from the unit. No sludge requiring removal shall be produced. The unit shall include provisions for chlorination of the clarified effluent, with a minimum rentention time of (15) fifteen minutes. The effluent from the unit shall meet the following requirements:

BIOCHEMICAL OXYGEN DEMAND (BOD), MAXIMUM ---------- 50 PPM
SUSPENDED SOLIDS, MAXIMUM----------150 PPM
CHLORINE RESIDUAL, MINIMUM----------1.0 mg/liter

3.0 MECHANICAL REQUIREMENTS

The unit shall be modular in layout, requiring minimum floor space, and shall be completely self-contained, with all components mounted on the skid and completely interconnected. Maximum horizontal dimensions shall be 5'-0"X10'-0". Component items shall be of dimensions permitting disassembly and removal through normal doors and hatches, without cutting any part. Feed to the unit, and effluent discharge will be by gravity flow. The unit shall be completely automatic in operation, and shall include all level controls and other devices required to start, stop and control pumps, comminutor, chlorinator and other functional components.

Materials of construction shall be selected for best resistance to the service conditions. Steel tanks and vessels shall be internally coated. All exposed exterior steel surfaces shall be coated in accordance with Specification 10-084-C2. Construction details shall be suitable for an outdoor, marine exposure subject to salt spray and splash.

4.0 ELECTRICAL REQUIREMENTS

Surge vessels shall have high level alarm switches, with SPDT or SPST N.C. output contacts rated 10 amps at 120 VAC. All controls shall be for 120 volt, single phase, 60 H_z power supply. All control devices and their output contacts shall be completely wired to a single terminal strip located in a watertight and explosion proof (NEMA 4,7,9) junction box mounted accessibly on the skid base. All wiring shall be #14 AWG or larger, type TW.

Integral horsepower motors shall be 480 volt, three phase, 60 H_z, explosion proof, squirrel cage induction motors with epoxy encapsulated windings. Fractional horsepower motors shall be 120 volt, single phase, 60 H_z, explosion proof. All motors shall have cast iron junction boxes with threaded conduit connections. All couplings and exposed rotating parts shall be guarded in accordance with the State of California Industrial Safety Orders.

Entire electrical installation shall meet the requirements of the NEC and State of California Electrical Safety Orders for an outdoor, Class 1, Division 1, Group "D" hazardous location. All items shall have U.L. approval labels, if available.

5.0 APPROVAL REQUIRED

Bidder shall affirm that his proposed unit is approved for the intended service by the U. S. Department of the Interior, Geological Survey, Conservation Division, Branch of Oil and Gas Operations, Pacific Region, under the requirements of their OCS Order No. 8. Before a purchase order is issued, supplier shall submit proof of such approval.

6.0 INFORMATION REQUIRED

6.1 Bidders shall submit three (3) copies of each of the following with their proposals:

(a) Preliminary outline dimensional drawing, with all components identified and shown in functional clarity.

(b) Complete data sheet for unit, giving rated capacity, guaranteed effluent quality, and complete description of all pumps, motors, controls and auxiliary equipment.

6.2 Supplier shall submit six (6) copies of each of the following within two (2) weeks of date of order:

(a) Fully dimensioned fabrication drawings, certified to be correct for construction, and showing structural details of skid base, mounting details of equipment, pipe and connection sizes, etc.

(b) Complete catalog information for all pumps, motors, controls and auxiliary equipment.

(c) Complete instructions for installation, operation and maintenance.

(d) Complete parts lists for all items.

7.0 SHIPMENT

Supplier shall be responsible for the packaging, shipment and safe arrival of the unit at the destination stated in Humble's request for quotation. All shipping containers shall be piece-marked and labeled "Sewage Treatment Unit".

8.0 GUARANTEE

Supplier and manufacturer shall guarantee the unit to meet all requirements of this specification and to be free of defects in material and workmanship for 12 months after the delivery date.. Defects or deficiencies shall be corrected at no additional cost to the purchaser.

16.2 VAPOR RECOVERY

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS CALIFORNIA

SHEET ___ OF ___

SPECIFICATION

RELIEF VALVES

REV

CUSTOMER HUMBLE OIL & REFINING CO.

JOB NO 10-084

PLANT LOCATION

IDENTIFICATION TAG NO			PSV-28 △		△	△ △
MAKE OR APPROVED EQUAL			CROSBY			
TYPE			JB-25			
MODEL			2J3			
BODY MATERIAL			STL			
PIPE SIZE	IN	OUT	2"	3"		
CONNECTIONS	IN	OUT	150# R.F.	150# R.F.		
TRIM MATERIAL	SPRING		SS	CS		
LIFTING GEAR	GAG		NO	NO		
CALCULATED ORIFICE AREA	SQ IN		0.91			
SELECTED ORIFICE AREA & LETTER			1.287	J		
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG			35			
OPERATING PRESSURE OF ASSOCIATED EQUIP			5			
RELIEVING PRESSURE PSIG			35			
BACK PRESSURE PSIG			0			
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			35			
FLOW TEMPERATURE F			100°F			
MW OR S G AT FLOW TEMP			MW = 25			
DESIGN CAPACITY MAX	GPM					
	SCFH					
	# HR		3000			
BASIS OF SELECTION			GAS INPUT			
VESSEL AREA EXPOSED TO FIRE						
COMMODITY			SOUR GAS			
OVER PRESSURE						
SPECIAL CONSTRUCTION & NOTES			COAT ALL WETTED PARTS PER. SPEC. 10-084-C1			
			REPRESS. GAS VAPOR RECOVERY SYSTEM			
LINE OR VESSEL NO						
PLAN NO						
RELEASE DRAWING						

BY DATE

DATE

BY

CHECKED

ENGINEER

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THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL BE ASSEMBLED AT

HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS, CALIFORNIA

SHEET ___ OF ___

SPECIFICATION — CONTROL VALVES — 084-PST-J1 — REV.

CUSTOMER HUMBLE OIL & REFINING CO. — JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		PCV 360 △		PCV 361 △		PCV 330 △		△
MAKE OR APPROVED EQUAL		VAREC		VAREC		FISHER		
TYPE		VAC. LINE		REPRESS.		PRESS. RED.		
MODEL		FIG. 180		FIG. 181		655 A		
SIZE	TYPE CONNECTIONS	2"	FLG'D.	2"	FLG'D.	1"	SCR.	
BODY MATERIAL	RATING	ALUM.	50#	ALUM.	50#	STL.	300#	
INNER VALVE TRIM MAT'L		18-8 S.S.		18-8 S.S.		SS		
INNER VALVE SIZE	TYPE	—	—	—	—	1"	Q0	
TOP WORKS		STD.		STD.		STD.		
FINS		—		—		—		
POSITIONER	BOOSTER RELAY	—	—	—	—	—		
POSITIONER BYPASS	W/GAGES	—	—	—	—	—		
AIR FILTER & REDUCER		—		—		—		
COMMODITY						SOUR GAS.		
FLOW TEMPERATURE °F						110°F		
PRESSURE, PSIG	IN / OUT	0	-3	5	0	85	5	
SPEC GRAVITY H_2O 1.0	@ 60°F / @ FLOW TEMP					.80	110°F	
SPEC GRAVITY @ 60° AIR 1.0	@ 60°F / @ FLOW TEMP	0.80		0.80				
GPM @ 60	NORM FLOW / MAX CAP					5-15 RED.	PSIG PRESS.	
SCF HR	NORM FLOW / MAX CAP							
# HR	NORM FLOW / MAX CAP		700		700		1000	
VALVE POSITION ON AIR FAILURE		SET TO START OPENING AT +1/10" H_2O WITH FULL OPENING AT + 5/10" H_2O		SET TO START OPENING AT -1/10" H_2O WITH FULL OPENING AT - 5/10" H_2O				
Cv						CALC. 130 ACT. 388		
SPECIAL CONSTRUCTION & NOTES						COAT ALL WETTED PARTS PER 10-084-C1.		
OPERATES WITH								
SERVICE		VAPOR RECOVERY MISC. TANKS		VAPOR REPRESS. MISC. TANKS		REPRESS. GAS TO VAPOR RECOVERY SYSTEM		
LINE NO								
PLANT NO								
PURCHASE ORDER NO.								

DATE

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16.3 EMERGENCY OIL SURGE

Humble Job 10240
H-B Job 10-084

Specification T-2

ATMOSPHERIC PRESSURE SURGE TANKS

T21 Potable Water Tank
T22 Diesel Storage and Emergency Surge Tank
T-2 Produced Water Surge Tank

1.0 GENERAL:

This specification applies to the design and construction of the above tanks. The tanks are to be used on a Humble Oil and Refining Company Offshore Platform near Santa Barbara, California. The tanks are to be all welded construction. Welding and fabrication details are to comply with API Standard 650. Ladders, platforms and handrails to comply with State of California and Federal Safety Regulations.

2.0 CONSTRUCTION:

T2 tank shall comply with API 650. Tanks T-21 and T-22 shall comply with API 650 welding and fabrication details. Tanks shall be as shown on Drawings 084-145, 084-146 and 084-143.

The tanks are to be furnished completely assembled f.o.b. trucks or barges at the jobsite specified on the Humble Request for Quotation. All exterior and interior seams shall be continuously sealed to provide for proper application of the protective coatings to protect against rusting corrosion and contamination. Each tank shall be tested by filling with water prior to shipment.

3.0 PROTECTIVE COATINGS:

All tank external surfaces including ladders and other appurtenances shall be coated in accordance with the attached Specfication 10-084-C2.

All internal surfaces of tanks T-2 and T-22 shall be coated internally in accordance with Specification 10-084C1. All internal surfaces of tank T-21 shall be coated in accordance with Specification 10-084-C2.

4.0 DRAWINGS:

Supplier shall submit 3 copies of shop drawings for approval prior to starting fabrication. Purchaser reserves the right to change nozzle and appurtenance orientation and location until approval of these drawings.

5.0 GUARANTEE

Supplier shall guarantee the equipment furnished to be free of defects in material and workmanship for 12 months after delivery date. Defects or defeciencies not meeting these specifications are to be corrected at the suppliers expense.

HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

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SPECIFICATION

LIQUID LEVEL INSTRUMENTS

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO. 10-084

PLANT LOCATION

IDENTIFICATION TAG NO		LI-LAH-LSH-1004 △		LI-LAH-1005 △		△		△
MAKE OR APPROVED EQUAL		VAREC						
TYPE		2500						
MODEL		B						
MOUNTING								
INDICATING OR RECORDING		INDICATING						
INTERFACE OR LEVEL		LEVEL						
COMMODITY		CRUDE OIL						
SPECIFIC GRAVITY AT 60°		.80 TO .95						
OPERATING PRESS.	TEMP	ATM						
MINIMUM DESIGN PRESS.	TEMP							
BODY MATERIAL		ALUM.						
CONNECTIONS		MFG. STD.						
FINS REQUIRED								
FLOAT MATERIAL	SIZE							
PILOT-RIGHT OR LEFT HAND		MATERIAL						
THROTTLING RANGE		TO BE STD.						
AUTOMATIC RESET		AS SHOWN						
AIR FILTER & REDUCER		IN VAREC						
MANUAL CONTROL BYPASS		CATALOG						
CHART NO	SIZE							
CHART DRIVE	REVOLUTIONS							
AS LEVEL RISES CONTROL PRESSURE								
SPECIAL CONSTRUCTION & NOTES		FURNISH WITH FIG. 2557 PROGRAMMER & 3 SPDT SWITCHES						
OPERATES WITH								
SERVICE		T-22 EMERGENCY TANK (CRUDE)		T-22 EMERGENCY TANK (DIESEL)				
VESSEL NO								
PLANT NO								
PURCHASE ORDER NO								

SAME AS 1004

-V

BY DATE

APPROVED

DATE

BY

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HOBBS-BANNERMAN CORP.

SANTA FE SPRINGS · CALIFORNIA

SPECIFICATION

RELIEF VALVES

SHEET

CUSTOMER HUMBLE OIL & REFINING CO. JOB NO 10-9E

PLANT LOCATION

IDENTIFICATION TAG NO			PSV-1001 △	PSV-1002 △	PSV-1003 △
MAKE OR APPROVED EQUAL			VAREC	SAME AS PSV-1001	SAME AS PSV-1001
TYPE					
MODEL			* FIG. 2000		
BODY MATERIAL			ALUM.		
PIPE SIZE	IN	OUT	4"	4"	
CONNECTIONS	IN	OUT	FLG. 125#	FLG. 125#	
TRIM MATERIAL	SPRING		STD.		
LIFTING GEAR	GAG		—		
CALCULATED ORIFICE AREA SQ IN			—		
SELECTED ORIFICE AREA & LETTER			—	—	
DESIGN PRESSURE OF ASSOCIATED EQUIP PSIG			3 oz.		
OPERATING PRESSURE OF ASSOCIATED EQUIP			ATM.		
RELIEVING PRESSURE PSIG			3 oz.		
BACK PRESSURE PSIG			1 oz.		
DIFFERENTIAL OR FACTORY SET PRESSURE PSI			** 2 oz.		
FLOW TEMPERATURE °F			100° F		
MW OR S.G. AT FLOW TEMP			.85		
DESIGN CAPACITY MAX	GPM		10,000		
	SCFH				
	#/HR				
BASIS OF SELECTION					
VESSEL AREA EXPOSED TO FIRE					
COMMODITY					
% OVER PRESSURE					
SPECIAL CONSTRUCTION & NOTES			** VACUUM SETTING IS 1/2 OZ.	* FURNISH WITH PIPED OUTLET	
SERVICE			T2 WATER SURGE TANK	T-22 EMERGENCY SURGE TANK	T-22 EMERGENCY SURGE TANK
LINE OR VESSEL NO					
PLANT NO.					
PURCHASE ORDER NO					

DATE

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17.0 MISC. AUXILIARY FACILITIES

SPECIFICATIONS FOR OFFSHORE LIVING QUARTERS

1.0 GENERAL

These specifications and the drawings and specifications herein are for the purpose of obtaining proposals and purchasing living quarters for an offshore platform near Santa Barbara, California. The purpose of this specification is also to:

1. Describe generally the marine type offshore living quarters and to indicate the character of workmanship to be performed

2. Give sufficient dimensions, sections and relative locations of various structural members, floor levels, column centers and offsets, with sufficient dimensions to convey adequately the type of structure intended.

3. To describe generally the outfitting equipment and furnishings to be supplied to provide an offshore living quarters complete and ready for occupancy.

4. And to indicate the type and quality of construction materials and equipment to be furnished. However, construction materials and equipment of equal or better quality may be substituted, subject to owner's approval, where noted "or equal". Top quality, new, unused materials, in good condition shall be used throughout and no materials of foreign manufacture will be used as substitutions.

2.0 GENERAL DESIGN

This quarters building shall be a two story structure designed to accommodate 50 men. Drawings 084-403 and 084-404 show suggested layout and should be used as a guide to the requirements.

The quarters building design shall provide structural requirements for withstanding a 30 pound per square foot horizontal wind loading.

The building will also be designed to meet the structural requirements of a 5700 pound per square foot concentrated load on any one square foot of the building's heliport deck area. (75% of maximum gross wt. of Sikorsky S-62 Helicopter). Ref. Sikorsky bulletin SM-115 "Technical Aspects of Heliport Design".

The building shall conform to the Uniform Building Code and comply with the laws of the State of California. The structural design for offshore living quarters shall be in full accordance with AISC Code of Standard Practice for Steel Buildings. This building shall meet all applicable U.S. CoastGuard requirements. Where conflicts occur, the more conservative design shall be used.

The heliport shall conform to all Federal Aviation Agency regulations and shall be designed in accordance with FAA advisory circular "Heliport Design Guide AC/150/5390, latest edition.

3.0 GENERAL LAYOUT

Quarters building shall be 42' X 42' with exterior access walkways, stairways and landings as shown on reference drawing. The shipment shall be made with all items in one structure fully assembled. Quarters shall contain a galley, dining room, two 3-man bedrooms, two superintendent rooms with connecting bath, one utility room, public rest room and janitor stores room on first floor and shall contain 7 six-man rooms, two wash room with toilet and shower facilities and linen storage space on the second floor.

The roof of the second story shall form a 60' X 60' heliport, fitted with suitable safety net, lighting, exterior access stairway and escape ladder located opposite stairway.

The quarters building shall be mounted on a structural steel base so designed as to rigidly support the building when skidding or lifting from the four "pick-up" columns attached to the base. The base shall further be designed to support the cantilevered portion of the building, as shown on the reference drawings. Suitable lifting pads shall be installed on "pick-up" columns and access through helicopter deck to same will be provided.

The utility room on the first floor shall contain potable water supply equipment, hot water heaters, air conditioning machinery, electrical transformers, and refrigeration compressors.

4.0 CONSTRUCTION SPECIFICATIONS

A. Exterior Walls

All exterior walls shall be of 3/16" steel plate adequately supported over steel framing so as to form a smooth continuous exterior surface. All plating forming exterior walls shall be butt welded continuous and shall be shrunk where necessary to provide a fair surface.

B. Insulation

All exterior walls and roof of air conditioned spaces shall be insulated with 2" of marine grade fiberglass insulation, 4.4 lbs/cu. ft. density.

All cold water piping and drain piping, located in overhead spaces or in walls within the air conditioned space, shall be adequately insulated to prevent condensate damage to sheathing or adjacent materials.

All chilled water piping of air conditioning system, located in walls or overhead spaces, shall be insulated as specified in Section VII, Air Conditioning and Heating.

C. Interior Walls

All interior walls except the kitchen and dining room enclosure wall shall be sheather with 5/16" Duraply plywood. The kitchen-dining wall

enclosure shall be constructed so that one face of the wall shall be of 3/16" steel sheet. The doors in this wall shall be of one hour fire rating. Duraply shall be installed in standard size sheets, 4'-0" X 8'-0" or 4'-0" X 10'-0" and the 4'-0" dimension shall extend in a horizontal direction with the length of the sheets extending from floor to ceiling. A suitable base shall be supplied all around walls. All wood nailers, screeds, blocking, etc., shall be "Penta" treated southern yellow pine or Douglas Fir, No. 1 grade or better. Wood nailers shall be firmly attached to the supporting steel with galvanized machine bolts, ram sets or stud weld bolts. All nails to be hot dip galvanized.

D. Floors and Floor Coverings

First floor sub floor shall be of 3/16" steel plate with inverted angle stiffeners top side to give smooth underside for minimum exterior maintenance. The steel deck shall be covered with 1" thick, Dow Chemical Type #33 styrofoam. Dow Chemical styrocrete shall be placed over styrofoam, grouted and troweled smooth and level above the top of flanges of angle stiffeners (see reference drawing details). Styrocrete shall be mixed and applied in accordance with manufacturer's recommendations. Armstrong Excelon Vinyl Asbestos floor tile, Dark Woodtone #789 or equivalent shall be laid over styrocrete in dining area, offices, passageways and janitors storage room. Armstrong Excelon Vinyl Asbestos floor tile, Light Woodtone #788 or equivalent shall be laid over styrocrete in superintendents' bedrooms. Armstrong S-700 adhesive or equivalent shall be used to lay vinyl tile. The galley and pantry floor shall be of smooth trowel finish Styrocrete, with two coats of Humble Epoxy Finish Gray 671. The utility room floor shall be of checkered plate, sandblasted, and painted with (1) prime coat #270 and (1) finish coat #571.

Unglazed ceramic tile, Random Block, Light Golden Oak, U.S.Tile Co. #5026 or equal shall be laid over styrocrete in superintendents' bath and public bath. A 4" ceramic tile base shall be installed all around walls and shower stalls.

Second floor shall be 3/16" steel plate over angle stiffeners. All plating shall be shrunk and faired to give smooth level surface.

Armstrong Excelon Vinyl Asbestos floor tile, Dark Woodtone #789, or equal, shall be laid over steel passageways and linen closet. Vinyl tile, Light Woodtone #788 or equal will be laid in all crews' bedrooms. Armstrong S-700 adhesive or equal shall be used to lay vinyl tile. All vinyl tile shall be laid in accordance with manufacturer's recommendations.

A styrocrete underlay and unglazed ceramic tile, Random Block, Light Golden Oak, U.S.Tile Co. #5026 or equal shall form the floor cover

in the wash room on the second floor. The total thickness shall not be less than 1-½" and shall have a gradual slope to a centrally located drain in wash room space. A 4" ceramic tile base shall be installed all around the walls. A riser or threshold of ceramic tile shall be constructed across the doors from the washroom to the passageways to prevent accumulated water from running into the passageways.

E. Ceilings

The ceilings of all spaces shall be acoustical tile erected on a 2' X 2' inverted tee grid metal suspension system of cold rolled zinc bond steel in baked white enamel finish. Acoustical tile shall be Acousti-Celotex, 12" X 12" X 1/2" in "Random Perforation" pattern, with kerfed edges. Acoustical tile to be supported in 2' X 2' exposed grid, with both 2' concealed metal tees and 1' concealed flat metal splines.

F. Helicopter Deck

The second story roof of the quarters building shall be structurally designed to serve as a heliport. The heliport shall be 60' X 60' and shall be constructed of 1/4" steel plate, butt welded and supported by suitable framing. A 4' wide 9 gage galvanized chain link fence, supported by a galvanized pipe frame, shall be constructed horizontally all around the heliport deck area as a safety net. The safety net across the front side of the building shall be hinged to allow it to be folded.

A flush deck hatch and an emergency escape ladder shall be provided at a location opposite the access stairway.

The periphery of the heliport shall be suitably lighted using 100 watt, exterior, vertically mounted vapor tight fixtures, equipped with blue globes and spaced at approximately 15 foot intervals. Fixtures are to be mounted so that blue globes extend approximately 2" above heliport deck elevation.

G. Exterior Walkways, Landings, Stairways & Handrails

Exterior walkways and landings are to be provided at locations shown on reference drawings. All landings and walkways are to be adequately supported by building structure to accommodate a 100 pound per square foot, uniformly distributed, live load.

Exterior inclined steel stairways are to be provided as shown on reference drawings to afford access between first floor and second floor and between second floor and helicopter deck.

All exterior walkways, landings and stairways are to be fitted with welded pipe handrails. Handrails are to be three tier type and are to be installed in full compliance with Uniform Building Code, U.S. Coast Guard and AISC requirements.

H. Doors, Windows and Blinds

All exterior doors shall be 3'-0" X 7'-0" hollow metal, full flush type with wire glass panel in upper section, "Fenestra" Model 3070-G or equivalent. Seven exterior doors will be required. Exterior doors shall be hung in steel frame with aluminum threshold suitable for installation in steel building. All exterior doors shall be fitted with a door closer and cylinder lock, - all to be keyed alike. All exterior doors are to be fitted with bronze hinges and all bronze hardware. All exterior doors to be weatherstripped.

All interior doors shall be 1'3/8", hollow core, exterior grade, birch doors. All interior doors, with the exception of doors to linen closet, janitors storage space, pantry, superintendents' bath and second floor washroom shall be sliding type with suitable hardware and mounted to recess within interior partitions. The second floor washroom doors shall be fitted with door closers. All interior doors shall be fitted with 8" X 24" louvered panels at bottom. Louvered panels to be so installed as to serve as kick-out panels to afford means of emergency exit. Doors to linen closet, janitors storage space and pantry shall be equipped with brass or bronze hardware and fitted with locks, - keyed differently.

On all interior doors, an identification plate shall be attached at approximately eye level indicating what space it serves, except for the 7 6-man bedroom spaces on the second deck and the 2 3-man bedrooms on the first deck, which shall be numbered. The plates shall be of black and white Formica with lettering not less than 1" high.

Shower stalls shall be fitted with suitable metal framed opaque plastic doors.

All water closet compartments shall be fitted with suitable doors. (3/4" Duraply with chrome plated spring hinges and latches.)

The windows shall be plate glass of 1/4" minimum thickness designed for the wind load specified. One mullion for the larger window will be allowed and none for the smaller window. The sash shall be type 304 (or equal) stainless steel.

Venetian blinds shall be provided for all windows and exterior doors. Blinds are surface mounted to fit window jambs, with slats of flexible aluminum alloy with baked enamel finish, nylon cord equalizers, pulleys and plastic tapes.

I. Built-In Cabinets

The base cabinets and the cabinets over the sinks and counter in the galley are to be constructed of 3/4" Duraply plywood and fitted with swinging doors, equipped with chrome plated cabinet hardware. Door catches will be provided on all cabinets. All raw edges shall be concealed with suitable metal joiner strips.

J. Exterior Welding

All spaces between exterior intermittent welding shall be sealed with Humble Weld 900 before painting, or seal welded at contractor's option.

5.0 ELECTRICAL SPECIFICATIONS

All electrical work shall comply with State of California Title 24 and the National Electric Code. Where conflicts occur the more conservative equipment shall be used. The area is classified as non-hazardous.

Electrical power supply for the offshore quarters building and supporting equipment will be provided by others. The power will be 480 V, 3 phase, 60 cycle. A 3 phase, 60 cycle, 480-120/208 V Delta-Wye, grounded neutral power transformer, supplied by contractor and located in the utility room, will be provided for secondary equipment.

The contractor will furnish and install 2-½" conduit from the front side of the building to a 440 volt distribution panel with a main disconnect breaker, located in the utility room. This panel is to have branch circuit breakers for central air conditioning equipment, for galley range and other 440 volt equipment, and for protection of the primary side of the power transformer. The transformer secondary will be connected to a 120/208 volt panel, which will supply all requirements for the quarters building, including washer, dryer, hot water heaters, pressure water sets, refrigeration compressors, etc. Air conditioning machinery in the utility room and the galley range shall be fed directly from the 440 volt panel.

The entire quarters building shall be wired from entrance panel to distribution panels required to provide circuits for lighting fixtures, receptacles and all other equipment requiring electrical power. Proper load distribution and phase balance shall determine the size and number of breakers in various panels. All power and lighting panels shall be of the circuit breaker type. The quarters electrical system, with the exception of the galley range and air conditioning machinery shall be 120/208 V, 3 phase, 4 wire, grounded neutral, 60 cycle system.

All electrical conductors are to be sized for 125% of maximum demand capacity. The minimum size wire for power and lighting shall not be less than #12 AWG.

Interior wiring may be Romex or equivalent and shall be concealed in walls and ceiling wherever possible.

All exterior wiring, such as helicopter deck lighting circuits and all cable runs which are all or partly in the utility room, shall be bronze or aluminum armored marine cable.

All interior electrical cables shall be sufficiently secured in wire ways or by brackets or clips and all cables are to be protected from chafing on sharp edges of steel structure by acceptable methods. Chafing tubes will be provided wherever electrical cable penetrates steel structural members.

All interior ceiling fixtures and bathroom lights are to be fluorescent type, Each berth shall be supplied with a wall mounted, spun aluminum, swivel type incandescent lamp, with switch and single convenience receptacle (EJS #950-C or equivalent).

In addition to receptacles required for appliance service, several duplex receptacles will be located throughout the building. For quantity and complete description of interior lighting fixtures, receptacles, switches, external flood lights, helicopter deck lighting fixtures, etc., refer to accompanying reference drawing.

Bathroom mirror fixtures are to have convenience receptacles. All bathroom fixtures are to be equipped with deluxe warm white lamps; all other fluorescent fixtures shall be equipped with deluxe cool white lamps.

All receptacles will be located 24" above the floor.

Lighting branch circuits shall be limited to a maximum connected load of 880 watts and shall be protected by circuit breakers rated at 15 amperes. This limitation will apply also for circuits serving general use receptacles, except in galley, where a 20 ampere receptacle circuit is to be provided. Any appliance, whether portable or fixed, rated in excess of 880 watts is to be on a separate circuit, and circuits serving more than one smaller appliance shall be limited to 880 watts of connected load.

There shall be no open splices in any of the wiring. All interior fixtures, switches and receptacles shall utilize galvanized steel connection boxes, fitted with wall plates or fixture canopies as applicable.

Each panel is to be provided with spare spaces only for future addition of circuit breakers. The number of spare breaker pole spaces available is to be a minimum of 15% of the breaker poles actually installed. Panel feeders shall be sized to allow for future use of the spare breaker spaces. Panels are to be flush mounted, with doors equipped with locks, - all keyed alike.

6.0 PLUMBING SPECIFICATIONS

An automatic cold potable water pressure system is furnished by others on the platform. The system will deliver 40 gallons per minute at pressures from 25 to 40 psig at the mid deck elevation. The quarters shall provide for a single connection to the supply.

A separate independent sanitary system, identical to the one described above, connecting water closets and urinals shall be provided as shown on accompanying drawings.

A drain and sewage piping system with sufficient traps and vent lines as shown in reference drawings shall be installed to serve this system.

(2) 100 gallon capacity, electric, double 4500 watt elements, glass lined water heaters will be furnished to supply hot water for the potable water system. Heaters will be arranged for 208 V operation. Each hot water heater shall be fitted with a relief valve and mixing valve.

All piping and fittings shall be galvanized schedule 40, sized to meet UPC practice, using brass or bronze valves.

7.0 AIR CONDITIONING AND HEATING SPECIFICATIONS

The intent of this section is to specify the requirements for seasonal comfort and ventilation in the living quarters in accordance with the following details.

A. Type of System

A system of insulated piping will circulate chilled water throughout for summer time cooling, and hot water for winter time heating.

Chilled water will be supplied to the system at a specified temperature by a packaged chiller unit. The refrigerant (F22) condenser will be air cooled. Hot water of the specified temperature will be supplied by an electric water heater unit. One common electric motor driven centrifugal pump will serve for both seasons' operation, supplying cold water during the cooling cycle and hot water during the heating cycle.

All equipment will be electric motor operated. Motors of 1 HP and larger will operate on 440 volt, 3 phase, 60 cycle service. All air handling units, controls and wash room ventilators will operate on 110 volt, single phase service. Bath room heaters will operate on 208 volts, single phase service.

The entire system to operate under full automatic control during the heating and cooling periods of operation, including safety protection against all possible operational hazards.

On the lower living quarter level, all bedrooms, dining area and offices will have both cooling and heating. The bathrooms will have heating only. A constant supply of outdoor air will be delivered to this level at the design temperature.

On the top living quarters level, all bedrooms and offices will have cooling and heating. The wash room will have heating only and ventilation. A constant supply of outdoor air will be delivered to this level at design temperature.

B. Design Conditions

During all periods requiring cooling, the indoor design shall be 75°F dry bulb temperature and 55% relative hemidity when the outdoor temperature is 90°F dry bulb and 79° wet bulb or less.

During periods requiring heating, the indoor design shall be 70°F dry bulb when the outdoor temperature is 40°F or higher.

C. Equipment Selection

The following items of equipment shall be furnished, delivered, set in place and substantially secured and interconnected electrically and properly piped for water supply, return and drain. Chiller shall have a capacity of 19 tons, using a split circuit, chiller, two 10 ton Freon 22 compressors, and one 2HP recirculating centrifugal pump, all factory assembled and interconnected to provide a package water chiller for supplying 45 GPM of 40° water, and complete with motor starters, refrigerant gages, mufflers, expansion valves, solenoid valves, shut-off valves, temperature control and freeze-up protection, pressure relief, safety controls and two refrigerant receivers. Chiller and suction lines to be factory insulated.

Refrigerant condensor shall be air cooled dual circuit, with stainless steel fan, copper fin coil, fan motor and starter and limitrol for low ambient winter time operation, selected and sized for 15°F TD, based upon 95°F ambient temperature. The condenser and compressors to be interconnected using type L hard drawn copper tube and sweat type fittings using silver solder. Liquid lines to have strainers, driers, sight flow indicators, shut-off valves and refrigerant charging valve.

Hot water heater shall be Chromolox, circulator type, rated 75 KW and arranged for 440 volt, 3 phase, 60 cycle electric service in 3 equal steps, furnished complete with thermostat set to provide 180°F water at the rate of 45 GPM. Include moisture resistance terminal cover and magnetic contactors for each of the 3 operating steps.

Water recirculating centrifugal pump shall be single stage, end suction type direct coupled with flexible coupling to a 2 HP, 3500 RPM motor, to have a capacity of 45 GPM @ 70' head, with non-overloading impeller. Pump to be bronze fitted, assembled with the motor on a common cast iron base and mounted on chiller assembly.

Space cooling and heating units to be the size and located as noted on the drawing. Each unit to be operated and controlled by a Jackes Evans control kit, consisting of a 3-way valve, type 701, operated by a Penn cooling and heating thermostat #8722 Model 1016 and a Klixon change-over control.

Electric heat for the bathrooms shall be Arvin Model 300E, or equivalent wall type heaters, complete with switch and thermostat, rated capacity 1500 watts.

Starters for all 440/3/60 motors shall be magnetic across the line type as required by Governing Electrical Code.

Furnish, install and connect an expansion tank, suspended from ceiling or equipment area and arranged to receive the return water from the cooling and heating system. Tank to be 18" diameter X 5' long heavy gage galvanized construction, fitted with fresh water make-up valved connection, overflow, sight glass, remote bulb thermometer and insulated with 4" thickness insulation, protected with a metal jacketed exterior.

Electric wiring and connections for power and controls shall be in accordance with electrical section of this general specification.

Cold water, hot water and condensate drain lines shall be type "M" hard drawn copper tube with 95/5 sweat soldered joints on all connections. Lines shall be sized and arranged as shown on drawing and shall have shut-off valves on all supply and return risers. Where each drain line enters the main drain header, provide a union, arranged for clean-out if necessitated. Provide a master filter in circulating lines with necessary piping for easy cleaning.

All copper lines shall test tight at 60# water test, then insulated completely between extreme points of connection, using Armstrong Cork Company's "Armflex" applied in accordance with the manufacturers recommendation.

When the entire installation has been completed, pressure tested and inspected, a test run of not less than 3 days shall be made on both the cooling and heating cycles and during these tests all temperature and safety controls must be adjusted, set and balanced in readiness for normal operation. Test runs shall be made in the presence of purchasers selected personnel.

8.0 PAINTING SPECIFICATIONS

All paint is to be supplied by contractor.

All exterior steel surfaces of the quarters building, such as walls, skid beams, underside and including all walkways, stairways and handrails, shall be sand-blasted to white metal and given a (4) coat system of Vinyl paint. The following schedule shall be followed.

(Humble Products)

First Coat	-	Vinyl primer red #521
Second Coat	-	Vinyl primer red #521 (tinted)
Third Coat	-	Vinyl body coat Gray #527
Fourth Coat	-	Vinyl finish gray #516

The heliport deck shall be sand-blasted to white metal and the following paint schedule applied.

(Humble Products)

First Coat - Humble Rust Ban #191
Second Coat - Epoxy #9664
Third Cost - Epoxy #674 with non-skid additive 86-111
Edging around hatches to be 250 black.

Interior wood walls and trim in bedrooms, offices, and passageways shall be given (1) prime coat #602 and (1) finish coat #9433 green. Trim to receive third coat of #9433. Wood walls and trim in other areas shall receive (1) prime coat #602 and (1) finish coat #650 gloss white. Steel walls and trim in bedrooms, offices, and passageways shall receive (1) prime coat #274, (1) coat #630, and (1) finish coat #9433. Steel walls and trim in other areas shall be given (1) prime coat #274, (1) coat #630 and (1) finish coat #650. Hidden steel shall be wire brushed and given (1) coat #274. All cabinet work and shelving shall be given (1) prime coat #602 and (1) coat #650. All interior doors to receive (3) coats varnish.

9.0 SAFETY EQUIPMENT

The following fire extinguishers are to be supplied and installed in the quarters building.

7 Elkart Model EA-SS, 2½ gallon, pressurized SS, U.S. Coast Guard approved fire extinguishers with brackets. (one extinguisher to be mounted near each exit, first and second floors).

5 Ansul, 20 lb. Model D, dry chemical fire extinguishers with mounting brackets shall be supplied. (One located in galley, one in each office, two in utility room)

A Kidde fire detection and general alarm system is to be supplied and installed as shown on reference drawing. Installation is to be made in accordance with manufacturer's recommendations.

1 MSA, 24 unit, type D, all weather first aid kit and 1 MSA spray kit shall be installed in the dining room.

1 U.S. Coast Guard approved emergency first aid kit (Davis Model X 173) shall be provided and installed in the dining room.

1 wall mounted blanket in container, MSA unit #10-53 shall be installed in the dining room.

10.0 OUTFITTING AND FURNISHINGS

A. Galley Equipment

1 - Electric, heavy duty marine range, Lang No. 60-2, or equivalent, suitable for operation on 440 V 3 phase, 60 cycle current, Finish - Hammerton Gray

1 - Exhaust hood for galley range, fabricated of 20 gage stainless steel, with backing extending down wall to range.

1 - Exhaust fan ILG Model RD-163 or equivalent with automatic shutter and guard for mounting in hood

1 - Intake blower fan, with automatic shutter for mounting in wall, ILG Model RD-163.

1 - Stainless steel cafeteria style steam table, equipped with tray, dish and utensil racks, recessed coffee urn rack with drain, 6 - 8" diameter stainless steel pans with covers. Heating element designed for operation on 208 V, 3 phase, 60 cycle current.

1 - Double compartment stainless steel sink, each compartment to be 18" X 24" X 14" deep, fitted with swing type plumbing fixture

2 - Storage cabinets located over sink and counter, constructed of 3/4" Duraply and fitted with shelving and swing type cabinet doors with door catches

1 - Preparation table 2' X 6' fitted with storage cabinets under with sliding doors

1 - Meat block, 24" X 24" mounted on floor stand

1 - General Electric Model GK40 Mark 313 Fryer, with Mod CX-69 Extra Fat Container, and Mod. CX-68 Syphon

1 - Ice cube maker, stainless steel finish, daily production capacity 200 lbs. (Scotsman SC-200 F SS air cooled) NO SUBSTITUTE

1 - Hobart Mod. A-120, 12 quart food mixer with standard equipment and one dough hook. For 115 Volt (AC)

1 - Pot and pan rack, with sliding hoods, mounted over counter

1 - Refrigerator, 65 cubic foot with remote located belt driven compressor and 3/4 HP, 120 V, single phase motor. Foster No. HR65-RD or equivalent

1 - Freezer, 65 cubic foot storage space with remote located belt driven compressor and 1 HP, 120 V, single phase motor. Foster No. LR65-R or equal.

B. Dining Room Furnishings

2 - Dining tables, 4' X 10', two pedestal base with Formica top

20 - Metal straight back chairs with green Naugahyde upholstered seat and back, Duro Chrome No. 32 or equal.

1 - Electric Coffee urn, Enterprise No. SU-72 or equivalent, suitable for mounting in rack on steam table counter.

1 - Water cooler, Westinghouse Model #W-15-D with stainless steel top or equivalent.

1 - 3 cushion, metal frame, 72" long couch with foam rubber cushions, upholstered in green Naugahyde. Rear legs to be vertical so as not to extend beyond back of couch.

1 - Zenith fringe area, 25" Table Model Color TV set, shelf-mounted on wall.

C. Office Furniture

2 - Double pedestal, 5' metal desks, Shaw-Walker #6034 or equal

2 - Swivel desk chairs, Shaw-Walker 8319B-62 or equal

4 - Metal side chairs with upholstered seat and back

2 - Legal size, 2 drawer file cabinets with locks, Shaw-Walker or equal

2 - Polyethylene Wastepaper baskets.

1 - Mail rack, wall mount

1 - Bulletin board, approx. 3' X 4'

1 - 14'0" X 12" bookshelf

D. Two 2-Man Superintendents Quarters

2 - Painted tubular steel flat spring double bunks with 33" X 78" foam rubber mattresses, foam rubber pillows and double wooden drawers mounted under bottom bunk equipped with locks, and with aluminum ladder to top bunk.

4 - 18" X 18" X 66" high steel lockers, green baked enamel finish with locks and (2) keys, keyed differently and master keyed.

2 - 24" wide X 36" long writing tables with drawer under

2 - Straight back metal chairs with green Naugahyde upholstered seat and back. Duro Chrome No. 32 or equal

E. Janitor and Storage Room

1 - Service sink enameled cast iron 24" X 20" with hot and cold faucet, Eljer E-2700-C or equal

28 ft. of 12" shelving

F. Superintendents' Bath and Public Rest Room

2 - Water closets with elongated rim and shelf top tank, Eljer #E-5245 or equal

1 - Shower stall, 32" X 32" X 76", equipped with 24" X 62" plastic shower door, Fiat Model 36-S-Pilot or equal

1 - Lavatories, 20" X 18" with self-closing faucets and lift waste, Eljer E-3341 or equal

1 - Lavatory mirror with polished stainless steel frame, Lawson #1420 or equal for location in public bath

1 - Medicine cabinet with mirror located in Superintendents' bath

2 - Stainless steel paper hand towel dispenser (Public bath)

1 - Stainless steel towel bar (Superintendents' bath)

1 - Toilet paper holders, Hall-Mack #671 CP or equal

1 - Electric wall heater, Arvin Model 300-E or equal

1 - Vathroom vent fan, 100 CFM, 115 volt for mounting in ceiling in public bath, Broan or equal

1 - Bathroom vent fan, 115 volt for mounting in wall, ILG Model PD-83 or equal

2 - Robe hooks, Hall-Mack #681 or equal

2 - Polyethylene waste paper baskets

G. Seven 6-Man and Two 3-Man Crews Quarters

16 - Painted tubular steel flat spring tripple bunks with 33" X 78" foam rubber mattresses, foam rubber pillows and double wooden drawers mounted under bottom bunk equipped with locks and with an aluminum ladder to top bunk

48 - 18" X 18" X 66" high steel lockers, green baked enamel finish with locks and keys

9 - 24" wide X 36" long writing tables with drawer under

9 - straight back metal chairs with Naugahyde upholstered seat and back, Duro Chrome No. 32 or equivalent

1 - Water cooler, Westinghouse Model #W-15-D or equal (LOcated in passageway)

H. Wash Room

6 - Water closets with elongated rim and shelf top tank, Eljer #E-5245, or equivalent

3 - Urinals with flush valves, Eljer #E-8190, or equal

5 - Shower stalls, 32" X 32" X 76", equipped with 24" X 64" plastic shower doors, Fiat Model 36-S-Pilot with joining strips, or equal

6 - Lavatories, 20" X 18" with self-closing faucets and lift waste, Eljer #E-3341, or equal

6 - Lavatory mirrors with polished stainless steel frame, Lawson #1420, or equivalent

6 - Stainless steel shelves, 18" long, Hall-Mack #49ST-18 SS, or equal

1 - Stainless steel paper towel dispenser

6 - Toilet paper holders, Hall-Mack #671 CP, or equal

6 - Robe hooks, Hall-Mack #681 GP, or equal

2 - Polyethylene waste paper baskets

1 - 8" exhaust fan ILG Model PD-83, or equal

1 - Automatic washer, Maytag model A-700 (No Substitute)

1 - Electric dryer, Maytag Model A-700 (No substitute)

2 - Electric wall heaters, Arvin Model 300-E, or equal

I. Utility Room Equipment

2 - 120 gallon capacity, electric, double element, glass lined hot water heaters arranged for 208 V operation, fitted with relief valves and mixing valves

1 - Potable water pressure system consisting of (1) Burke Mod. 12C42, 1 hp, bronze fitted pump, and (1) 120 gal. capacity galvanized steel pressure tank rated for 75 psi maximum working pressure and necessary pressure switches, air volume controls, gages, etc., so as to be a completely automatic system.

1 - Sanitary water pressure system, identical to potable system

2 - Refrigeration compressor units to serve refrigerator and freezer units previously described under galley equipment

1 - Intake and exhaust system consisting of a 1200 CFM centrifugal fan mounted to supply fresh air from outside, through a system of duct work with a grill directed toward compressors. Exhaust louvers to be on each side of room

1 - Electrical panel board and transformer, per drawings

Chiller tank and other air conditioning equipment as detailed on drawings.

11.0 EQUIPMENT TO BE SUPPLIED BY OWNER

All tools, spare parts, life rafts, life preservers, ring buoys, stokes litter basket, galley stores, linens, blankets, galley outfitting (such as pots, pans, cutlery, crockery, dishes, glassware, brooms, mops, pails, etc.) shall be furnished by owner. Also office equipment such as radios, typewriters, adding machines, etc., will be furnished by owner.

12.0 TESTING, INSPECTION & SUPERVISORY SERVICE

All piping systems, electrical systems, air conditioning systems, alarm systems and all machinery and equipment shall be thoroughly tested to insure proper operation prior to acceptance by owner.

Owner's representatives shall have free entry, at all times while work on' the contract is being performed, to all parts of the contractor's yard and shops which concern the fabrication of materials or other work ordered. The contractor shall afford the owner's represnetative, without charge, all reasonable facilities to satisfy him that the material is being furnished in accordance with these specifications. All tests and inspections shall be made at the place of construction prior to delivery unless otherwise specified, and shall be so conducted as not to interfrer unnecessarily with other construction work in progress.

Four sets of descriptive literature and operating and maintenance manuals for all major appliances and equipment shall be furnished to the owner by the contractor at time of delivery.

13.0 TECHNICAL DATA

Three copies of the following shall be furnished with the proposal:

(1) Floor plans and elevations

(2) Statement of detailed conformance with this specification with a list of items proposed to substitute as equal or better than those specified.

(3) Scheme for packaging and delivery to jobsite.

The following shall be furnished in 3 copies for approval prior to starting fabrication:

(1) All shop fabrication drawings and construction drawings

(2) Structural calculation

The following shall be furnished in 6 bound book copies when the equipment is shipped:

(1) Plans and elevation drawings

(2) Structural and architectural details

(3) Heating, Air Conditioning and Ventilating, Plumbing, and potable Water system layout schematics and details

(4) Complete indexed list of all equipment complete with parts lists, installation, maintenance and operation instructions.

(5) Electrical single line diagram and electrical plans and details. Control schematics for all systems shall be included.

(6) Copy of final design basis for all systems including a copy of those specifications.

14.0 DELIVERY

The equipment shall be delivered to the jobsite designated in the Humble Request for Quotation. The units shall be delivered f.o.b. on a barge with all lifting devices intact for use by others in picking-up and setting the units on the platform structure.

15.0 GUARANTEE

The supplier shall guarantee all equipment to meet these specifications and to be free of defects in material and workmanship. Defects or deficiencies occurring within 12 months of the delivery date shall be corrected at the expense of the supplier.

17.2 PLATFORM CRANES

SPECIFICATION
PLATFORM CRANES
(Two Required)

1.0 GENERAL

This specification applies to the purchase of two 75 ton diesel engine driven cranes for permanent installation and use on a Humble Offshore Platform near Santa Barbara. The cranes are to provide for adapting to two 76" OD X 0.50" wall cylindrical steel crane pedestals. The cranes shall be fitted with a 4'-0" long pedestal base to match the platform pedestal. The 360° pedestal platform and access ladder to crane are furnished by others. The cranes operate in continuous wet salt air atmosphere. All equipment shall be suitable for Class 1, Group D, hazardous location.

2.0 BASIC REQUIREMENTS

The cranes shall be Unit Mariner 750 (or approved equal). They shall be capable of swinging 360°. They shall be fitted with 110 feet of boom. Three 15 feet and one 20 feet boom inserts shall be removable leaving a basic two piece 45 foot boom. The basic unit with 45 foot boom shall meet the following minimum safe load ratings:

Class B rating - based on API "Specification for Load Ratings for Offshore Cranes"

Radius Ft.	Class B Load
15	97,000
25	61,000
35	41,000
45	29,000
55	20,000

The following are the same ratings for the 110 foot boom.

Radius	Class B Load
20	42,400
30	34,600
40	28,800
50	23,200
60	18,600
70	15,100
80	12,200
90	9,800
100	7,500
110	4,700

The unit shall be equipped with two cable drums, one for the main load line and one for the auxiliary load line. The main load line works shall provide for precision power load lowering. A 40 ton triple sheave hook block shall be furnished. All necessary hoist cable, sheaves cable clamps and cable guards shall be furnished fabricated and assembled as far as practical.

3.0 CAB AND BASE

These units shall be two Unit Mariner Model 750 or approved equal. The power unit shall be a diesel engine complete with: (1) air starting system (for 100 psig air); (2) air supply swivel joint;(3) spark arrestor and quiet muffler (Maxim); (4) 100 gallon (min.) fuel tank and complete fuel system;(5) foot throttle for the engine; (6) mechanical tachometer for the engine with hour meter; (7) gages for engine oil pressure, jacket water temperature, torque converter oil temperature and (8) all other necessary instruments and accessories to make the unit safe and functional. The power unit shall be equipped with a torque converter or device approved as equal in smoothness and reliability.

The cab shall provide essentially 360° visibility by the operator, with safety glass windows. An adequate counterweight shall be provided on the cab base (minimum of 20,000# fixed type). A 24 volt, 70 amp, 1600 watt spark-proof auxiliary electrical system including alternator rectifier and battery shall be provided along with a cab dome light, a trouble light and two boom tip flood lights (Plyle National or approved equal).

4.0 OPERATING WORKS

The boom and load line hoists shall be independent. An automatic boom hoist disengage shall be provided to prevent operation of load and boom hoist concurrently. The boom shall be provided with an adequate boom stop and a boom angle indicator.

The rotation, boom and load line works shall be equipped with air operated fail safe brakes complete with controls to coordinate the brakes with the operating works. The operating clutches shall provide adequate margins of safety for the most severe conditions.

5.0 PAINTING AND PROTECTIVE COATING

All items of the cab, boom, base and adapter (excluding mechanical items and instruments in the cab, drums swing gear, and lights) shall be protectively coated in accordance with attached Specification 10-084-C2. Zinc Chromate primer shall be applied to applicable excluded items. A compatable tie coat shall be applied to the Humble Rust Ban protective coating and the Crane Manufacturers standard yellow enamel paint system applied to the entire units.

6.0 SHIPMENT AND DELIVERY

The supplier shall package the units, assembled as far as practical, and be responsible for safe arrival to the destination specified on the Humble Request for Quotation.

7.0 TECHNICAL DATA

Proposals shall include 3 copies and a complete description of the units offered including:

(1) Load and hoisting capabilities
(2) Engine make and horsepower
(3) Description and data on works that operate swing, boom and load lines, including clutches, brakes, etc.
(4) Description of boom, sheaves, guides, blocks.
(5) Description of load control
(6) Description of safety features
(7) List of similar Cranes in offshore or marine service.
(8) Sketch of pedestal adapter.

8.0 GUARANTEE

The supplier shall guarantee the equipment to meet these specifications in addition to those submitted with the proposal. Defects or deficiencies in the units occuring within 12 months after delivery date shall be corrected at the expense to the supplier.

17.3 ACID STORAGE

ACID STORAGE TANKS
T24, T25 & T26
(3required)

1.0 GENERAL

This specification applies to the design and construction of one or more Hydrochloric Acid Storage Tanks for use in acidizing wells on an offshore platform near Santa Barbara, California. The tanks store 35%, 1.175 specific gravity hydrochloric acid. The external surfaces of the tanks are exposed to wet salt air atmosphere.

2.0 CONSTRUCTION

The tanks shall be as shown on Drawing 084-142. The tanks are to be constructed to comply with the API-650 code for welded storage tanks except the metal thickness shall be increased by 17.5% to provide for the high gravity of the acid. All interior surfaces of the tanks shall be lined with 3/16" natural rubber sheets of Goodyear LS-55-1 (or approved equal) applied and cured in accordance with the suppliers specifications. Cements and primers used shall be those specified by the manufacturer of the rubber sheets. All welds, surfaces and steel edges and corners shall be ground to a minimum radius of 1/16" radius. All surfaces shall be sandblasted to white metal just prior to adding the primer. All nozzle necks and flange faces shall be lined. All joints shall be lapped and cemented with cements totally resistant to HCL. The underside of the roof and the vents shall be lined. Shell and roof manholes and covers shall be lined.

Furnish all material and install level indicator purge and dip pipe, purge meter, press regulator and pressure switch as shown on the drawing.

3.0 TECHNICAL DATA

The supplier shall submit approval drawings and specification (3 copies) prior to starting any fabrication. The drawings shall be shop drawings showing details of construction and lining. All materials shall be specified complete by manufacturer's and product identification. Detail description of the rubber lining shall be submitted including weld and surface preparation. Supplier shall hydrostatically test the tanks and spark test the lining. Details of the spark test shall be stated in the technical data.

One approved copy of all data will be returned to the supplier prior to starting the work.

4.0 DELIVERY

The supplier shall deliver, f.o.b. trucks at the jobsite, all three tanks. He shall be responsible for any damage to the liner until accepted by Humble.

5.0 GUARATNEE

The supplier shall guarantee the tanks to meet all requirements of these specifications and to be free of defects in workmanship and material. Defects or deficiencies appearing within 12 months of delivery date shall be corrected at the expense of the supplier.

ACID PUMP P24
(One required)

1.0 GENERAL

This specification applies to the purchase of one electrically driven pumping unit for use in transfering 35% hydrochloric acid. The unit is used on an offshore platform near Santa Barbara, California. The area is classified as hazardous, Class 1, Division 1, Group D. The pump is exposed to wet salt air atmosphere.

2.0 DESIGN AND CONSTRUCTION

The pump shall be capable of pumping 40 gallons per minute of 35% HCL of 1.175 specific gravity at 50 to 90°F with a differential head of 44 feet. The power is 440V, 3 phase, 60 hz. The pump shall be a 1½ X 1E-6A1 Durcon Mark II, Series E, Group II, Centrifugal pump with braided teflon packing. The pump speed is 1750RPM.

A fabricated steel base shall be furnished of adequate rigidity to maintain alignment of all items when mounted on a relatively flexible steel deck. The base shall have a drip lip to catch all leakage. The base shall be coated with heavy epoxy coating adequate to resist the HCL. A coupling and coupling guard shall be furnished meeting the State of California Safety Orders. All external parts of the pump motor guard and base not of Durcon shall be coated with epoxy by the manufacturer.

The motor shall be sized to be non-overloading at end-of-curve condition of the pump.

All necessary lubrication and lubrication equipment shall be furnished with the pump and/or motor.

3.0 TECHNICAL DATA

The following data shall be furnished with the proposal in 3 copies:

1. Dimensional outline drawing
2. Cross-sectional drawings of pump showing all materials of construction.
3. Motor manufacturer, horsepower and catalog number
4. Accessories listed with manufacturer's and catalog number
5. Performance curves
6. Pump Data Sheet

The supplier shall furnish 6 copies of the above final data in addition to 6 copies of parts list and installation, maintenance and operating instructions.

4.0 SHIPMENT

Supplier shall be responsible for packaging, shipping and safe arrival of the equipment at the destination specified in the Humble Request for Quotation.

5.0 GUARANTEE

The manufacturer and/or supplier shall guarantee the equipment to meet all requirements of these specifications. Defects of deficiencies found within 12 months of delivery shall be corrected at the expense of the supplier and/or manufacturer.

18.0 STANDARD SPECIFICATIONS

HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS
SANTA FE SPRINGS, CALIFORNIA

REV

SPECIFICATION PIPING

CUSTOMER HUMBLE OIL & REFINING COMPANY JOB NO. 10-084

PLANT LOCATION OFF-SHORE

CLASS A

Commodities: Oil and Gas

150 lb. ANSI Standard-Raised Face-Carbon Steel

MAXIMUM TEMPERATURE:

500° F.

MAXIMUM PRESSURE:

275 P.S.I. @ 100°F.
150 P.S.I. @ 500°F.

PIPE: ASTM A-53 Gr. A or B

2" and larger schedule 40 seamless beveled ends.
1½" and smaller schedule 80 threaded and coupled.

FITTINGS:

2" and larger to be ASTM A-234 Gr. WPA buttweld schedule 40'.
1½" and smaller to be 3000 lb. forged steel screwed, ASTM A-105 Gr. 2

FLANGES:

2" and larger 150 lb.USAS RF weld neck ASTM A-181 Gr. 1 schedule 40 bore. Flanges connecting to equipment and special items are to match those connections in rating, size, bore, etc. Use flat faced flanges where indicated on drawings. All faces to be serrated.

GASKETS:

Flexitallic Style CG or Spirotallic 912, Type 304 SS and asbestos.

BOLTING:

Studbolts, ASTM A-193 Grade b-7 full threaded with 2 ASTM A-194 Class 2 heavy pattern Hex. nuts.

UNIONS:

1½" and smaller 3000 lb. forged steel screwed, ASTM A-105 GR. 2, steel to steel integral seat.

PLUGS:

1½" and smaller - screwed solid bar stock.

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SPECIFICATION PIPING

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CUSTOMER HUMBLE OIL & REFINING COMPANY JOB NO. 10-084

PLANT LOCATION OFF-SHORE

(CLASS A)

BRANCH CONNECTIONS:

Use butt weld tees, 3000# F.S. couplings, or 3000# Bonney Weld-O-Lets (or Thread-O-Lets for 1½" and smaller). Non-reinforced stub-ins are acceptable on relief header. Stainless steel tubing to be used beyond valve on instrument connections (See Instrument Piping Spec.).

VALVES:

Valves to be as shown on the drawings or valve list.

Fabrication to be in accordance with ANSI Code B31.3, Section V. All welds subject to radiograph inspection by owner. Acceptability is in accordance with ASME Code Section VIII, Paragraph UW-51, latest edition.

DATE

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THIS SPECIFICATION CONSTITUTES A BILL OF MATERIAL AND WILL ACCOMPANY ALL COPIES OF THE PURCHASE ORDER

HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET 1 OF 1

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SPECIFICATION PIPING

CUSTOMER HUMBLE OIL & REFINING. CO.

JOB NO. 10-084

PLANT LOCATION OFF SHORE

CLASS AA

Commodities: Instrument Air

PRESSURE RATING:

125 psi @ 100° F.

FITTINGS:

2" and smaller to be screwed, 150# ASTM A182 GR F304
(Laddish or Equal)

UNIONS:

2" and smaller to 150# screwed ASTM 182 GR. F304
(Laddish or Equal)

VALVES:

Gate Valves to be Powell Fig. 1832 200# screwed end Gate Valve Type 316 S.S. (or equal)
Check Valves to be Powell Fig. 1847 200# screwed end swing check valve, Type 316 S.S.

PIPE:

ASTM A-312 Seamless Type 304, Schedule 40

NOTE:

(1) Use Teflon tape on thread make-up of all joints.

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SPECIFICATION PIPING

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CUSTOMER HUMBLE OIL & REFINING COMPANY

JOB NO. 10-084

PLANT LOCATION OFF-SHORE

CLASS B

Commodities: Oil and Gas

300 lb. ANSI Standard-Raised Face-Carbon Steel

MAXIMUM TEMPERATURE:

500°F.

MAXIMUM PRESSURE:

720 P.S.I. @ 100°F.
675 P.S.I. @ 350°F.

All items same as Class A except flanges. All flanges to be 300 lb. USAS RF weld neck ASTM A-181 GR. 1.

VALVES:

Valves to be as shown on drawing or listed on the valve list.

FABRICATION:

Same as Class A.

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SHEET 1 OF ____

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SPECIFICATION PIPING

CUSTOMER HUMBLE OIL & REFINING COMPANY **JOB NO.** 10-084

PLANT LOCATION OFF-SHORE

CLASS C:

Commodities: Oil and Gas

600-lb.ANSI Standard-Raised Face-Carbon Steel

MAXIMUM TEMPERATURE:

500°F.

MAXIMUM PRESSURE:

1440 psi @ 100°F.
1250 PSI @ 500°F.

PIPE:

2" and larger to be ASTM A-53 Grade B schedule 80 seamless.
1½" and smaller ASTM A-53 GR A or B schedule 80.

FITTINGS:

ASTM A-234 GR. WPA
Schedule 80 for 2" and larger sizes and
Schedule 80 for 1½" and smaller.

FLANGES:

600 lb. USAS Raised face, serrated, welding neck, with bore to fit pipe
ASTM A-105 GR. 1 or 2.

GASKETS:

Flexitallic Style CG or Spirotallic 912, Type 304 SS and asbestos.

BRANCH CONNECTIONS:

Use 3000# Bonney Weld-O-Lets, 3000# couplings, or butt weld tees.
Threaded connections to be used only to connect instruments.
Use all 3000# F.S.fittings and schedule 160 nipples to block valve.
Stainless steel tubing to be used beyond block valve on instrument connections. (See instrument piping specification).

VALVES:

Valves to be as shown on drawings or valve list.

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ENGINEERS - CONSTRUCTORS

SANTA FE SPRINGS, CALIFORNIA

SHEET ____ OF ____

REV

SPECIFICATION PIPING

CUSTOMER HUMBLE OIL & REFINING COMPANY **JOB NO.** 10-084

PLANT LOCATION OFF-SHORE

(CLASS C)

BOLTING:

Studbolts, ASTM A-193 Grade B7 full threaded with 2 ASTM A-194 Class 2H heavy pattern hex nuts.

Fabrication to be in accordance with USAS Code for pressure piping B31.3, Section V. All welds subject to radiograph inspection by owner. Acceptability is in accordance with ASME Code Section VIII, Paragraph UW-51, Latest Edition.

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SPECIFICATION PIPING

REV

CUSTOMER HUMBLE OIL & REFINING COMPANY JOB NO. 10-084

PLANT LOCATION OFF-SHORE

(CLASS D)

VALVES:

Valves to be shown on drawings or valve lists.

FABRICATION:

In accordance with USAS Code for pressure piping B31.3, Section V. All welds subject to radiograph inspection by Owner. Acceptability is in accordance with ASME Code Section VIII, Paragraph UW-51, latest edition.

DATE

BY

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ENGINEER

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HOBBS-BANNERMAN CORPORATION

ENGINEERS · CONSTRUCTORS
SANTA FE SPRINGS, CALIFORNIA

SPECIFICATION PIPING

REV

CUSTOMER HUMBLE OIL & REFINING COMPANY JOB NO. 10-084

PLANT LOCATION OFF-SHORE

CLASS D (CLASS D)

Commodities: Oil & Gas.
900 lb. USAS Standard raised-face carbon steel.

MAXIMUM TEMPERATURE:

500°F.

MAXIMUM PRESSURE:

2160 psig. @ 100°F (900# ASA Standard).

PIPE: ASTM A-53 GR. B, seamless:

2" thru 6": Schedule 80 seamless, beveled ends.
1½" and smaller: Schedule 80 threaded and coupled.

FITTINGS:

2" and larger: ASTM A-234 GR. WPA buttweld Schedule 80.
1½" and smaller: 3000# forged steel screwed, ASTM A-105 Gr. 2.

FLANGES:

900# USAS RF, ASTM A-105 GR. 1 or 2, welding neck, bore to match pipe. Flanges connecting to equipment and special items are to match those connections in rating, size, bore, etc. Use flat-face flanges where indicated on drawings. All faces to be serrated.

GASKETS:

Flexitallic style CG or spirotallic 912, type 304 s.s. and asbestos.

BOLTING:

Studbolts, ASTM A-193 GR. B-7, full threaded, with two ASTM A-194 Class 2H heavy pattern nex nuts.

BRANCH CONNECTIONS:

Use 3000# Bonney weld-o-lets, 3000# couplings, or butt-weld tees. Threaded connections to be used only to connect instruments. Use all 3000# F.S. fittings and Schedule 160 nipples to block valve. Stainless steel tubing to be used beyond block valve on instrument connections. (See Instrument Piping Specification.)

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PIPING SPECIFICATION
35% HCL ACID PIPING

This specification applies to the piping used in the HCL acid system. Piping 2" and larger shall conform to the Class A specification except all pipe fittings and flanges shall be rubber lined. The lining shall be 3/16" thick Goodyear LS-55-1 (or approved equal) applied fully in accordance with the manufacturer's specification. Goodyear recommended primer and cement shall be used to obtain a fully compatable system. All welds and metal surfaces to be coated shall be ground to a minimum radius of 1/16". All surfaces shall be sandblasted to white metal and the primer applied shortly thereafter. Flange faces shall be lined. All rubber lined surfaces shall withstand a 10,000 volt spark test without any holidays.

Piping 1½" and smaller shall be rigid PVC with cemented joints. PVC piping shall be continuously supported in steel angle or channel. The piping shall be bonded to the supports at 18" centers with stainless steel bands.

EPOXY-EPOXY MASTIC COATING

1. TYPE OF SYSTEM: 10 Mil Epoxy-Epoxy Mastic System.

2. TYPE OF SURFACE: Black or galvanized steel.

3. TEMPERATURE LIMITATIONS: Up to 225° F.

4. REFERENCES.

4.1 The grades of surface preparation and application procedures used in these specifications are described in detail in the following Steel Structures Painting Council Specifications, and reference may be made to them.

4.1.1 Solvent Cleaning: SSPC SP-1-63.

4.1.2 White Metal Blast Cleaning: SSPC SP-5-63, using 16- to 35-mesh Silica sand, and 80 - 10 psi Nozzle pressure.

4.1.3 Shop, Field, and Maintenance Painting: SSPC PA-1-53T.

5. STANDARD SCHEDULE. (All Humble Products)

	Min. Dry Film Thickness (Mils)	Min. Drying Time Per Coat (Hr.)
5.1 Black or galvanized steel surfaces:		
1st coat: Epoxy Primer 6666	2.0	8-12
2nd coat: Epoxy Mastic 6664	6.0	8-12
3rd coat: Epoxy Finish 6671	2.0	8-12
5.2 Minimum dry film thickness in 3 coats	10	

5.3 Do not exceed 72 hours drying time between coats.

5.4 The bottom chime on all bolted tanks must be caulked with fiber glass reinforced epoxy prior to the application of the coating system.

6. SURFACE PREPARATION.

6.1 For new work, remove all oil and grease by Solvent Cleaning, and clean all welds. Follow by White Metal Blast Cleaning. On galvanized surfaces, blast to roughen byt not remove the galvanizing, then remove protruding particles of galvanizing by power buffing without destroying the anchor pattern.

6.2 For maintenance work, clean areas to be spot patched using methods specified in Paragraph 6.1. Remove all loose, cracked, or nonadherent coating. Remove all foreign matter from surface of existing sound coating before adding refresher coat.

7. APPLICATION.

7.1 Storage, mixing, straining, thinning, and application of paint shall be in accordance with manufacturer's recommendations. Remove all paint spatter and overspray from surfaces not intended to be painted.

7.2 For new work, apply not less than three coats, as specified in Paragraph 5, to a final total dry film thickness of not less than 10.0 mils as measured by an Elcometer or Mikrotest dry film gauge. If 10.0 mils are not obtained in three coats, add additional finish coats until a minimum of 10.0 mils is obtained. A stripe coat of Epoxy Primer 6666 shall be brushed on all edges, welds, and crevices before the first prime coat is applied.

7.3 For maintenance work, spot patch and apply an overall refresher coat. For spot patching, apply the same number of coats and film thickness specified for new work in Paragraph 7.2. For refresher coat, apply one finish coat over the existing sound coating. In either case, the finish coat shall match the color of the existing finish coat.

7.4 Contractor shall check the entire coated surface with a Tinker & Rasor M-1 holiday detector, or approved equal. Areas containing holidays shall receive additional finish coats until holiday-free.

8. SAFETY

8.1 Take proper precautions before cleaning surfaces in areas where fire or explosion hazards exist. Ground all air-moving and spray equipment. Keep sources of ignition 150 feet up wind from open containers of paint and solvents and openings in tanks and pipelines. Dispose of waste so as not to cause property damage or bodily injury.

SPECIFICATIONS FOR APPLICATION OF COATINGS TO EXTERNAL SURFACES

1.0 SCOPE AND NATURE OF WORK

1.1 All work shall be performed in strict accordance with these specifications. All phases of the work shall be available at all times for observation by a representative of Humble. Inspection is at the option of the purchaser. Notify Humble 7 days before starting coating work and submit detailed schedule of work.

2.0 SURFACE PREPARATION

2.1 Remove deposits of oil and grease by solvent cleaning in accordance with methods outlined in Steel Structures Painting Council Specification SP 1-63.

2.2 Grind smooth all rough welds and sharp steel edges; remove all weld spatter and welding flu.

2.3 Sandblast all surfaces to be coated to near white as defined by the Steel Structures Painting Council in "Surface Preparation Specification No. 10", to provide a surface free from all oil, grease, dirt, mill scale, rust, corrosion products, oxides, paint or other foreign matter.

2.4 After sandblasting, all dust shall be removed from the prepared surfaces preparatory to the application of coating by brushing, wiping with clean, dry rags, or by other acceptable methods.

2.5 Since blasted surfaces rust rapidly, the coating must be applied as soon as possible after blasting. Do not allow blasted surfaces to remain uncoated overnight. If any rust forms on the surface or oil, grease or other organic matter contacts the surface prior to application of coating, the surface shall be reblasted.

3.0 MIXING

All mixing, straining, and thinning of coating shall be in accordance with the manufacturer's printed instructions and recommendations.

4.0 STANDARD SCHEDULES

4.1 External Coating System

Apply Humble Rust Ban 191 to minimum dry film thickness of 3 mils. Apply Rust Ban 195 curing solution and wash and scrub thoroughly to remove all white salt deposition.

5.0 APPLICATION

All material shall be applied in accordance with detailed instructions by the manufacturer.

6.0 INSPECTION

6.1 Each coat shall be inspected prior to the application of the next coat. Areas found to show signs of improper application shall be repaired or recoated in accordance with the manufacturer's recommendations.

6.2 Dry film thickness shall be determined by the Elcometer Thickness gauge or comparable instrument.

6.3 Surface preparation and application of all coatings shall be subject to the approval of the Field Inspector.

6.4 Supplier to notify purchaser seven days prior to starting coating work giving complete schedule of the coating so that purchaser may inspect any or all of the work at his option.

7.0 GUARANTEE

Supplier to guarantee the coatings to be free of defects in workmanship and material and to meet the requirements of this Specification. He will repair or replace any defective or substandard work, revealed within 12 months of the first service date, at no cost to Humble.

19.0 FACILITY CONSTRUCTION

WORK BY PRIME CONTRACTOR

1.0 GENERAL

This specification applies to the work and material to be furnished by the Prime Contractor. The Prime Contractor is the contractor selected by Humble Oil and Refining Company to be responsible for the overall assembly of facilities on the platform modules and also the final assembly check out and testing at the offshore platform site. The platform is to be located near Santa Barbara approximately 9 miles off shore. The assembly of the modules is to be done at a location stated in the Humble Request for Quotation.

2.0 SCOPE OF WORK BY PRIME CONTRACTOR

Prime Contractor shall be responsible for the coordination of all work. He shall review all suppliers drawings and do necessary final engineering to adapt the final selected equipment to the facility. He shall adapt the facilities by designing and installing all necessary structural supports, braces, hangers, access platforms and walkways. He shall be responsible for field checking all as-built equipment prior to planning its installation to assure dimensional fit up. Prime Contractor shall receive, unload, store if necessary, and make final assembly of all equipment items furnished by Humble. He shall be fully responsible and accountable for all material and equipment delivered to him by Humble. The Prime Contractor shall make all necessary provisions to secure the equipment on the platform modules for safe transport to the offshore jobsite. He shall assume the cost of repairs to equipment or material not properly protected.

The Prime Contractor shall furnish all work, material and equipment, except that furnished by Humble, necessary to complete the work described in the specifications herein, the specifications referenced herein and shown on the Drawings listed herein. (These documents are contained in Volumes 1 & 2 of "Engineering Study for Initial Platform Production Facilities - Santa Barbara Channel"). The material and equipment furnished by Humble is described in Par. 3. The Prime Contractor is responsible for compliance with all Federal, State and local codes, laws and regulations at the fabricating site and at the final offshore jobsite.

3.0 WORK MATERIAL AND EQUIPMENT BY HUMBLE

Humble Oil & Refining Company shall furnish only the following:

(1) Ten copies of these Specifications and Drawings.

(2) Installation permits from Federal Government and State of California (if required).

(3) Packaged Production Separators and Gas Scrubber Unit as described in Specification 10-084-PSU

(4) Packaged Well Test Unit as described in Specification 10-084-WTU.

(5) Packaged Well Clean Separator Unit as described in Specification 10-084-WCS.

(6) Packaged Production Surge Tanks as described in Specification 10-084-PST

(7) Crude Oil Booster Pumps in accordance with Specification 10-084-P4A.

(8) Crude Oil Shipping Pumps in accordance with Specification 10-084-P4B.

(9) Oil Metering Package as described in Specification 10-084-OMP.

(10) Meter Prover as described in Specification 10-084-MPI.

(11) Packaged Sweet Gas Unit as described in Specification 10-084-PSGU.

(12) Packaged Vapor Compressors as described in Section 7.2.

*(13) Packaged Injection and Sales Gas Compressors as described in Section 7.2.

*(14) Packaged Gas Dehydration Unit as described in Section 7.2.

*(15) Packaged Turbine Generator Units as described in Specification 10-084-PTG with waste heat exchangers as described in Specification 10-084-WHE.

*(16) Flotation Unit as described in Specification 10-084-FLOU.

(17) Vent Surge Tank V-6, Oil Sump V-7, Water Sump V-8 and Well Clean Tank V-10 as described in Specification 10-084-V6.

(18) Therminol Expansion Tank T-20 and Diesel Fuel Tank T-23 as described in Specification 10-084-T-20.

(19) Therminol Circulation Pumps P-20A and P20B as described in Specification 10-084-P20.

(20) Crude Oil Heat Exchangers E1A, E1B and E2A as described in Specification 10-084-CHE.

(21) Potable Water Tank T-21
Emergency Storage Tank T-22
Produced Water Surge Tank T-2
Clean Water Surge Tank T-2A as described in Specification T-2.

(22) Produced Water Pumps P21A & P21B as described in Specification 10-084-P21A

(23) Oil and Water Sump Pumps as described in Specifications 10-084-P1A, 10-084-P2 and 10-084-P5A.

(24) Vent Stack Seal as described in Specification 10-084-VENS.

(25) Fire Protection and Wash Down Water Pumps as described in Specification 10-084-EWDP, 10-084-EDFP, 10-084-EFP.

(26) Diesel Fuel Transfer Pumps P101A and P101B as described in Specification 10-084-P101.

(27) Potable Water Pump P-22 as described in Specification 10-084-P22.

(28) Packaged Sewerage Treatment Unit as described in Specification 10-084-STU.

*(29) Acid Storage Tank T24 as described in Specification 10-084-HCLS. Additional tanks may be specified by Humble later if required.

(30) Acid Transfer Pump P24 as described in Specification 10-084-HCLP.

(31) Main Sub-Station 10-084-MSS installed complete. No work on material required by Prime Contractor.

(32) 34.5 KV Load Break Oil Switch as described in Specification 10-084S.

(33) 34.5 KV Submarine Cable Specification 10-084SC. Humble will lay cable and pull same to Item 32. Prime Contractor will connect to Item 32.

(34) Power Equipment as described in 10-084-PC.

(35) Fire Detector and Gas Detector Units as described in Specification 10-084-FDU and 10-084-GDW.

(36) Air Compressor Units as described in Specification 10-084-AC1.

(37) Main Control Panel as described in Specification 10-084-MCP.

(38) Pump Control Panel as described in Specification 10-084-PCP.

(39) Crew Quarters as described in Specification 10-084-LQ.

(40) Platform Cranes as described in Specification 10-084-CRANE.

(41) Packaged hydraulic power and control unit for control and operation of sub-surface safety valves.

(42) Cathodic protection power and control units (If required).

* The above items marked with (*) may at the option of the Prime Contractor be delivered to the off shore site f.o.b. barges by Humble. These include items (13), (14), (15), (16), and (29).

(43) Cathodic protection anodes and their installation excluding power and feeders to anode tubes. (Not required if sacrificial type anodes are used)

(44) Well Head completions including well head safety valves, wing valves, flow beans and piping to connect the flow lines to the manifolds are Humble's work.

(45) Humble will install submarine pipelines up to first block valves on platform.

(46) Humble will run all services to the drilling equipment.

4.0 EQUIPMENT LAYOUT LOCATING AND SETTING

The equipment location and layout shall comply with the loactions shown on the Drawings. Minor loaction changes to adapt for the final equipment selections will be allowed, however, these must be approved by the Humble Engineer. The Prime Contractor shall design and install the equipment attachments and anchors to the platform structure. The Prime Contractor shall coordinate the final nozzle and appurtenance orientation on vessel, and equipment to assure proper fit-up. The Prime Contractor shall design and install additional structural supports for equipment such as the engine driven fire pump support and platforms supports for the main fire monitors on the crane pedestals.

The Prime Contractor shall make final alignment of all running equipment at the offshore site to assure proper conditions for operation without damage to the equipment. The final cleaning, servicing and preparation for operation is the Prime Contractor's work.

5.0 PIPING AND INSTRUMENTATION

Specification 10-084-WS-P, Section 19.2 applies to this work.

6.0 ELECTRICAL WORK

The electrical work is described in the attached Electrical Work Specification 10-084-EWS (Section 19.3).

The Prime Contractor shall be responsible to check the layout against the final selected equipment and make necessary modifications to adapt. The complete electrical control and power systems shall be checked out and put into operation as part of the Prime Contractor's work.

7.0 PROTECTIVE COATING

The Prime Contractor shall protectively coat piping as described in Specification 10-084-PC-1 (Section 19.5) and 10-084-C2.

Acid Piping shall be rubber coated internally as specified in Specification 10-084-ACIDP and externally coated in accordance with Specification 10-084-C2.

8.0 Thermal Insulation shall be provided by the Prime Contractor as described in Specification 10-084-PVHI (Section 19.0).

9.0 Plumbing work external to Crew's quarters is Prime Contractor's work. This shall comply with the Uniform Plumbing Code.

10.0 Ventilation equipment and ducts shall comply with the Uniform Mechanical Code.

11.0 Prime contractor to install cathodic protection system power supply and controls and run electrical leads to and connect to anode tubes.

THERMAL INSULATION

1.0 GENERAL

This specification applies to the installing thermal insulation for Humble Off-Shore Platform near Santa Barbara, California. The piping and equipment to be insulated and the insulation thickness are shown on the piping and instrument drawings. The work includes but is not necessarily limited to the following:

(1) Therminal heating fluid piping and equipment
(2) Crude Heat Exchangers
(3) Crude Surge Tank Boots on V4A and V4B
(4) Suction piping to crude oil booster pumps P4A, P4C and P4D (future).

Some piping and equipment on internally coated and welding to these items for insulation anchors is forbidden.

2.0 PIPING INSULATION

2.1 Piping is defined as all pipe, valves, fittings, flanges and instrument connections.

2.2 No insulation should be applied until all items are cleaned and tested. Pipe insulation shall be applied with staggered circumferential joints. Pipe insulation shall be wired on with annealed wire, either black or galvanized, spaced approximately 6" O.C. for piping 6" and smaller and on 9" centers for larger pipe in the following gauges:

Pipine 12" and under 16 gauge
Piping larger than 12" - 14 gauge.

The wires should be drawn taut to imbed them flush with the face of the insulation, firmly twisted, the excess ends cut off and the twisted ends bent over and imbedded in the insulation. Bands may be substituted for wire if desired.

All cracks, voids and joints in the pipe insulation should be filled with cement either trowelled or palmed on.

Good application practice dictates that piping and equipment insulation, located either indoors or outdoors, be completely finished as soon as possible after roughing in.

2.3 Pipe bends and long and short radius ells may be insulated with mitred segments of pipe insulation. Dimensions of mitred segments for long and short radius ells are shown in reference tables in this manual.

Individual mitred segments may be prefabricated into ell covers by cementing together to form two half covers. A cement finish should be applied over insulation on bends and ells, after it has been securely wired on, to give a smooth, even surface.

Fittings and valve bodies under 2½" in size may be insulated with insulating cement applied in approximately ½" thick layers to a thickness equal to that of adjacent insulation.

For piping 3" and larger, the entire surface of screwed and welded fittings and valves (including bonnet) and the bodies of flanged fittings and valves may be insulated with block insulation½" thinner than adjacent insulation. The blocks shall be securely wired in place and finished with a total of ½" of insulating cement applied in two layers.

Flanged fittings and valves may be insulated in a manner similar to flange insulation.

Flanges, Flanged Fittings and Valves

For permanent type flange covers, either sectional pipe insulation of proper size to fit the outside diameter of the flange or block insulation lags shall be used to cover the flange. The flange insulation shall be ½" thinner than the adjacent pipe insulation, allowing for ½" of cement finish, and should extend approximately 2" over the ends of the pipe insulation. Annular spaces between flanges and pipe insulation may be filled with rings or collars of blocks or insulating cement. The flange insulation shall be wired on and finished with ½" of insulating cement trowelled to a smooth even surface.

Steam Traced Lines

Tracers should be secured snugly against traced lines with bands or wires. Sheet metal pans between insulation and tracers is optional construction. After the tracers and sheet metal pans have been installed, the two half sections of pipe insulation should be wired in place. All joints and voids in the insulation should then be filled with insulating cement and the insulation finished as required. See finishes.

A heat transfer cement such as "Thermon", or approved equal, may be used in lieu of the sheet metal shielf. This cement should completely cover the tracer, applied with a trowel or caulking gun, in a "V" shape with a minimum thickness at the center of the tracer of ¼". Width of cement at top of "V" will vary with size of tracer. Refer to manufacturer's recommendations.

The horizontal or side lap in the jacket may be additionally secured with 1" X 3/4" galvanized or copperized butter-tub staples using one staple between each loop of wire. On horizontal lines, the longitudinal lap shall be located on the side of the pipe with the lap turned down and on vertical lines the felt shall be lapped downward to shed water.

2.4 Sheet Metal Jackets

Insulated lines are to be finished with a metal jacket. Metal jackets consist of aluminum. Flat aluminum half hard in roll form of .016" and heavier thicknesses with an integral vapor barrier and should be cut and machine rolled to the proper "stretch out" to allow for a 2" or 3" horizontal lap. Aluminum should be secured to pipe insulation with stainless steel bands and seals either ½" or 3/4" wide by .015" or .020" thickness. Spacing for bands on pipe insulation averages 9" to 12". End or circumferential laps in jackets should be a minimum of 2".

Finishes on Bent Pipe, Fittings, Valves and Flanges

Fittings, valve and flange insulation shall be finished with either a fibrated asphalt emulsion or a canvas. Generally where a waterproof felt finish is applied on piping, the pipe bend, fitting, valve and flange insulation is finished with a fibrated asphalt emulsion trowelled on to a total wet thickness of ¼" which shrinks when dry to 1/8" thick. Where this finish comes in contact with straight pipe insulation, such as on bends or ells, the mastic finish sould extend under the felt several inches. The mastic finish may be reinforced with 1" galvanized 19 gauge mesh wire or asphalt impregnated glass fabric.

Prefabricated aluminum fitting covers may be substituted for the above fitting finish.

3.0 EQUIPMENT INSULATION

All vessels, ducts, exchangers, etc. requiring insulation on which pipe insulation cannot be used shall be insulated with block insulation in thicknesses and types as recommended under various sections of this manual.

Blocks shall be applied in staggered joint construction held temporarily in place with applicator's rubber bands, or springs and securely wired or banded on approximately 9" centers with black annealed wire or steel bands. The gauge of the wire or the width and gauge of the bands will vary with the size of the equipment and the service which it performs. Blocks shall be closely fitted in place and all joints pointed with insulating cement. When equipment is insulated cold or before being put into service, allowances should be made for expansion to prevent excessive strain on the wires or bands securing the blocks.

On vessels, exchangers, etc., which are 54" in diameter and under, blocks should be used to insure the block insulation conforming closely to the curvature of the vessel. On equipment over 54" in diameter, a 6" wide flat block may be used. Should 12" wide blocks be used, they may require scoring on the underside to give proper fit depending on diameter of vessel.

A 1", 19-gauge galvanized mesh wire (galvanized after weaving) shall be applied over the blocks, stretched tightly over the entire area and thoroughly secured with black annealed wire staples.

Insulation finishes on equipment insulation shall be applied as previously described under piping. The mesh wire should be placed between the first and final layer of cement.

Horizontal expansion joints should be provided at the support angles where required to allow for the vertical expansion in the vessels. Vertical expansion joints should also be provided to compensate for the circumferential expansion if the temperature and diameter of the vessel warrant their use.

Aluminum sheeting with stainless steel bands may be substituted for the above finish. The material and finish shall be same as stated in Par. 2.3.

4.0 INSULATING MATERIALS

All piping and equipment insulation shall be calcium silicate rated for temperatures up to 1,250°F. The material shall be Pabso Caltemp (or approved equal). Thickness required are shown on insulation symbols on the piping and instrument drawings.

Humble Job 10240
H-B Job 10-084

CODE REFERENCES

The following is a list of codes that are referenced in this report:

1: United States, Department of Interior Geological Survey, Conservation Division, Branch of Oil and Gas Operations, Pacific Region Outer Continental Shelf Orders No. 1, thru and including No. 10

2: California Administrative Code, Title 8, General Industrial Safety Orders, Petroleum Safety Orders for Drilling and Production, Fired and Unfired Pressure Vessels.

3: California Administrative Code Title 24, Part 3, Basic Electrical Regulations, State Building Standards Electrical Code.

4: International Conference of Building Officials, Uniform Building Code and Uniform Plumbing Code and Uniform Mechanical Code, latest editions. Uniform Building Code - Standards (latest edition).

5: American Institute of Steel Construction, Manual of Steel Construction and codes referenced therein.

6: American Society of Testing Materials Standards, Part One - Ferrous Metals and Part Two - Non-Ferrous Metals latest edition.

7: National Electrical Code - latest edition.

8: United States Government Department of Labor, Occupational Safety and Health Administration, Title 29, Part 1910 (standards for sound levels).

9: American Society of Mechanical Engineers ASME Code for Unfired Pressure Vessels Section VIII.

10: American Petroleum Institute Standard 650 (latest edition) for Welded Steel Tanks for Oil Storage.

11: American National Standards Institute ANSI (formerly American Standards Association ASA) Code for Pressure Piping ANSI (ASA or USAS) B31.3 Petroleum Refinery Piping (latest edition).

12: Manufacturers Standardization Society for Valve and Fitting Industry.

13: Standards of the National Electrical Manufacturers Association.

14: Standards of the Institute of Electrical and Electronic Engineers.

15: Standards of Insulated Power Cable Engineers Association.

16: American Petroleum Institute
Reciprocating Compressors for General Refinery Service
API Standard 618.

19.2 PIPING & MECHANICAL

PIPING AND INSTRUMENT WORK

1.0 GENERAL

The piping and instrument work is defined by the Piping and Instrument Diagrams. The plans, elevations and details show all piping 1½" and larger. Small utility and instrument piping is shown schematically only. The prime contractor shall provide this piping as indicated on the P & I Diagrams and on the instrumentation schematics.

2.0 PIPING SUPPORTS, HANGERS, BRACKETS, CLIPS AND ANCHORS are to be designed, furnished and installed by Prime Contractor in accordance with Section 19.4, Specification 10-084-WS-5. Provisions shall be made on pipe and conduit supports for installation of 20% additional future pipes and conduits. The layout of these supports is subject to approval by the Humble Engineer prior to starting the detail design. Design loads shall provide for pipes full of water and conduits with the specified conductors.

3.0 All piping work shall conform to the ANSI Code for Pressure Piping Petroleum Refinery Piping ANSI B31.3, latest editions. Piping materials shall conform to the Class indicated on the P & I Diagrams and shown in the Piping Specifications in Section 18.1.

4.0 All piping welds are subject to radiographic inspection by inspectors as directed by Humble. The initial inspection will be paid for by Humble. Repairs and re-inspection costs are to be paid by the Prime Contractor. The acceptability of welds is in accordance with ASME Code Section VIII, Par. UW52.

5.0 All piping is to be hydrostatically tested at 150% of its design pressure as determined by the highest setting of any relief valve or rupture disc in the system. Only potable grade water shall be used for testing. All equipment and instruments shall be isolated prior to the tests. All tests shall be held for a minimum of one hour. Pressure recorders shall be used and a record shall be kept of each test. After final test all piping shall be drained and dried by passing warm air through the piping.

6.0 Instrument tubing materials shall conform to those shown on the drawings. All tubing shall be continuously supported in steel channels or firmly attached to piping runs. All tubing bends shall be neatly made with tubing benders.

7.0 All instruments shall be as described in the data sheets and/or on the specification sheets.

8.0 The Prime Contractor shall use only those craftsmen that are fully qualified and whose trades are normally engaged in piping and instrument installation. The work shall be first class in all respects including appearance. Humble reserves the right to refuse acceptance of any piping or instrument installations due to poor appearance. All piping to be run plumb and square.

19.4 STRUCTURAL

STRUCTURAL STEEL AND MISCELLANEOUS IRON WORK

1.0 GENERAL

1.1 Prime Contractor shall design, furnish material and construct:

(1) All piping and electrical conduit supports including main pipeways, hangers, anchors, brackets, clips and miscellaneous attachments to make the work a complete job. Pipeway and conduit supports shall be a maximum of 10 feet spacing along pipeways and conduit runs.

(2) Firewalls, control room walls, doors, windows, ceilings as indicated on the plans shall be designed for 30PSF wind load. The walls shall have a minimum of ¼" thick steel plate.

(3) Platforms, walkways and handrails as indicated and required by State of California Safety Orders listed in Section 1.6.

1.2 Prime Contractor shall furnish all materials, fabricate and erect the flare boom as shown on the drawings. He shall make any necessary modifications to the platform structure to adapt the boom.

2.0 DESIGN AND CONSTRUCTION

Design and Construction shall comply with the following:

(1) State of California Safety Orders
(2) United States Coast Guard Regulations
(3) AISC Code (latest edition).
(4) Uniform Building Code (latest edition) except wind load to be 30psf and the seismic loading shall be 20% of the dead load + line load.

Shop drawings shall be submitted in triplicate to the Humble Engineer for approval prior to starting the fabrication work.

2.1 All welds shall be continuously seal welded to eliminate crevices that cannot be properly protected with the protective coating.

2.2 All edges and corners shall be ground to a minimum of 1/8" radius prior to coating.

2.3 All steel work shall be protectively coated in accordance with Specification 10-084-C2.

PROTECTIVE COATING OF PIPING

1.0 GENERAL

This specification applies to Humble's offshore platform near Santa Barbara. Its purpose is to define what piping on the platform is to be coated and reference to the specifications for that work.

"Piping" as used herein means pipe, valves, flanges, bolts, valves and fittings.

2.0 PIPING TO BE COATED EXTERNALLY

All piping on the platform is to be coated externally in accordance with Specification 10-084-C2 except stainless steel piping.

3.0 PIPING TO BE COATED INTERNALLY

The following piping shall be internally coated:

Piping shown on the P & I Diagrams as "C" condensate, "E" emulsion, "FW" firewater, "JW" jetting water, "MP" meter prover, "PW" process water, "POW" potable water, "SG" sour gas, VR vapor recovery, "WC" well cleanup, "WW" washdown water. The protective coating shall be Tube-Kote TK21, 12 to 15 mils thick heat cured epoxy (or approved equal). All welds to be ground smooth prior to application of coating. Surface preparation to be same as Specification 10-084-C2.

4.0 PIPING NOT TO BE INTERNALLY COATED

The following piping shown on the P & I Diagrams shall not be internally coated: "DF" diesel fuel, "DG" dry gas, "FG" fuel gas, "GD" gravity drain, jacket water on pumps, "OD" oil drains, "MUD" mud to barge loading, "SWG" sweet gas, TL therminal, V vent relief and stainless steel piping in instrument air system.

20.0 FACILITY OPERATION

FACILITY OPERATION

1.0 GENERAL

The production facilities shall operate so as to separate the oil, gas, and free water into separate fluid streams in order to pump the oil to shore, to move the gas to shore or to reinject it, and to clean the produced water for ocean disposal. These facilities shall not allow any oil leaks, vapor emissions, or oily water to enter the ocean. Every consideration will be given to safety to insure that personnel are not subject to any known hazards.

2.0 TESTING, START-UP, AND DEBUGGING

After the facilities have been completely installed, the equipment will be subjected to comprehensive testing procedures. All lines and equipment will be hydrostatically tested in accordance with applicable codes. Instrument functions and operation will be checked for proper installation.

The facilities are further checked by process and operating personnel before startup. This phase of checkout normally includes familiarization of operating personnel to platform safeguards and instructions in shut-down procedures.

After it is determined that the platform facilities are free of any leaks, and it is apparently free of obvious flaws, start-up of units will proceed. The actual startup of the crude units would be expected to be relatively uncomplicated. Individual separators would be placed on line, and the crude placed in the surge tanks. Pumps and compressors would be started individually to test the operation of each unit.

It is not anticipated that facility start-up would cause any abnormal emission of sulfur dioxide or hydrocarbons. It may be necessary to flare small volumes of gas until a sufficient flow rate is obtained to start the compressors.

The water cleaning system can be charged with seawater to provide operational testing. The operation of this system is relatively simple and it is not expected that this system will prove unduly troublesome. Adjustments of this equipment as produced water is obtained would be expected.

3.0 NORMAL OPERATIONS

In normal operation, the facility should be capable of almost minimal operator attention except for monitoring the production rates. As more wells come on production, it will be necessary for him to observe that all the equipment is functioning properly at the new rate, but the automatic controls on the system should provide for this type of fluctuation.

Well testing will occupy some of the operators time to determine individual well rates.

Because the exact quantity of produced brine with the crude oil cannot be determined precisely until operation commences, it may be necessary to treat produced brine only a portion of the day until the quantity of brine increases. This may be the most efficient brine handling procedure.

Measured variables of flow, pressures, and levels can be observed by operating personnel in the control room. Alarms and status indicators of valve positions will be displayed for the operating personnel in the control room. Fire and gas detectors have indicators which will show if a sensing point has detected abnormal conditions. In case of upsets in unit operations, the operators can shut-down and by-pass separators or pumps, and, if necessary, shut down the entire platform without damage to equipment or release of any undesirable material to the environment.

One of the main duties of the operator will be to check operation of all safety equipment particularly as required by the USGS regulations. The operator will be responsible for making all the tests required by the OCS Orders.

4.0 ENVIRONMENTAL IMPACT

In operation, the production facilities should release no odors. All vapors generated by the crude oil in the surge tanks, and those vapors from the water cleaning system will be collected by the vapor recovery system and compressed for sales. During upset conditions, it is planned to burn all vapors to prevent emission of hydrogen sulfide with the gas. This will be done through the flare stack. Oil is kept in a closed system and all oil drains are piped to the oil sump for recovery. The decks are completely curbed and drains will collect any oil spills.

All water from washdown and rain is also collected and treated to prevent any contamination. The produced brine water is completely treated to remove oil to the quality required by the USGS regulations and disposed into the ocean through the disposal tube.

Noise levels should be minimal as electric motors are used extensively. The gas turbine-driven generator units will be equipped to reduce noise levels to those acceptable to current Federal Health and Safety Regulations.

5.0 EMERGENCY CONTROL AND OPERATIONS

Pressure vessels require pressure relieving devices to prevent rupture of the vessel. All the vessels on the platform are tied into the closed vent system. In all operations emergencies can occur due to mechanical failures and human errors. In case of emergency on platform all sources of oil, gas and water are shut-off to isolate the platform. This includes

shutting in wellheads and all pipelines from the platform. If a vessels relief system has been actuated it will be relieved thru the vent system which returns all liquids to a vent scrubber and thence to an emergency surge tank. All spilled liquids will be recovered through the deck drain system and pumped back into the oil system.

21.0 DRAWINGS

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-103	Test Separators V-2A, V-2B Piping Elevations
-104	Test Separators V-2A, V-2B Instrumentation Details
-105	V-2A-L.P. Test Separator
-106	V-2B-H.P. Test Separator
-107	Production Separator V-1A Gas Scrubber V-3 Piping and Instrumentation Diagram
-108	V-1B and V-1C Separator Piping and Instrumentation Diagram
-109	Gas Scrubber V-3, Production Separator V-1A Piping Plan
-110	Gas Scrubber V-3, Production Separator V-1A Piping Elevation
-111	Sandstone Separator V-1C and Production Separator V-1B Piping Plan
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-142	Sweet Gas Scrubber V-5 and Acid Tanks T-24, T-25, T-26
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-167	Sweet Gas Scrubber and Filters Piping Plan and Sections
-168	Crude Oil Metering Skid Piping Plan and Sections
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