UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of TEXAS UTILITIES GENERATING COMPANY, et al. (Comanche Peak Steam Electric Station Station, Units 1 and 2)	Docket Nos. 50-445-1 and 50-446-1

CASE'S ANSWER TO APPLICANTS' STATEMENT OF MATERIAL FACTS AS TO WHICH THERE IS NO GENUINE ISSUE REGARDING THE EFFECTS OF GAPS ON STRUCTURAL BEHAVIOR UNDER SEISMIC LOADING CONDITIONS

in the form of

AFFIDAVIT OF CASE WITNESS MARK WALSH

1. Applicants state:

"All bolts in multiple bolt, bearing-type connections will react imposed shear loads within at most the distance of the bolt hole tolerances. (Iotti, Finneran Affidavit at 8 /1/.)"

I disagree with this statement (and with some of the statements in the Affidavit). At the point all bolts begin to react the shear loads (that is, when the last bolt will have received a 1 lb. shear load), the first bolt that has reacted the shear load may have the shear load of 1,000 lbs., and this may have exceeded the allowable shear capacity of the bolt. This is assuming that the first bolt that reacted the shear load has not failed when the last bolt begins to resist the shear load.

/1/ I believe that the actual citation should be at 4-5.

One of Applicants' primary arguments which is contained in the back-up Iotti/Finneran Affidavit is regarding the definition of "oversized" bolt holes. This is addressed in detail in answer 2. following.

One example of statements with which I disagree which is made in the Affidavit of Dr. Iotti and Mr. Finneran is found on page 5 of the Affidavit (last paragraph, continuing on page 6), wherein they cite "Structural Design Guide to AISC Specifications for Buildings," by Paul F. Rice and Edward S. Hoffman (Attachment B to Affidavit).

Although the one page (268) from that document which Applicants have attached appears to be accurate /2/, their discussion and the portion cited (which is out of context) are very misleading. (See Attachment A, pages 264 through 271 of the Rice/Hoffman text.) In the portion attached by Applicants, Messrs. Rice and Hoffman are only talking about connections that receive static loads (i.e., loads that do not change direction) because the yielding stress criteria is not applicable in friction-type connections, as will be discussed later. The connections referenced by Messrs. Rice and Hoffman specifically exclude the supports that have dynamic loads (as will be shown below) such as most of those supports at CPSES. In addition, the inelastic deformation in bearing-type connections is recognized by the AISC Code at 1.5.2.2, where the allowable bearing stress is 1.35 Fy.

Therefore, the Applicants' statements are lacking reference to the

/2/ It should be noted that I have not reviewed the entire text of the other reference cited by Applicants, "Plastic Design of Steel Frames," and cannot state whether or not it is taken out of context.

specific amount of inelastic deformation allowed by the AISC Code for a non-dynamically loaded structure.

On pages 265-266 of the Rice/Hoffman text, following a discussion of AISC and ASTM specifications, it is stated (the numbers Messrs. Rice and Hoffman have placed in parentheses refer to sections from AISC or ASTM):

> "The use of ordinary (A307) bolts is limited by a number of Specification requirements. The allowable stresses are low: tension Ft = 20 ksi on the threaded area; and shear Fv - 10 ksi (1.5.2.1). The slip before full bearing is achieved on a group of ordinary bolts effectively rules out the sharing of stress in a mixed connection. Holes are to be taken as 1/16 in. larger than the nominal diameter (1.23.4), and the ordinary bolt does not expand to fill out the hole like a driven rivet nor can it be used for dependable friction. Stress sharing may not be assumed between ordinary bolts and rivets or welds (1.15.10; 1.15.11). In addition, low-strength bolts are not permitted in important field connections including . . . connections subject to vibration, impact, or stress reversal (1.15.12) . . . " (Emphases added.)

As discussed above, according to Messrs. Rice and Hoffman (Applicants' own chosen authority), A307 bolts are not permitted in connections subject to vibration, such as those at Comanche Peak.

Applicants have admitted that the connections at Comanche Peak are subject to vibration. Applicants' witness Finneran stated, in regard to the support which Jack Doyle and I noticed that had failed during hydrotesting (Tr. 4793/15-4794/4):

> "Q: (By Mr. Reynolds) Would you render an opinion on why the paint that Mr. Doyle talked about may have flaked during the flow of fluid through the pipe?
>
> "BY WITNESS FINNERAN:
> "A. I would say that possibly vibration may have been a cause for paint coming off of the deformed area during flow of fluid during the pipe; one possible cause.
>
> "Q. Yes. So what you are saying is that it could have been that when the deformation was caused during construction, the paint cracked but remained on, and then when vibration occurred due to hydrostatic flow, the paint chipped off?

"BY WITNESS FINNERAN:
"A. It's a possibility. I couldn't say if that's exactly what happened." (Emphases added.)

And at Tr. 5002/24-5003/9, Mr. Finneran further testified:

"Q: (By Mr. Walsh) Is vibration a common occurrence at Comanche Peak?

"BY WITNESS FINNERAN:
"A. I think all piping systems that have fluids in them or flowing to them are possibly subject to some vibration.

"Q: How about other pipes, main steam? Will they have vibrating effects?

"BY WITNESS FINNERAN:
"A. Quite possibly there will be vibration in the main steam piping." (Emphases added.)

The ASME Code requires the Applicants to minimize vibration where it states:

"**NF-3112.2 Design Mechanical Loads.** . . . The requirements of (a), (b), and (c) below shall apply.

". . . (c) Component supports shall be designed to minimize vibration."

In addition, according to Messrs. Rice and Hoffman (Applicants' own chosen authority), Applicants are also barred from using A307 bolts because of stress reversal.

As indicated above, Messrs. Rice and Hoffman cited the AISC code (to which the Applicants are committed through Specification MS-46A), Section 1.15.12, which states, in part:

"**Field Connections**

"Rivets, high strength bolts or welds shall be used for the following connections:

. . . Connections for supports of running machinery, or of other live loads which produce impact or reversal of stress.

"In all other cases field connections may be made with A307 bolts." (Emphases added.)

CASE requested, through discovery on the issue of Applicants' Motion for Summary Disposition regarding generic stiffnesses, the drawings which the Applicants used in their Motion. Of the 60 supports which the Applicants provided (I count 59, but this is immaterial to this point), 52 had reversible loads which is a reversal of stress on the supporting connection. (See Attachment B, the referenced 59 drawings.) On the drawings, the reversal of loads is shown in the block listing the loads and the direction of the load is indicated as + or - . Of the 7 supports which do not contain reversible loads (CT-1-013-006-S22S, CT-1-013-004-S32S, MS-1-001-002-C72S, MS-1-01-001-C72S, CT-1-013-002-C42S, CC-2-011-719-A53R, CT-1-013-011-S22R), 5 are spring cans and 2 are rigid-type supports. Based on this random sample, 88% of these supports require high strength bolts due to the requirement of a reversal of stress (load) /3/, according to the AISC Code (to which the Applicants are committed in design specification MS-46A).

It is also obvious from the preceding discussions that Applicants are in violation of ANSI N45.2.11, 3. DESIGN INPUT REQUIREMENTS, 3.2 Requirements, which states, in part:

> "The design input requirements should include the following where applicable:
>
> > "(9) Mechanical requirements such as vibration, stress, shock and reaction forces." (Emphases added.)

/3/ Stress is equal to the load divided by the cross-sectional area of the item under consideration.

2. Applicants state:

"Applicants' specifications for bolt hole tolerances are 1/16" for up to 1" diameter bolts and 1/8" for 1" and greater diameter bolts. (Iotti, Finneran Affidavit at 7.)"

I agree that this appears to be Applicants' current practice (although Applicants have not provided copies of the specifications themselves with their Motion for Summary Disposition). However, I do not agree with the implication, which is obviously that Applicants' specifications are acceptable. I maintain that Applicants' practice (or specifications) is contrary to applicable codes and NRC regulations.

One of Applicants' primary arguments which is contained in the back-up Iotti/Finneran Affidavit is regarding the definition of "oversized" bolt holes. This is a crucial argument for Applicants, because according to their own statement (bottom of page 6, Iotti/Finneran Affidavit):

> "The 8th Edition of the AISC Manual of Steel Construction is quite instructive on this point. At page 5-58 of the Manual, Paragraph 1.23.4.3 (Attachment C) states 'Oversized holes may be used in any or all plies of friction-type connections, but they shall not be used in bearing-type connections.'" (Emphasis added.)

Applicants claim (Affidavit, page 7) that they use more stringent tolerances than defined by the AISC Code (to which Applicants are committed, according to their Design Specification MS-46A). A claim the Applicants make in the Iotti/Finneran Affidavit (page 7) is:

> "AISC defines 'oversized' as d + 3/16" for bolts up to and including 7/8" diameter, d + 1/4" for 1" bolts, and d + 5/16" for bolts greater than or equal to 1 1-1/8" (sic) diameter."

I do not agree with Applicants' representation as to AISC's definition of "oversized." A point which the Applicants fail to make is as shown in Attachment C to their Affidavit, AISC Table 1.23.4, "Maximum Sizes of Fastener Holes, Inches" (emphasis added) -- that is, that these are the maximum size of holes. For a 1" diameter bolt, the maximum size hole for a standard hole is 1-1/16". If the hole is greater than 1-1/16" up to and including 1-1/4" for a 1" diameter bolt, the hole is considered oversized.

It is apparent that the Applicants do utilize an oversized hole for the 1" and greater bolts. As stated previously, paragraph 1.23.4.3 of Attachment C of the Applicants' affidavit (from 8th Edition, AISC Manual of Steel Construction, page 5-58), states:

> "Oversized holes may be used in any or all plies of friction type connections, but they shall not be used in bearing type connections." (Emphasis added.)

It can be seen from what is shown above that bearing type connections can only be used with standard size holes. If the hole is greater than a standard size hole, bearing connections are not allowed. Therefore, the Applicants are not in compliance with the AISC Code to which they are committed (according to their design specification MS46-A).

On page 7 of Applicants' affidavit, they state:

> "Thus, Applicants' specifications for bolt hole tolerances can definitely not be called 'oversized,' as that term is generally used in the construction industry."

Although the Applicants have not sized their bolt holes to the maximum allowed for an oversized condition, the bolt hole is still an

oversized hole (as discussed above). And, as the term is generally used in the construction industry, holes are considered to be oversized if they are over a standard sized hole, up to and including the maximum oversized hole allowed. Contrary to what Applicants state (Affidavit, page 7), they are not in compliance with standard industry practice.

There are several aspects of this matter of which the Board should be aware. One of the most important is whether or not Applicants even attempt to determine the size of bolt holes and, if so, how? During the 6/6/84 telephone conference call between Applicants/NRC Staff/and me, I requested documentation (original and all revisions of procedures or whatever other documentation exists) showing that QC inspectors inspect the whole tube steel base plates prior to inserting the bolt (which is the only way QC could be certain when inspecting that there were no oversize holes). (See 6/6/84 conference call Tr. 74-76.)

In Applicants' 7/15/84 letter to CASE President Juanita Ellis (received by CASE 7/16/84), Applicants' counsel stated (page 2, second full paragraph):

> "Second were materials concerning Applicants' practice regarding the inspection of bolt holes in base plates, which relates to the motion concerning the effect of gaps. This information is attached. Copies of an example of the Material Identification Log, and the associated hanger drawing, for support H-BR-2-5B-001-009-3 are provided. This log is filled out by the QC inspector prior to release of materials, including base plates, from the fabrication shop. Although not separately called out on the log, one of the attributes of base plates the QC inspector examines is bolt hole size." (First emphasis in the original; second emphasis added.)

I agree with the statement of Applicants' counsel that the

inspection of base plates for bolt hole size is not separately called out on the Material Identification Log, and in reviewing these documents (see Attachment C), I see no reference to the QC inspectors' verifying the hole size.

There is additional information which indicates that QC inspectors do not inspect for oversize bolt holes. In the sworn affidavit of Howard J. "Robbie" Robinson (sent to the Board and parties with CASE's 11/28/83 Answer to Board's 10/25/83 Memorandum (Procedure Concerning Quality Assurance)), Mr. Robinson stated (page 7):

> "My duties as general foreman over the fab shop consisted of fabricating items such as pipe hangers, cable tray hangers, and Q miscellaneous steel assemblies for subsequent installation in the field. . . I did, over a period of about three years, engage in an ongoing argument with one of the foremen within the steel hanger department whose duty was to install hangers in the field where he challenged the practice in the fab shop of drilling 1" holes in base plates to the code allowable of 1-1/16" diameter for a 1" bolt. His stand had been that we were allowed to overdrill the hole to a 1-1/8" diameter. . . he . . . made the statement to me that he had been drilling them oversize all along and intended to continue to. If he in fact did drill these holes oversize, and I believe that he did, one must assume that any subsequent QC inspection failed to identify this." (Emphases added.)

(See also discussion under answer 2. preceding.)

Further confirmation of what I believe to be the truth of this matter is to be found in a document concerning an investigation conducted by Applicants into allegations which had been made. (See Attachment D, 3/9/84 TUGCO Office Memorandum to Distribution from Jerry C. Walker, Subject: Resolution of QAI-0001, and the attached 2/22/84 TUGCO Office Memorandum from Boyce Grier to Antonio Vega, Subject: Investigation of Allegations QAI #0001.) Item 3, page 2, of the

2/22/84 Memorandum discusses allegations of an alleger that an oversize hole (1-1/2") had been drilled for a 1-1/4" Hilti bolt in a hanger base plate (i.e., a hole 1/4" larger in diameter than the bolt). Mr. Grier states that he subsequently identified the support in question as CC-2-070-002-A33R (copy of the as-built drawing for the support is Attachment F to his report). He further states:

> "There is nothing in the documentation package for this pipe support to indicate a requirement for or the approval of an oversize hole. I reviewed the reports of the QC inspections for the Hilti installation for this support. These are contained in the following:
>
> > "IRMH-19682, dated 7/1/81
> > "IRMH-53200, dated 2/15/83
> > "IRMH-53257, dated 2/22/83
>
> "These reports do not indicate any nonconforming or unsatisfactory conditions. (Blacked-out) stated during his interview that he had no knowledge of oversize holes ever being drilled for Hilti bolts.
>
> "I made inquiry of pipe support engineering (Jay Ryan) as to whether an oversize hole for a Hilti bolt in the support in question would be of concern. I was told that it would not be a problem.
>
> "The allegation that an oversize hole had been drilled for a Hilti bolt could neither be confirmed or dismissed. It appears that physical inspection of the holes for the support in question would be the only way to resolve this matter. In view of the response from Engineering regarding the significance of this matter, it does not appear necessary to pursue the matter further." (Emphases added.)

Thus, the investigator reviewed the documentation packages and saw no indication of an oversize hole or of a requirement for or the approval of an oversize hole. He reviewed the reports of the QC inspections, which did not include the Material Identification Log which Applicants' counsel referenced as being the documentation I

requested regarding Applicants' practice for the inspection of bolt holes in base plates. When he checked with pipe support engineering (Jay Ryan), he was told that the 1/4" oversize bolt hole would be no problem, although no basis is given in the report for Jay Ryan's disposition of the problem. Based on Jay Ryan's position, the investigator ceased his investigation -- even though he admitted that he could neither confirm or dismiss the allegation.

Therefore, as demonstrated above, Applicants' statement that they have no oversize holes (including those greater than the 1/8" criteria Applicants claim to use) is without substance.

3. Applicants state:

"Test data indicate that bolts of the kind Applicants use have margins of safety for shear displacements equal to the maximum bolt hole tolerances ranging from 5.6 (1 1/4" super kwick Hilti) to 3.2 (1 1/4" Richmond Inserts). (Iotti, Finneran Affidavit at 8-9.)"

I agree with this statement, but I do not see where it is material to the Board. This statement discusses displacements only. For the Applicants to be in compliance with IE Bulletin 79-02 the factor of safety must be based on ultimate load, not displacement.

Using the test data shown in Attachment A to Applicants' testimony in September 1982 (Applicants' Exhibit 142D, admitted at Tr. 4794, Attachment B), for a 3/4" diameter Hilti bolt loaded in shear, the load at 1/8" displacement is 10,000 lbs. The allowable load as listed in the PSE Manual (see Attachment E, PSE Manual, Section V, Hilti Concrete Anchor Bolts, Rev. 0, 1/8/82, page 8 of 10, Figure 6) is 3,693 lbs. for

a 3/4" diameter Hilti with 9-1/4" embedment. Therefore at 1/8" displacement, the Hilti bolt has exceeded its allowable by 10,000/3,693 = 2.71.

The same philosophy can be used for the Richmond insert. Referring to Applicants' Exhibit 142D, Attachment C, sheet labeled 5, at a displacement of .125" (1/8"), the shear load is approximately (14 + 16) /2 = 15 kips. The capacity for a 1" diameter A307 bolt is 7.85 kips. Therefore, the load in the bolt has exceeded the established allowable by 15/7.85 = 1.91.

In addition, in the design of pipe supports at CPSES, the designer assumes the support is rigid at the bolted connections and does not move, and determines the stiffness of the support or determines the deflection for the support based on this assumption (that is, that the bolted connections don't move). Now the Applicants are stating that the bolted connections by themselves will move 1/8". It would appear that the Applicants are not utilizing appropriate design assumptions. Only if the Applicants were utilizing friction type connections, would their assumptions be proper.

At this time it would be appropriate to bring to the Board's attention what I believe Applicants are up to. The Applicants, in this Motion for Summary Disposition, are addressing the consequences of gaps in bearing type connections. The Applicants have claimed to this Board on the record (for example, Tr. 5154/18-5154/15, 5161/7-25, and 5208/1-17) that they utilize bearing type connections in the design of base

plates utilizing Hilti bolts. But in response to one of Cygna's questions in regards to Hilti bolts, the Applicants informed Cygna that they are designed as friction type connections and will not move because they are pretorqued. See Attachment F (copy of the 4/19/84 letter, with relevant attachments, from L. M. Popplewell, Project Engineering Manager, TUGCO, to Ms. Nancy Williams, Project Manager, Cygna Energy Services), wherein Applicants state (bottom of page 9):

> "Using our design approach, the Hilti joints, since they are pretorqued, would perform as a friction joint within their working loads." (Emphasis added.)

This is a complete reversal of philosophy by the Applicants, not presented to the Licensing Board before. At Tr. 5208/1-7, Dr. Chang states that the loads due to pretorquing are to set the wedges and the pretorque value used is too small to be considered sufficient as a friction-type connection.

It is apparent that the Applicants are singing a different song in their response to Cygna. There is no indication within the Phase 3 Cygna Report that Cygna investigated whether or not the Hilti bolts are torqued sufficiently to be considered as a friction-type connection.

One must consider whether or not the statement made to Cygna is true (i.e., the pretorque provided to the Hilti bolts is sufficient to consider them as friction connections). The allowable shear force assuming a safety factor of 2 can be calculated by the following formula modified from the Applicants' Motion for Summary Disposition on cinched-up U-bolts, page 14 of Affidavit, modified to accommodate the shear force requirement:

$V = (T/K \times D)(.4)/FS$

where V = the allowable shear capacity

.4 = the coefficient of friction between concrete and steel

K = torque coefficient = .3

D = diameter of bolt (say, a 3/4" diameter)

T = the applied torque

FS = factor of safety = 2

The Brown & Root procedures shown in CASE Exhibit 669B (Attachment to Deposition/Testimony of CASE Witness Jack Doyle), sheet 10P, for a 3/4" diameter bolt has a required torque of 150 foot-lbs.

The allowable shear value is thus

$1/2 \left((150)(12) / (.3)(.75) \right) (.4) = 1{,}600$ lbs.

The allowable listed in the PSE Manual for a 3/4" diameter Hilti bolt is 3,693 lbs. or a (3693/1600)(100) = 231% difference.

The above analysis does not include creep effects on the concrete; these effects will decrease the pretorqued value. The coefficient of friction between the nut and the Hilti bolt was assumed to be .3. Therefore, my analysis is on the very liberal side, and the Applicants' statement to Cygna that the Hilti bolt connection is a friction connection is lacking proper consideration.

In addition, when Brown & Root tested the Hilti bolts for compliance to IE Bulletin 79-02 and compared pretorque to ultimate load, they neglected to consider an important factor. This factor is that Brown & Root did not measure the load induced into the bolt due to

pretorquing, but rather the ultimate load due to pretorquing in a tension test. To have measured the pretorqued value would have required Brown & Root to measure the displacement of the bolt due to an applied load. When the bolt first begins to displace is when the pretorqued value is determined.

4. Applicants state:

"Consideration of all bolts in multiple bolt, bearing connections, with bolt hole tolerances equivalent to those used by Applicants, to react shear loads equally is accepted industry practice and is premised on the fact that the inelastic localized deformations that could result from self-limiting stresses do not unacceptably reduce the ultimate bolt capacity. (Iotti, Finneran Affidavit at 5-7.)"

I disagree with this statement. As already discussed above, accepted industry practice does not allow bearing-type connections when the bolt hole is greater than the maximum standard sized hole. The inelastic localized deformations that the Applicants are relying on have limitations that the Applicants failed to address, as shown above; i.e., allowable bearing stresses and when bearing connections can and cannot be used. Therefore, the conclusion that the Applicants have attempted to make is not complete and violates established code allowables and industry practice.

5. Applicants state:

"The report CASE relied on (CASE Exhibit 1001) to support its contention that at most two bolts may be considered to react shear loads in multiple bolt, bearing connections addressed connections in which bolt hole tolerances from 1.33 times bolt diameter, up to 1/2" for 1" bolts, may be present.

"These conditions could result in a safety factor for shear displacement of only 1.1. (Iotti, Finneran Affidavit at 9-10)."

I disagree with the first sentence. As stated above, the inelastic deformations that occur with the Applicants' position will exceed established code allowables (i.e. allowables based on load, not displacement) with these oversized holes the Applicants use. What Dr. Fisher (referenced in the Iotti/Finneran Affidavit) was addressing was a warning to engineers and designers of the new Code provisions; i.e., an allowance for excessively oversize holes in column base plates where tensile forces are not commonly seen, and the shear force is accommodated by the compressive load of the column. With the old Code (i.e., the 7th Edition), no oversize hole was allowed with A307 bolts to resist a shear load. But the new Code not only allows the oversize hole but the hole can be larger because, as Dr. Fisher states, columns are generally not experiencing tensile loads. Therefore, Dr. Fisher provides methods to accommodate connections for columns that do not contain sufficient compressive loads.

I partially agree with the second sentence, to the extent that it is correct when one considers displacement only, and not allowable stress, for a nuclear power plant.

6. Applicants state:

"In a seismic event, only the first quarter cycle loading could cause preferentially loaded bolts to deflect in shear.

"For the remainder of the cycles the bolts will equally react the loading (Iotti, Finneran Affidavit at 13.)"

I agree with the first and second sentences; however, they are not reflective of the true extent of the problem, as discussed in the following.

The Applicants' example and position is demonstrated in Figure 1 below. At the end of the first quarter cycle loading on a two-bolt base plate, the bolt that reacts first may deform at the peak of the cycle, as shown in Figure 1b below, as the Applicants state. And as shown in Figure 1c, the bolt is permanently deformed. In addition to this, Applicants have another flaw in their presentation. They assume that the bolt is behaving in a ductile manner, under a shear load. This assumption is not consistent with the following statement from NRC Regulatory Guide 1.124 ("Service Limits and Loading Combinations for Class 1 Linear-Type Component Supports," admitted at Tr. 5901, page 1.124-2, B.1.b.):

> "The increase permitted by NF-3231.1 and F-1370(a) of Section III for shear stresses or shear stress range should not be more than 1.5 times the level A service limits because of the potential for non-ductile behavior." (Emphasis added.)

Nowhere in ASME NF are the level A service limits or the AISC Code for shear stress allowed to exceed the yield strength of the material. Therefore, the Applicants are in violation of the ASME code, as well as the AISC Code, when they allow the bolts to exceed the yield strength in shear and deform.

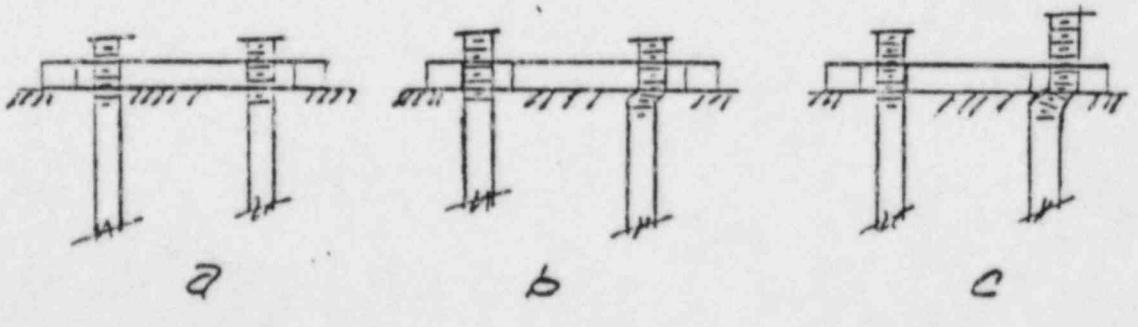


FIGURE 1

The above example consisted of a stiff plate and a flexible bolt. Another condition can also occur, and that is a stiff bolt and a flexible plate, as shown in Figure 2 following.

As shown in Figure 2b, at the end of a 1/4 cycle the original circular hole for bolt A has deformed into an eliptical type of configuration. At the end of the 1/2 cycle, there is now a gap on both sides of bolt A, as shown in Figure 2c below, and there is no bearing between bolt A and the plate. At the end of the 3/4 cycle, the hole for bolt B has now deformed into an eliptical type of configuration, as shown in Figure 2d. At the end of the first full cycle, as shown in Figure 2e below, there are now two permanently elyptical-type holes with gaps twice as large as before the cyclic motion began, and neither bolt A or B is in bearing. If the original gap for a 1" diameter bolt was 1/8", the gap now is 1/4", and this would definitely be considered an oversized hole in that particular direction. This is <u>not</u> allowed for bearing type connections, as Applicants should agree.

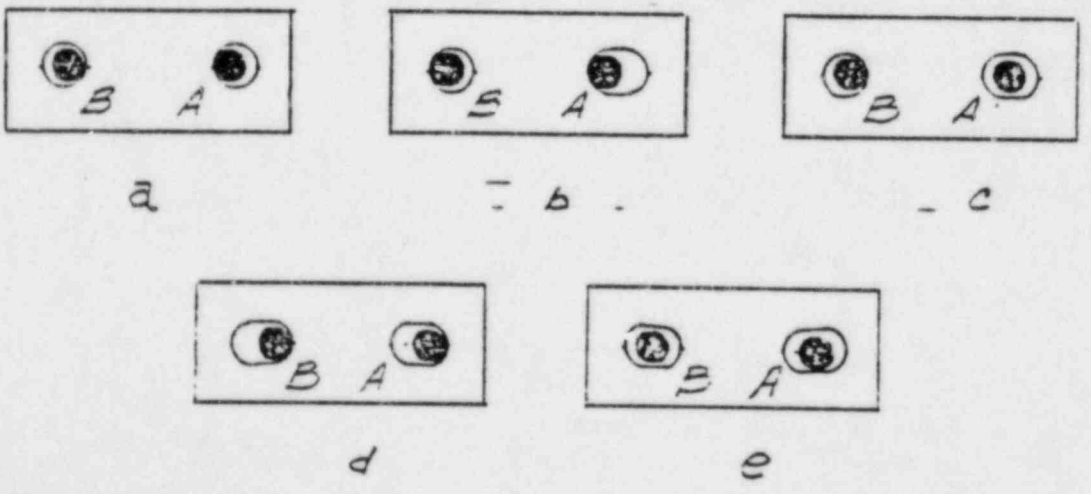


FIGURE 2

The deformation discussed in example 2 is possible since the AISC Code at 1.5.2.2 allows the bearing stress of the plate to exceed the yield strength of the plate in the bearing type connection. The deformation discussed in example 1 (the condition which the Applicants cite) is possible, but would conflict with Regulatory Guide 1.124. And nowhere in the AISC Code is the bolt stress allowed to exceed the yield strength in shear.

Example 2 is realistic when one considers the A307 bolt/tube steel/Richmond insert condition. When the axial force from the tube steel member is transferring this axial load to the bolt by means of shear, the NRC Special Inspection Team (SIT) (as well as the Applicants) claimed that approximately 85% of the axial force being transferred as shear is in the flange of the tube steel member closest to the concrete. The thickness of the tube steel is at most 1/2" thick and the bolt is 1-1/2" diameter (minimum) for supports within the containment. The bolt is designed for an allowable stress value equal to 10 ksi (from Table 1.5.2.1 of the AISC Code, 7th Edition), yet the allowable bearing stress of this thin tube steel member has an allowable of 48.6 ksi for yield strength equal to 36 ksi. The allowable capacity for a 1-1/2" diameter bolt is equal to 17.67 kips. Due to the high allowable for bearing stress, the allowable force for the tube steel member is equal to 36.45 kips. This high allowable will permit deformations for the bearing type connections when cyclic loads are not a consideration. For this reason, example 2 shown above is more realistic for the supports at Comanche Peak than the Applicants' example and position. In either case, the gap is an unacceptable

condition for a dynamically loaded structure, and is not permitted under the AISC Code, Section 1.15.12 discussed in item 1, page 3, of this affidavit.

7. Applicants state:

"The effect of gaps in seismic analyses cannot be defined in absolute terms. The effect is dependent on many factors, including the nature of the excitation (magnitude and distribution of frequencies), and the size, orientation and number of gaps. (Iotti, Finneran Affidavit at 13-14.)"

As indicated on page 14 of the Applicants' Affidavit, the existence of gaps in bearing type connections is a very complicated issue by the fact that non-linearities introduce additional impact loadings, as well as impact damping, and as the Applicants stated: "Clearly, consideration of such effects would require complex analyses which depart from accepted practices." (Page 14 of Affidavit.) Not only do I agree with this statement, but the AISC Code has recognized the complexity of the gap in bearing type connections due to cyclic loads. Paragraph 1.15.12 Field Connections requires high strength bolts for supports which produce impact or reversal of stress, as discussed above in Answer 1, page 3 of this Affidavit.

Therefore, the complexity to which the Applicants refer is their own doing. The Applicants decided to use bearing type connections with low strength bolts, and consequently are now attempting to justify their erroneous decision. The Applicants have resorted to crying on the Board's shoulder about how complex it would be if they were required to analyze the supports as they now exist.

8. Applicants state:

"Impact damping also occurs in seismic events where gaps are present.

"To account for this damping, however, would require consideration of effects that require complex analyses which depart from accepted design practices. (Iotti, Finneran Affidavit at 14.)"

I agree with the first sentence.

I agree with the second sentence, as discussed above in answer 7. However, I disagree with their back-up statement on page 14 of the Iotti/Finneran Affidavit, that the impact damping values would be greater than those specified by Regulatory Guide 1.61, for the following reasons: If the Applicants' position is that a higher damping value would be allowed for bearing type connections, it is obvious that Regulatory Guide 1.61 does not allow bearing type connections for cyclic loads, or it would have been listed as a specific item, with a higher damping value. But since bearing-type connections are <u>not</u> common industry practice for seismically qualified supports, Regulatory Guide 1.61 did not list it. Therefore, the Applicants' conclusion that a higher damping value should be allowed due to the bearing type connection would conflict with Regulatory Guide 1.61, as well as the AISC Code (to which Applicants are committed.)

9. Applicants state:

"Material damping will take place as the gap is transversed without a corresponding feed of energy from the seismic event.

"This is a beneficial effect for the seismic response of the system. (Iotti, Finneran Affidavit at 14-15.)"

I agree with the first sentence, as far as it goes, and if one is not concerned with the inelastic behavior and unpredictable behavior of the connection.

I disagree with the second sentence, because you lose the ability to predict the response of the system; you do not know where supports will be moving due to the bearing type connection; you do not know which supports will have the inelastic deformations of the bolts.

10. Applicants state:

"Each of the factors discussed in Findings 7-9 cannot be accounted for in the typical linear response spectrum analyses, as are used at Comanche Peak. (Iotti, Finneran Affidavit at 15.)"

I agree with this sentence, but that does not necessarily mean that the Applicants' position is a correct one. To begin with, IE Bulletin 79-02 required the Applicants to perform tests on expansion anchor bolts. The Applicants neglected to measure the amount of displacement that occurs at the allowable shear value. This is the Applicants' own negligence.

Another important factor which the Applicants were negligent on is the use of the Richmond insert/A307 bolt/tube steel connection. 10 CFR 50.34(a)(2) states:

"50.34 **Contents of applications; technical information**

"(a) Preliminary safety analysis report. Each application for a construction permit shall include a preliminary safety analysis report. The minimum information to be included shall consist of the following: . . .

"(2) A summary description and discussion of the facility, with special attention to design and operating characteristics, unusual or novel design features, and principal safety considerations." (Emphasis added.)

This Richmond insert/A307 bolt/tube steel connection is not mentioned in the Applicants PSAR, although it is unusual and novel, as I have stated and the Applicants' own witnesses have admitted. (See Walsh, Tr. 3145/6-3146/8; Krishnan, Finneran, Scheppele, Reedy, and Chang, Tr. 5061/18-5065/8.)

In addition, during the 7/3/84 meeting in Bethesda between the NRC Staff and Cygna Energy Services regarding the Cygna Phases 1 and 2 Independent Assessment Program, during a discussion between the Staff's Mr. Terao and Cygna's Ms. Williams, Mr. Terao also indicates that he recognizes that this is an unusual and novel design and points out the importance of the design organization's (such as Gibbs & Hill) having followed ANSI N45.2.11, Section 6.2, which states:

> "The extent of the design verification required is a function of the importance of the safety of the item under construction, the complexity of the design, the degree of standardization, the state of the art, and the similarity with previously proven designs."

Mr. Terao discusses examples of an unconventional design, then states (7/3/84 Meeting Tr. 57):

> "I don't really see that there's a problem with Richmond inserts, just like there is no problem with the modeling of dual function restraints, in other words, just the Richmond inserts alone, taken by themselves, there's no problem.
>
> "But it has to do with the design considerations that go along with it. And one of design considerations is the use of the tube steel with the holes in it as anchorage for the Richmond insert."

(See full discussion, 7/3/84 Staff/Cygna meeting Tr. 50-57.)

11. Applicants state:

"Each of the factors discussed in Findings 7-9 can only be accounted for with difficulty by performing nonlinear time history analyses. (Iotti, Finneran Affidavit at 15.)"

I agree with this statement. Based upon this statement by itself, it would seem reasonable that the Board require the Applicants to either perform the non-linear time-history analysis which they reference above or utilize a friction-type connection in the supports that are already constructed. But, as discussed in answer 12. below, the utilization of a friction-type connection would validate the assumptions the designers used in their original analysis.

12. Applicants state:

"Identifying the effects of gaps by comparison of the results of nonlinear time history (with gaps) and response spectrum (without gaps) analyses is difficult and one may not discern whether particular results are attributable to differences in individual variables or assumptions or the analytical techniques themselves. (Iotti, Finneran Affidavit at 15-16.)"

I agree with this statement. From what the Applicants have just stated, it would appear that they must be required to install at all supporting connections a friction-type connection to validate their original assumptions, and to have them fabricated as friction-type connections. The Applicants may, in the future, state that their being required to redesign their supports for friction-type connections would be costly (in the hopes that the Board will give them yet a third chance), but as stated above in the previous answers, the Applicants should have done it right to begin with.

13. Applicants state:

"Comparison of the results obtained by response spectra analyses and nonlinear time history analyses which simulate actual gaps in systems show that

"a) the seismic response spectrum method, which ignores the nonlinearities, is more conservative than the non-linear time domain method (which includes gaps), and

"b) the effect of gaps on reduction of response frequency is negligible due to the transient nature of the seismic acceleration loading."

"(Iotti, Finneran Affidavit at 16-17.)"

I disagree with Applicants' statements, because if what Applicants state were true, the AISC Code would allow bearing type connections in dynamically loaded structures and supports -- it does not. If the Applicants wish to use the nonlinear time domain method (which includes gaps) to be less conservative than the response spectra method, that would be their option; but as stated above in answer 12, this is not realistic.

In summary, I believe that the Applicants did not properly consider the effects of gaps in the initial or final (i.e., vendor certified) design of pipe supports. The AISC Code does not allow bearing type connections in supports where there is a cyclic type load. The Applicants, on the majority of their supports, have cyclic type loads. They utilize bearing type connections and are therefore in conflict with the AISC Code (to which they are committed). The Applicants rely on references to inelastic deformations to justify their position but omit the consideration of full cyclic loads in the inelastic deformation discussions. They depend on damping factors that are not recognized by the NRC in Regulatory Guide 1.61 for a

justification, after the fact, of their negligence. Because of these gaps, the Applicants are not able to predict how these systems will react to imposed loadings.

If they planned to use this unusual and unique design, Applicants should have initially included it in their PSAR -- they did not. They freely admit that it would be difficult to properly analyze the as-built condition of the supports as they now exist. And finally, Applicants state that the gaps that do exist at Comanche Peak in pipe supports (which I believe are in violation of the AISC Code) are more conservative than the Code requires the Applicant to comply with. In essence, Applicants are trying to convince the Board that not complying with the AISC Code is conservative. I do not agree.

Attachments:

Attachment A -- "Structural Design Guide to AISC Specifications for Buildings," by Paul F. Rice and Edward S. Hoffman, pages 264 through 271 -- (see answer 1, page 2)

Attachment B -- 59 drawings (received on discovery re: Applicants' Motion for Summary Disposition regarding generic stiffnesses), demonstrating reversible loads -- (see answer 1, page 5)

Attachment C -- Copies of an example of the Material Identification Log and associated hanger drawing for support H-BR-2-5B-001-009-3, regarding Applicants' practice re: inspection of bolt holes in base plates -- (see answer 2, pages 8-9)

Attachment D -- 3/9/84 TUGCO Office Memorandum to Distribution from Jerry C. Walker, Subject: Resolution of QAI-0001, and attached 2/22/84 TUGCO Office Memorandum from Boyce Grier to Antonio Vega, Subject: Investigation of Allegations QAI #0001, regarding allegations of oversize bolt hole -- (see answer 2, pages 9-10)

Attachment E -- PSE Manual, Section V, Hilti Concrete Anchor Bolts, Rev. 0, 1/8/82, page 8 of 10, Figure 6, re: allowable load for Hilti bolt -- (see answer 3, pages 11-12)

Attachment F -- 4/19/84 letter with relevant attachments, from L. M. Popplewell, Project Engineering Manager, TUGCO, to Ms. Nancy Williams, Project Manager, Cygna Energy Services, advising Cygna that Hilti joints perform as a friction joint -- (see answer 3, page 13)

The preceding CASE's Answer to Applicants' Statement of Material Facts As To Which There Is No Genuine Issue was prepared under the personal direction of the undersigned, CASE Witness Mark Walsh. I can be contacted through CASE President, Mrs. Juanita Ellis, 1426 S. Polk, Dallas, Texas 75224, 214/946-9446.

My qualifications and background are already a part of the record in these proceedings. (See CASE Exhibit 841, Revision to Resume of Mark Walsh, accepted into evidence at Tr. 7278; see also Board's 12/28/83 Memorandum and Order (Quality Assurance for Design), pages 14-16.)

I have read the statements therein, and they are true and correct to the best of my knowledge and belief. I do not consider that Applicants have, in their Motion for Summary Disposition, adequately responded to the issues raised by CASE Witness Jack Doyle and me; however, I have attempted to comply with the Licensing Board's directive to answer only the specific statements made by Applicants.

/ Mark Walsh
(Signed) Mark Walsh

STATE OF TEXAS

On this, the 12 day of August, 1984, personally appeared Mark Walsh, known to me to be the person whose name is subscribed to the foregoing instrument, and acknowledged to me that he executed the same for the purposes therein expressed.

Subscribed and sworn before me on the 12 day of August, 1984.

Samuel W. Nestor
Notary Public in and for the
State of Texas

SAMUEL W. NESTOR
My Commission Expires
1-31-85

My Commission Expires: _____

Structural Design Guide to AISC Specifications for Buildings

Paul F. Rice
Edward S. Hoffman

VNR VAN NOSTRAND REINHOLD COMPANY
NEW YORK CINCINNATI ATLANTA DALLAS SAN FRANCISCO
LONDON TORONTO MELBOURNE

Van Nostrand Reinhold Company Regional Offices:
New York Cincinnati Atlanta Dallas San Francisco

Van Nostrand Reinhold Company International Offices:
London Toronto Melbourne

Library of Congress Catalog Card Number: 75-40491
ISBN: 0-442-26904-8

Manufactured in the United States of America

Published by Van Nostrand Reinhold Company
450 West 33rd Street, New York, N.Y. 10001

Published simultaneously in Canada by Van Nostrand Reinhold Ltd.

15 14 13 12 11 10 9 8 7 6 5 4 3 2

Library of Congress Cataloging in Publication Data

Rice, Paul F 1921-
Structural design guide to AISC specifications for buildings.

Includes bibliographical references and index.
1. Structural design—Handbooks, manuals, etc.
2. Building—Contracts and specifications. I. Hoffman, Edward S., 1920- joint author. II. Title.
TA658.3.R52 690 75-40491
ISBN 0-442-26904-8

This book is intended t
tine designs with the spe
steel and joist constructi

Each new AISC Speci
language for safe struct
plastic design, each nev
economy of material wa
design calculations.

The increasing compl
for design. Computer
however, and computers

This Guide does not
the Manual of Steel C
mentary, shows how to
Manual. It converts so
to direct design. It pr
design.

Tables 3-1 and 3-2 p
AISC equations for all
beam section, or solut
about three minutes.

Specification require
tions have been assemb
frames, composite cor
based on structural st
cussed to aid the str
specifications.

It is assumed that us
as well as the terms ar
requirements in the or

5

CONNECTIONS

General

The latest AISC Specifications permit a wide variety of connections. The basic requirement, appropriate with the sophisticated combinations of different types of steel to be connected, different design requirements of connections, and different means of connections, is a performance requirement consistent with the overall development of the Specifications. This requirement states simply "... that the design of connections be consistent with the assumptions as to the type of construction...." (1.2). Each of the detailed requirements for the design of connections simply builds upon this basic requirement. By implicitly or explicitly requiring that the design of a particular type of connection be consistent with the design assumptions as to the type and amount of force to be transmitted, and rotation capacity (or rigidity) consistent with the rotation assumed necessary to develop the connection forces, the basic performance requirement is completed (1.2).

The Specifications explicitly recognize inelastic behavior in connections of members designed as elastic: "virtually unchanged" angles at the joints in rigid frames, "non-elastic" deformation of parts of connections in Type 2 and 3 construction, and "inelastic rotation" for wind connections with Type 2 construction (1.2). Elastic behavior in the connections of members under plastic design is implicitly recognized (2.1).

Scope

For the purposes of this Chapter, connections are most conveniently considered as classified on two bases; (1) materials used (rivets, bolts, pins, or welds), and (2) the assumed behavior of the connection (design requirements: rigid, semi-rigid, or plastic for moment; shear transmission only; tensile or compressive force only; or combinations). In addition to forming joints between two or more steel members or parts of members, connections are required to elements composed of other structural materials. For composite action with concrete elements not bonded by encasement, shear connections are required (1.11.1). Shear connections may utilize specially designed shear connectors or standard welded stud connectors (1.11.4; 1.4.6). For connection of steel column bases to transmit any direct tension or shear, anchor bolts are required (1.22).

It is not intended in th
in the *AISC Handbook*,
presentation of a wide r
search in this area. (See
explanations and illustra
overlooked or troublesor
able interpretations to re
extension of such interp
been desirable to extend
plate connections were
design to cover an appa
Code. During the interi
revised to agree with the

Rivets, Pins, and Bol

Rivets and Pins. The re
years ago and were in
been directed toward
there has been little ch
the requirements for, ar
in little need for interp
available under ASTM
are given in Table 1.5.
(1.14.2); computed as p
diameter of the rivet ho

The use of pin conn
modern steel building,
ing special design. The
unchanged from previo

Perhaps the most use
alterations or additions
construction, bearing-t
(1.15.10). If used in c
strengthening existing
place loads, and the ne

Bolts. Bolts may be cl
A325, for F_t = 40 ksi,
(A307) bolts are usabl
may be designed for eit

The use of ordinary
The allowable stresses
10 ksi (1.5.2.1). The
fectively rules out the
$\frac{1}{16}$ in. larger than the n
fill out the hole like a
ing may not be assum
In addition, low-streng
column splices in all
where width/height <

It is not intended in this chapter to duplicate the design aids, detail data, and examples in the *AISC Handbook*, Part 4, Connections. Equally, space limitations do not permit presentation of a wide range of examples to illustrate even the recently published research in this area. (See "Selected References".) Rather, the purpose here is limited to explanations and illustrations of all applicable Specification requirements that might be overlooked or troublesome in routine work. This aim will include indication of reasonable interpretations to resolve apparent conflicts or ambiguities in the Specifications, and extension of such interpretations where the Specifications seem to have omissions. It has been desirable to extend this aim somewhat in that design aids for bearing plate and base plate connections were included as well as an extension of concrete bearing connection design to cover an apparent gap between the AISC Specifications and the ACI Building Code. During the interim between preparation and publication, AISC specifications were revised to agree with the latest ACI Building Code.

Rivets, Pins, and Bolts

Rivets and Pins. The requirements for the use of rivets and pins were established many years ago and were in many AISC Specifications. Since most of the late research has been directed toward welded, and more recently high-strength bolted connections, there has been little change in the Specifications for the use of rivets. Familiarity with the requirements for, and a sharply reduced use of, rivets in building construction results in little need for interpretations of these Specifications. Rivets of Grades 1 and 2 are available under ASTM A502 (1.4.3). Allowable stresses (for tension and bearing only) are given in Table 1.5.2.1 (1.5.2.1). Net sections for tension members must be used (1.14.2); computed as prescribed (1.14.3); and allowance of $\frac{1}{16}$ in. made plus the nominal diameter of the rivet holes (1.14.5).

The use of pin connections, originally popular in truss construction, has declined in modern steel building, and is usually encountered only for very special situations requiring special design. The general requirements for the use of pins are brief and essentially unchanged from previous Specifications (1.14.6).

Perhaps the most used application of these Specification requirements today will be in alterations or additions to existing buildings in which rivets or pins were used. For new construction, bearing-type connections can not be assumed to share stress with welds (1.15.10). If used in combination, the welds must be designed for the entire stress. In strengthening existing construction, bearing connections can be assumed to carry the in-place loads, and the new welds designed only for the additional stress (1.15.10).

Bolts. Bolts may be classified by strength as (1) low, A307, for $F_t = 20$ ksi; and (2) high, A325, for $F_t = 40$ ksi, and A490, for $F_t = 54$ ksi . . . (1.5.2.1). The ordinary low strength (A307) bolts are usable only in bearing connections (1.5.2.2). The high strength bolts may be designed for either bearing or friction connections (1.5.2.1).

The use of ordinary (A307) bolts is limited by a number of Specification requirements. The allowable stresses are low: tension $F_t = 20$ ksi on the threaded area; and shear $F_v = 10$ ksi (1.5.2.1). The slip before full bearing is achieved on a group of ordinary bolts effectively rules out the sharing of stress in a mixed connection. Holes are to be taken as $\frac{1}{16}$ in. larger than the nominal diameter (1.23.4), and the ordinary bolt does not expand to fill out the hole like a driven rivet nor can it be used for dependable friction. Stress sharing may not be assumed between ordinary bolts and rivets or welds (1.15.10; 1.15.11). In addition, low-strength bolts are not permitted in important field connections including column splices in all buildings with $H \geq 200$ ft., and where width/height < 0.25; also where width/height < 0.40, for $H \geq 100$ ft.; beam-column or column-bracing connections

where $H > 125$ ft.; frames carrying cranes with more than five-ton capacity; and connections subject to vibration, impact, or stress reversal (1.15.12); nor for flange-to-web nor cover plate-to-flange connections of built-up girders (1.10.4).

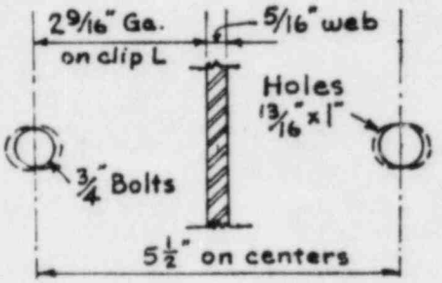
High strength bolts (1.16.1) and welds are considered essentially equivalent as connections, and, for friction-type joints assembled prior to the welding, the high-strength bolts may be assumed to share stress with welds in a mixed connection (1.15.10) or with rivets (1.15.11). Gross sections may be used for the design of compression members (1.14.2), and for the flanges of both built-up and rolled-shape girders provided the area of holes is equal to or less than fifteen percent of gross flange area (1.10.1). For tension members net section area is the basis of design (1.14.2). In friction-type joints resisting direct tension, the shear stress permitted with high strength bolts must be reduced (1.6.3).

Slotted Holes for Bolted Shear Connections. The use of short-slotted holes is permitted under 1974 AISC Specification for "Structural Joints Using ASTM A-325 or A-490 Bolts," Section 3, subject to the approval of the designer. They can be used in either friction-type or bearing-type connections, provided a washer is installed over the hole.

The normal hole size for a $\frac{3}{4}$" ϕ bolt is $\frac{13}{16}$", whereas a short-slotted hole is $\frac{13}{16}$" deep by 1" long (or $\frac{3}{16}$" longer in the horizontal dimension). While the Specifications state that the hole can be either vertical or horizontal, the authors suggest only the horizontal slotted method be used. End clip holes only would be slotted, not the holes in the connection beam or column. See sketch, a full scale view of the end clip holes and bolt relationship for a typical $\frac{5}{16}$" thick web.

The advantages to this system are many, several of which are:

1. Greater erection speed with less field burning of misaligned holes.
2. The use of one size clip angle with a set gauge will accommodate web thickness from $\frac{3}{16}$" to $\frac{9}{16}$".
3. The reduction in sizes of clips to fabricate and stock should help reduce costs.
4. The speed of erection (and elimination of mill web thickness tolerance problems) should help reduce cost.



Short-slotted holes layout for clip ∠s - shear connection

Welds

General. Full penetration groove-welds can be designed for full development, same stress as the base metal (1.5.2.1), by selection of the specified matching electrode and welding process (1.17.2). For all fillet, plug, and slot welds, and partial penetration groove-welds, reduced permissible stresses upon the effective throat area (1.14.7) are specified (1.5.2.1). In no case may the stresses exceed that for the base metal, or if different, the weaker base metal (1.5.2.1).

Special Considerations. A number of minor special considerations arise in the specification of welding. Generally, net sections are not a consideration except for plug and slot welds in which the gross area of the holes is deducted to check the fifteen percent maximum allowed (1.10.1; 1.14.3). The Specifications require preheating for various conditions, including all work when the temperatures are below 32°F (1.23.6). Except for single- and double-angle or similar minor members, welds are to be laid out to avoid eccentric axial force or such eccentricity must be considered in the design of the connection

and the member connecte
to accommodate the nece
and the selection of the co

As previously noted, wi
quired as a mixed conne
required prior to the welc
also important, though n
generated in the operati
strained, leave correspond
local inelastic yielding, b
warping and lamellar tear
caution of a specified *seq*
avoid warping. Even afte
to retain adverse residua
pected, stress relief by h
service is not provided un

The use of a proper s
same can also be specif
Particularly with thicker
restrained and the result
should be given to the
practicable sequence as
strains without developir
the entire connection d
economical to specify a p

Connection Design

Classification. In additi
connections, certain arb
established. All connec
support not less than s
shear in flexural memb
members, all at allowab
members are to be desi
(1.15.2). These minim
of light members such
bers are required to me
the minimum six kips
strength of the membe
truss in which the mini
load for open web stee
design stress or half th
Joists; Examples.)

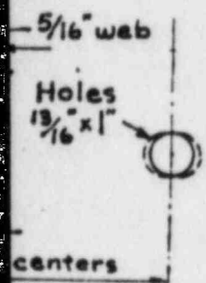
As noted previously,
metho d or the design
the transmission of she
bers connected and tra

*"Commentary on Highly
1973.

capacity; and connec-
for flange-to-web nor

equivalent as connec-
he high-strength bolts
.15.10) or with rivets
on members (1.14.2),
ed the area of holes is
For tension members
joints resisting direct
educed (1.6.3).

ted holes is permitted
TM A-325 or A-490
can be used in either
led over the hole.
d hole is $\frac{13}{16}$" deep by
ecifications state that
only the horizontal
the holes in the con-
clip holes and bolt re-



oles layout
ear connection

development, same
tching electrode and
l partial penetration
oat area (1.14.7) are
base metal, or if dif-

rise in the specifica-
cept for plug and slot
ifteen percent maxi-
ing for various con-
1.23.6). Except for
laid out to avoid ec-
n of the connection

and the member connected (1.15.3). For the usual shear connection requiring flexibility to accommodate the necessary simple-end rotations assumed, the locations of the welds and the selection of the connection elements must be coordinated (1.15.4).

As previously noted, where welding at high-strength bolted friction-type joints is required as a mixed connection with shared stress, the final tightening of the bolts is required prior to the welding. The *sequence* of completing purely welded connections is also important, though not explicitly covered by the Specifications (1.23.6). The heat generated in the operations of welding creates intense shrinkage strains which, if restrained, leave corresponding residual stresses (1.23.6). These stresses can be relieved by local inelastic yielding, but where local inelastic yielding is also restrained or limited, warping and lamellar tearing* may result. For many welded assemblies, the simple precaution of a specified *sequence* of welding may be employed to balance the strains and to avoid warping. Even after this precaution, certain complex assemblies may be expected to retain adverse residual stresses. For cases where this condition is anticipated or suspected, stress relief by heating must be specified by the Engineer (1.23.6). (Note: this service is not provided unless it has been specified and will normally be an added cost.)

The use of a proper *sequence* to avoid creation of shrinkage stresses or to minimize same can also be specified in many connections where lamellar tearing might occur. Particularly with thicker sections, where both the direction of the shrinkage is completely restrained and the resulting stress is normal to the surface of the section, consideration should be given to the welding sequence. If the condition can not be eliminated by a practicable sequence as a first choice for a solution, it may be possible to relieve the strains without developing large stresses by use of soft wire "cushions" or by revision of the entire connection detail. At least for simple cases it should, of course, be more economical to specify a particular welding sequence. (See Examples this chapter.)

Connection Design

Classification. In addition to the general requirements previously cited for the design of connections, certain arbitrary minimum design requirements for connections have been established. All connections for members carrying calculated stress must be "designed to support not less than six kips" (except lacing, sag bars, and girts), presumably six kips shear in flexural members, six kips tension in ties, and six kips bearing in compression members, all at allowable stress levels (1.15.1). Eccentric connections of axially loaded members are to be designed to transmit the resulting moments as well as the axial force (1.15.2). These minimum requirements naturally become most significant in the design of light members such as axially loaded members in trusses. Connections for such members are required to meet an additional requirement that they transmit the design load or the minimum six kips, whichever is larger, and develop at least half of the effective strength of the member (1.15.7). Note: joists are regarded as a special very limited-size truss in which the minimum connection capacity is simply specified as twice the design load for open web steel joists (4.5); or for the longspan and deep longspan joists, as the design stress or half the allowable strength of the member (103.5b). (See Chapter 4: Joists; Examples.)

As noted previously, connection types may be classified on the basis of the connection method or the design function. Broadly, connections may be described as *flexible* (for the transmission of shear only, 1.15.4), or *rigid* (maintaining the angle between the members connected and transmitting full moment capacity of the most flexible element at the

*"Commentary on Highly Restrained Welded Connections," *Engineering Journal*, AISC, 10, No. 3, 1973.

joint as well as the shear, 1.15.5), or *semi-rigid* (transmitting a pre-determined fraction of the full moment capacity as a rigid joint and further loads in shear as a flexible joint with corresponding angle change to supply rotation for the additional loads, 1.15.5; 1.2).

Flexible Connections. "Flexible" connections are designed to transmit shear without exceeding allowable unit stresses on the connectors as a group or the connection as a whole. The use of an average capacity for each of several connector elements sharing the total load is justified by allowing self-limiting localized stresses determined by an elastic joint analysis to exceed the yield point and create inelastic localized deformations of the connector materials, or by inelastic deformations of the connection elements (1.15.4). The simplest examples of localized deformation occur in the assembly of bearing-type bolted connections where the cumulative tolerances permitted exist on (1) out-of-round in the bolts, (2) oversize holes ($\frac{1}{16}$"), and (3) center-to-center location of the holes in the different elements connected. The extreme degree of such inelastic action occurs with a two-bolt bearing-type connection where one bolt is loosely fitted and one is very tight. Until the material of the connected element surrounding the loaded bolt or the bolt yields and deforms ($+\frac{1}{16}$"), the load is not shared and a 50 percent adjustment will be developed as the load increases. For larger (and thus more important) members, more bolts or rivets will be required and the degree of adjustment required on each will be less. Lesser adjustments are required for a long line of bolts or rivets intended to share stress equally. Even if perfectly fitted, yielding and inelastic deformations occur, maximum at and beginning at the first loaded bolt or rivet, and decreasing to a minimum at the last. (See Figs. 5-1

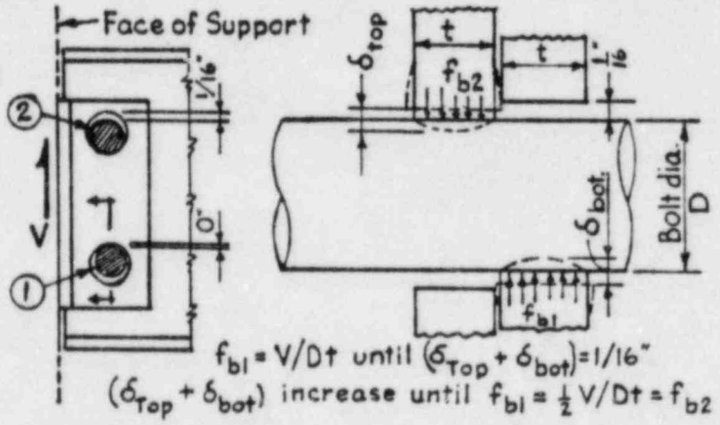
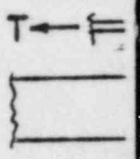


FIG. 5-1 Self-Limiting, Localized Deformations—Two Bolts.

and 5-2.) After this localized inelastic adjustment in the connectors for shear transmission, consider the inelastic adjustments that occur to reduce the "elastic theory" moments.

Inelastic deformation in the connection elements, typically angles, will occur and reduce the restraint which would transmit moment. The common double-angle shear bearing connection is extremely stiff longitudinally for the transmission of shear, and it depends upon the minor inelastic bearing deformations around each fastener to equalize the shear stresses in the fasteners. The same double-angle member is relatively flexible and will twist to permit a relatively large angular rotation reducing moment transmission. (See Fig. 5-3.)

Experience and tests confirm the practical assumptions of shear transfer only and the



Inelast
plates
ginning
tinuing
s_2, s_3,
in all

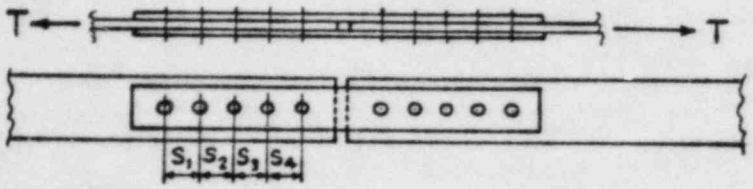
FIG. 5-2 Self-Li

FIG. 5-3 Self-Limi Angles.

use of an average s
served in one series
limits correspondin
mately the same for
Figure 5-4 presents
reported from thes
"s" (see Fig. 5-3)
support. Coping t
and required angle
deep connections.

For Type 2 const
design drawings; al
capacity for the se
signed for one half

[1]"Moment-Rotation
neering Journal, AISC



Inelastic deformations occur successively in the plates at each fastener and in the fasteners, beginning and largest at the first loaded, and continuing until the elastic strains in the spaces s_1, s_2, s_3, and s_4 become proportional to equal stress in all fasteners.

FIG. 5-2 Self-Limiting Deformations—Axial Stress on Line of Separate Fasteners.

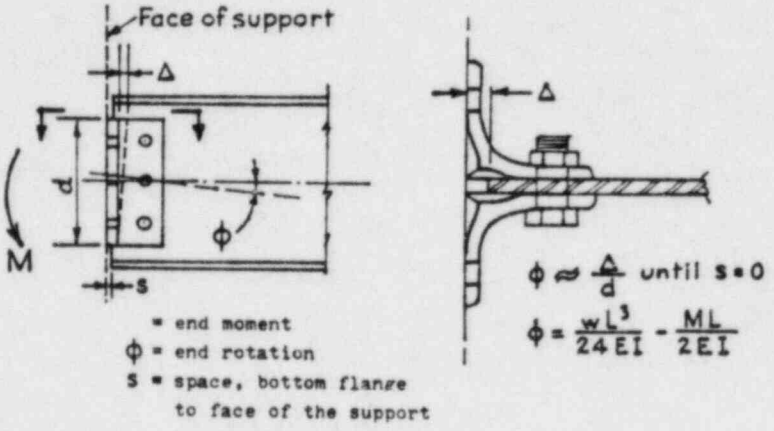


FIG. 5-3 Self-Limiting Deformation (Twist) in the Connection Elements (⌊⌊) Two Angles.

use of an average shear stress per unit weld or separate fastener. The actual rotations observed in one series range from 0.84 to 0.97 times Φ_0, the "simple beam rotation." These limits corresponding to moments ranging from three to sixteen percent were approximately the same for a single end plate connector or the common double-angle connector.[1] Figure 5-4 presents the usual device for an approximate analysis. An additional caution reported from these tests is that the moment stiffness increases abruptly when the space "*s*" (see Fig. 5-3) closes and the lower flange transmits compression to the face of the support. Coping the bottom flange where a quick analysis of the proportions of depth and required angle change show the usual clearance to be inadequate may be desirable for deep connections.

For Type 2 construction (flexible connections) all the reactions should be shown on the design drawings; alternatively, only those exceeding one half the tabulated uniform load capacity for the sections used, together with a general note that connections shall be designed for one half the capacity unless otherwise noted, should be shown.

[1] "Moment-Rotation Characteristics of Shear Connections," Kennedy, October, 1969, 6, No. 4, *Engineering Journal*, AISC.

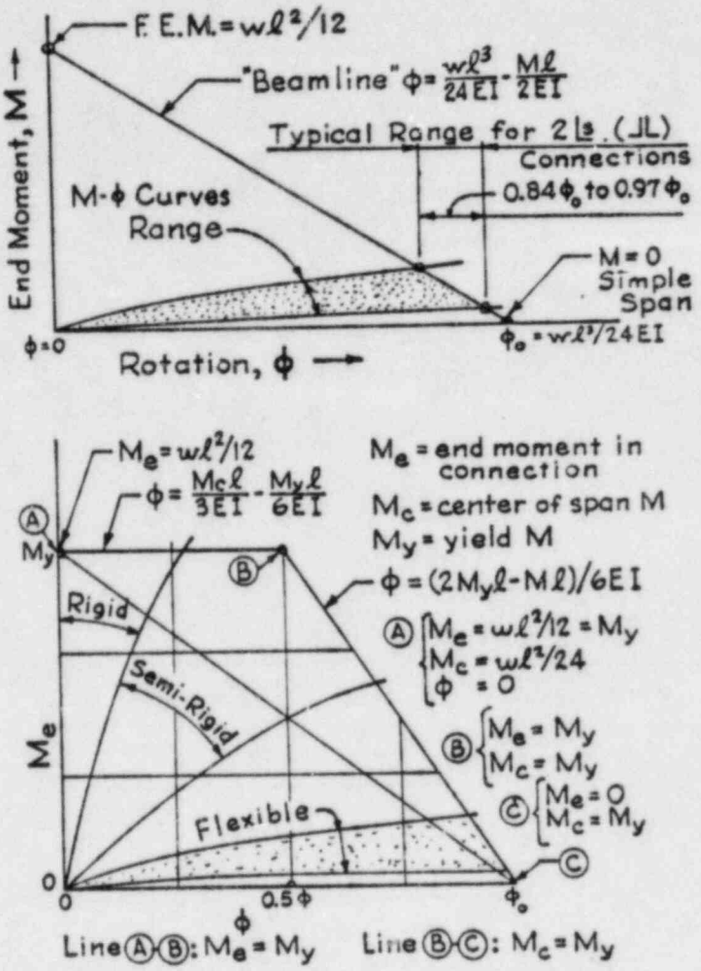


FIG 5-4 Uniformly Loaded Elastic Beam Line—Rotations at Connection.

Rigid Connections (Type 1 Construction). The AISC Specifications requirement is quite realistic: that rigid connections hold the original angles "virtually" unchanged (1.2). This requirement in elastic design is usually satisfied by connections designed to develop the full section of the flexural member or the full moment at yielding of the more flexible member connected. It will be noted from Fig. 5-4 that the rigid frame analysis ($\Phi = 0$ at the allowable stress) may be satisfied by such a connection which would have a very small rotation at 0.66 to $0.60F_y$, but would be capable of a significant rotation at yielding of the flexural member (line A-B).

A diagram similar to Fig. 5-4 but with point A representing an end moment, $M_e = M_p$, and point C, a center span moment, $M_c = M_p$, can be prepared for plastic design. Connections capable of achieving full collapse load (hinges at both ends and center of span) would be required to reach $\Phi = 0.5\Phi_0$, point B. The simpler concept of "plastic redesign," where only end hinges are required to form at the factored load, would require connections with a somewhat less rotation capacity, along line A-B. See Fig. 5-5.

Semi-Rigid Connections (Type 3 Construction). (See Fig. 5-4.) Ideally, the semi-rigid connections for Type 3 construction will behave elastically between the $\Phi = 0$ ordinate

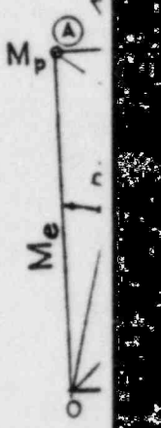


FIG. 5-

and the "rigid" co
determined end m
velop the yield m
practical cases wh
required, the exce
hinges only will fo
more rotation cap

Masonry Bearir

General. The AI
on masonry and
regulations (1.5.
low allowable st
block, and hollo
terials. Values s
tion is therefore
and brick laid in
of the masonry
tional associatio
AISC Specificat
fractions of th
economy.** T
codes. *For bea*
mend the use o

Beam Bearing
beam bearing p

*All mortars util
**Supplement N

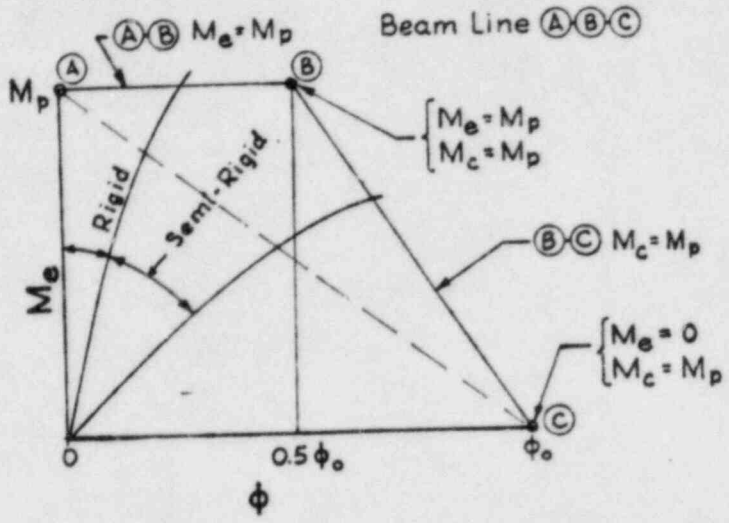


FIG. 5-5 Uniformly Loaded Plastic or Rotations at Connection.

and the "rigid" connection up to a predetermined end moment. Upon reaching this predetermined end moment (M_y for the connection), a rotation capacity sufficient to develop the yield moment at the center of the span, $M_c = M_y$, should be available. In practical cases where the nearest available rolled section will be above the design capacity required, the excess capacity will be provided at the midspan. As in plastic redesign, end hinges only will form at the full design load. Since these hinges are designed for $M_e = M_y$, more rotation capacity is required (to cross line B-C).

Masonry Bearing Connections

General. The AISC Specifications provide very conservative allowable stresses for bearing on masonry and concrete which apply in the absence of Code (statutory Building Code) regulations (1.5.5). For all masonry laid up in mortar, most statutory codes also provide low allowable stresses. Usually, codes distinguish among solid masonry units, bricks or block, and hollow units as well as among different classes of mortar and masonry materials. Values so prescribed range in general from 50 psi to 400 psi. The AISC Specification is therefore seldom applicable since it includes only stone masonry, $F_p = 0.400$ ksi, and brick laid in "cement" mortar,* $F_p = 0.250$ ksi (1.5.5). *The authors recommend use of the masonry bearing values prescribed in local Codes or those recommended by national associations dealing with masonry products.* For bearing stresses on concrete, the AISC Specifications, $F_p = 0.35f'_c$ on the full area and $F_p = 0.35f'_c\sqrt{A_2/A_1} \leq 0.70f'_c$ on fractions of the area, utilize recent ACI Building Code (ACI 318-71) refinements for economy.** The ACI Building Code is of course usually applicable under local statutory codes. *For beam-bearing plates and column base plates on concrete, the authors recommend the use of bearing values prescribed by the ACI Building Code.*

Beam Bearing Plates. The approved design (Chapter 2, pp. 82-83, *AISC Handbook*) for beam bearing plates is the formula:

$$t = \sqrt{3f_p(n)^2/F_b}$$

(*Continued on page 274*)

*All mortars utilize cementitious materials and the term "cement" can be quite properly applied to all.
**Supplement No. 3, 1974.

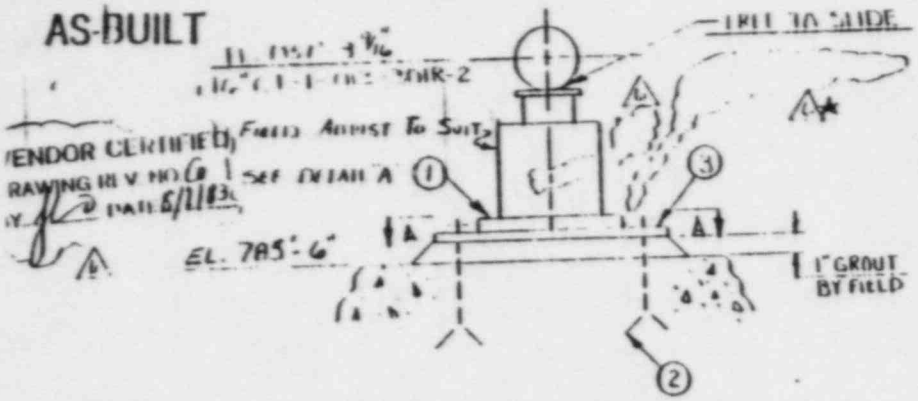
FOR OFFICE AND ENGINEERING USE ONLY

ATTACHMENT B

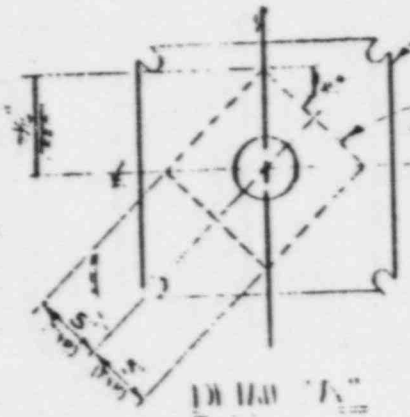
RELATED CORRESPONDENCE

BLUELINE J-5 81

AS-BUILT



ELEV. LKG. NORTH



NOTE:

4) DRIVING DEVICES FOR HIGH STRENGTH NUTS ARE NOT REQUIRED PER DCA RAV

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP	PBS	CSS PRIM	SEC	AISC
	PIPE SUPPORT CONSISTING OF:	ONE					
1	#13 "F" Fig. 82 w/Travel Stops w/Load Flange. Hot Load 2943 #, Cold Load 3[illegible] w/ Load Column Extended 1 1/2"	1			X		
2	3/4"-10" Hilti Kwik Concrete Anchors, TN-SP	4		X	X		
3	[illegible] SECTION A-A	1					
	[illegible] 2945 GR 63						
	HANGER ASSEMBLY SKETCH & ENGINEERING	1					
	MARKED & TAG						
	MARK# CT-1-013-006-S22S						
	Apply one coat of Carbo Zinc #11 to above material except that which shall be coated w/heat preventative.						

REV	DATE	DRN	CHK	APP	DESCRIPTION
1	8-2 [illegible]	[illegible]	VPL	CJ	REV. VENDOR CERT. DET. PER [illegible]

REV	DATE	DRN	CHK	APP	DESCRIPTION
3	[illegible]	[illegible]	[illegible]	[illegible]	REVD PER FIELD [illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Approved By: [illegible]

Initial [illegible]

QUAN SHIP PBS CSS PRIM SEC AISC

[illegible] R.I.

DRP Inc. CT-1-SS-OP. [illegible]

Data Point: [illegible]

Pipe Mat'l. SA-358 [illegible]

Insul. — Bldg. [illegible]

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Brown & Root, Inc

REF DRAWING NUMBERS

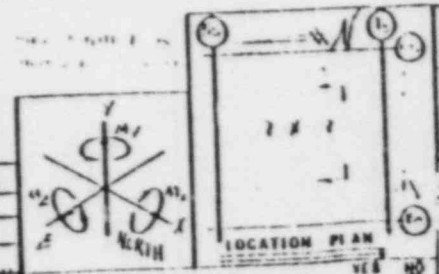
PIPE: [illegible] ELECTRICAL: [illegible]

STEEL: [illegible] HVAC: [illegible]

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET						
EMERGENCY						
FAULTED						

MOVEMENTS	
X	[illegible]
Y	[illegible]
Z	[illegible]

NORM OPER DISPL	
DX	[illegible]
DY	
DZ	



THIRD PARTY INSPECTION ☒ ☐

CODE CLASS: [illegible]

REV	DATE	DRN	APP	DESCRIPTION
2	[illegible]	[illegible]	[illegible]	ISSUED FOR CONST
1	[illegible]	[illegible]	[illegible]	[illegible]
0	[illegible]	[illegible]	[illegible]	[illegible]

CUSTOMER Texas Utilities Service, Inc.

ORDER OR CONT. NO. CP-0046A

JOB NAME Comanche Peak 1 & 2

MARK NO. CT-1-013-006-S22S

SKETCH NO.

SHEET 1 OF 2 REV. 2

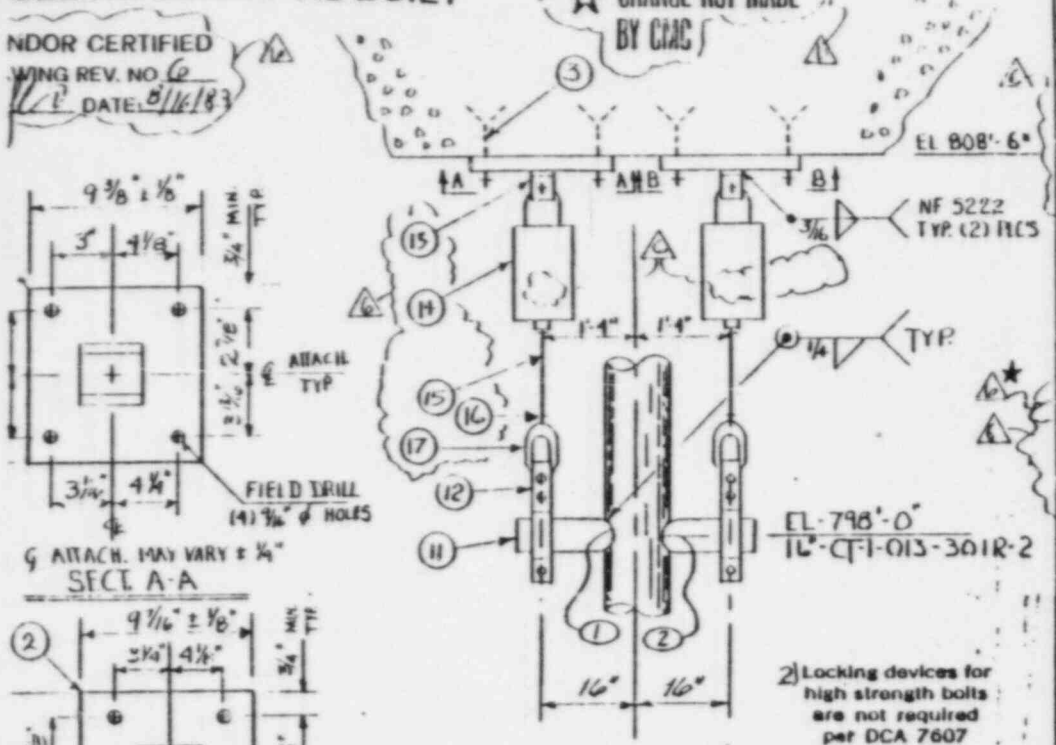
FOR OFFICE AND

FOR ENGINEERING USE ONLY

UELINE 10-9-81 AS-BUILT

☆ CHANGE NOT MADE BY CMC

NDOR CERTIFIED
WING REV. NO. 6
DATE: 8/16/83



ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP
1	1/2" C.S. IP PER SECT A-A (SA 36/SA 515 GR 65)	1	
2	1/2" C.S. IP PER SECT B-B (SA 36/SA 515 GR 65)	1	
3	1/2" x 3 1/2" MULTI-KWIK PLATE (3 3/4" MIN EMB)	4	
4	PBD-05 WELD BEAM ATTACH (SA-36)	2	
5	VSB-07 VARIABLE SPRING, HL = 556 LB	2	
	CL = 972 MVT. 5/8" UP W/ TRAVEL STOPS		
6	RET-05 END THREADED ROD 9'-6 3/4" LG	2	
7	REN-05 WELDLESS EYE NUT (A668-B)	2	
8	FHN-5/8 HEX HEAD NUT	1	
9	PHH 16" OD HIT PIPE 3/4" x 9" STOCK L = 1'-4", PLATE 3/8" x 6" w/ 3/4" NUTS (SA-36)	1	
10	12" x 16" x 1/2" STAINLESS STEEL BASE PLATE (SA-240 TP 304) 16" ø 16 PER SECT C-C	4	
11	8" SCH 40 STAINLESS PIPE 12" LG FIELD TRIM TO SUIT (ASTM 358/SA 312 TY 304)	2	
12	PTC-080-030B PIPE CLAMP (SA-36)	2	
13	6'-6" OC WELDED BEAM ATTACH (SA 36)	2	
14	VSP-10 VARIABLE SPRING SUPPORT w/ TRAVEL STOPS, HL = 1177 LB CL = 1212, UNT = 0.67" UP	2	
15	PT-06 ROD 3/4" ø x 9'-8 1/2" (TRIM OUT 10" EXT) (SA 36)	2	
16	PHH-5/8" HEAVY HEX NUTS (A563 GR A)	1	
17	REN-05 WELDLESS EYE NUT (A 668 GR C)	1	

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	9/8	GR			REVD AS NTD ~ REF: E.M.H.S.R.I SEE NT. 1
3	9/1	GH	RL		REVD AS NTD: REF CMC 61288 R3, DCA 7607 ADT 2, AS BUILT
2	8/16	GH	Q		REVISED PER CMC 61726

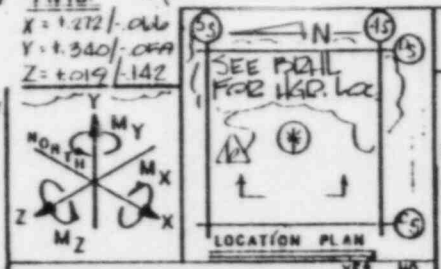
MARK # CT-1-013-1104-3325
PAINT: CARBO ZINC # 11

FOR OFFICE AND ENGINEERING USE ONLY

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

NORM. OPER DISPL.	
DX	+.076"
DY	+.040"
DZ	-.02"

MVTS
X = +.272 / -.046
Y = +.340 / -.044
Z = +.019 / -.142



2) Locking devices for high strength bolts are not required per DCA 7607

NOTE.
1) By issue of rev. 4 of this Drawing, the following Documents are voided: CMC-55201

CON'T ABOVE

DRWG Iso. CT-1-SB-08 R.1
T.P.D. Iso. CT-1-SB-08 REV 3
Data Point 254 / PROB AP21-32 R.0
Pipe Mat'l. SA-358, CL 1, TP 304
Insul. ——— Bldg. SB

4802

THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME-III-CL 2

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: MI-0605-H.V.14 ELECT: E1 0X01 01 R9
STEEL: SI-0605 REV 9 H.V.A.C.: MI 0X51 R...

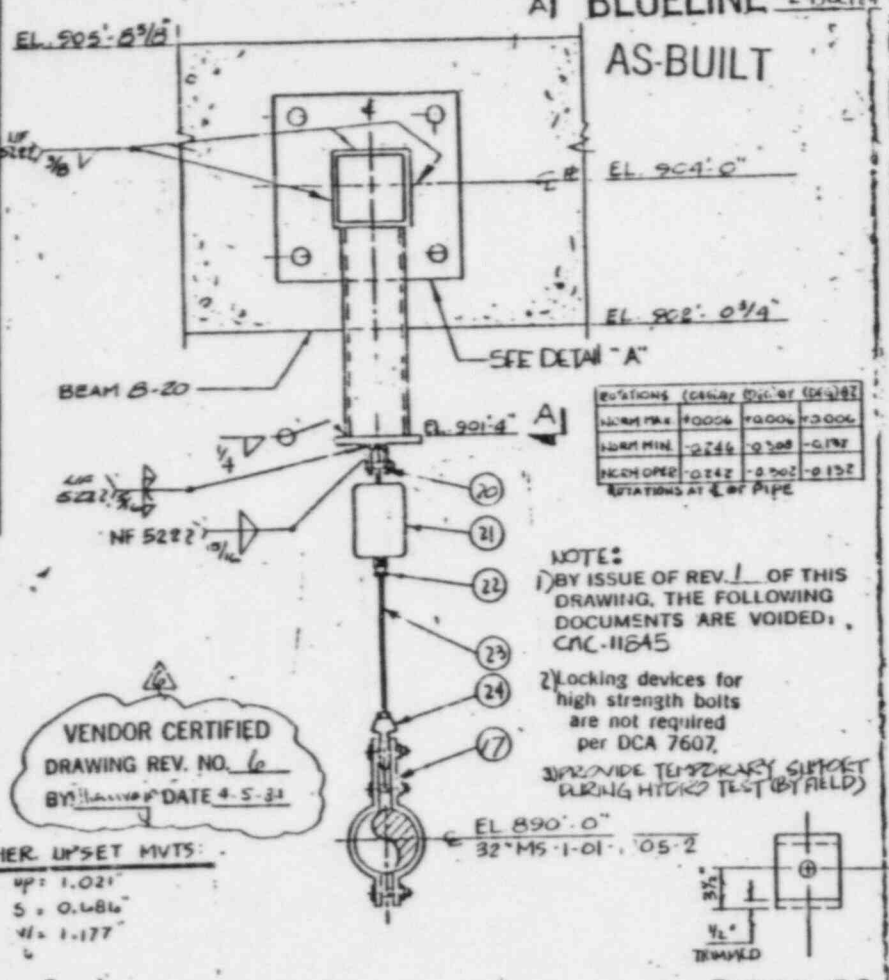
CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN		(-1242)				
NORMAL & UPSET	(1)					
EMERGENCY						
FAULTED						

REV	DATE	DWN	APP	DESCRIPTION
4	6/30	TG	RR	ISSUED FOR CONST F.M 1-10
3	10/10	KL	MR	REVISED AS NOTED PER ECN REV 1 MARK NO WAS 332
2	11/21	RE	SW	REVD. AS NTD. - REF. E.M.H.S. LT. R.2 & MK WAS CT-1-013-1004-3325
1	5/11	SW	LR	REVD AS NOTED REF MK# WAS CT-1-901-013-3325

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO. CT-1-013-1004-3325
SKETCH NO.
SHEET 1 OF 1 REV. 4

A1 BLUELINE - 24 JULY 84

AS-BUILT



ROTATIONS (DEGREES)	X	Y	Z
NORM MAX	+0.006	+0.006	+0.006
NORM MIN	-0.246	-0.308	-0.192
NORM OPER	-0.242	-0.302	-0.132

ROTATIONS AT ℄ OF PIPE

NOTE:
1) BY ISSUE OF REV. 1 OF THIS DRAWING, THE FOLLOWING DOCUMENTS ARE VOIDED: CAC-11845
2) Locking devices for high strength bolts are not required per DCA 7607.
3) PROVIDE TEMPORARY SUPPORT DURING HYDRO TEST (BY FIELD)

VENDOR CERTIFIED
DRAWING REV. NO. 6
BY [illegible] DATE 4-5-84

THER. UP'SET MVTS:
up: 1.021"
S : 0.686"
u: 1.177"

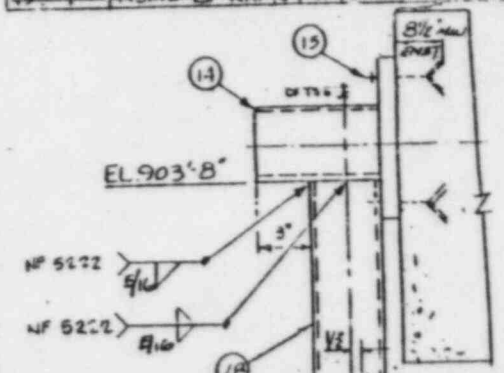
DETAIL 20

ELEV. LKG SOUTH

ITEM NO	NO REQ'D	DESCRIPTION	WT.	ASME OR ASTM	MIC.
1	1	DCD 16 WELDED BEAM ATTACH			
2	1	VLD 0 THRU HL END [illegible]			
3	1	VARIABLE SPRING SUPPORT			
4	2	FHN 1" ø HEAVY HEX NUT		A 194	
5	1	RST 10K" TURNBUCKLE ROD ENDS 11 1/2"		SA 36	
6	1	REN 16 WELDLESS EYE NUT		[illegible] GR C	
7	1	PTC 220 x 22.4 PIPE CLAMP		SA 36	
8	1	TS 2 1/2 x 6 x .375"		[illegible]	
9	1	TS 8 x 6 x .375"		A 307	
10	1	WS x 25		SA 36	
11	8	RNP 12 EXCEPT 1" x 6" x 6" STK		SA 36	
12	4	RAT 16 A 1'-3" LG STUDS		[illegible]	
13	8	FHH 1 1/4" ø HVY HEX NUTS		A 307	
14	1	FP 3/4" x 8" x 8"		SA 36	
15	1	TS 8 x 8 x 1/2" x 9" LG.		A 36	
16	4	1 1/4" SUPER BOLT x 13"		A SC GR B	
17	1	2" THK C.S.R. PER DETAIL "A"		[illegible]	
18	1	PTC 320-2832 PIPE CLAMP		SA 36	
18A	1	TS 6 x 6 x 1/2" x 2'-9" LONG		SA 36	
	1	ASME ID NAME PLATE W/ MARKING		A307 GR B	

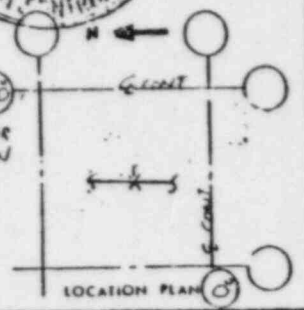
FOR OFFICE AND ENGINEERING USE ONLY

SECTION A-A



FIELD REVISION OF SUPPORT DESIGN AS BUILT CONDITION CPSA - [illegible] DATE 7-19-84 ENGINEER [illegible]

CPSES
85-1195
CONTROL
COPY



SEE BAHL FOR H4R LOCATION

GRAV	THER	HYDRO	OBE	SSE	SEISMIC WEIGHTS (LBS) OPER	EMERG	FLTD	THER	SEISMIC VERT	LAT	LONG
(SEE NOTE 3)					1393						

* WT OF COMPONENTS INCLUDED

REFERENCE DRAWINGS:		REV
ISOMETRIC	MS-1-RB-07	P
P.S. ISOMETRIC	MS-1-RB-02	8

		REV
PIPING	2323-M1-0506	8
STRUCTURAL	2323-S1-0334	2

		REV
B1 SUPPT ISO		
ELECTRICAL	2323-E1-0501	8
H.V.A.C.	2323-M1-0552	5

HIPSI: MS-1-RE-C1

CODE/CLASS: B1/2
PAINT: [illegible]
ZONE ~

PIPE CLASS	43-1-001/R1
DATA POINT SUPPT CLASS	SS
	SC-1-1

OWNER TEXAS UTILITIES SERVICES INC.
PROJECT COMANCHE PEAK UNITS NO. 1 & 2
ENGINEER GIBBS & HILL INC.

CPSES 85-1195

Brown & Root, Inc
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
RE DN	5/3/79	IM P	5/15/79	NA	5/15/79

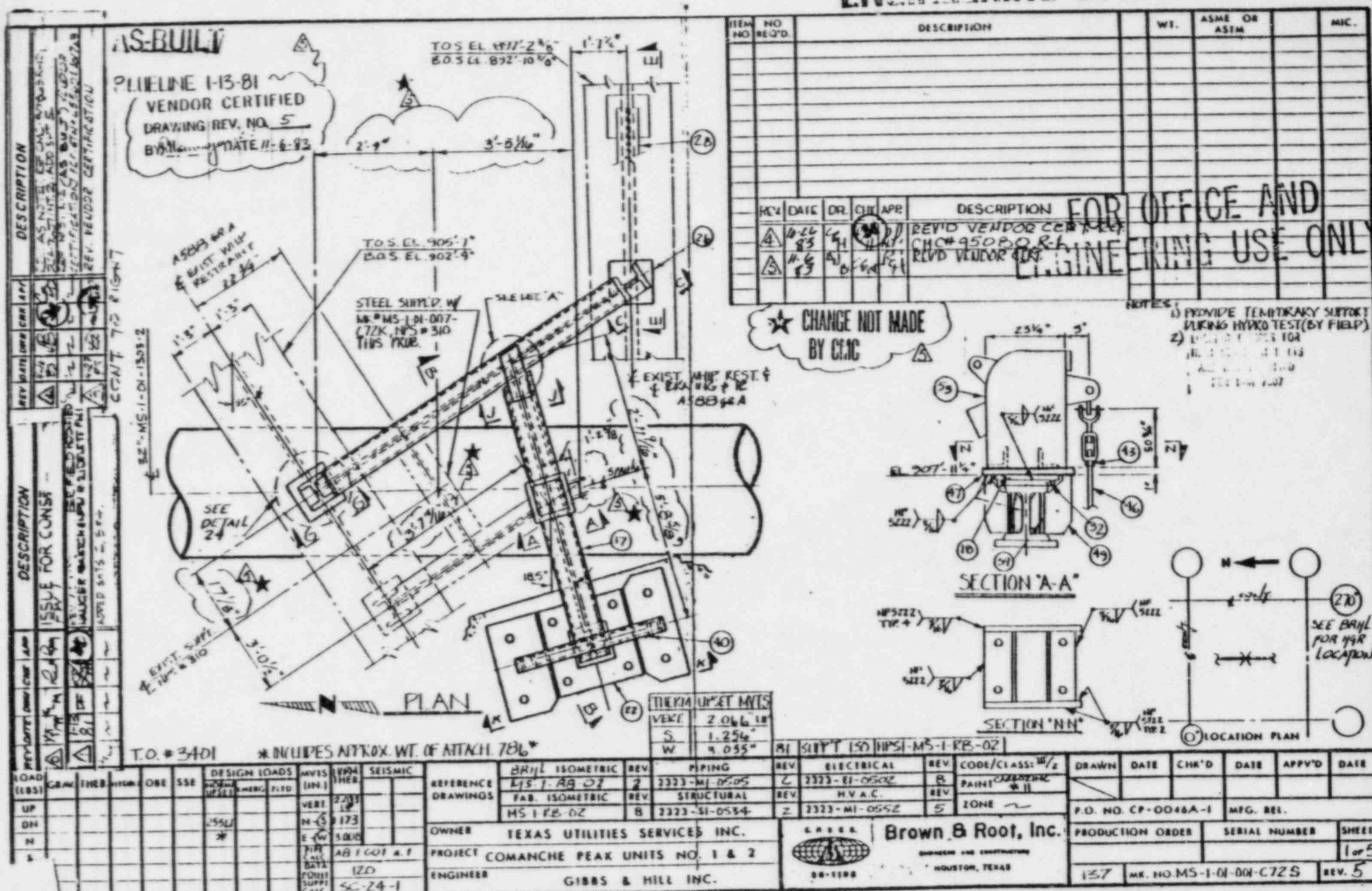
P.O. NO. CP-0046 A-1 MFG. REL.

PRODUCTION ORDER	SERIAL NUMBER	SHEET
		1 OF 2

138 MK. NO. MS-1001-002-C725 REV 6

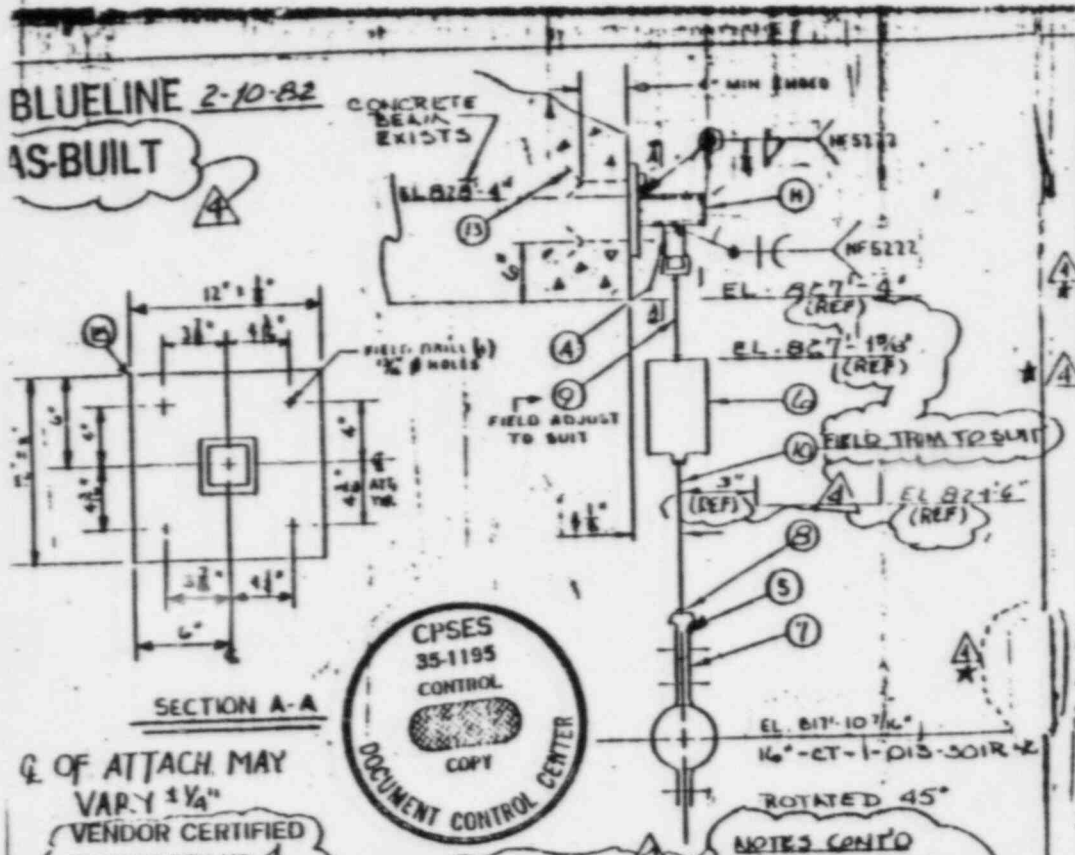
FOR OFFICE AND ENGINEERING USE ONLY

FOR OFFICE AND ENGINEERING USE ONLY



BLUELINE 2-10-82

AS-BUILT



CPSES 35-1195 CONTROL COPY DOCUMENT CONTROL CENTER

℄ OF ATTACH. MAY VARY ± 1/4"

VENDOR CERTIFIED
DRAWING REV. NO. 4
BY JLD DATE 11/15/83

BRHL ISO CT-1-SR-08 R-1
I.F.D. Iso. CT-1-SR-08 REF 5
Data Point 241 / AB-1-82 R-0
Pipe Rat'l 9A-3538 CL1 TP304
Insul. — Bldg. S

NOTES

4) BY ISSUE OF REV. 2 OF THIS DRAWING, THE FOLLOWING DOCUMENTS ARE VOIDED:
CMC 33089

REV	DATE	DWN	CHK	APP	DESCRIPTION
1	9/6	RL	DF		REV AS NTD REF FMHS R 1 SEE NT 5
2	10/4	RL	DF		REVISED AS NTD, REF L0032, DCA R07477; AS BUILT
3	~	~	~	~	VENDOR CERTIFICATION; REF QTN 62726

NOTES (CONT'D)

5) BY ISSUE OF REV. 3 OF THIS DRAWING, THE FOLLOWING DOCUMENTS ARE VOIDED:
CMC 33447

NOTES CONT'D

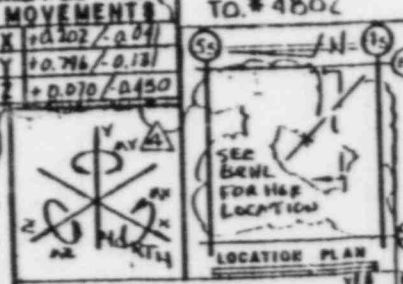
6) Locking devices for high strength bolts are not required per DCA 7607

NORM. OPER. DISPL.	
DX	+0.047
DY	+0.180
DZ	-0.080

* NOT CHANGED BY CMC

MOVEMENTS		
X	+0.202	-0.091
Y	+0.716	-0.131
Z	+0.070	-0.450

TO # 4806



THIRD PARTY INSPECTION

CODE CLASS: ASME-III-CL 2

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP
	HANGER ASSEMBLY CONSISTING OF:	ONE	
	MATERIAL EXIST		
1	Carbon Steel (SA516 GR 65 or SA 361 Plate)	1	
	Detail A, TW-148		
3	5/8" x 6" Hilti Kwik Concrete Anchors, TW-24	4	
3	5/8" x 6" Hilti Kwik Concrete Anchors, TW-24	1	
	18x13 (SA-36) @ 7.35# long, TW-14		
4	1 1/4" Fig. 66N W/Load Pin Steel Attachment	1	
5	1 1/4" Fig. 290N Eye Nut	2	
6	1 1/4" "A" Fig. 98N W/Travel Stops (Hot Load-54714 Cold Load-3418)	1	
7	1 1/4" Fig. 295N Pipe Clamp	1	
8	1 1/4" Hex Nuts (SA-307 GRB)	4	
9	1 1/4" Rod Fig. 140N W/Thread Full Length	1	
10	1 1/4" Rod Fig. 140N W/12" Thread Both Ends	1	
	HANGER ASSEMBLY SKETCH AND ENGINEERING	1	
	BUNDLE AND TAG	1	
	MARK # CT-1-013-002-S42S		
	16" OD N.D.E. /PAR 2.5.1 of the Unit Price Structure		
	Apply one coat of Carbo Zinc #11 to above ect'l except th'ds which shall be coated w/a rust preventative		
11	W6 x 15 x 2'-0" (SA 36)	1	
12	PL 1"x1'-0"x1'-0" to C.S. R (SA-36) Spec A-A	1	
13	3/4"ø x 7" LG HILTI ANCHOR	4	
14	TS 5"-5"-5/16" (A500 GRB) x 6" LG.	1	
15	3/4" R (SA36/SA515 GR 65) PER SEC A-A	1	

Approved By: DCP
Date: 1/24/84

P.O.: MATERIALS AND OPERATIONS	SEE SKETCH NO.	SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS

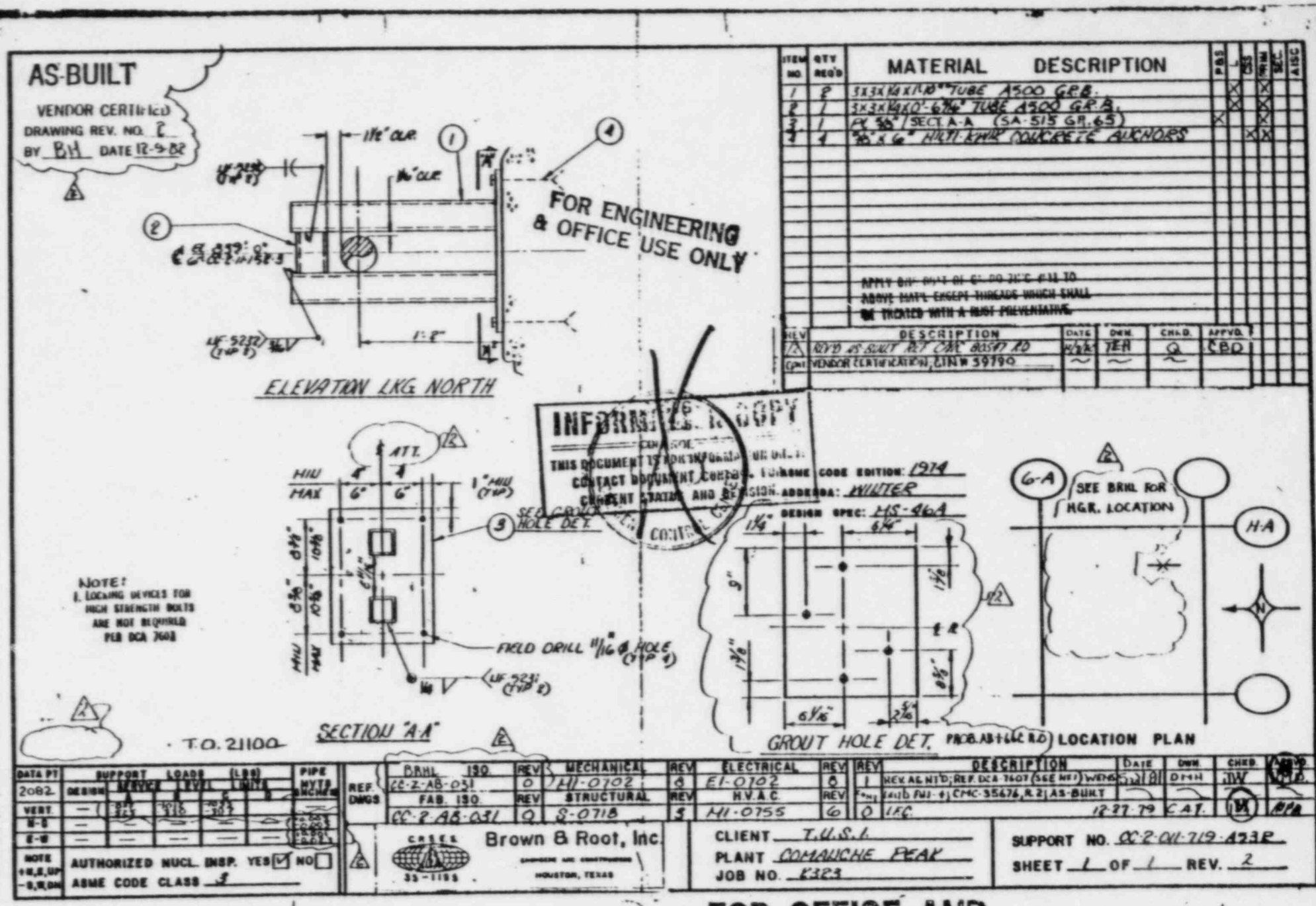
PIPE: 81-0416 REV 13 ELECT: 81-8822 W R-2
STEEL: 81-0409 REV 4 H.V.A.C.: 81-0423 R 6

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN		836				
NORMAL & UPSET						
EMERGENCY						
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	6/14	RL	DF	FW	ISSUED FOR CONST.
4	11/17	RL	DF	FW	IFC. F.W.E. Revised AS Noted PER ITE REPL MARK # NO. V-0-2-0-16
5	11 12	RL	DF	FW	REV'D AS NOTED, REF: FIELD MODIFIED HANGER SKETCH
6	80	RL	DF	FW	SEE NT. 4, DELETED REV'S 1 & 2 DELETED F.W.E. & REF (7)

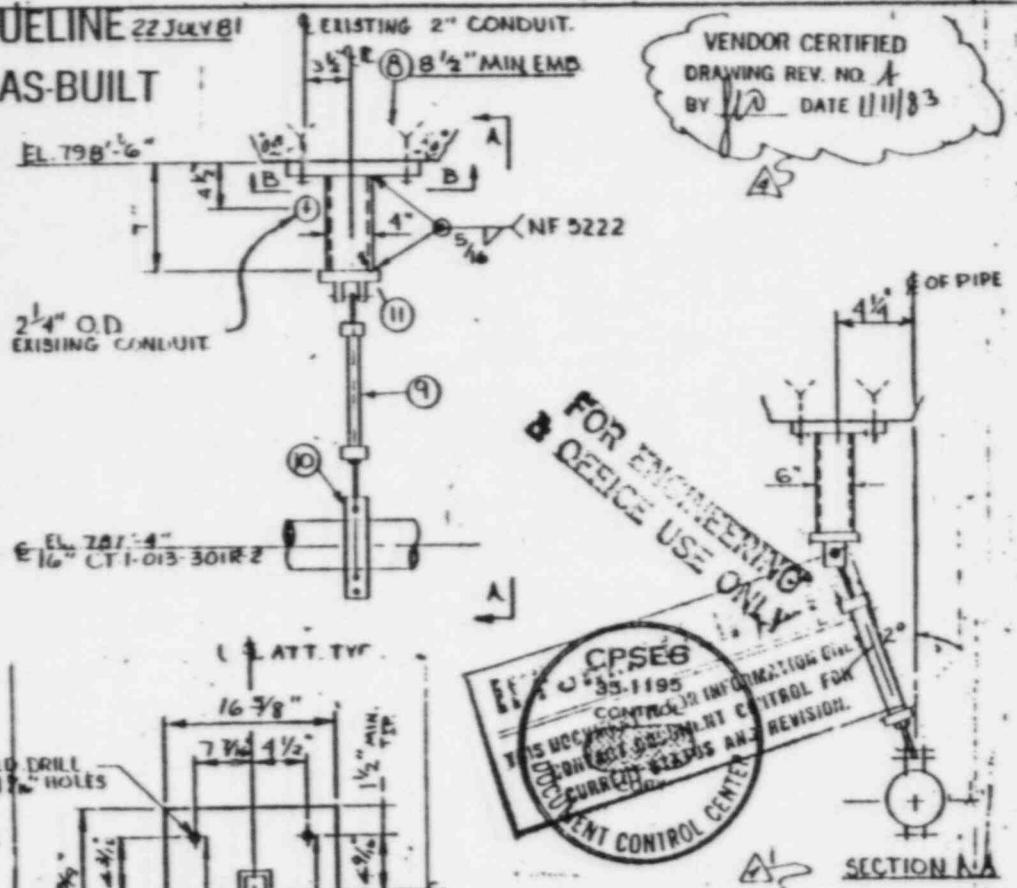
CUSTOMER Texas Utilities Services Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-002-S42S
SKETCH NO.
SHEET 1 OF 1 REV. 4

FOR OFFICE AND


AS-BUILT
VENDOR CERTIFIED
DRAWING REV. NO. 2
BY BH DATE 12-5-82
FOR ENGINEERING & OFFICE USE ONLY
ELEVATION LKG NORTH
SECTION "A-A"
GROUT HOLE DET.
LOCATION PLAN
SEE BRNL FOR H.G.R. LOCATION
FIELD DRILL 11/16 Ø HOLE (TYP 4)
NOTE:
1. LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7603
MATERIAL DESCRIPTION
APPLY ONE COAT OF GALVITE G-11 TO ABOVE HAFL EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE
DESCRIPTION
VENDOR CERTIFICATION, CINN 39790
CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-964
T.O. 21100
Brown & Root, Inc.
HOUSTON, TEXAS
CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 6323
SUPPORT NO. CC-2-011-719-A23R
SHEET 1 OF 1 REV. 2
AUTHORIZED NUCL. INSP. YES NO
ASME CODE CLASS 2
FOR OFFICE AND

LUELINE 22 July 81

AS-BUILT



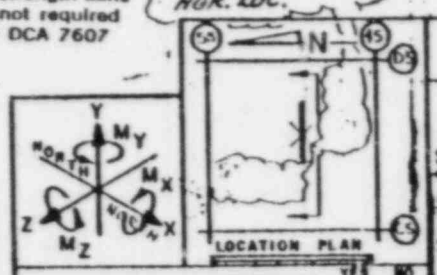
VENDOR CERTIFIED
DRAWING REV. NO. A
BY [illegible] DATE 11/11/83

FOR ENGINEERING & OFFICE USE ONLY

CPSES 33-1195 CONTROLLED INFORMATION FOR USE ONLY. THIS DOCUMENT CONTAINS INFORMATION THAT IS CONFIDENTIAL AND PROPRIETARY TO BROWN & ROOT, INC. AND IS NOT TO BE DISCLOSED OUTSIDE BROWN & ROOT, INC. OR ITS CLIENTS WITHOUT THE PRIOR WRITTEN CONSENT OF BROWN & ROOT, INC. DOCUMENT CONTROL CENTER

NOTES:
4) Locking devices for high strength bolts are not required per DCA 7607

SEE BRHL FOR NGR. LOC.



BRHL Iso. CT-1-38-08 Rev. 1
B.R.P. Iso. CT-1-SB-8 Rev. 3
Data Point 250 PROB 18-1-32 R.O
Pipe Mat'l. SA 358 & 1-TP 304
Insul. — Bldg. SA

T.O. 4802

THIRD PARTY INSPECTION
CODE CLASS: ASME III 2

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PRS	L	CRS	PRIM.	SEC.	AISC
7	1 1/4" C.S. R. Per Sec. B-B (SA 515 GR 65 OR SA 36)	1			X			X		
8	1-1/2" HILTI KWIK CONC. ANCHOR	2					X			
9	SRS-30-RO SWAY STRUT C.C. 8'-10"	1					X			
10	SR-30-160 PIPE CLAMP	1					X			
11	3/8" x 6" "Z" x 0'-3 3/4" LONG STRUCTURAL TUBING (A-500 G-B)	1			X			X		

REV	DATE	DWN	CHK	APP	DESCRIPTION
A	11/11	[illegible]	Q	[illegible]	VENDOR CERTIFICATION REF. QTN 62726

MARK # CT-1-013-011-522R
PAINT: CARBO ZINC # 11

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PRS	L	CRS	PRIM.	SEC.	AISC

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. A SHEET OF

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

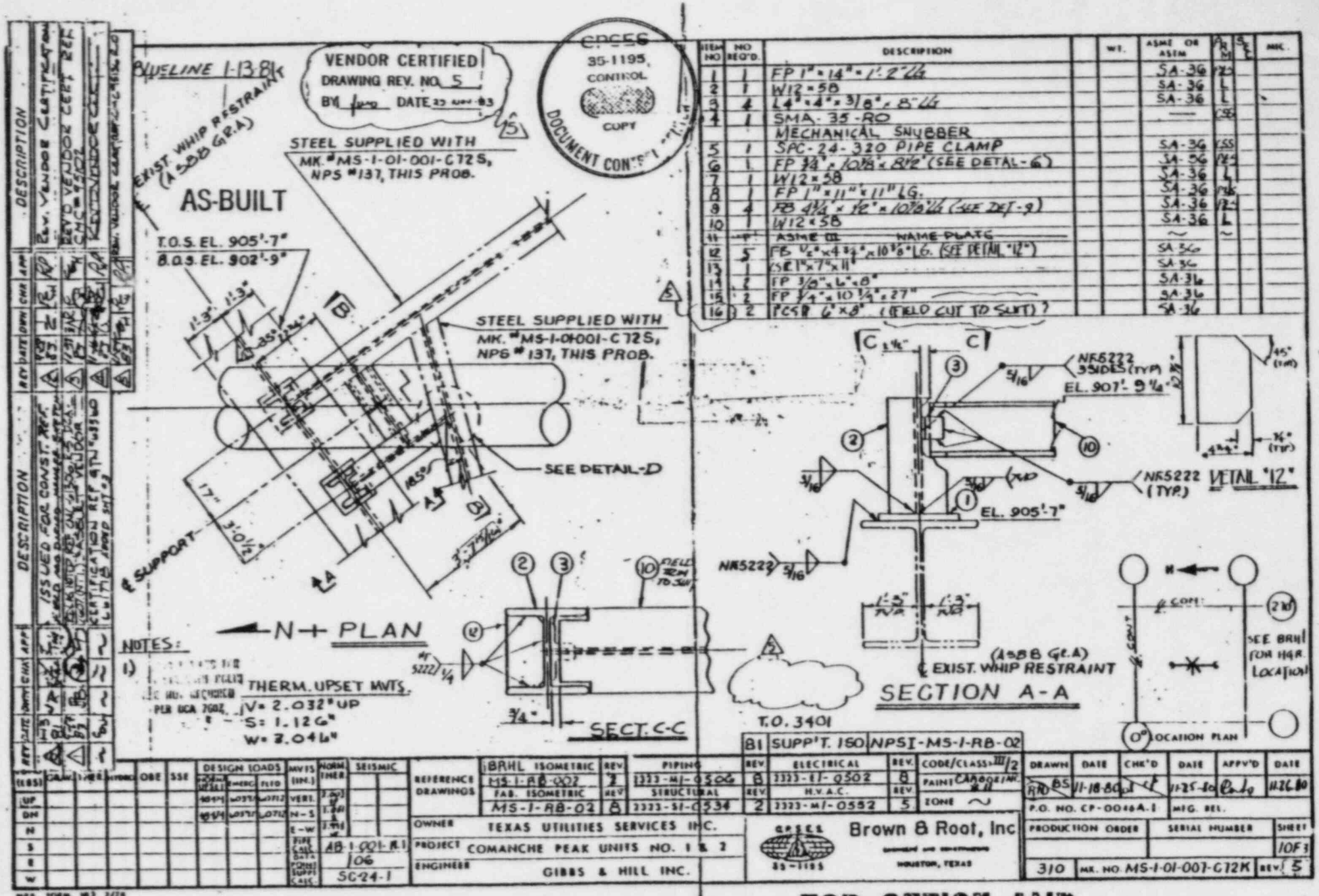
REF. DRAWING NUMBERS
PIPE: MI-Qielle Rev 11 ELECT: EI-0400 Rev
STEEL: SI-0400 Rev. 17 H.V.A.C.: MI-0430 Rev

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN		-3143				
NORMAL & UPSET		-4081				
EMERGENCY		-1749				
FAULTED		-5716				

REV	DATE	DWN	CHK	APP	DESCRIPTION
A	5-9-80	DC	WK	[illegible]	ISSUED FOR CONST.
1	9/16/80	KDW	[illegible]	[illegible]	REVISED AS NOTED
2	7/16/81	KJS	[illegible]	[illegible]	ITR III REV. 1 REV'D AS NOTED REF ITR'S CM65321S, F.M.N.S.
3	11/11/83	KJ	RH	[illegible]	REV'D AS NTD REF CHG ORDER 1 & DCA 7607 (SEE SH. 4)

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak I & E
MARK NO. CT-1-013-011-522R
SKETCH NO. —
SHEET 1 OF 1 REV. A

FOR OFFICE AND
FOR OFFICE USE ONLY



ITEM NO	NO REQ'D.	DESCRIPTION	WT.	ASME OR ASTM	GRADE	MFR.
1	1	FP 1" x 14" x 1'-2 1/2" LG		SA-36		
2	1	W12 x 58		SA-36		
3	4	L4" x 4" x 3/8" x 8" LG		SA-36		
4	1	SMA-35-RO				
		MECHANICAL SNUBBER				
5	1	SPC-24-320 PIPE CLAMP		SA-36		
6	1	FP 3/4" x 10 1/8" x 8 1/2" (SEE DETAL-6)		SA-36		
7	1	W12 x 58		SA-36		
8	1	FP 1" x 11" x 11" LG.		SA-36		
9	4	FB 4 1/4" x 1/2" x 10 7/8" LG (SEE DET-9)		SA-36		
10	1	W12 x 58		SA-36		
11	4	ASME III NAME PLATE		~		
12	5	FB 1/2" x 4 3/4" x 10 1/8" LG. (SEE DETAIL "12")		SA 36		
13	1	WSE 1" x 7" x 11"		SA 36		
14	2	FP 3/8" x 6" x 8"		SA-36		
15	2	FP 3/4" x 10 1/2" x 27"		SA-36		
16	2	PCSB 6" x 8" (FIELD CUT TO SUIT)		SA-36		

DESIGN LOADS				MVTS (IN.)	NORM THER	SEISMIC
	OBE	SSE	DW + THERMAL	EMERG	FLUID	
UP			10 3/4	0.373	0.712	VERT. 2.203
DN			10 3/4	0.373	0.712	N-S 1.241
N						E-W 3.998
S						FIRE CASE DATA
E						POWER SUPPLY CASE
W						

REFERENCE DRAWINGS		REV	PIPING	REV	ELECTRICAL	REV	CODE/CLASS III/2
ISOMETRIC	BRHL	2	3323-MI-0506	8	3323-EI-0502	8	PAINT CARBOZINC #11
ISOMETRIC	MS-1-AB-002	2	STRUCTURAL	REV	H.V.A.C.	REV	ZONE ~
ISOMETRIC	FAB. MS-1-AB-02	8	3323-SI-0534	2	3323-MI-0552	5	

OWNER TEXAS UTILITIES SERVICES INC.
PROJECT COMANCHE PEAK UNITS NO. 1 & 2
ENGINEER GIBBS & HILL INC.

CPCES 35-1195

Brown & Root, Inc
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

B1 | SUPP'T. 150 | NPSI-MS-1-RB-02

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
RD BS	11-18-80		11-25-80		11-26-80

P.O. NO. CP-00646A-1 | MTG. REL.

PRODUCTION ORDER	SERIAL NUMBER	SHEET
		10F3

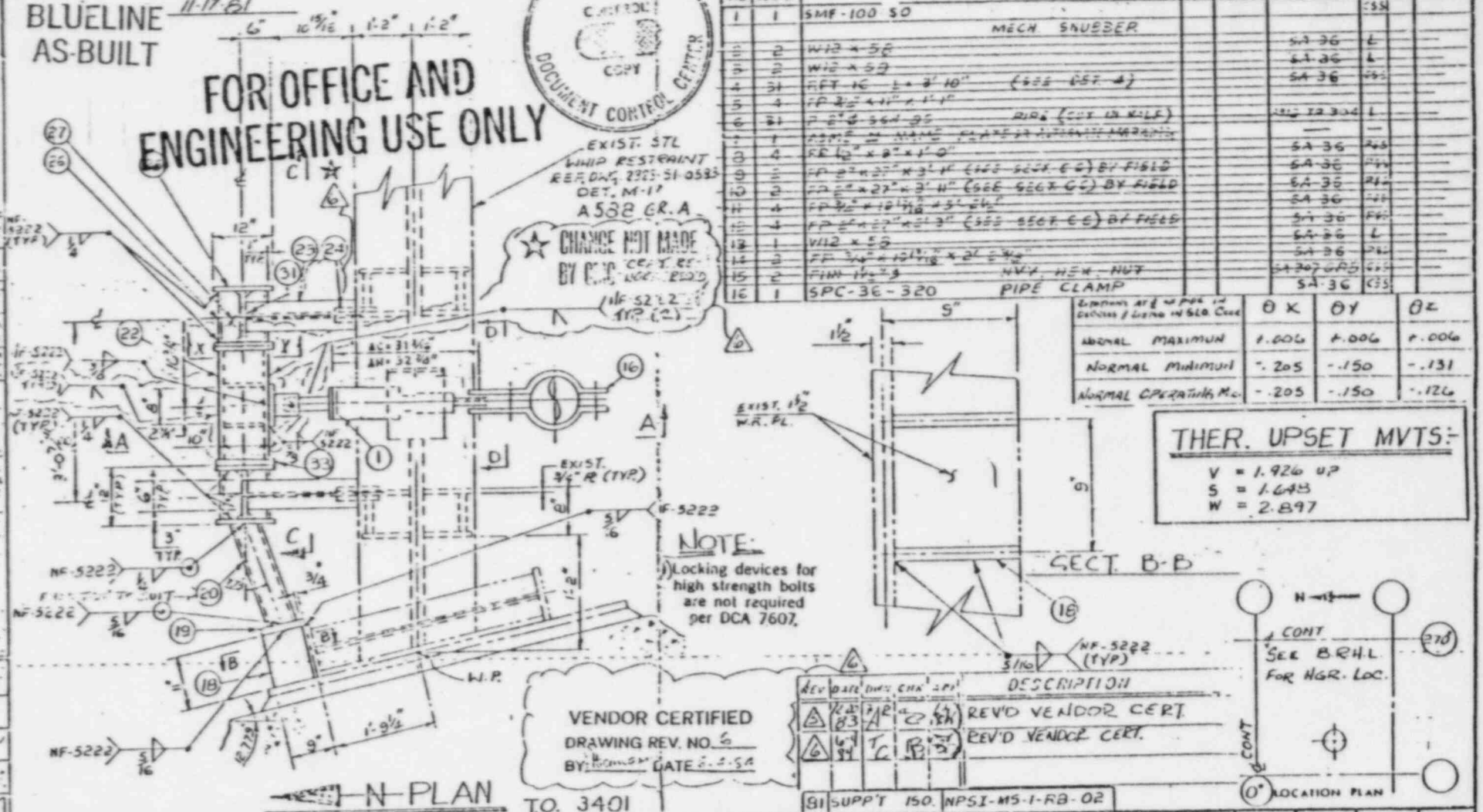
310 | MK. NO. MS-1-01-001-C12K | REV. 5

AB-1-001-R.1
106
SC-24-1

NPS FORM NO 3 2/76

FOR OFFICE AND ENGINEERING USE ONLY

BLUELINE AS-BUILT 11-17-81



ITEM NO	NO REQ'D	DESCRIPTION	WT.	ASME OR ASTM	GR	MTL	MIC.
1	1	SMF-100 SO MECH SNUBBER				SSN	
2	2	W12 x 58		SA 36	L		
3	2	W10 x 33		SA 36	L		
4	31	PIPE 16" Sch 40 L = 8' 10" (SEE DET. 4)		SA 36			
5	4	PL 2" x 4'-11" x 1'-4"					
6	31	PIPE 6" Sch 80 DIA. (CUT TO FIT)					
7	1	[illegible]					
8	4	FR L2" x 8" x 1'-0"		SA 36			
9	2	PL 2" x 27" x 3'-11" (SEE SECT C-C) BY FIELD		SA 36			
10	2	PL 2" x 27" x 3'-11" (SEE SECT C-C) BY FIELD		SA 36			
11	4	PL 3/4" x 10 1/16" x 3'-6"		SA 36			
12	4	PL 2" x 27" x 3'-11" (SEE SECT C-C) BY FIELD		SA 36			
13	1	W12 x 58		SA 36	L		
14	2	FF 3/4" x 10 1/16" x 2'-6 3/16"		SA 36			
15	2	FHN 1 1/2"-8		SA 307 GRB			
16	1	SPC-36-320 PIPE CLAMP		SA 36			

Expansions are in pipe in direction of travel in SEQ. Case	θX	θY	θZ
NORMAL MAXIMUM	+.006	+.006	+.006
NORMAL MINIMUM	-.205	-.150	-.131
NORMAL OPERATING MAX.	-.205	-.150	-.126

THER. UPSET MVTS:-
V = 1.926 UP
S = 1.648
W = 2.897

REV	DATE	DWN	CHK	APP'D	DESCRIPTION
5	12-83	AR	[illegible]	[illegible]	REV'D VENDOR CERT.
6	6-84	TC	RB	[illegible]	REV'D VENDOR CERT.

VENDOR CERTIFIED
DRAWING REV. NO. 6
BY: [illegible] DATE 6-4-84

LOAD (LBS)	GRAV	INER	HYDR	OBE	SSE	DESIGN LOADS	NORMAL THER	SEISMIC
UP						VERT 1112		
DN						N-S 1594		
N						E-W 2353		
S						PIPE CAP. DATA	AP-1-001-21	
E							109	

REFERENCE DRAWINGS		REV
S.R.H.L. 150		6
MS-1-RB-002		2
PAR. ISOMETRIC	REV	
MS-1-RB-02		8

PIPING	REV
2323-SI-0582	8
STRUCTURAL	REV
2323-SI-0532	2

ELECTRICAL	REV
2323-EI-0502	8
H.V.A.C.	REV
2323-MI-0552	5

COLD/CLASS II/2
PAINT [illegible]
ZONE —

OWNER TEXAS UTILITIES SERVICES INC.
PROJECT COMANCHE PEAK UNITS NO. 1 & 2
ENGINEER

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

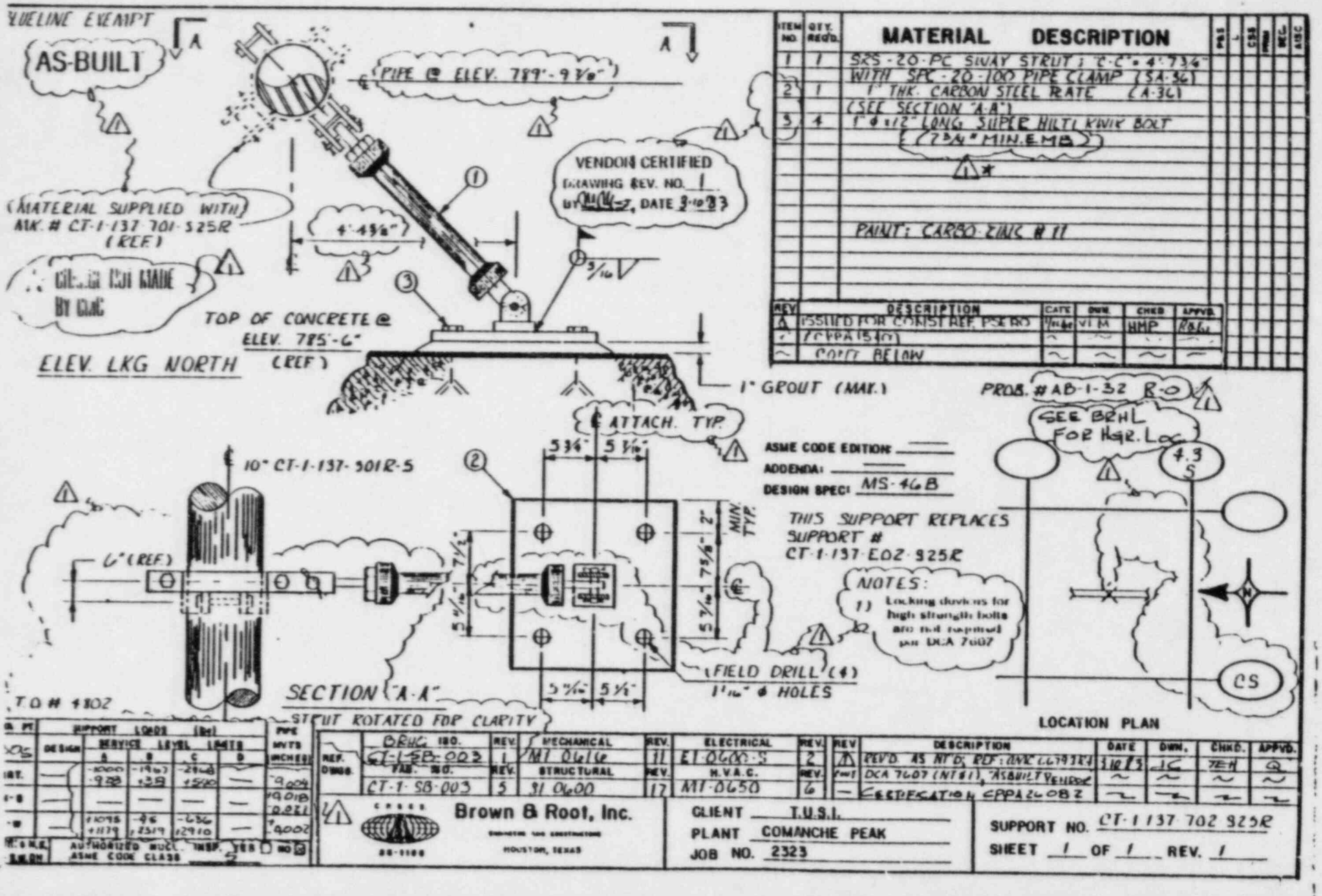
SUPP'T 150.	NPSI-MS-1-RB-02

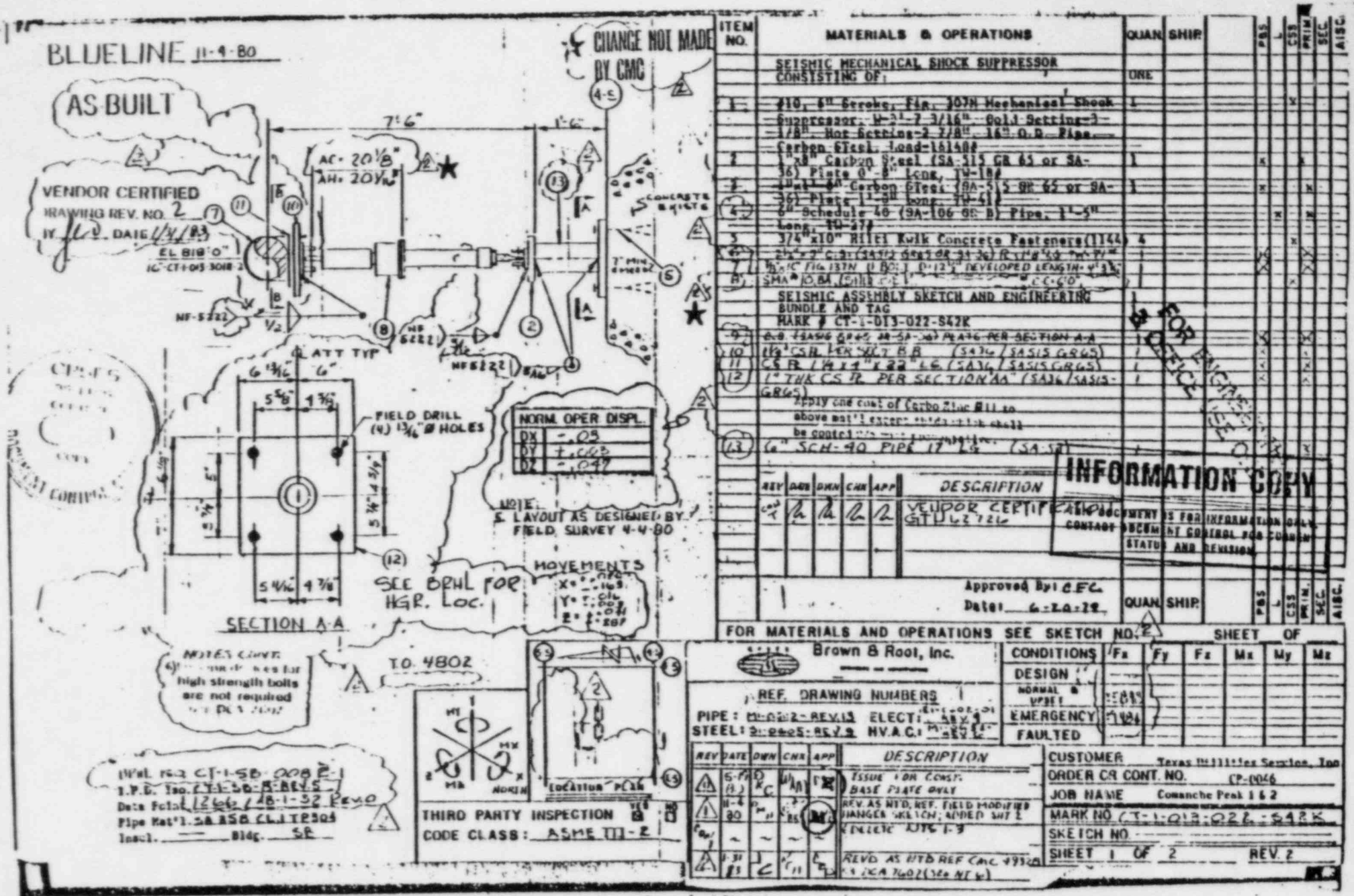
DRAWN	DATE	CHK'D	DATE	APP'D	DATE
BS	12-1-80	DP	12-4-80	[illegible]	12-10-80

P.O. NO. CP-0046A.1 MFG. REL.

PRODUCTION ORDER	SERIAL NUMBER	SHEET
		10F5

309 MS-1-001-006-C72K REV. 6





ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP
	SEISMIC MECHANICAL SHOCK SUPPRESSOR CONSISTING OF:	ONE	
1	#10, 6" Stroke, Fig. 307N Mechanical Shock Suppressor, W-3'-7 3/16" Cold Setting-3-1/8" Hot Setting-2 7/8" 16" O.D. Pipe. Carbon Steel, Load-161408#	1	
2	1" x8" Carbon Steel (SA-515 GR 65 or SA-36) Plate 0'-8" Long, TW-18#	1	
3	1" x8" Carbon Steel (SA-515 GR 65 or SA-36) Plate 1'-8" Long, TW-51#	1	
4	6" Schedule 40 (SA-106 GR B) Pipe, 1'-5" Long, TW-37#	1	
5	3/4"x10" Rifel Kwik Concrete Fasteners (1144)	4	
6	2"x2"x1/4" C.S. (SA36) Angle 0'-3 1/2" Long, TW-7#	1	
7	8"x8"x1/4" C.S. (SA36) Plate 0'-8" x 0'-8" TW-51#	1	
8	SMA 10.84 Cable Set	1	
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG MARK # CT-1-DI3-022-S42K	1	
9	6.0 THICK GRADE 36 CS PLATE PER SECTION A-A	1	
10	1/2" CS H.H. SQ.T. B.B. (SA36) (SA515 GR65)	1	
11	C.S. PL 1/4 x 1" x 22" LG. (SA36) (SA515 GR65)	1	
12	1" THK CS PL PER SECTION AA (SA36) (SA515-GR65)	1	
	Apply one coat of Carbo Zinc #11 to above mat'l except [illegible] shall be coated [illegible]		
13	6" SCH-40 PIPE 17" LG. (SA-53)	1	

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	12-6-82	RC	[illegible]	[illegible]	VENDOR CERTIFIED AS-BUILT

INFORMATION COPY
DOCUMENT IS FOR INFORMATION ONLY
CONTACT DCM AT CONTROL FOR CURRENT STATUS AND REVISION

Approved By: C.F.C.
Date: 6-20-82

FOR OFFICE AND ENGINEERING USE ONLY

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. 2 SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M-0302-REV.13 ELECT: [illegible]
STEEL: S-0005-REV.9 HV.A.C.: [illegible]

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET						
EMERGENCY						
FAULTED						

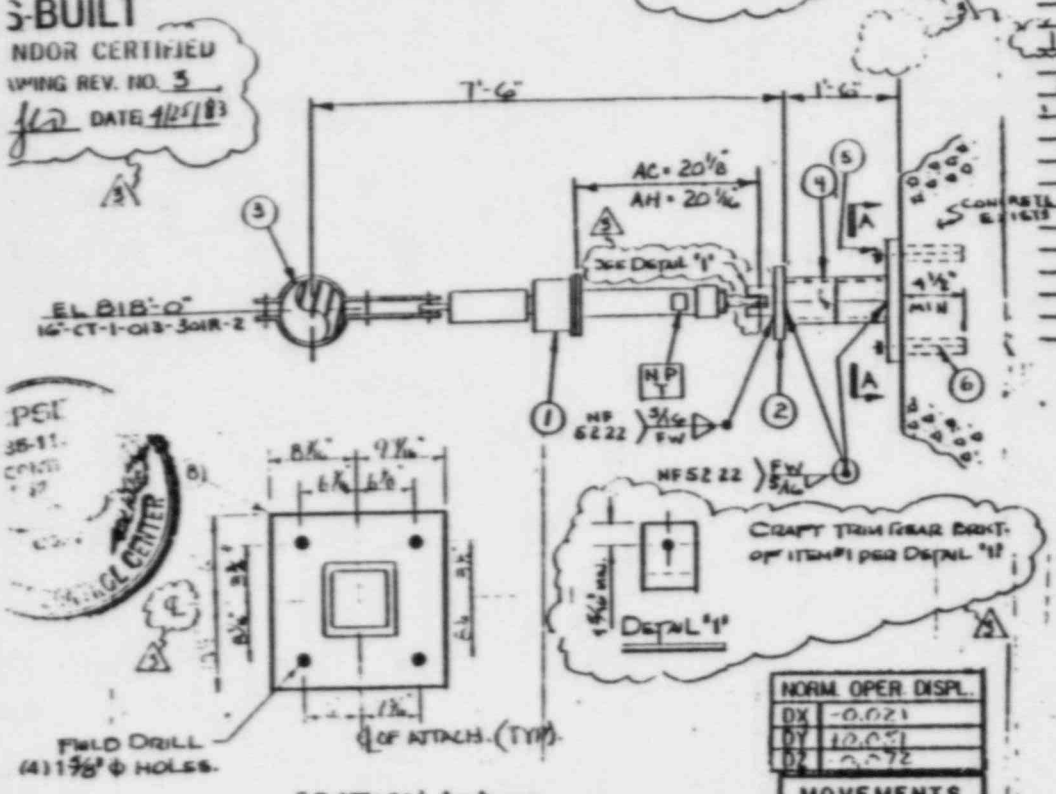
REV	DATE	DWN	CHK	APP	DESCRIPTION
2	5-19-82	RC	[illegible]	[illegible]	ISSUE FOR CONST. BASE PLATE ONLY
1	11-4-80	[illegible]	[illegible]	[illegible]	REV. AS NTD. REF. FIELD MODIFIED HANGER SKETCH; ADDED SHT 2
Rev	~	~	~	~	~
0	1-31-80	[illegible]	[illegible]	[illegible]	REVD. AS NTD REF CMC 4993 & PCA 7602 (See NCR)

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-1046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-DI3-022-S42K
SKETCH NO.
SHEET 1 OF 2 REV. 2

FOR OFFICE AND ENGINEERING USE ONLY

FOR OFFICE AND ENGINEERING USE ONLY

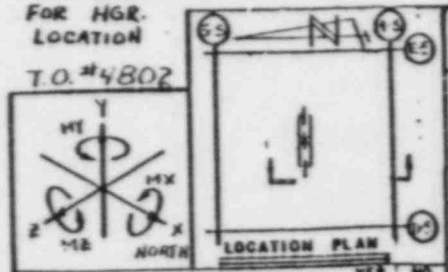
LUELINE
S-BUILT
NDOR CERTIFIED
WING REV. NO. 3
DATE 4/25/83



NORM. OPER. DISPL.	
DX	-0.021
DY	10.031
DZ	-0.072

MOVEMENTS		
X	+.018	-.122
Y	+.278	-.045
Z	+.063	-.388

SEE BRHL FOR HGR. LOCATION



1) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 2607

BRHL ISO. CT-1-SB-008 Rev 1
I.P.D. Iso. CT-1-SB-B-REV.5
Data Point 164 / PROB# AB-1-32 Rev 0
Pipe Mat'l. SA 358 CL.1 TP304
Insul. ____ Bldg. SB

THIRD PARTY INSPECTION YES ☐ NO ☐
CODE CLASS: ASME III-2

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PBS	L	CSS	PRIM.	SEC.	AISC
	SEISMIC SWAY STRUT ASSEMBLY CONSISTING OF	ONE								
1	SMA-10 RO SNUBBER	1					X			
2	C.S. R 1"×8"×8" (SA 36)	1			X		X		X	
3	SPC-14160 PIPE CLAMP	1								
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING	1								
	BUNDLE AND TAG MARK # CT-1-013-021-S42K	1								
	NEW MATERIAL REQUIRED									
4	½" x 4" x ½" STRUCTURAL TUBING (A-500, 76) GR. B) 1'-4 3/4" LONG, TW = 39 #	1				X		X		
5	1 1/2" HEX NUT (SA-307 GR. B)	A								
6	1 1/2" x 8 1/2" FIG 140N W/THREAD FULL LENGTH	4						A		
7	1 1/2" x 1' 4" CARBON STEEL (SA 36 GR. B) SEAMLESS PLATE, 1' 4" LONG, TW = 9 #	1			X			X		
8	CARBON STEEL PLATE (8"x11½"x1½") PER SECTION A-A (SA 36)	1								

Approved By: R. EL
Date: 6-20-79

INFORMATION COPY
THIS DOCUMENT IS FOR INFORMATION ONLY. CONTACT DCA/CE CONTROL FOR CURRENT STATUS AND REVISION.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. ____ SHEET ____ OF ____

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0612-REV.13 ELECT: E1-0602-01 REV.9
STEEL: S1-0605-REV.9 H.V.A.C.: M1-0625-REV.6

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET	±2736					
EMERGENCY	±4247					
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	7-8-83	MH		M	ISSUED FOR CONST; REF. FIELD MODIFIED HANGER SKETCH: 1 TT R1 NPSE, R.O.A
1	5/11/83	R	MV	M	REVISED WITH REF. CMC #1369 & N.C.A. AS BUILT
0	4/25/83	Q		M	VENDOR CERTIFICATION. REF: GTN# 62726
3	4/25/83	MAH		M	REV'D. VENDOR CERTIFICATION REF: CMC #90040 R-1.

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-021-S42K
SKETCH NO. ____
SHEET 1 OF 1 REV. 3

FOR OFFICE AND ENGINEERING USE ONLY

BLUELINE 1-12-81

AS-BUILT

ALL TOL DIMENSIONS ± 1/4" UNO.

CPSES 35-1195 CONTROL COPY DOCUMENT CONTROL CENTER

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY [illegible] DATE 7/28/83

SECTION A-A

PLAN VIEW @ EL. 815'-6 1/2"

16-CT-1-018-301 R-2

NORM. OPER. DISPL.	
DX	± 0 - .039
DY	± 0 - .046
DZ	± 0 ± .036

MOVEMENTS	
X	+.350 -.068
Y	+.877 -.145
Z	+.067 -.441

6" MINIMUM EMBED.

NOTES:

4) Locking devices for high strength bolts are not required per DCA 7607

★ CHANGE NOT MADE BY CMC

SEE BASIL FOR HGR. LOCATION

LOCATION PLAN

Path: FW CT-1-SB-0 R-1
B.R.P. Iso CT-1-SB-8-REV. B
Data Point 260/1908 M-1-32 R-0
Pipe Mat'l. SA 358 Cl. 1 - TP 304
Insul. ~ Bldg. SB 7/0" 4802

THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME III-2

ITEM NO.	NO REQD	PART CALL-OUT	DESCRIPTION	MATERIAL	MIC. NO.	WT.	P&S	CSS PRIM	CSS SEC	AISC
1	1	C.S.P. 1¼" THK	(SEE SECT. A-A)	SA-36			X	X	X	
2	4	ASA-1-12	(EXP. ANCHOR)							
3	1	SME-10-80	SNUBBER							
4	1	GREA-40 [illegible]	HAMMER ASSY KIT							
5	1	SPC-14-1600	PIPE CLAMP	SA-36			X	X	X	
6	1	ASME SB NAME	PLATE							

SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG — 1
MARK # CT-1-013-019-S42K — 1

Apply one coat of Carbo Zinc #11 to above mat'l except th'ds which shall be coated w/a rust preventative.

FOR OFFICE AND ENGINEERING USE ONLY

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	7 28 83	MD	[illegible]	RD	REV'D VENDOR CERTIFICATION, REF. NCR # M-73905

Approved By: C.E.G.
Date: 6-20-79

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0617, REV. 13 ELECT: E1-0602, REV. 8
STEEL: S1-0605 REV. 5 H.V.A.C.: M1-0605, REV. 5

CONDITIONS	Fx	Fy	Fz	Mx	My
DESIGN					
NORMAL & UPSET			+175		
EMERGENCY			+214		
FAULTED					

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	1-12-81	R.H.	[illegible]	[illegible]	ISSUED FOR CONST. - NEW FIELD MODIFIED HANGER SKETCH, ITEM 1, NPSI R-0A, DELETED NT'S 1-3
1	12-28-81	R.H.	Q	[illegible]	REV'D AS BUILT REF: CMC 49769 DCA 7607 (M14) AS BUILT
					VENDOR CERTIFICATION, REF: GTH # 023256

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-019-S42K
SKETCH NO. 1
SHEET 1 OF 1 REV 2

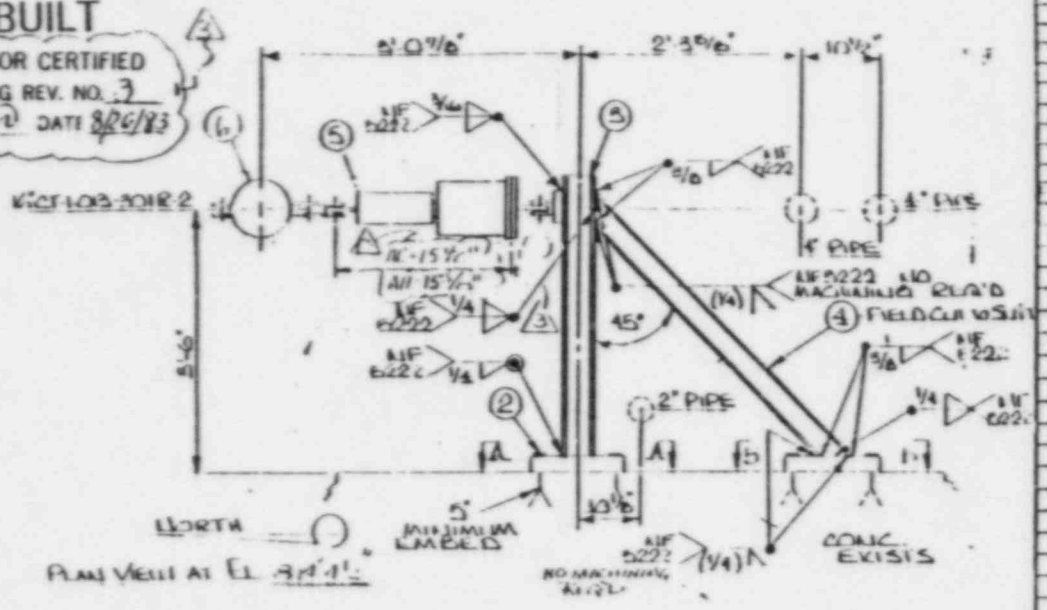
cb

FOR OFFICE AND ENGINEERING USE ONLY

FOR OFFICE AND ENGINEERING USE ONLY

BLUELINE

AS-BUILT
VENDOR CERTIFIED
DRAWING REV. NO. 3
DATE 8/26/83



ITEM NO.	NO REQ'D	PART CALLOUT	DESCRIPTION	MATERIAL	MIC NO.	WT.	POS	L	CSS	PRIM	SEC	AISC
1	2					11						
2	8											
3	1			SA 36		19						
4	1			SA 36		23						
5	1		ENGINEER									
6	1	STD. ID 160	PIPE CLAMP	A 36		60						
7	1											
8	1											
9	-											

SEISMIC ASSEMBLY SKETCH AND ENGINEERING
BUNDLE AND TAG
MARK # CT-1-013-018-S42K

Apply one coat of Carbo Zinc #11 to above mat'l except those which shall be coated w/a inert protective.

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	8-3	MH	M	H	REV'D VENDOR CERT REF MCR-M-77925
1	8-3	MH	M	H	REV'D VENDOR CERT REF. CMC 19016

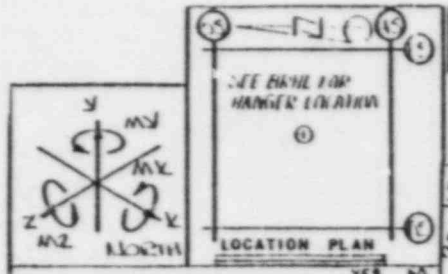
Approved By: C.F.L.
Date: 6-20-79

QUAN.	SHIP.	PRIM	SEC

MOVEMENTS	
X	+0.319 / -0.319
Y	+0.824 / -0.824
Z	+0.824 / -0.824

NORM OPER DISPL.	
DX	+0.079
DY	+0.162
DZ	-0.012

NOTE
4) Locking devices for high strength bolts are not required per DCA 7607



THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME III 2

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1062 P 13 ELECT: E1002 ONLY
STEEL: S1005 K 9 H.V.A.C.: M1062 P 16

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	8-3	JK			REV'D AS-BUILT PER FIELD MARK-UP DWG.
1	7-25	LN			REV'D AS-BUILT PER FIELD MARK-UP DWG.

CONDITIONS	Fx	Fy	Fz	Mx	My	M
DESIGN						
NORMAL & UPSET						
EMERGENCY						
FAULTED						

CUSTOMER Texas Eastern Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-018-S42K
SKETCH NO.
SHEET 1 OF 2 REV. 2

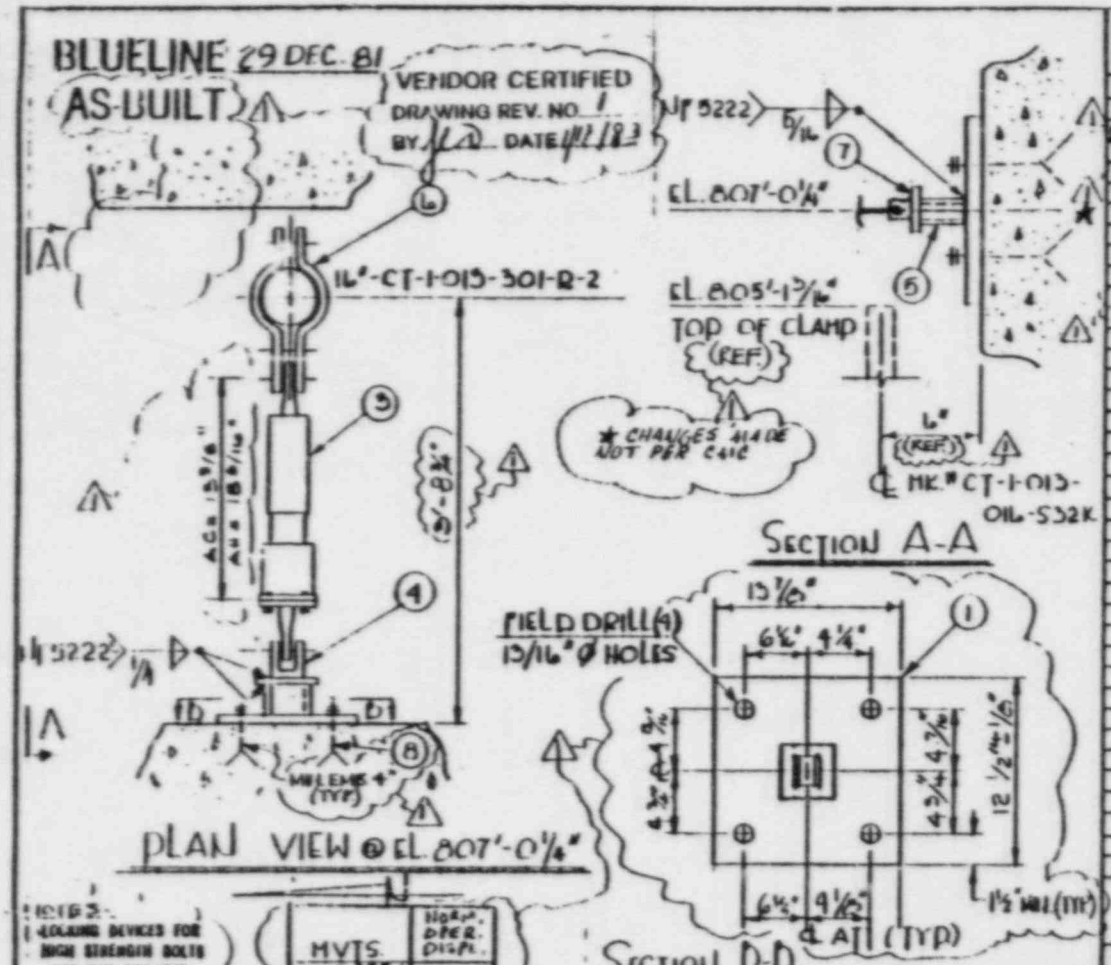
FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Iso. CT1-SB-SR3
Data Point 260 / PROG. MH 1 KO
Pipe Mat'l SA 358 Cl. 1 TP304
Insul. — Bldg. SB

BLUELINE 29 DEC. 81

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY [illegible] DATE 12/18/81



ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP
1	PCS R PER SECTION D-D	1	
2	SA36/SA53 GR B CL 2		
3	3/4" x 10" MULTI KNIF SCNG. ANCHORS 3" MIN. EMB	4	
4	SHP 3 TYPE 50, SNUBBER (LOAD-N63) C-C 30'0"	1	
5	XRB-D REAR BRACKET (ASSY. 1/S4 3C)	1	
6	1 1/2" TS 3"x3"x 1/4" WALL LG (A500 GR.B)	1	
7	SPC-10-160 PIPE CLAMP (SA36)	1	
8	1/2" CS R 3"x3" (SA36/SA108 GR 42)	1	
A	3"x3"x1" LG W/ 11 ENK FAT	1	

MARK # CT-1-013-017-S32K
PAINT: CARBO ZINC # 11

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS R9
PIPE: M1-0409-R M ELECT E1-0401-01
STEEL: S1-0402-R12 HVAC M1-0451-R6

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET			1285			
EMERGENCY			1463			
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
A	12/29/81	FA			ISSUE FOR CONST. PER CMHS & III R1

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO. CT-1-013-017-S32K
SKETCH NO.
SHEET 1 OF 1 REV. 1

PIPE Iso. CT-1-SB-8 R.1
D.R.P. Iso. CT-1-SD-8-R3
Data Point 30/PROD AB-1-32-R.0
Pipe Mat'l. SA358 CL 1 TP304
Insul. ——— Bldg. SD

T.O. 4802

THIRD PARTY INSPECTION
CODE CLASS: ASME III-2

FOR OFFICE AND

INFORMATION COPY

THIS DOCUMENT IS FOR INFORMATION ONLY. CONTACT DISTRIBUTION CONTROL FOR CURRENT REVISION AND VERSION.

FOR ENGINEERING OFFICE USE ONLY

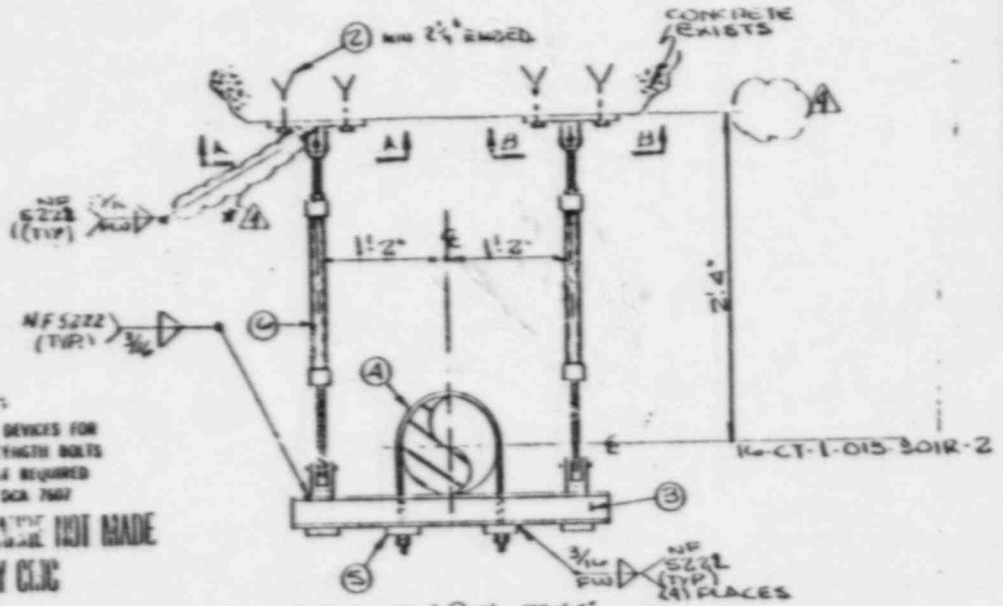
FOR OFFICE AND ENGINEERING USE ONLY

'E LINE 11-19-80

BUILT

OR CERTIFIED
G REV. NO. 4
DATE 4/03/13

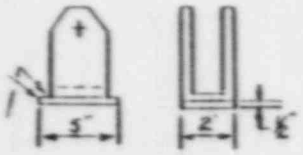
CPSES
35-1195
CONTROL
COPY
DOCUMENT CONTROL CENTER



PLAN VIEW @ EL. 794'-4"

TES:
ING DEVICES FOR
STRENGTH BOLTS
INAL REQUIRED
PER SCA 7607

ORIGINAL NOT MADE BY C.E.C.



DETAIL 1

T/04802

PARTS LIST
BRP Iso. CT-1-SB-B-REV 3
Data Point 3524
Pipe Mat'l. SA 358 CL 1 TP 304

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP.	PBS	L	CSS	PRIM	SEC	AISC
1	R 1" x 8 1/8" x 9 5/8" (SA-36)	1		X			X		
2	BSA - 12 - 5/2 Conc. Anchors	8				X			
3	C 4 x 5.4 x 3'-8 3/4" (SA-36) P.R.3/4"	2		X		X			
4	PAS-160 STD U-Bolt (SA-36) L=14 1/2	1				X			
5	RWP-07 (SA-36)	4				X			
6	SAS-06-BA SWAY STRUT C-C=31 1/2"	2				X			
7	R 1/2" x 2" x 5" (SA-36) SEE DETAIL 1	4		X			X		
8	R 1" x 9 1/4" x 10 3/8" (SA-36)	1		X			X		

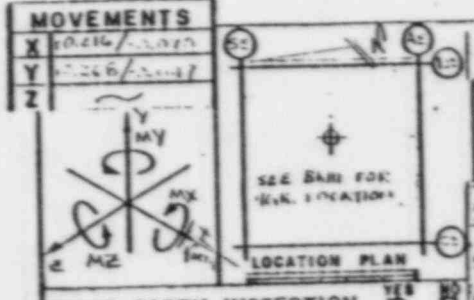
REV	DATE	DWN	CHK	APP	DESCRIPTION
4	3/28/13				REVISED VENDOR CERTIFICATION

MARK # CT-1-015-014-S32R
PAINT: CARBO ZINC # 11

Approved By: C.E.C.
Date: 6-20-12

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

MOVEMENTS		
X	0.216	-0.217
Y	0.266	-0.267
Z		



Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0405 REV 14 ELECT: E1-0601 REV 9
STEEL: S1-0402 REV 12 H.V.A.C.: M1-0521 REV 21

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET			-1194			
EMERGENCY			-2466			
FAULTED						

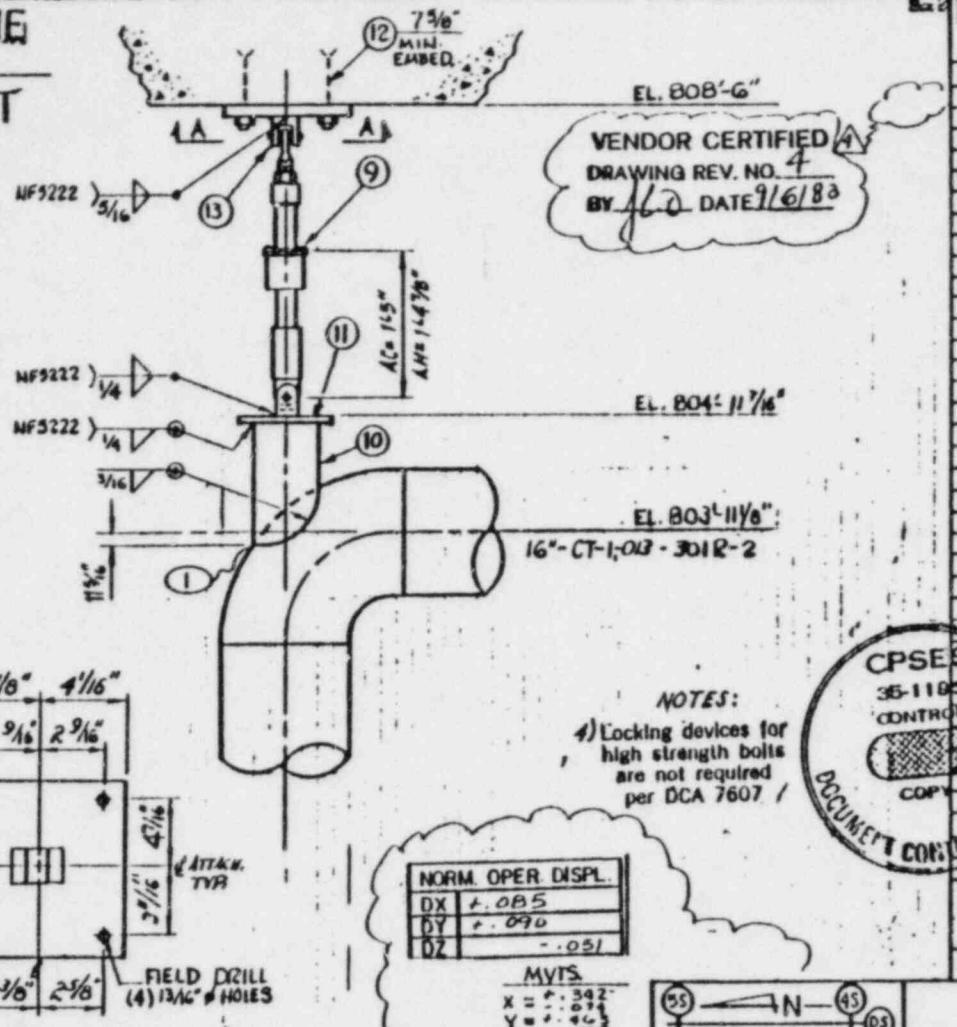
THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME III - 2

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	11-14 8-0	E			ISSUE FOR CONST, REF FIELD BOARD
2	7-24 11	Q			MATERIAL SELECTION TABLE ADDED. NOTE AS NOTED. REF ENC #8246 DCA #601 (SEE SHEET 1) "AS BUILT"
1	3/5/12	M R	Q		REVISED PER FIELD REQUEST.

CUSTOMER: Texas Utilities Service, Inc.
ORDER OR CONT NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO CT-1-013-014-S32R
SKETCH NO. 2
SHEET 1 OF 2 REV. 4

FOR OFFICE AND ENGINEERING USE ONLY

UELINE
16-81
-BUILT



VENDOR CERTIFIED
DRAWING REV. NO. 4
BY AD DATE 9/6/83

NOTES:
4) Locking devices for high strength bolts are not required per DCA 7607

CPSES
36-1100
CONTROL
COPY
DOCUMENT CONTROL CENTER

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PBS	L	CSS	PRIM.	SEC.	AISC.
8	C.S. PLATE, 7/8" THK., PER SECT A-A (SA36/SA515GR65)	1			X			X		
9	SMA-3-SO SNUBBER L=1'-7 3/16"	1					X			
10	8" SCH. 40S PIPE STANCHION W/ RB. (A312-TP304)					X		X		
11	C.S. PLATE, 3/4" x 12" x 12" (SA36/SA515 GR65)	4			X			X		
12	3/4" x 10" HILTI-KWIK CONC. ANCHORS	4					X			
13	xRB-10 GEAR BRACKET (AG60D/SA36)	2					X			

FOR OFFICE AND ENGINEERING USE ONLY

MARK # CT-1-013-013-S32K
PAINT: CARBO ZINC # 11

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	9-6-83	Q			VENDOR CERTIFICATION. REF. GTN # 62726

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

SECTION A-A

NORM. OPER. DISPL.	
DX	+.085
DY	+.090
DZ	-.051

MVTS
X = +.342
Y = +.464
Z = +.077
.337

THIRD PARTY INSPECTION
CODE CLASS: ASME III-2

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: M1-0405 Rev. 14 ELECT: E1-0401 01 R-9
STEEL: S1-0402 Rev. 12 H.V.A.C.: M1 0451 R 6

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET 4		±2156				
EMERGENCY		±3342				
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	9/6/83	ECE	RK		ISSUE FOR CONST. PER FIT R.1
3	8/31/83	AD	DF		REV'D AS NOTED. REF. FMNS. MK # WAS CT-1-013-013-S32K.
2	8/21/83	SW	DF		REV'D AS NOTED REF MK # WAS CT-1-001-013-S32K
1	7/26/83	RM	AB		REV AS NT'D REF CMC 5 PRV PIT DCA 7607. SEE NT 4 AS BUILT

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO CT-1-013-013-S32K
SKETCH NO.
SHEET 1 OF 1 REV. 4

B.R.H.L Iso. CT-1-SB-00BR.1
I.P.D. Iso. CT-1-SB-B Rev 3
Data Point 1253/P808 AB-1-32 R.0
Pipe Mat'l. SA358 TP304
Insul. ~ Bldg. SB

T.O. 4802

BLUELINE 27 JULY 81

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 5
BY [illegible] DATE 1/13/83

NOTE:
4) Locking devices for high strength bolts are not required per DCA 7607

MULTI VIOLATION: 1⅛" REQ. EXIST. PER MK# CT-1-010-007-522K

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP		PBS	L	CSS	PRIM	SEC	AISC
2	1¼" X 12" MULTI KWIK CONC. ANCHORS (1149)	4					X			
4	W8X17 (SA-36) 2'-6½" LONG	1					X			
5	W6X12 (SA-36) 0'-6⅜" LONG, SEE DET "J"									
6	1" C.S. PL Per Sec A-A (SA515Gr65 or SA-36)	1			X					
7	½" X 8" X 0'-8" LG. C.S. PL (SA-36 or SA515Gr 65)	1			X					
8	SMF-3-50 SNUBBER C-C 1'-6⅞" L 2"	1					X			
9	SPC-10-160 PIPE CLAMP (SA-36)						X			
10	XRB-10 REAR BRACKET (A668-D / SA36)	1					X			
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG MARK # CT-1-013-012-S32K	1								
	Apply one coat of Carbo Zinc #11 to above mat'l except th'ds which shall be coated w/a rust preventative.									

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	7-30	[illegible]	[illegible]	[illegible]	REVD AS NTD. REF. SMC L3814 REVISED 7607 TO AS-BUILT
5	1/13/83	Q	[illegible]	[illegible]	VENDOR CERTIFICATION. REF GIN# 62726

Approved By: C.E.C.
Date: 6-20-79

QUAN SHIP

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Brown & Root, Inc.

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN 4	---					
NORMAL & UPSET	±896					
EMERGENCY	1393					
FAULTED	---					

REF. DRAWING NUMBERS
PIPE: M1-0102 REV 14 ELECT: E-6001 REV 9
STEEL: S1-0602 REV 12 H.V.A.C: M-6151 REV 7

REV	DATE	DWN	CHK	APP	DESCRIPTION
0	5/8/80	DKC	[illegible]	[illegible]	ISSUE FOR CONST.
1	7/24/80	EW	KK	[illegible]	BASE PLATE ONLY REVISED AS NOTED PER ITT REV 1
2	8/26/80	MP	[illegible]	[illegible]	REV AS NOTED PER ECN #1
3	1/13/83	KS	[illegible]	SA	REV'D AS NOTED PER ITT REV 5 ECN 1 1 1 1

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT NO. CP-0016
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-012-S32K
SKETCH NO.
SHEET 1 OF 1 REV. 5

TQ 4802

BRHL No. CT-1-38-008 Rev 1
ARL No. CT-1-SB-B REV 3
Data Point 53/PROB# AB-1-32 Rev 0
Pipe Mat'l. SA 358-Gr 1 TP 304
Insul. ~ Bldg. S.B.

NOT CHANGED BY CMC

THIRD PARTY INSPECTION
CODE CLASS: ASME III-3

SEE BRHL FOR HGR LOCATION

LOCATION PLAN

PLAN VIEW @ EL. 794'-11 3/4"

SECTION A-A

DETAIL 1

MOVEMENTS	
X	+.233 -.062
Y	+.281 -.049
Z	+.003 -.025

NORM. OPER. DISPL.	
DX	.071
DY	.056
DZ	-.004

FIELD TRIM TO SUIT

CONCRETE EXISTS

NF 5222

16" CT-1-013-301 R-2

EQ. OF

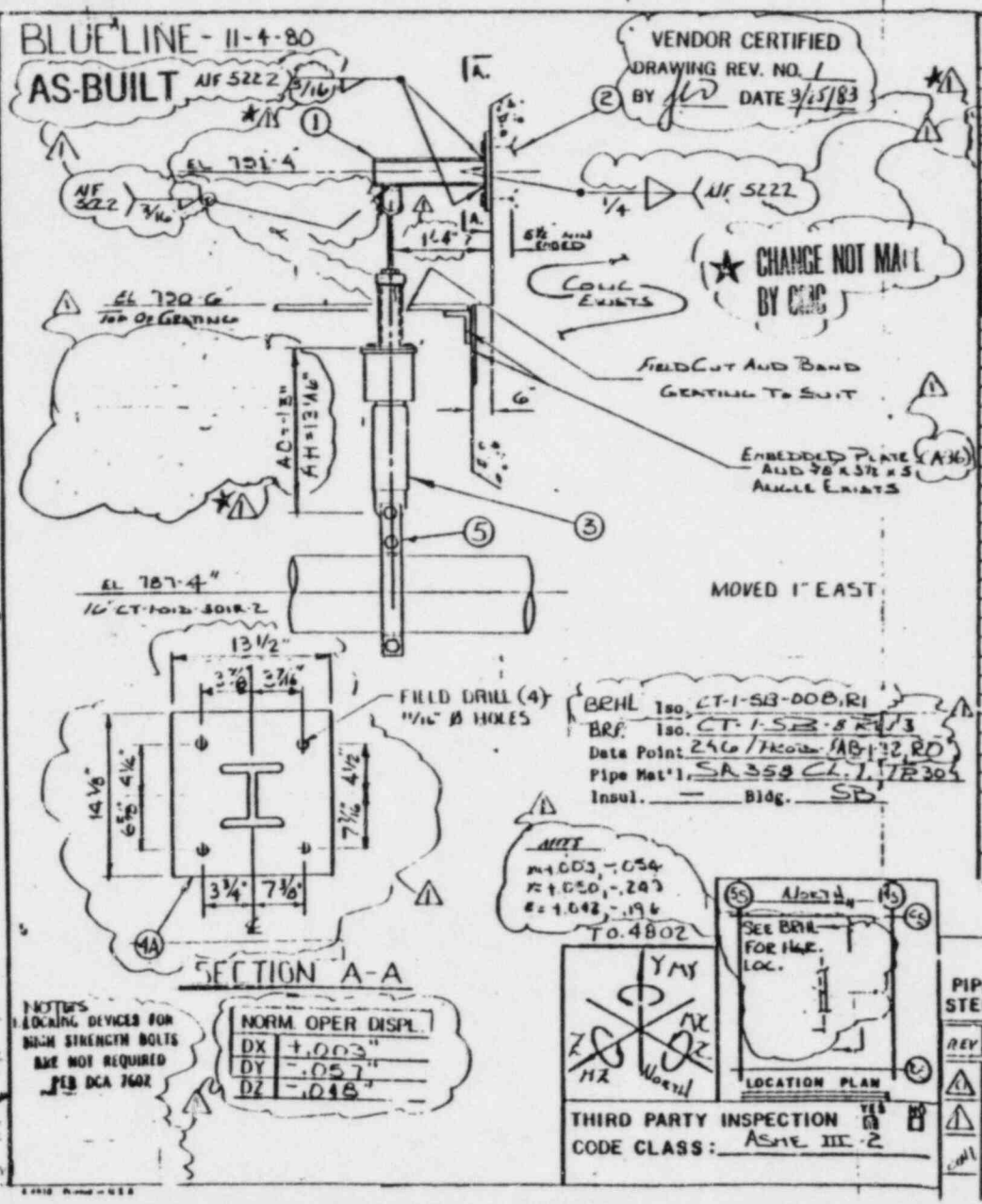
CONTROL

CONTAINMENT

THE PROJECT CENTER

BLUELINE - 11-4-80

AS-BUILT



ITEM NO.	NO REQ'D	PART CALL-OUT	DESCRIPTION	MATERIAL	MIC. NO.	WT.	PBS	L	CSS	PRIM.	SEC.	MISC.
1	1	WAX13X1-3'-8"		SA36		12		X		X		
2	4	BSA58-BV2	(BY FIELD						X			
3	1	SMA-1 RO	SNUBBER	(C-C=2'-5 3/8")		11			X			
4	1	SMT-1 K=[illegible]	TRANSITION FIT			8						
4A	1	C.S.P. [illegible]	SECT. A-A	(ABC GASKETS)								
5	1	ESPC 08-160	PIPE CLAMP	SA36		47			X			
	1	PROVIDE TEMPORARY SPACER C-C=28 5/16"				20						

SEISMIC ASSEMBLY SKETCH AND ENGINEERING 1
BUNDLE AND TAG 1
MARK # CT-1-013-009-S22K

Apply one coat of Carbo Zinc #11 to above rail except ends which shall be coated w/a rust preventative.

Approved By: C.E.C.
Date: 6-20-79

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF
Brown & Root, Inc.

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET		329				
EMERGENCY		499				
FAULTED						

REF. DRAWING NUMBERS
PIPE: M-0006 Rev 12 ELECT: E-0000 Rev 12
STEEL: S1-0037-Rev 10 HV.A.C.: M-0050 Rev 6

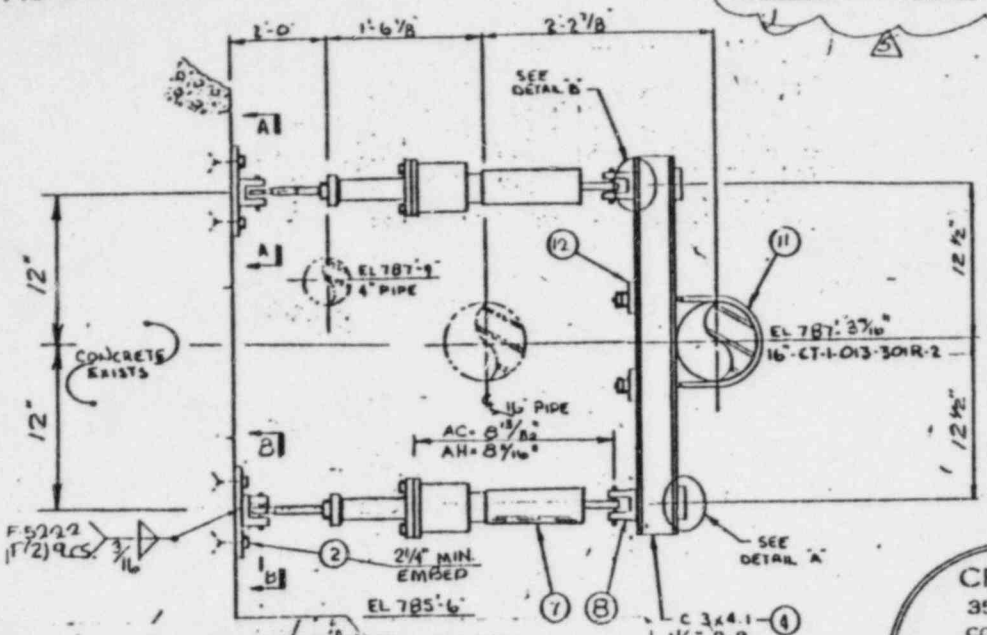
REV	DATE	DWN	CHK	APP	DESCRIPTION
1	11-4-80	MH	[illegible]	[illegible]	ISSUE FOR CONST. REF. CWP MODIFIED HANGERS SEE RHW 7A1
2	3-25-83	MH	[illegible]	[illegible]	REVISED PER CM 59159-2 REACTION(S) ADDED
cont					VENDOR CERTIFICATION REF CTN-142220

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-009-S22K
SKETCH NO.
SHEET 1 OF 1 REV. 1

BLUE LINE – 9 SEPT. 81

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 5
BY BU DATE 3-15-84



FOR OFFICE AND ENGINEERING USE ONLY

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP		PBS	L	CSS	PRIM	SEC
	SEISMIC MECHANICAL SHOCK SUPPRESSOR CONSISTING OF: MATERIAL EXISTS	ONE							
1	3/8"x8" Carbon Steel (SA-515 GR 65 or SA-36) Plate 0'-8" Long, TW-14#	2			X			X	
2	1/2"x5 1/2" Hilti Kwik Concrete Anchors (11L41)	8					X		
3	# 1/2, 2 1/2" Stroke, Fig. 307N Mechanical Shock Suppressor, H-3'-3 3/4", Cold Setting 1 1/4", Hot Setting 1 1/8", W/Additional Rear Bracket, Load 2.8, Ordered In Parts	2					X		
4	C3x4.1, (SA-36) 2'-5" Long TW-18#	4				X		X	
5	7/8" Fig. 60N Washer Plate	4					X		
6	7/8"x16" Fig. 137N U-Bolt, D-1" I 1/2", Developed Length-4'-5 3/4"	1							
7	EMA-½-GO RUBBER	2					V		
8	XRB-01e REAR BRACKET (A1A0/6436)	4					X		
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING	1							
	BUNDLE AND TAG	1							
	MARK # CT-1-013-007-S22K								
9	½"C.S.P.L. PER SECT "A-A" (SA 36 & SA-515 GR 65	1			X			V	
10	½"C.S.P.L. PER SECT "BB" (SA-36 & SA-515 GR 65	1			X			X	
11	BOLT-U-BOLT B= 1-1/2" (SA 36)	1					X		
12	WASHER PL. (SA-36)	4					X		
	Apply one coat of Carbo Zinc #11 to above mat'l except th'ds which shall be coated w/a rust preventative.								
13	ASME NAMEPLATE	1							
14	½" THK. PL 2"x2" (SA-36)	2							

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	8-17-83	[illegible]	Q	[illegible]	REV'D AS-BUILT VENDOR CERTIFIED PER CATLIN 27276
5	3-15-84	[illegible]	[illegible]	[illegible]	REV'D VENDOR CERT., UF CASE-47275

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

CPSES
35-1105
CONTROL
COPY
DOCUMENT CONTROL

T.O. 4802

NORM. OPER. DISPL.	
DX	+.016
DY	-.047
DZ	-.050

MOVEMENTS	
X	+.019 -.013
Y	+.041 -.223
Z	+.043 -.209

NOTE

14) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

THIRD PARTY INSPECTION YES ☒ NO ☐
CODE CLASS: ASME III-2

BRHL Iso. CT-1-SB-008/R.L
B.R.P. Iso. CT-1-SB-8 REV 3
Data Point 44/PR28 = 28-1-32/R.D 1
Pipe Mat'l. SA. 358 CL 1, TP 304
Insul. ~ Bldg. SB

FIF/JN

Brown & Root, Inc.

REF. DRAWING NUMBERS

PIPE: MI-0606 REV 13 ELECT: E1-0000 REV 12
STEEL: S1-0600 REV. 17 H.V.A.C.: MI-0650 REV 6

CONDITIONS	Fx	Fy	Fz	Mx	My	M
DESIGN						
NORMAL & UPSET			±911			
EMERGENCY			±213			
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	5-19-83	DKC	WJF	[illegible]	ISSUED FOR CONST. BASE PLAT & STAT
2	4-4-83	KDH	RRR	CLR	REVISED AS NOTED PER [illegible]
1	3-31-83	DF	[illegible]	[illegible]	REV AS NOTED PER FMHG
0	3-16-83	TJW	JD	WJF	REV AS NOTED; REF CMC 61292 R: DCA 7607 (SHEET 4) AS BUILT

CUSTOMER Texas Utilities Service,
ORDER OR CONT. NO. CP-0048
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-007-S22K
SKETCH NO. ~
SHEET 1 OF 2 REV. 5

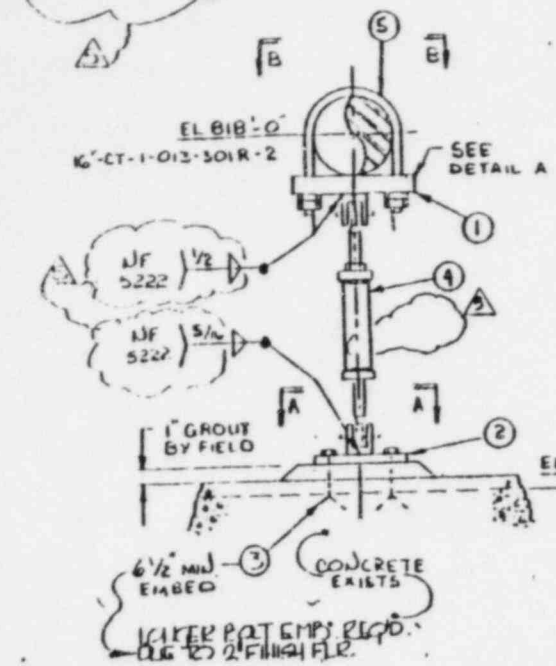
cb

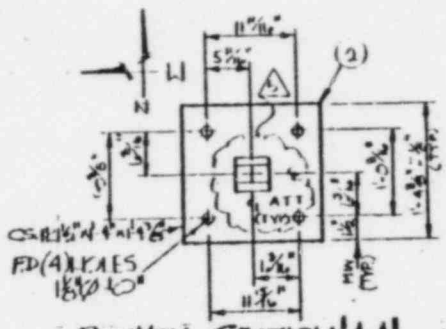
FOR OFFICE AND

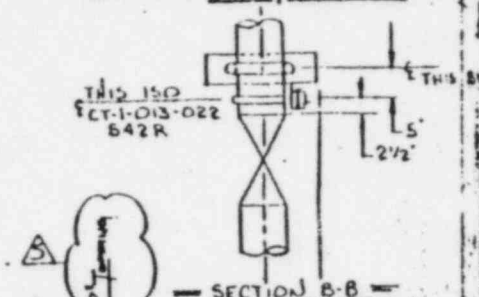
#3 FOR OFFICE AND ENGINEERING USE ONLY

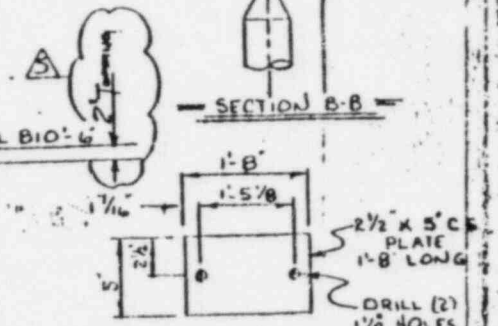
BLUELINE 12 8 80

VENDOR CERTIFIED
DRAWING REV. NO. 5
BY [illegible] DATE 12/1/83
AS-BUILT





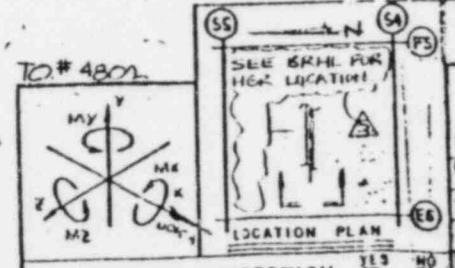




NOTES:
1. BY ISSUE OF REV. 4 OF THIS DRAWING, THE FOLLOWING DOCUMENTS ARE VOIDED: CPC #0196 & HO

NOTES CONT.
2. Locking devices for high strength bolts are not required per DCA 7607

I.S.O. [illegible]
I.P.D. Iso. CT-1-SB-8 Rev 5
Data Point: [illegible]
Pipe No.: SA358-CL 1 [illegible]
Insul. ~ Bldg. SB



THIRD PARTY INSPECTION YES ☒ NO ☐
CODE CLASS: ASME III-2

NO	MATERIAL	QUAN	SHIP
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING		
1	2 1/2" X 5" Carbon Steel (SA515-GR.6 or SA-36) Plate, 1'-8" long, TW=71#	1	
2	1 1/2" X 1'-5" Carbon Steel (SA515-GR.60 or SA-36) Plate, 1'-8" long, TW=30#	1	
3	1" X 12" Hilti-Kwik Concrete Anchors (HHK)	4	
4	SNS Type PA #2½, C-C=1'-9"	1	~T = 160 #
5	PUR-160 TI=5 1/2", B=1'-1" (SA 36)	1	~T = 12 #
6	16" NK II CS. SEE SECT A-A (SA-36 & A 515 GR 65)	1	
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING MARK NO. CT-1-013-001-S42R	1	
	CARBO ZINC #11		

NPSI CERTIFIES THAT THE SUBSTITUTIONS IN HARDWARE AND MATERIAL SPECIFIED IN THE BILL OF MATERIAL ARE EQUIVALENT TO THOSE SPECIFIED BY THE DESIGNER AND SUITABLE FOR THE INDICATED LOADINGS.

6/4/80
DATE FOR PROJECT MANAGER

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	12 8 80	CF	[illegible]	M	[illegible]
3	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0612 Rev. 13 ELECT: E-0602 Rev 9
STEEL: S1-0605 Rev 9 H.V.A.C. [illegible]

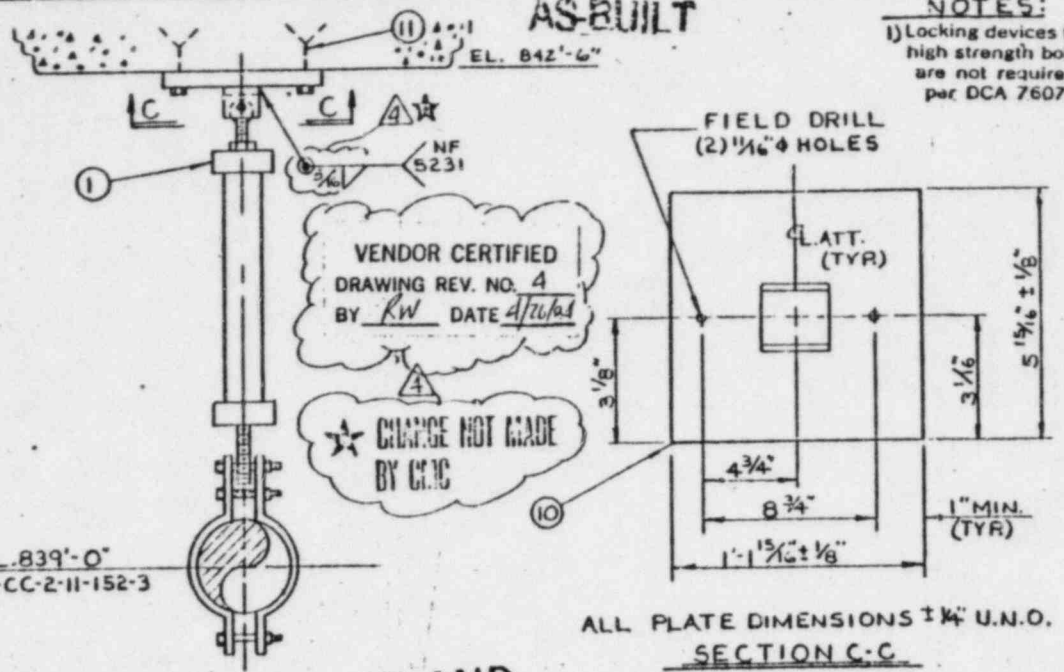
CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET		1.216				
EMERGENCY		1.824				
FAULTED		2.128				

REV	DATE	DWN	APP	DESCRIPTION
0	6/3/80	[illegible]	[illegible]	ISSUED FOR CONST. P.W. 1&2
1	10/24/80	[illegible]	[illegible]	REVISED PER CPC FILE AND ITT REV 1
2	10-15-81	JW	[illegible]	REDESIGNED & REDRAWN - ADDED "R" TO MK NO. - PLATE TW "2 - PER ITT RQ
3	6/3/82	[illegible]	[illegible]	REVISED AS NOTED PER APPD REV. 3 & ITT REV. 3

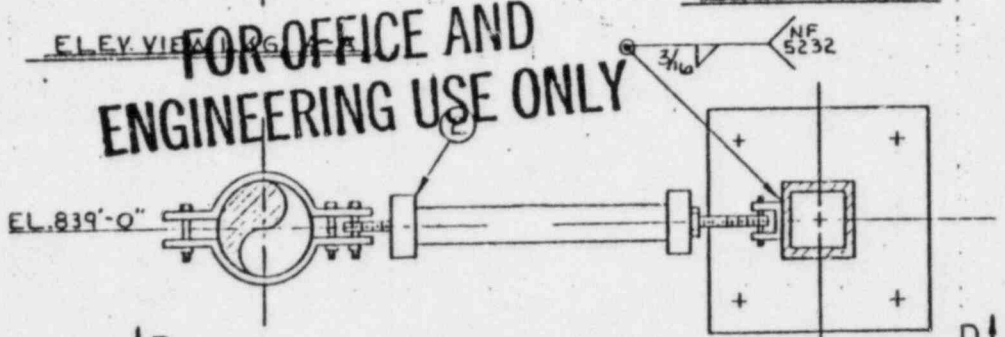
CUSTOMER [illegible]
ORDER OR CONT. NO. CP-0015
JOB NAME [illegible]
MARK NO. CT-1-013-001-S42R
SKETCH NO.
SHEET 1 OF 1 REV. 5

AS-BUILT

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607



SECTION C-C



ELEV. VIEW LKG. B-B

FOR OFFICE AND ENGINEERING USE ONLY

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	P&S	CSS	PRIM	SEC.	AISC
1	1	SRS-08-PC SWAY STRUT WI		X			
		SPC-08-060 PIPE CLAMP					
2	1	SRS-03-PC SWAY STRUT WI		X			
		SPC-08-060 PIPE CLAMP					
4A	1	1" THK PL PER SECT E-E (SA-36/SA515 GR 65)	X				
8	1	T.S. 1/4" x 4" x 4" x 4'-1 1/2" LG. (A-500 GR. B)		X		X	
10	1	CS PL 1" THK. PER SECT C-C (SA-36 OR SA-515 GR 65)	X			X	
11	2	5/8" x 8 1/2" HILTI KWIK CONCRETE ANCHORS			X		
12	4	1" x 12" SUPER HILTI CONCRETE ANCHORS			X		

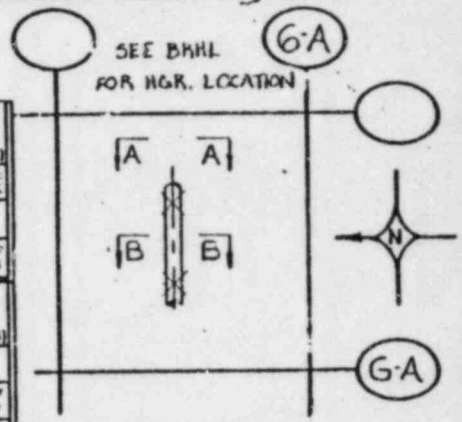
APPLY ONE COAT OF CARBO ZINC #11 TO ABOVE MATL EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE

V	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
2	VENDOR CERTIFICATION; PER 39790	6/7/84	TBH	[illegible]	CED
3	REV'D VENDOR CERT PER 9264	8/9/85	VM	[illegible]	[illegible]
4	REV'D VENDOR CERT.	4/27/84	JAR	[illegible]	[illegible]

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

DATA PT.	SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
1088	DESIGN	SERVICE LEVEL LIMITS A	B	C	D		
VERT.	—	—	—	—	—		-0.025 -0.025
N-S	—	-30 +103	-901 +954	-1058 +811	—		—
E-W	—	—	—	—	—		-0.010 -0.014

DATA PT.	SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
2093	DESIGN	SERVICE LEVEL LIMITS A	B	C	D		
VERT.	—	-632 -636	-1175 +1252	-1547 +741	—		—
N-S	—	—	—	—	—		-0.517 -0.517
E-W	—	—	—	—	—		-0.011 -0.011



LOCATION PLAN

T.O. 21100
PROB. A8-1-660 S.D.

SEE LOAD LISTS

	BRHL	REV	MECHANICAL	REV	ELECTRICAL	REV
REF. DWGS.	CC-2-AB-031	0	MI-0702	8	E1-0702	8
	FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-031	0	S-0718	3	MI-0755	6

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
0	IFC	11-30-83	[illegible]	[illegible]	[illegible]
1	[illegible]	[illegible]	~	~	~
2	FOR (SEE NT. 1) ADDED SPC 2, "AS BUILT"	~	~	~	~

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-716-A53R
SHEET 1 OF 2 REV. 4

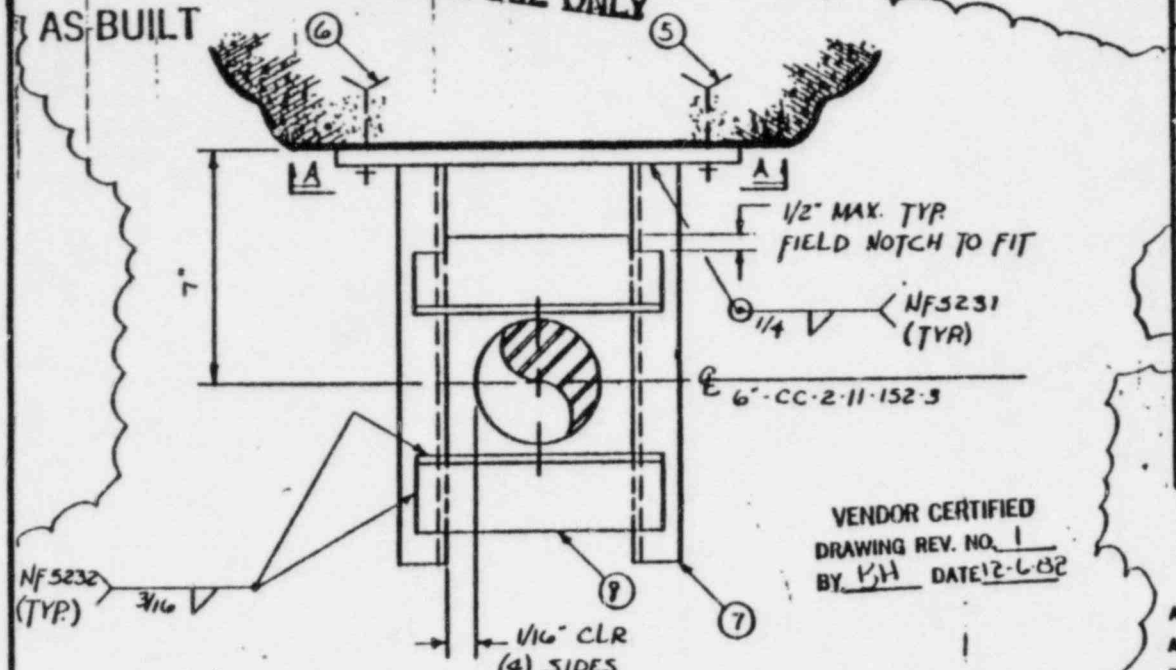
NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES [V] NO [ ]
ASME CODE CLASS 3

FOR OFFICE AND ENGINEERING USE ONLY

FOR ENGINEERING & OFFICE USE ONLY

AS BUILT



PLAN VIEW

@ ELEV. 839'-9"

MVT'S	
Y	+0.025 -0.152

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7602

T.O.# 21101

ITEM NO.	QTY. REQ'D.	MATERIAL DESCRIPTION	PAINT	L	CSA	FIRE	WELD	ASME
4	1	5/8" THK CS PL PER SECT. A-A (SA36)	X			X		
5	1	3/4" Ø HILTI KWIK CONCRETE ANCHORS			X			
6	3	3/4" Ø 10" HILTI KWIK BOLTS			X			
7	2	L 1/4" x 3" x 3" x 14" LG. (SA36)	X			X		
8	2	L 1/4" x 3" x 3" x 12" LG. (SA36)	X			X		

INFORMATION COPY

THIS DOCUMENT IS FOR INFORMATION ONLY. CONTACT DOCUMENT CONTROL FOR CONTROLLED STATUS PRINTS. VENDOR

PAINT: CARBOZINC #11

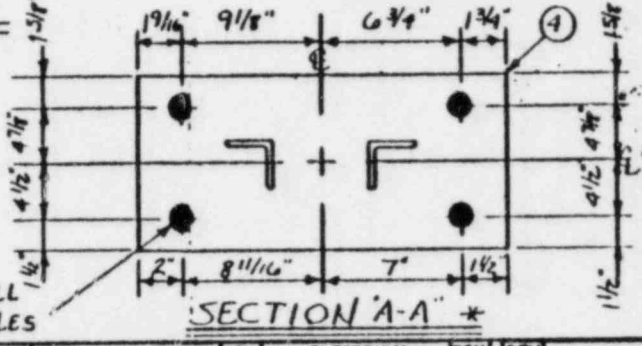
PROBLEM: #AB-1-66C. REV-0

REV	DESCRIPTION	DATE	DWN.	CHKD.	APVD.
CONT	AS BUILT, VENDOR CERTIFICATION; GTN # 69792	~	~	~	~

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY KH DATE 12-6-82

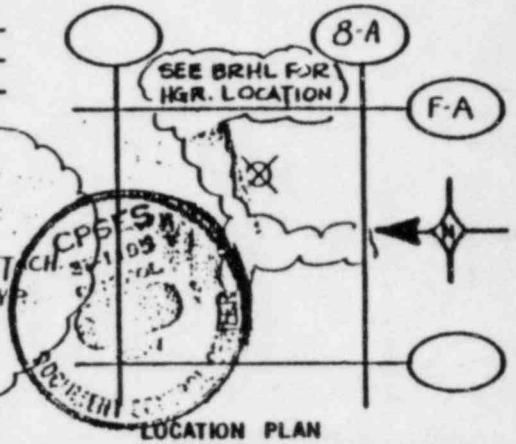
* CTR. LINE OF ATT. MAY VARY ± 1/8"

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-96A



FIELD DRILL (4) 13/16" Ø HOLES

SECTION A-A *



LOCATION PLAN

DATA PT.	SUPPORT LOADS (lbs) DESIGN	SERVICE A	SERVICE B	LEVEL C	LEVEL D	LIMITS	PIPE MVTS (INCHES)
2105							
VERT.							
N-S							
E-W							

NOTE * N, E, UP -S, W, DN

AUTHORIZED NUCL. INSP. YES ☒ NO ☐

ASME CODE CLASS 3

REF. DWGS.	STRESS ISO.	REV.	MECHANICAL	REV.	ELECTRICAL	REV.
	M2-3231-23	A	M1-0702	8	E1-0711	9
	BRHL ISO.	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
1	CC-2-AB-032	1	S-0721	4	M1-0756	5

REV	DESCRIPTION	DATE	DWN.	CHKD.	APVD.
1	REVD AS NID REF CAN 69690 E	12/6/82	JR	KP	RE
CONT	33-4442 R3 DCA 7602 (NT) CONT ABOVE	~	~	~	~
0	LFC.	2-19-79	C.A.T.	KP	MPA

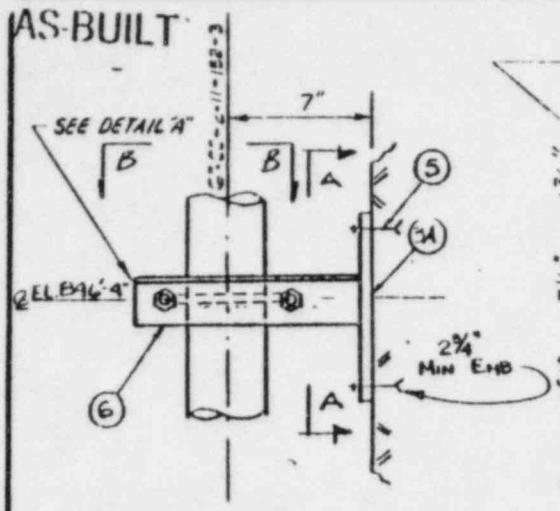
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

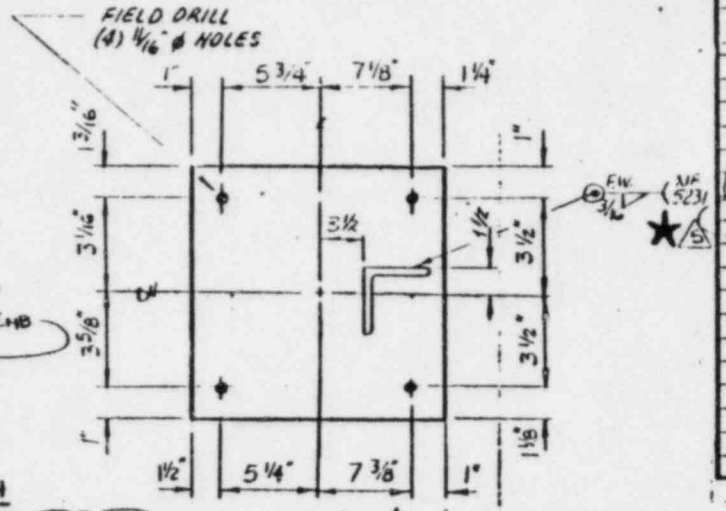
CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-710-A33R
SHEET 1 OF 1 REV. 1

FOR OFFICE AND ENGINEERING USE ONLY

AS-BUILT



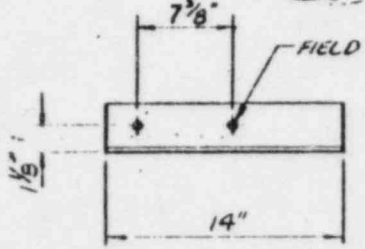


ITEM NO	QTY REQ'D	MATERIAL DESCRIPTION	PBS	L	CSS	PRIM	SEC.	AISC
1	1	PUH-060			X	X		
2	1	3"x3"x3/8" ANGLE SA 36 SEE DETAIL 'A'		X				
3	1	8"x1/2" PL SA-36 -- SEE SECTION 'A-A'	X			X	X	
4	4	1/2"ø x 3¼" MULTI-KWIK CONCRETE ANCHOR			X	X		
5	9	5/8"ø x 5½" HILTI KWIK CONCRETE ANCHOR			X			
6	1	3/16"x 3"x 3" ANGLE x 14"LG		X		X		
3A	1	3/16"x 9½" C.S. PLATE x 15⅝" LG (SASE CFS)				X		
7	1	1/16" CJP 3"x3" A 500 GR C						
8	1	5/16" CJP 3"x3½" SA 36						
		PAINT CARBO ZINC #11						

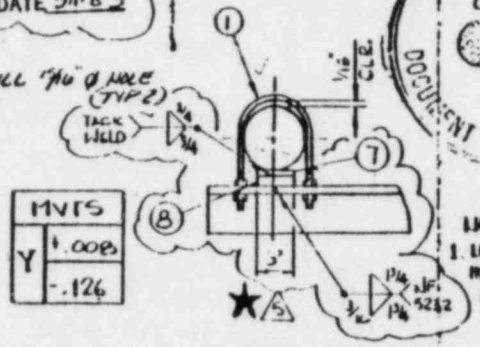
REV	DESCRIPTION	DATE	DWN	CHKD	APPVD
4	REV'D WELDING SPECIFICATION REF CMC M-7749	8/8/83	SEB		
5	REVD PER VENDOR CERTIFICATION	9-1-83	SL	TC	

REV	DESCRIPTION	DATE	DWN	CHKD	APPVD
2	VENDOR CERTIFICATION REF GTN 5790	11/5/81	JR		
3	REVD WELDING SPECIFICATION REF CMC M-7749	11/16/81	SEB		

VENDOR CERTIFIED
DRAWING REV. NO. 5
BY [illegible] DATE 9-1-83



DETAIL-A



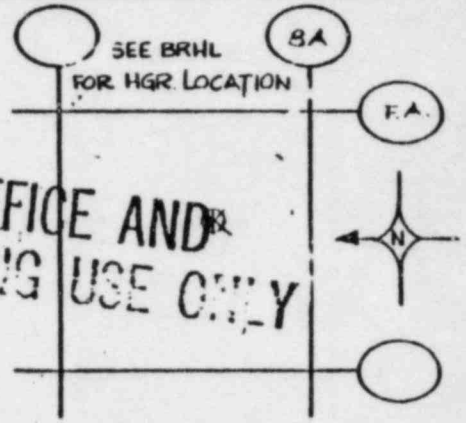
NOTE:
1. LOOKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7601

CPSES 35-1195 CONTROL COPY DOCUMENT CONTROL CENTER

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-66A

P.E. CERTIFICATION

PROB: AB-1-66C REV 0



★ CHANGE NOT MADE BY CMC

To # 21101.

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE A	LEVEL B	LEVEL C	LIMITS D	PIPE MVTS UNCHKD
2106						
VERT						
N-S		-31	-199 / 1060	-338 / 1220		
E-W		-21	-132	-89 / 39		

NOTE: +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐
ASME CODE CLASS 3

REF DWGS	STRESS ISO	REV	MECHANICAL	REV	ELECTRICAL	REV
	M2-3231-3G	A	M1-0702	8	E1-0711	9
	BRHL ISO	REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-032	1	S-0721	4	M1-0756	5

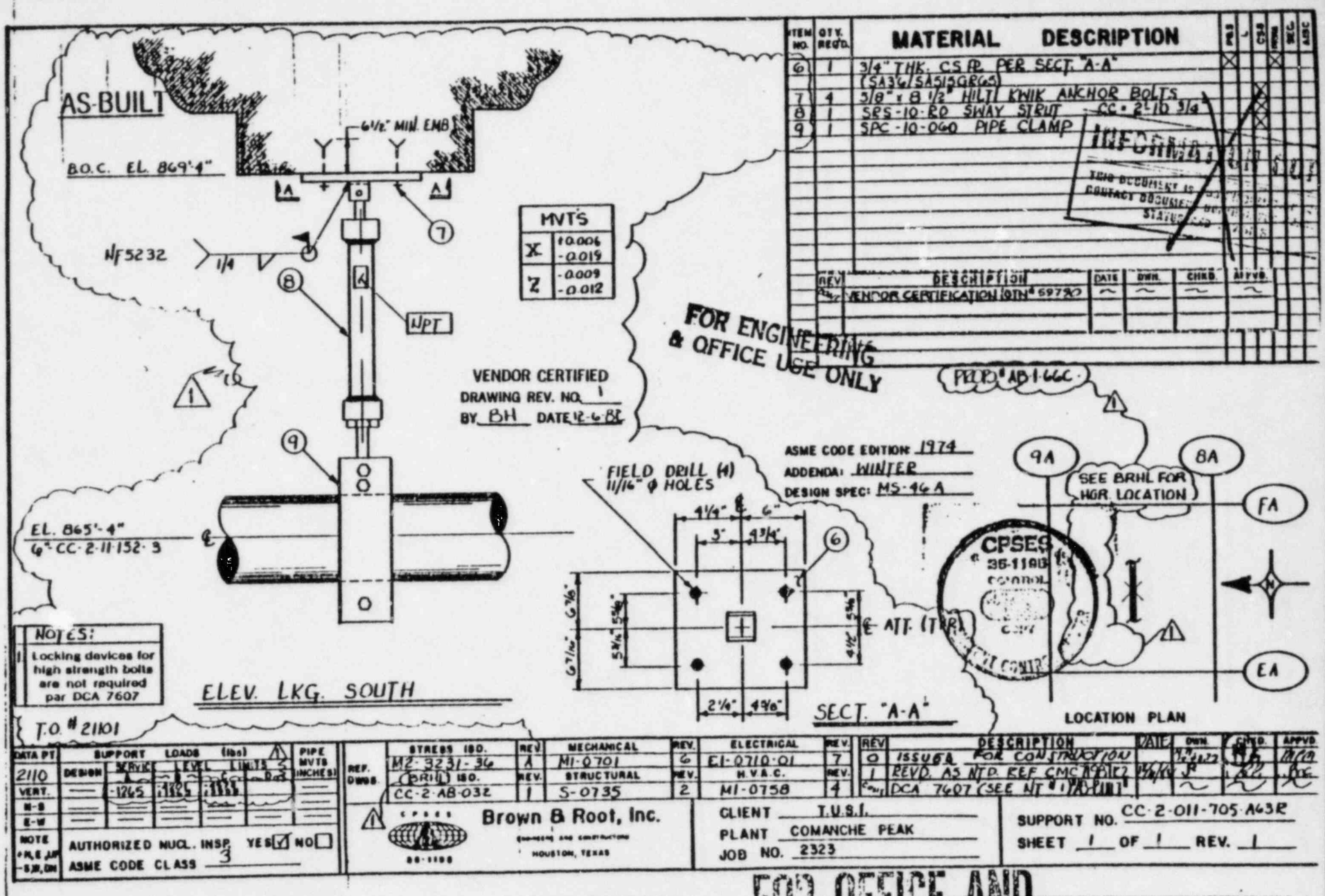
REV	DESCRIPTION	DWN.	CHKD.	APPVD
0	IFC 11/30/79		DA	
1	REV'D AS NOTED PER REF CMC 3542 REV 5, PIPING		EE	
--	REVI. VERIFIED CORRECTED PER NCR DCA 7601 SEE NCR A-8086			

CPSES 35-1195

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-11-709-A63R
SHEET 1 OF 1 REV. 5



ITEM NO.	QTY. REQ'D.	MATERIAL DESCRIPTION
6	1	3/4" THK. C.S. PL PER SECT. "A-A" (SA36/SA515GR60)
7	4	3/8" x 8 1/2" HILTI KWIK ANCHOR BOLTS
8	1	SRS-10-RO SWAY STRUT CC-2-10 3/4
9	1	SPC-10-060 PIPE CLAMP

REV.	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
1	VENDOR CERTIFICATION (QTN 6978)				

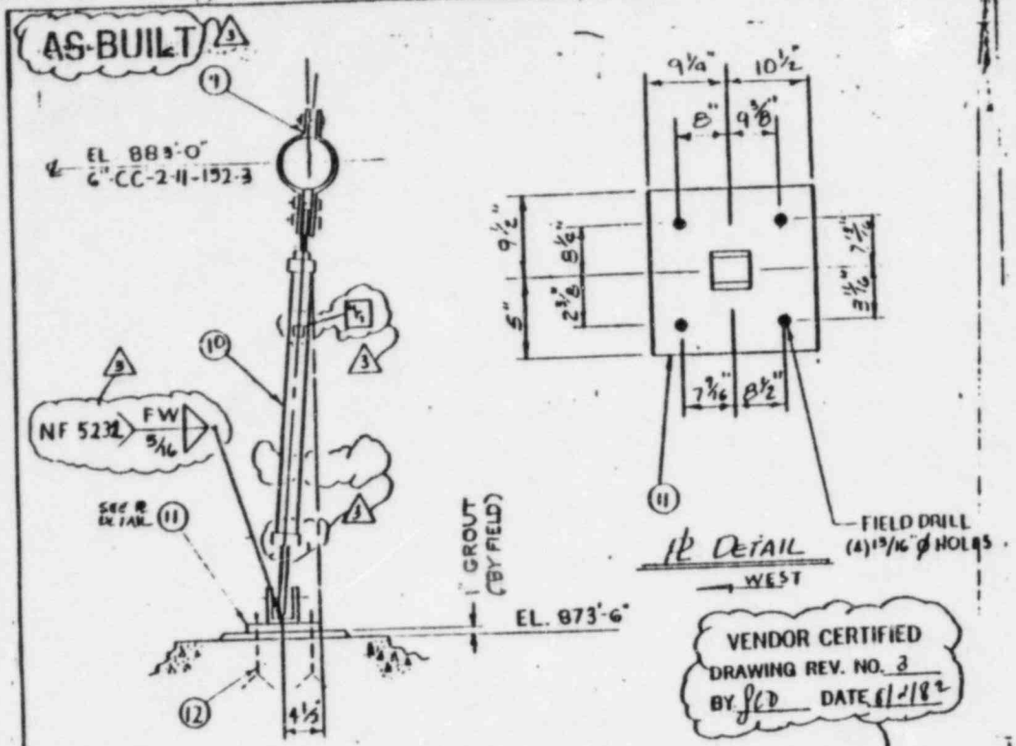
DATA PT	SUPPORT LOADS (lbs) DESIGN	OPER.	FAULTED LIMITS	PIPE MVTS (INCHES)
2110				
VERT.	—	-1265		—
N-S	—	—		—
E-W	—	—		—

NOTE + IS UP, - IS DOWN

REF. DWGS.	STRESS ISO.	REV.	MECHANICAL	REV.	ELECTRICAL	REV.
	M2-3231-36	A	MI-0701	6	EI-0710-01	7
	(DRIL) ISO.	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
	CC-2-AB-032	1	S-0735	2	MI-0758	4

REV	DESCRIPTION	DATE	DWN	CHKD	APPVD
0	ISSUED FOR CONSTRUCTION				
1	REVD. AS NTD. REF CMC A81Z2 DCA 7607 (SEE NT #1) PER PIR				

AS-BUILT



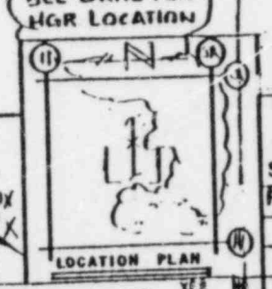
ELEVATION LOOKING EAST

½ DETAIL WEST

VENDOR CERTIFIED
DRAWING REV. NO. 3
BY JCD DATE 6/2/82

CPSES 36-1195 CONTROL COPY DOCUMENT CONTROL CENTER

SEE BRHL FOR HGR LOCATION



LOCATION PLAN

Note
4) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7601

BRHL ISO. CC-2 AB-50 R.1
I.P.D. ISO. CC-2-AB-50 R.0
Data Point 2132 / AB 1466 R0
Pipe Nat'l. SA106-GRB
Insul. 1½" Bldg. A

To: 21100

ITEM NO.	MATERIALS & OPERATIONS	QUAN	SHIP
9	SEISMIC SWAY STRUT ASSEMBLY CONSISTING OF	ONE	
10	SMS (SWAY STRUT CLAMP) NPSPC-14060	1	
11	SRS (SWAY STRUT) TYP PC, SIZE #14 CC DIA. = 100 9/16"	1	
12	1/2" THK. C.S. PLATE (SA-36 OR SA515 GR.65) SEE DETAIL 'A'	1	
	3/4" ø x 10" LONG. HILTI KWIKI BOLT CONCRETE ANCHORS	4	
	DO NOT PAINT GRINNELL		
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG MARK # CC-2-011-006-A73R	1	1
	Apply Carbo-Zinc #11 to above mat'l except th'de which shall be treated with a rust preventative		

FOR ENGINEERING & OFFICE USE ONLY

REV	DATE	DWN	CHK	APP	DESCRIPTION
3		JR	RL	MY	REVD AS BUILT PER CMC-7196A, VENDOR CERTIFICATION REC'D GTN # 59190
CONST	~	~	~	~	

Approved By: CFC
Date: 4-23-79

INFORMATION

QUAN SHIP

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. 3 SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: 1M-0105-01-R0
STEEL: 5-352-FA-1
ELECT: E-0104-R3
H.V.A.C.: 1M-0139-R4

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	6/2	JW	RL	RM	ISSUE FOR CONST
2	1/20	FC	FY	MY	FW 1-22 REVISED PER NRC REV 0A
1	8/1	DB		JW	PER NCR 81-0153 REVISED FW 22 REVISED AS NOTED PER DCA-7601 (SEE NOTE 4) CMC-40553 R4,
ORIG	—	—	—	RM	WELDS IN CWP FW 1-22, DELETED NOTE 1-3 AS BUILT

CONDITIONS	Fx	Fy	Fz	Mx	My
DESIGN					
NORMAL & UPSET		2868			
EMERGENCY		154			
FAULTED		3004			
		336			

THIRD PARTY INSPECTION
CODE CLASS: ASME III 3

CUSTOMER Texas Utilities Service
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CC-2-011-006-A73R
SKETCH NO.
SHEET 1 OF 1 REV. 5

FOR OFFICE AND

FOR OFFICE AND ENGINEERING USE ONLY

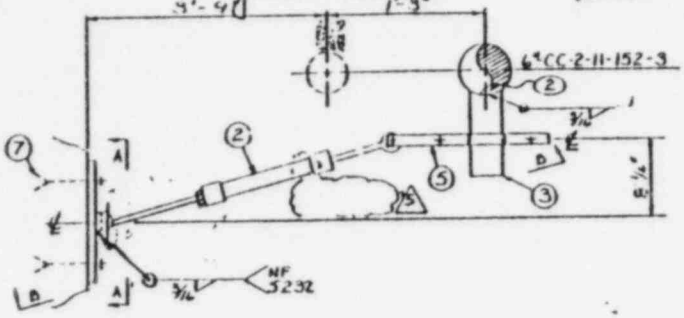
BLUELINE

AS-BUILT

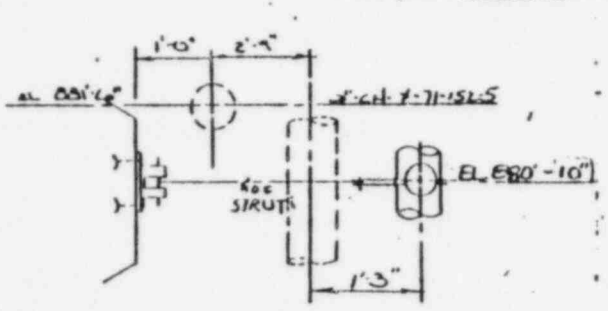
VENDOR CERTIFIED
DRAWING REV. NO. 5
BY [illegible] DATE 7/19/83

(CHANGE NOT PER CMC)

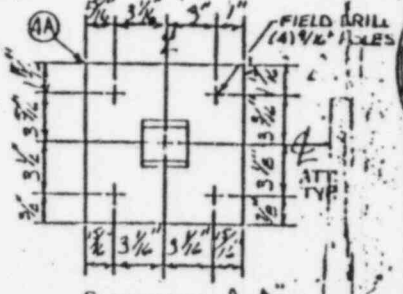
NOTE:
1) Locking devices for high strength bolts are not required per DCA 7607



PLAN VIEW

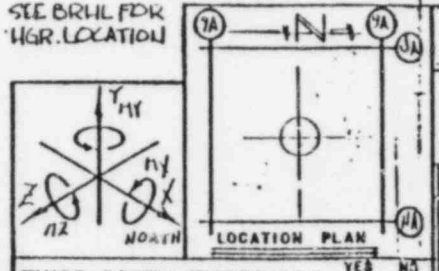


SECTION B-B



SECTION A-A

SEE BRHL FOR HGR. LOCATION



THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME III-3

T.O.# 21101

PRIM ISO CC-2-AB-050 R.1
I.P.D. Iso. CC-2-AB-050 R.0
Data Point: 2131 (AB-LLC R)
Pipe Mat'l. SA106 GR.B
Insul. 1/2" Thk. A

ITEM NO.	NO REQ'D	PART CALL-OUT	DESCRIPTION	MATERIAL	MIC. NO.	WT.	P&S	L	CSS	PRIM.	SEC.	AIBC
1	4	BSA 12-517	Front ANCHORS									
2	1	SRS 04.80	SWAY STRUT		67	20			X			
3	1	PIPE [illegible]		SA106 GR.B	D	9	X		X			
4	1	PL 3/8"x8"x9"		SA515 GR.65 SA-36	D		X		X			
5	1	SAC-01.-030	PIPE CLAMP		D	7			X			
6	1	ANVIL 2000A	ASME III PLATE									
7	4	1/2" X [illegible]	CONC. ANCHORS						X			

NO MATL'S BY SUBMITTAL

SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG - MARK # CC-2-011-005-A73R — 1 1

Apply Carbo-Zinc #11 to above mat'l except th'ds which shall be treated with a rust preventative

CPSES 35-1195 CONTROL

FOR OFFICE AND ENGINEERING USE ONLY

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	[illegible]	[illegible]	Q	[illegible]	REVD AS NTD REF. CAC 13587 DCA-7607 LEE NT.4 AS BUILT
[illegible]	[illegible]	~	~	~	VENDOR CERTIFICATE; REF GTH #39MD
5	7/19/83	[illegible]	[illegible]	[illegible]	REV. VENDOR CERT.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. (SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0103-01 R0/0 ELECT: M-0104 R3
STEEL: S-0135 R0/2 H.V.A.C.: M1-0157 R5

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET	-762 +761		-6 +41			
EMERGENCY	-762 +559		-9 +33			
FAULTED						

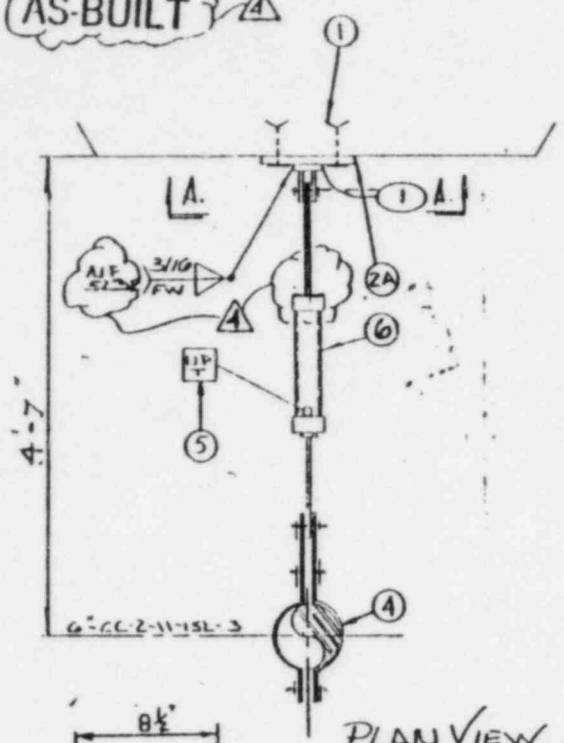
REV	DATE	DWN	CHK	APP	DESCRIPTION
6	6-5-84	JM	[illegible]	[illegible]	ISSUE FOR CONST. FW 1-2
1	2-20-84	LR	[illegible]	[illegible]	REV. PER NPSI REV 1A
2	4-25-84	JC	[illegible]	[illegible]	REV. AS NOTED REF. CAC 31066 R1
3	9-26-84	[illegible]	[illegible]	[illegible]	REV. AS NOTED REF. CME #35578 R3 PNDF 1134 R.1

CUSTOMER Texas Utilities Service, Inc
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak S.E.S.
MARK NO. CC-2-011-005-A73R
SKETCH NO.
SHEET 1 OF 1 REV. 5

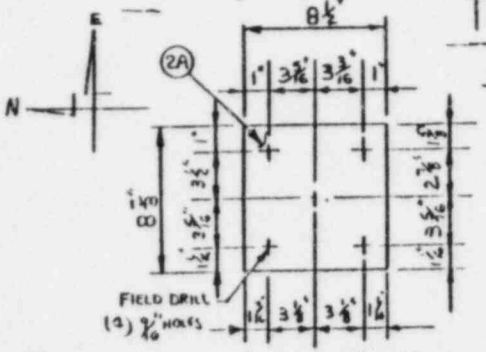
cb

AS-BUILT 4

OTE: CONT.
CKING DEVICES FOR
H STRENGTH BOLTS
RE NOT REQUIRED
PER DCA 7607



PLAN VIEW
@ EL 877'-10"
NORTH



SECTION "A-A"
T.O. 21100'

4 BRHL ISO. CC-2-AB-50 REV. 1
I.P.D. Iso. CC-2-EE-36-1.0
Data Point 2129 / PAB-1-CC-RO
Pipe Mat'l. SA106 GR.B
Insul. 1½ Pldg. A

SEE BRHL FOR
HGR. LOCATION

4 VENDOR CERTIFIED
DRAWING REV. NO. 4
BY JCD DATE 2/15/82

THIRD PARTY INSPECTION YES ☒ NO ☐
CODE CLASS: ASME III-3

CPSES
35-1195
CONTROL
COPY
DOCUMENT CONTROL CENTER

FOR ENGINEERING
OFFICE USE ONLY

ITEM NO.	NO REQ'D	PART CALL-OUT	DESCRIPTION	MATERIAL	MIC. NO.	WT.	PBS	L	CSS	PRIM.	SEC.	AISC
1	4	BSA 12-5½	CONC. ANCHORS		—							
2	1	R 4"W X 8"D X 8"		SA36		7	X			X		
2A	1	SRS-06-CO	SWAY STRUT		6720	20			X			
		CC = 2'-6⅜"										
4	1	SPC-06-CO	PIPE CLAMP	SA36	D	19			X			
5	1	DWG 20184	ASME III PLATE									
2A	1	R ½"x8½"x8½"	C.S. PLATE	SA36			X			X		
6	1	SRS-04-RO	SWAY STRUT CC = 2'-8"						X			

NO ADD'L BY GRINNELL

SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG
MARK # CC-2-011-004-A73R

Apply Carbo-Zinc #11 to above mat'l except th'ds which shall be treated with a rust preventative

1

REV	DATE	DWN	CHK	APP	DESCRIPTION
1	1-14-82	PJB	[illegible]	[illegible]	REV. AS NOTED REF DCA 7607 ITEM "4, CMC 36686 & PHBP
CONF	~	~	~	~	324 - DELETED NT 21-3 (AS BUILT)
4	[illegible]	JR	[illegible]	EPK	VENDOR CERTIFICATION REF. GIN # 59790

QUAN. SHIP.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. 4 SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0705-01 R.0 ELECT: E1-0704 R.3
STEEL: S-0735 R.2 H.V.A.C: M1-0707 R.4

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN			405			
NORMAL & UPSET			1429 -932			
EMERGENCY			960 -101			
FAULTED			1041			

REV	DATE	DWN	CHK	APP	DESCRIPTION
0	6-5-79	JW	[illegible]	M	ISSUE FOR CONST FW 1
1	2-21-80	RJ	RJ	M	REV. PER NRST REV 0A
2	4-24-80	MKS	KM	[illegible]	REVD AS NOTED REF DCA 324

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CC-2-011-004-A73R
SKETCH NO. —
SHEET 1 OF 1 REV. 4

FOR OFFICE AND
[illegible]

INFORMATION COPY

THIS DOCUMENT IS FOR INFORMATION ONLY. CONTACT DOCUMENT CONTROL FOR CURRENT STATUS AND REVISION.

FOR STAKING

ENGINEERING USE ONLY

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 4
BY [illegible] DATE 11/29/83

NOTES CONT:

4) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

ITEM NO.	NO REQ'D	PART CALL-OUT	DESCRIPTION	MATERIAL	MIC NO.	WT.	PBS	L	CSS PRIM	CSS SEC.	AISC
1	1	PCA 12-512	CONC ANCHORS								
2	1	PL 1/2" x 8" x 8"	C.S. PLATE	SA36		5			X		
3	1	SAS 01-RO C-C=52 1/8"	SWAY STRUT		670	20			X		
4	1	P 3" SCH 10 X 5 3/8"		SA106GB	P	3		X	X		
5	1	SAS 01-030	PIPE CLAMP	SA36	P	7		X			
6	1	DWG 2078A	ACME HI PLATE								
7A	1	1/2" x 8 1/16" x 8 1/16"	C.S. PLATE	SA36/A615				X		X	

4

HARDNESS BY GRINNELL

SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG MARK # CC-2-011-003-A73R

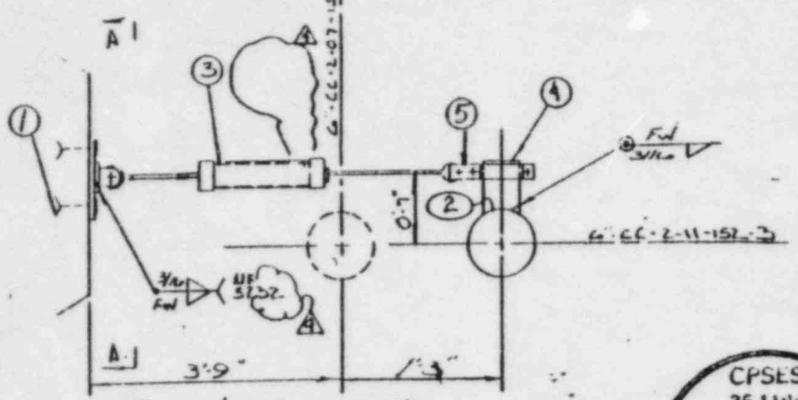
Apply Carbo-Zinc #11 to above mat'l except th'ds which shall be treated with a rust preventative

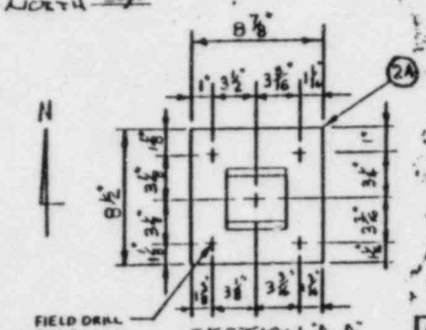
FOR ENGINEERING & OFFICE USE ONLY

REV	DATE	DWN	CHK	APP	DESCRIPTION
4	1-23-80	VM	Q	CED	VENDOR CERT. REF. SIN59790

Approved By: GFC
Date: 4-22-79

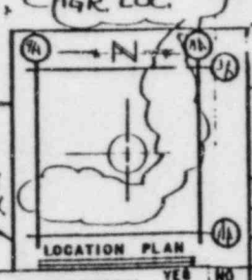
FOR MATERIALS AND OPERATIONS SEE SKETCH NO. _____ SHEET _____ OF _____





CPSES 35-1195 CONTROL COPY DOCUMENT CONTROL CENTER

SEE BRIL FOR HGR. LOC.



Brown & Root, Inc.

REF. DRAWING NUMBERS

PIPE: M-0105-01-RO ELECT: E1-0704- REV. 8
STEEL: S-0735 E 11 H.V.A.C.: M10769-REV.4

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN 4						
NORMAL & UPSET	-124 1913					
EMERGENCY	-124 1938					
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
5	6-5-79	JW	[illegible]	M	ISSUE FOR CONST. FW 1-2
3	2-20-80	FP	[illegible]	JW	REV PER NPSI REV 04
2	1-28-80	[illegible]	[illegible]	[illegible]	REV'D AS NOTED REFERED 70113

CUSTOMER Texas Utilities Services, Inc.
ORDER OR CONT. NO. CP-0050
JOB NAME Comanche Peak 1 & 2
MARK NO. CC-2-011-003-A73R
SKETCH NO. _____

THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME III-3

Q 21100 DRILL Iso. CC-2-AB-50 R1
I.P.D. Iso. CC-2-AB-50 R01
Data Point 2129 (APDB AB & UC RO)
Pipe Mat'l. SA106 GR B

A

FOR OFFICE AND

ENGINEERING USE ONLY

BLUELINE 1-13-81

AS-BUILT

NOTE:
1) Locking devices for high strength bolts are not required per DCA 7607

ITEM NO	NO REQ'D	DESCRIPTION	WT.	ASME OR ASTM	GR	CL	MISC.
1	1	PIPE SCH 60		SA106GrB	L		
2	1	FP 1½" X 24" X 2'-2"		SA-36	P&S		
3	1	SMF-100-BA MECH. SNUBBER		~	CSS		
4	1	1½" C.S. R. (SEE DET A) SHLD		SA-36	P&S		
5	1	TS 10X6X.500"		A500GrB	L		
6	1	FP 1" X 12" X 1'-2"		SA-36	P&S		
7	2	FP ½" X 11" X 1'-0" CUT TO JOINT		SA-36	P&S		
8	2	PP ½" X 8" X 1'-0" CUT TO JOINT		SA-36	P&S		
9	1	TS 10X6X.500" X 5'-0" LG FLD CUT TO SUIT		A500GrB	L		
10	1	PP 1½" X 12" X 3'-3" BY FIELD		SA-36	P&S		
11	3	FP ½" X 7" X 11"		SA-36	P&S		
12	1	TS 10X6X.500" FIELD TRIM TO SUIT		A-500GrB	L		
13	2	FB 4" X ½" X 6"		SA-36	P&S		
14	2	TS 10X6X.500"		A500GrB	L		
15	6	1¼" Ø x 12" SQ HD BOLT W/ HEX NUT (BY FIELD)		SA-36	CSS		
16	4	1" Ø x 12" SQ HD BOLT W/ HEX NUT (BY FIELD)		SA-36	CSS		

FOR OFFICE AND ENGINEERING USE ONLY

VENDOR CERTIFIED
DRAWING REV. NO. 8
BY [illegible] DATE 2-7-84
★ CHANGE NOT MADE BY CMC

1	1	UPSET THERM MVT. UP = 1.903" S = 1.663" W = 2.874"
1	1	
1	1	

SECTION C-C

T.O.S. EL. 882'-10" (EXIST. WHIP RESTRAINT A588 GR A STEEL)

EL. 890'-0" 82° Ø MS-1-01-1305-2

EL. 888'-11"

PLAN VIEW

LOCATION PLAN

LOAD (LBS)	GRAV.	THERM.	HYDRO	OBE	SSE	DESIGN LOADS (OPER.)	DESIGN LOADS (HYDRO)	DESIGN LOADS (TEST)	MVTS (IN.)	THERM.	SEISMIC
UP						52478	65914	65248	VERT.	UP 1.903	
DN						53410	66917	66246	N-S	DOWN 1.663	
N									E-W	E 2.874	
S									TOTAL (OPER.)	48-1-001/R1	
E						4101	5210	5328	SEISMIC (OBE)	10	
W						4101	5210	5328	SEISMIC (SSE)	SC-24-1	

REFERENCE DRAWINGS					
DRIL. ISOMETRIC	REV	PIPING	REV	ELECTRICAL	REV
MS-1-RB-02	2	2323-M1-0552	6	2323-E1-0892	0
FAB. ISOMETRIC	REV	STRUCTURAL	REV	H.V.A.C.	REV
MS-1-RB-02	0	2323-S1-0550	2	2323-M1-0652	5

OWNER	TEXAS UTILITIES SERVICES INC
PROJECT	COMANCHE PEAK UNITS NO. 1 & 2
ENGINEER	GIBBS & HILL INC.

81 | SUPP'T. 150. | NPSI-MS-1-RB-02 | T.O. 3401

CODE/CLASS: III/2
PAINT CARBOZINC
ZONE ~

Brown & Root, Inc
HOUSTON, TEXAS

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE
DL	11-18-80		11-26-80		12680

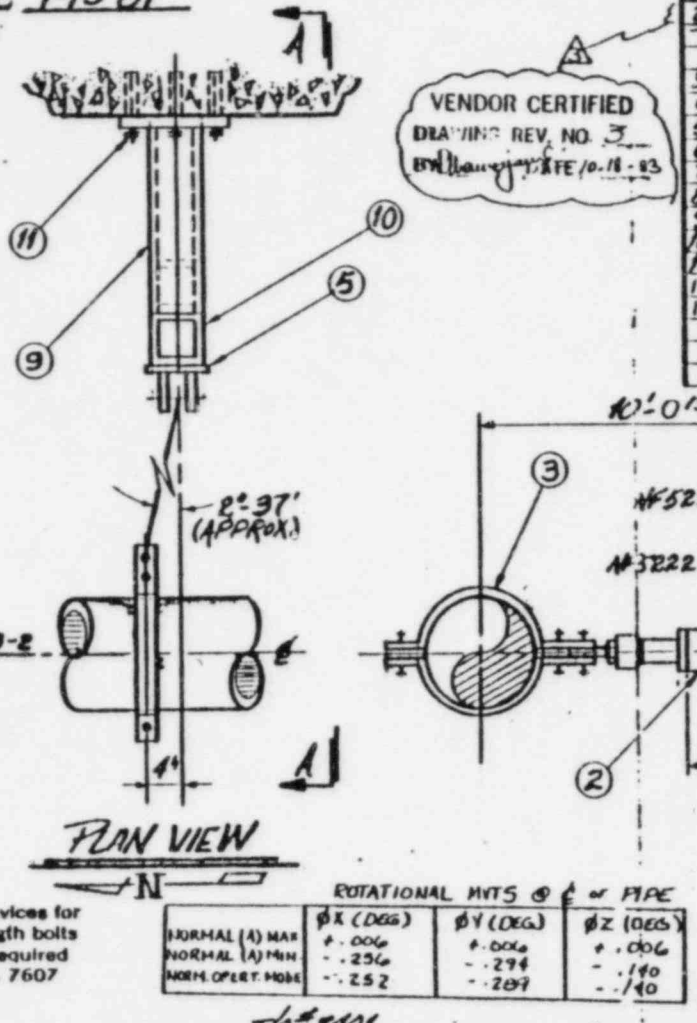
P.O. NO. CP-0046 A-1 | MFG. REL.

PRODUCTION ORDER	SERIAL NUMBER	SHEET
308	MK. NO. MS-1-01-005-C72K	REV. 8 1

1 OF 5

BLUELINE 1-13-81

AS-BUILT



VENDOR CERTIFIED
DRAWING REV. NO. 3
BY [illegible] DATE 10-18-83

ITEM NO	NO REQ'D.	DESCRIPTION	WT.	ASME OR ASTM	MAT'L	MIC.
2	1	SMA-35-50 MECH. SNUBBER		~	CSS	
3	1	SPC-24-320 PIPE CLAMP		(SA-36)	CSS	
4	1	ASME III NAME PLATE		~	~	
5	1	SMRA-35		~	CSS	
6	1	1 1/2" THK. C.S.P. PER SECT'C-C"		SA36	CS	
7	1	1 1/2" THK. C.S.P. PER SECT "A-B"		SA36	CS	
8	6	1 1/4" X 18" SUPER HILTI KWIK BOLT			CSS	
9	2	T.S. 6" X 6" X 1/2" X 1'-5 1/16" LG.		A500GRB	C	
10	1	T.S. 8" X 8" X 1/2" X 3'-9" LG		A500GRB	C	
11	12	2" DIA HEX NUTS		A194GR7	CSS	
12	1	T.S. 6" X 6" X 5/8" X 3'-3 5/8" LG.		A500GRB		
13	2	1 1/2" CH. R. PER DET. 1		SA36 W.M.S.		

FOR OFFICE AND ENGINEERING USE ONLY

10'-0 13/16" ENGINEERING 2'-0 7/16"

EXIST'G 2" DIA ANCHOR BOLTS

*CHAMFER T.S. 3/4" TO CLEAR WELD

ELEV 890'-0"

22 13/16"

22 13/16"

13 3/8" MIN. EA18.

SEE BRHL FOR HGR LOC

N

CONT.

CONT.

270

LOCATION PLAN

NOTES:

1) Locking devices for high strength bolts are not required per DCA 7607

ROTATIONAL MVTS @ ℄ of PIPE

	ØX (DEG)	ØY (DEG)	ØZ (DEG)
NORMAL (A) MAX	+.006	+.006	+.006
NORMAL (A) MIN	-.256	-.294	-.190
NORM. OPERT. MODE	-.252	-.289	-.190

T/O # 3401

LOAD (LBS)	DRAW	THER	HYDRO	OBE	SSE	DESIGN LOADS (NORMAL WEIGHT)	(EMERG)	(FLD)	MVTS (IN.)	(THER)	(INCR. (OPSCT)
UP									VERT.	UP 2.943	UP 4.338
DN									N-S	2.259	4.34
N									E-W	2.122	2.355
S									PIPE AXIAL	AB-1-001 R.1	
E						40480	38280	59500	PIPE LAT.	112	
W						40420	38280	59500	CONST SUPT CALC	SC-24-1	

REFERENCE DRAWINGS		REV		REV		REV		REV
	BRHL ISOMETRIC MS-1-RB-002	2	PIPING 2323-MI-0506	B	ELECTRICAL 2323-EI-0503	7	CODE/CLASS: NC-2	
	FAB. ISOMETRIC MS-1-RB-02	8	STRUCTURAL 2323-SI-0532	2	H.V.A.C. 2323-MI-0562	5	PAINT [illegible]	
							ZONE ~	

OWNER TEXAS UTILITIES SERVICES INC.

PROJECT COMANCHE PEAK UNITS NO. 1 & 2

ENGINEER GIBBS & HILL INC.

CP 0 0 8 8

88-1108

Brown & Root, Inc.

ENGINEERS AND CONSTRUCTORS

HOUSTON, TEXAS

DRAWN	DATE	CHK'D	DATE	APPV'D	DATE

P.O. NO. CP-0046 MFG. REL.

PRODUCTION ORDER	SERIAL NUMBER	SHEET
		1 of 2

307 MK. NO. MS-1-001-005 C72R REV. 3

DESCRIPTION

ISSUED FOR CONSTRUCTION FIELD MODIFIED HANGER SKETCH

REVISED AS NOTED. ADDED CONFIGURATION BOX

ADDED UNIT 1 ADDENDUM

AS-BUILT PER VENDOR CERTIFICATION

REF. VENDOR CERTIFICATION REV. 0 TO # 6550

KEYED VENDOR CERT.

DWG. APP'D

DATE

BY

CHK'D

DATE

APP'D

DATE

FOR OFFICE AND ENGINEERING USE ONLY

BLUELINE EXEMPT

AS-BUILT

VENDOR CERTIFIED DRAWING REV. NO. 1 BY [illegible] DATE 3-10-83

ITEM NO.	QTY. REQ'D.	MATERIAL DESCRIPTION
1	1	SWAY STRUT SRS-20-PC CC=3'-7¾" WITH SPC-20-100 PIPE CLAMP (SA36)
2	1	1" THK CARBON STEEL PLATE (A 36) (SEE SECTION "A-A")
3	4	1" Ø x 12" LG. SUPER HILTI KWIK BOLT
4*	1	TUBE STEEL 4"-18" x ½" x 19½" LG. (A500 GRB)

PAINT: CARBO ZINC # 11

REV	DESCRIPTION	DATE	DWN	CHKD	APPVD
1	ISSUED FOR CONST W/PCE R.O.	3/10/83	VLM	WMP	[illegible]
-	FOLLOW CONT BELOW	~	~	~	~

ELEV. 789'-9⅛"

MATERIAL SUPPLIED WITH MK.# CT-1-137-702-S25R (REF.)

10" CT-1-137-301 R.5

1" GROUT

ATT.

* FIELD CUT TO SUIT

PROB # AB-1-32-R9

ELEV. LKG. NORTH

FIELD DRILL (4) 1 1/16" Ø HOLES

SECTION "A-A" STRUT SHOWN ROTATED FOR CLARITY

LOCATION PLAN

ASME CODE EDITION: ---

ADDENDA: ---

DESIGN SPEC: MS-46B

NOTES:
1) THIS SUPPORT REPLACES SUPPORT # CT-1-137-E02-S25R
2) [illegible]

O.H 4802

SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
	DESIGN	SERVICE LEVEL LIMITS A	B	C	D	
X		3352	6271	6793		±0.001
		-72	1697	1276		±0.014
Y						±0.016
						±0.019
Z		-2961	4885	5583		±0.004
		-63	1163	1279		±0.012

AUTHORIZED NUCL. INSP. YES ☐ NO ☒
ASME CODE CLASS [illegible]

BRHL ISO.	REV.	MECHANICAL	REV.	ELECTRICAL	REV.
CT-1-SB-003	12	MI-0616	11	EI-0-X015	2
FAB. ISO.	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
CT-1-SB-003	5	SI 0600	17	MI-0650	6

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
1	REVD AS NTD: REF: CMC 66908 R.A. DCA 7607 NE2, NY UNIT	3/8/83	VLM	ZEH	CJ
UNIT		~	~	~	~
COMM	VERIFY CLEARANCES REF: CPPA 21182	~	~	~	~

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CT-1-137-701-S25R
SHEET 1 OF 1 REV. 1

BLUELINE EXEMPT

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY [illegible] DATE 1-27-93

DESIGN CHANGES

ITEM NO.	QTY. REQ'D.	MATERIAL DESCRIPTION
1	1	L5 3"x5"x.300x2'-1" LG (CUT TO SUIT) A 36 CLB
2	1	STRUT, SES-20 PC, CC-8 3/4" NUT & WASHER SPC 20-100
3	1	8.1" THICK (SEE SECTION A-A)
4	4	1"x12" SUPER HILTI KWIK CONC. ANCHOR (MIN. EMB. = 8 1/2")

PAINT PIPE 3'-0"

REV	DESCRIPTION	DATE	DWN	CHKD	APPVD
CONST	DCA-7607 (SEE NT 1) "AS BUILT"				
CONST	VENDOR CERTIFICATION REF CPPA 26082				

(PROD# AB-132 R0)

SECTION "B-B"

ROTATED 45°

1/8" VENT HOLE

1CT-1-017-151R-5

2'-4" (REF)

10'-6 3/4" (REF)

PLAN VIEW @ EL. 788'-6" (REF.)

SECTION A-A
ALL DIMENSIONS ± 1/2"

FIELD DRILL
(4) 1 1/16" ϕ HOLES

ASME CODE EDITION:
ADDENDA:
DESIGN SPEC: NF, 1989 B

ENGINEERING OFFICE USE ONLY

CONSTRUCTION COPY
THIS DRAWING IS FOR INFORMATION ONLY.
ENGINEERING CONTROL FOR CURRENT STATUS AND REVISION.

LOCATION PLAN

SEE DRWG FOR HGR LOCATION

4.35

C-5

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607

See CPPA # 14919
For 'E' Number Information
10" 4802

DATA PT	SUPPORT LOADS (lbs)					PIPE MVTS (INCHES)
	DESIGN	SERVICE LEVEL LIMITS A	B	C	D	
EXP						+ .002 - .001
VERT.						
N-S		-1757 TYP.	-5269 +211D	-7249 +5.7D		
E-W						+ .007 - .007

NOTE: 4 N.E. 1/4 - 2 N.E. 1/4

AUTHORIZED NUCL. INSP. YES ☐ NO ☒
ASME CODE CLASS 1 2 3

REF. DWGS.

BRNL ISO	Rev	MECHANICAL	REV.	ELECTRICAL	REV.
CT-1-SB-003	1	M1-0205	14	E1-0662-01	2
FAB. ISO	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
CT-1-SB-003	5	S1-0600	17	M1-0650	6

REV	DESCRIPTION	DATE	DWN	CHKD	APPV'D
A	ISSUED FOR CONSTRUCTION	1/26/93	T. PT	SWL	[illegible]
1	(CCAA 14121)				
1	REV. AS NTD REF: CA1C6-092, R 2, (CN1 2181)	CL	Q	CBT	

CPSES
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CT-1-017-704-S25E
SHEET 1 OF 1 REV. 1

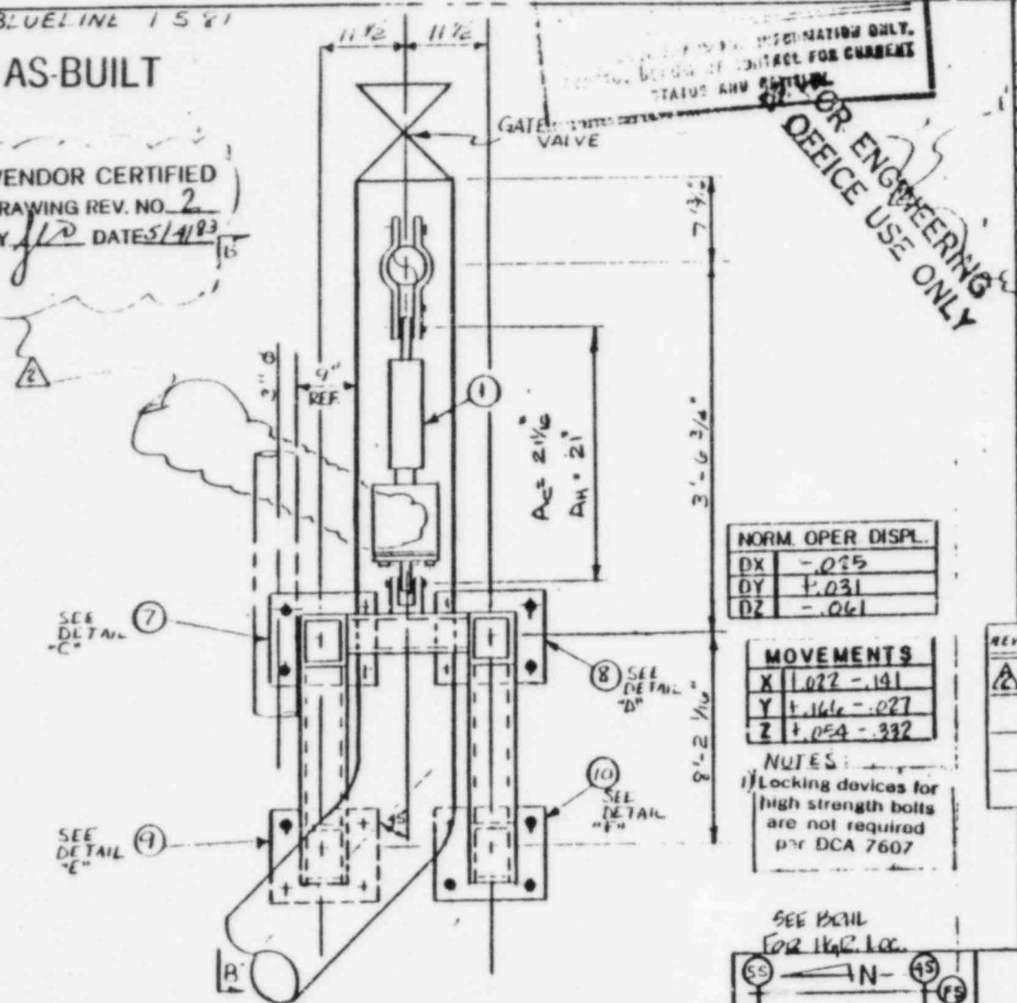
FOR OFFICE AND ENGINEERING USE ONLY

BLUELINE 1581

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY JLD DATE 5/4/83

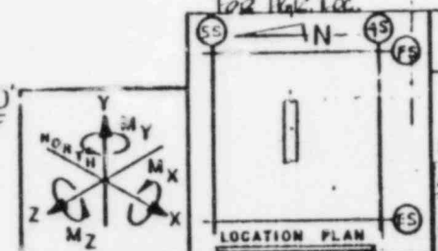
FOR ENGINEERING OFFICE USE ONLY



NORM. OPER DISPL.	
DX	-.025
DY	+.031
DZ	-.061

MOVEMENTS		
X	1.022	-.141
Y	+.166	-.027
Z	+.054	-.332

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607



THIRD PARTY INSPECTION
CODE CLASS: ASME III-2

TO #4802 PLAN VIEW @ EL. 818'-0"

N

BCHL Iso. CT1SB08B21
I.P.D. Iso. CT1SB8 REV 5
Data Point 6610/PIPE AB-1-3206
Pipe Mat'l. SA358 CL. 1 TP304
Insul. ____ Bldg. SB

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.	WT	PBS	CBS	PRIM.	SEC.
1A	SNUBBER 10 KIP	2		128		X		
1B	SNUBBER TO FORWARD BRACKET	2				X		
2	PIPE SCH 40 x 9 5/16" STANCHION (SA312 TP304)	2		65		X		
5	STD 14.100 PIPE CLAMP (SA36)	2		136		X		
6	BSA 1-12 (BY FIELD)	16				X		
7	3/4" CS FR SEE DETAIL "C" (SA515GR65/SA36)	1			X		X	X
8	3/4" CS FR SEE DETAIL "D" (SA515GR65/SA36)	1			X		X	X
9	3/4" CS FR SEE DETAIL "E" (SA515GR65/SA36)	1			X		X	X
10	1/4" CS FR SEE DETAIL "F" (SA515GR65/SA36)	1			X		X	X
12	ASME III NAME PLATE	1						
13	TS 8"x6"x 1/2" x 8'-10" LG (A500GRB)	2				X	X	X
14	TS 8"x6"x 1/2" x 13'-0" LG (A500GRB)	2				X	X	X
15	TS 6"x6"x 1/2" x 17" LG (A500GRB)	2				X	X	X

REV	DATE	DWN	CHK	APP	DESCRIPTION
A	5/4/83	A	RD	PGL	REV'D VENDOR CERTIFICATION REF. CMC 900714, R.1

MARK # CT-1-013-023-S42K
PAINT: CARBO ZINC # 11

QUAN.	SHIP.	PBS	CBS	PRIM.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. ____ SHEET ____ OF ____

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: M1-0612 REV 13 ELECT: E1-0602-01 REV 9
STEEL: S1-0605 REV 9 H.V.A.C.: M1-0632

CONDITIONS	Fx	Fy	Fz	Mx	My
DESIGN					
NORMAL & UPSET			±470		
EMERGENCY			±940		
FAULTED					

REV	DATE	DWN	CHK	APP	DESCRIPTION
A	1-5 81				ISSUED FOR CONST. REF. FIELD MODIFIED HANGER SKETCH. NPSL REV. 0-A & ITT REV. 1.
B	5/6				REV'D AS PER REF CMC 823454.1
C					VENDOR CERTIFIED, REFERENCE: GTN 62776

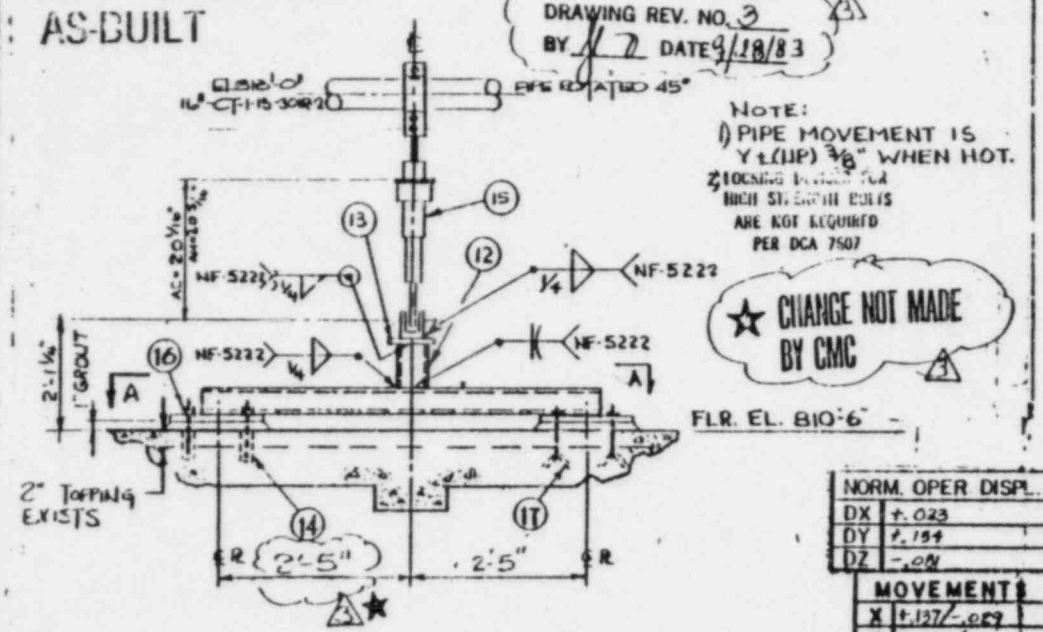
CUSTOMER Texas Utilities Service, Inc
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO. CT-1-013-023-S42K
SKETCH NO.
SHEET 1 OF 3 REV. 2

CONT ABOVE

FOR OFFICE AND ENGINEERING USE ONLY

BLUELINE 1-16-81
AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 3
BY [illegible] DATE 9/18/83



NORM. OPER DISPL.	
DX	+.023
DY	+.154
DZ	-.014

MOVEMENTS	
X	+.137/-.089
Y	+.714/-.117
Z	+.071/-.451

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.
	SEISMIC MECHANICAL SHOCK SUPPRESSOR CONSISTING OF:	DSR	
1	#10, 6" STROKE, FIG. 307N MECHANICAL SHOCK SUPPRESSOR, W=1'-9 1/8", 16" O.D. PIPE, CARBON STEEL, LOAD=18897#	1	
8	T.S. 3/8" x 6" x 4" x 5'-8" LG. (A500 GR B)	1	
9	C.S.R 1"x1'-0 1/8"x1'-3 1/4"/DETAIL 'B' (SA 36/SA 515 GR 65)	1	
10	C.S.R 1"x1'-6 1/8"x1'-7 3/8"/DETAIL 'C' (SA 36/SA 515 GR 65)	1	
11	3/4"ø HILTI KWIK CONC. ANCHOR	4	
12	T.S. 3/8"x6"x4"x1'-1 3/8" LG. (A500 GR B)	1	
13	C.S.R 3/4"x0'-5"x0'-7 3/4" (SA 36/SA 515 GR 65)	1	
14	1 1/4"ø THREADED ROD FOR RICHMOND INSERT (FIELD CUT TO LENGTH) (SA-36)	4	
15	SMA-10 PC, T-T=1/8" UPTMP: 9191 W/SPC-14-16C SNUBBER W/PIPE CLAMP	1	
	SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG	1	
	MARK # CT-1-013-020-S42K	1	
16	FXN-1 1/4" HEX NUTS	8	
17	1 1/4"x18" SUPER HILTI KWIK BOLTS W/13 1/8" MIN EMBE.	4	
18	1" C.S.R. (PER DETAIL "B") SA 36	1	
	Apply one coat of Carbo Zinc #11 to above mat'l except th'ds which shall be coated w/a rust preventative.	1 lot	

REV	DATE	DWN	CHK	APP	DESCRIPTION
3	9/18/83	VM	RH	[illegible]	REV'D VENDOR CERT

Approved By: S.F.C.
Date: 6-20-79

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: M1-0612-REV.2 ELECT: E-0608-REV.9
STEEL: S1-0608-REV.4 H.V.A.C.: M1-0612-REV.2

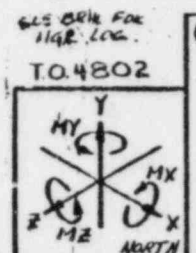
CONDITIONS	Fx	Fy	Fz	Mx	My	dx
DESIGN						
NORMAL & UPSET		15058				
EMERGENCY		39191				
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	9/18/83	KC	VM	[illegible]	ISSUED FOR CONST.
1	8/10/81	[illegible]	[illegible]	[illegible]	REF. NPSI R 0-B REV AS NTD; REF FIELD MODIFIED HANGER SKETCH IT-1, DTL NT1-3 APPLY SHEET 2.
A	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

CUSTOMER Texas Instruments Service, Inc.
ORDER OR CONT. NO. CE-0135
JOB NAME Comanche Peak 1 & 2
MARK NO. CT-1-013-020-S42K
SKETCH NO.

BASIL NO. CT-1-SB-020/S.1
I.P.D. Iso. CT-1-SB-B-REV.5
Data Point Se2 / PROB
Pipe No. 1.2A 258 CL.1 TP 204

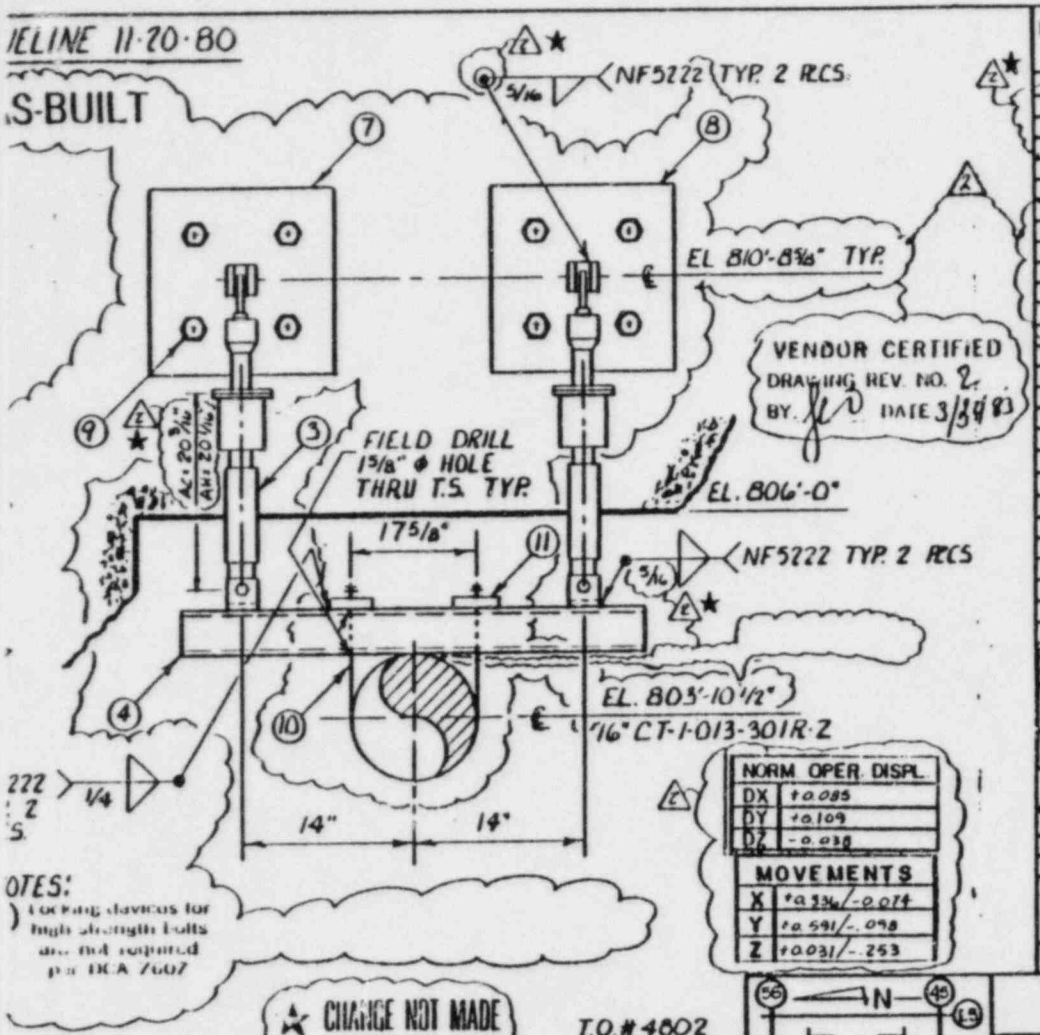
T.O. 4802



THIRD PARTY INSPECTION YES
CODE CLASS: ASME III-2

IELINE 11-20-80

S-BUILT



ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PBS	L	CSS	PRIM.	SEC.	AISC.
3	SMAE10 BA SNUBBER C-C-5'-7"	2								
4	T.S. 5/16" x 4" x 4" x 2'-10" LG. A500GRB	1								
7	C.S. R PER DETAIL A SA36 OR SA515GR65	1								
8	C.S. R PER DETAIL B SA36 OR SA515GR65	1								
9	1¼" ϕ x 17" SUPER HILT KWIK BOLT	8								
10	1¼" ϕ ROD B-12 1¼" [illegible] 5½" DEVELOPED LENGTH 4'-11" SA36	1								
11	3/4 C.S. R 4"x4" W/ 13/16" ϕ HOLE @ CENTER SA36	2								

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	3/31/83	JTN	[illegible]	[illegible]	ISSUED FOR CONST. - REF. ITT R.1 - BASE PLATE ONLY
1	11-20-80	[illegible]	[illegible]	[illegible]	ISSUED FOR CONST. REF FIELD MODIFIED HANGER SKETCH 8 REF ITT R-2 & DELETED NOTE 1-3 & ADDED SHT 2 OF 2
CHG.	--	--	--	--	

MARK # CT-1013-016-537K
PAINT: CARBO ZINC # 11

QUAN.	SHIP.		PBS	L	CSS	PRIM.	SEC.	AISC.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. _____ SHEET ___ OF ___

NORM OPER. DISPL.	
DX	+0.085
DY	+0.109
DZ	-0.038

MOVEMENTS	
X	+0.336/-0.014
Y	+0.591/-.098
Z	+0.031/-.253

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607

CHANGE NOT MADE BY CE.IC

T.O.# 4602

THIRD PARTY INSPECTION
CODE CLASS: ASME III-2

BRUL Iso. CT-1-SB-008/R.1
I.P.D. Iso. CT-1-SB-8 REV. 5
Data Point 256/PROB.# AB-1-32/R.0
Pipe Mat'l. SA-358-CL1 TP304
Insul. ~ Bldg. SB

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS REV. 9
PIPE: M1-0604 R.14 ELECT: E1-0X0-01
STEEL: S1-0L02 R.12 H.V.A.C.: M1-DC51RL

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET	—	5377				
EMERGENCY	—	9259				
FAULTED						

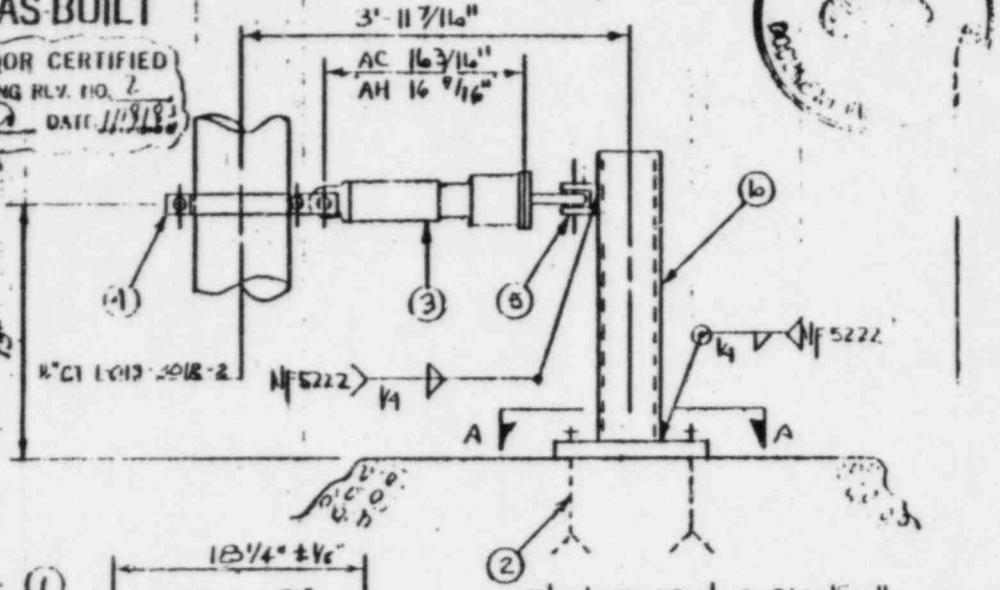
REV	DATE	DWN	CHK	APP	DESCRIPTION
2	3/30/83	CML	[illegible]	Q	REV'D. AS NT'D. REF: CMC 4/409 R.7 DCA 7607 NT 4 ASSIGNT VENDOR CERTIFICATION; REF; GTN G2TRG
CHG.	~	~	~	~	

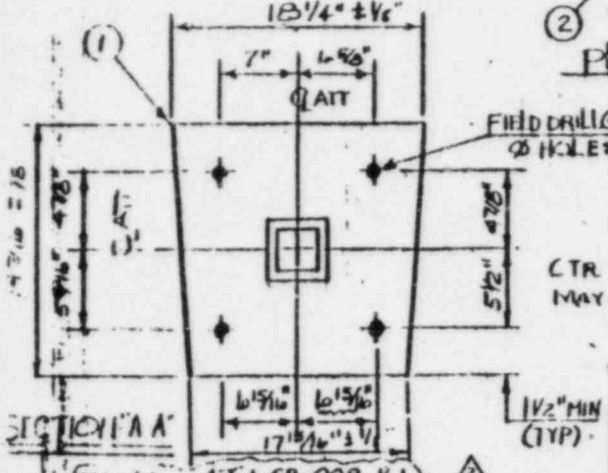
CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO. CT-1-013-016-537R
SKETCH NO. ~

BLUELINE 12-18-81

AS-BUILT

VENDOR CERTIFIED DRAWING REV. NO. 2 DATE 11/9/82





SECTION A-A

PLANVIEW @ El 803'-10 7/16"

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607

CTR LINE OF ATT MAY VARY ± 1/4"

MOVEMENTS	
X	[illegible]
Y	[illegible]
Z	[illegible]
NORM OPER DISPL.	
DX	[illegible]
DY	[illegible]
DZ	[illegible]

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.
1	3/4" C.S.R. PER SECT "A-A" (SA36/SA516 GR 60)	4	
2	1"x6" HILTI KWIK BOLTS (1¼" PENETRATED)	4	
3	SME-3-50 SHUBEER CONN.	1	
4	SPC-10-160 PIPE CLAMP (SA-36)	1	
5	XBE-10 REAR BRACKET (ALLAD/SA36)	1	
6	T.S. 14"x16"x16" x 1/8" LG (A-500 GR B)	1	

MARK # CT-1-013-015-5332
PAINT: CARBO ZINC # 11

QUAN. SHIP.

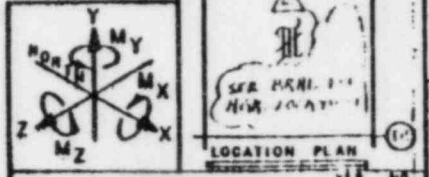
FOR ENGINEERING & OFFICE USE ONLY

INFORMATION COPY

THIS DOCUMENT IS FOR INFORMATION ONLY. CONTACT BROWN & ROOT, INC. CONTROL STATUS AND REVISIONS.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

BRN Iso. CT-1-SB-008 R.1
ERP Iso. CT-1-SB-8 R-3
Data Point 1256/PROD. AR-1 R.0
Pipe Mat'l. SA 358 CL 1 TP304
Insul. — Bldg. SP
TOT 1902



THIRD PARTY INSPECTION
CODE CLASS: ASME NC-2

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS R-9
PIPE: LI-0401 R14 ELECT: EI-0401 01
STEEL: SI-0402 R12 HV.A.C.: HI-0451 R1

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET	±990					
EMERGENCY	±545					
FAULTED						

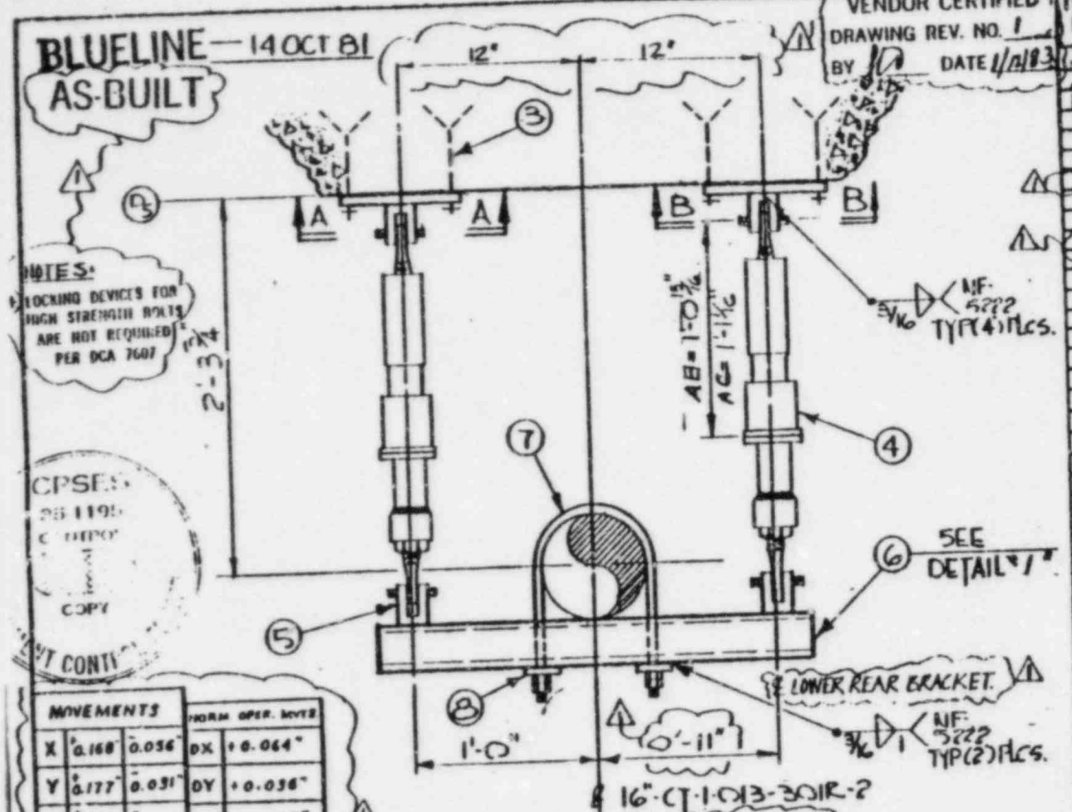
REV	DATE	DRWN	CHK	APP	DESCRIPTION
2	11/9/82	RN	DZ		ISSUE FOR CONSTRUCTION
1	9/1/82	CC			REF. BT REV-1 THIS REVD AS NOTED PER CA 2107 SEE NT-1 (MC-332E, A-2) NIT VENDOR CERTIFICATION REC.
0	4/1/82				GTN # 63726

CUSTOMER Texas Utilities Services Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak [illegible]
MARK NO. CT-1-013-015-5332R
SKETCH NO.
SHEET OF REV. 2

FOR OFFICE AND ENGINEERING USE

BLUELINE — 14 OCT 81
AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY [illegible] DATE 11/11/83

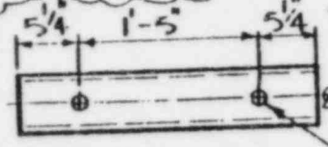


PLAN VIEW @EL. 789'-10"

NOTES:
LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

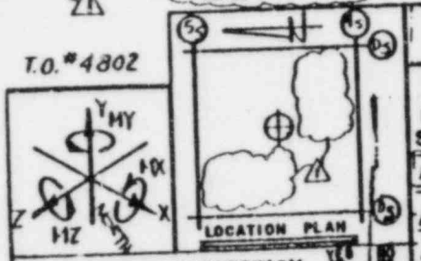
CPSES
COPY

MOVEMENTS			WORK OPER. MOVES	
X	±0.168"	-0.036"	ΔX	+0.064"
Y	±0.177"	-0.031"	ΔY	+0.036"
Z	±0.171	-0.022	ΔZ	+0.025"



DETAIL "1"

SEE BRNL FOR HANGER LOCATION



BRHL ISO. CT-1-58-008-REV.1
B.R.P. ISO CT-1-53-B-REV.3
DATA POINT S1246/AB-1-32/R.0
PIPE MAT'L. SA-376 CL.1 TP304
INSUL ~ BLDG. 2B

THIRD PARTY INSPECTION
CODE CLASS: ASME III

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.	PAS	J-BOLT	RBM	SEC	AISC
1	1/2" C.J.P. PER SECTION "A-A" (SA-336GR.F65/A-36)	1		X		X		
2	1/2" C.J.P. PER SECTION "B-B" (SA-336GR.F65/A-36)	1		X		X		
3	1" Ø HILTI KWIK COIL ANCHOR (3 1/2" MIN EMBED)	5			X			
4	SHA-1-30 SNUBBER SC-2-1 1/4"	2			X			
5	XPB-08 REAR BRACKET (A688-D/SA36)	1		X		X		
6	T.S. 4"x4"x1/4" 2'-3 1/2" LG. PER DETAIL "1" (A500GRB) FIELD TRIM TO SUIT.	1			X			
7	PIR-160 U-BOLT B. 1-3	2			X			
8	PWP-07 WASHER PLATE (SA-36)							

UNCONTROLLED COPY

PACK: CT-1-013-010-322K
PAINT: CARBO ZINC 11

QUAN. SHIP.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS F.12
PIPE: M1-0606 REV.13 ELECT: E1-0605
STEEL: S1-0600 REV.17 H.V.A.C.: M1-0600 R6

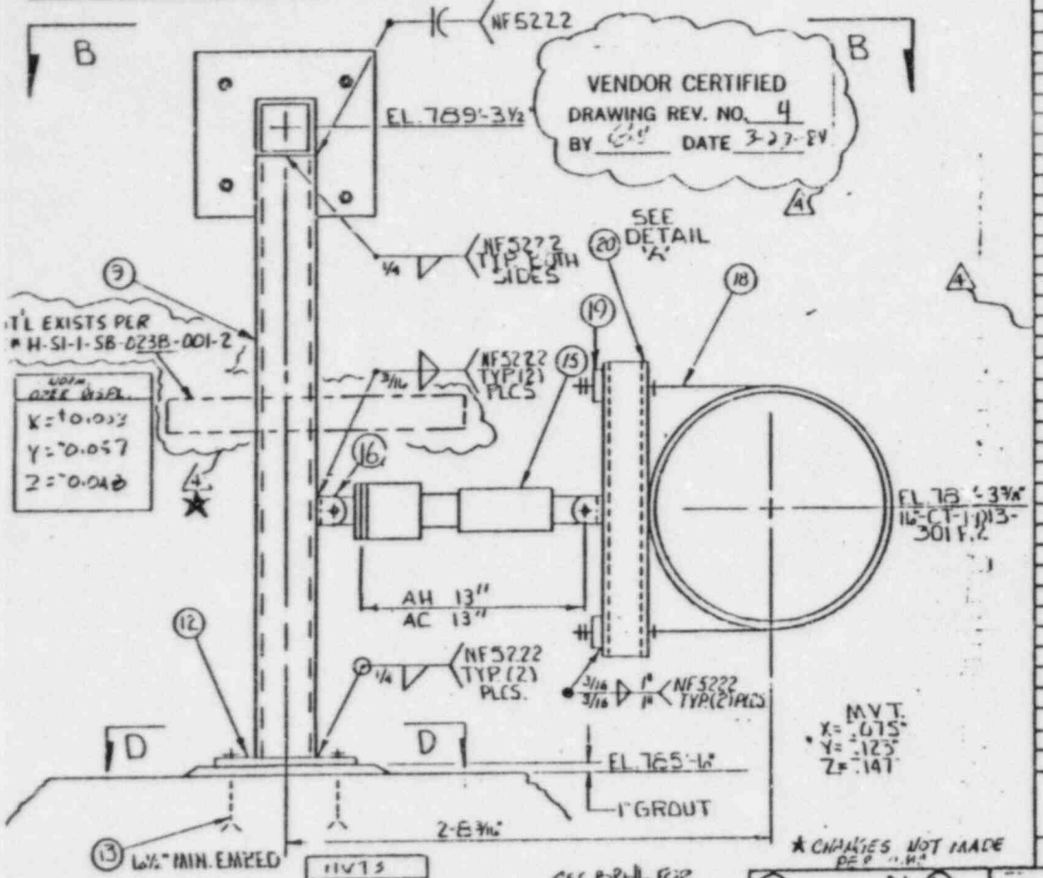
CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN			2848			
NORMAL & UPSET			4210			
EMERGENCY						
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
0	5/16	JL	[illegible]	[illegible]	ISSUED FOR CONST. REF. ITT REV. 1, F.M.H.S.
1	11/21/83	[illegible]	Q	[illegible]	REVISED PER CHG. 7A270 & DCA 7607 (SEE NOTE 2) "AS BUILT"
		~	~	~	VENDOR CERTIFIED "CP-07M-627"6

CUSTOMER TEXAS UTILITIES SERVICE INC.
ORDER OR CONT. NO. CP-0046
JOB NAME COMANCHE PEAK #2
MARK NO. CT-1-013-010-322K
SKETCH NO.
SHEET 1 OF 2 REV.

FOR OFFICE AND FIELD ENGINEERING USE ONLY

BLUELINE 2-16-81 AS-BUILT

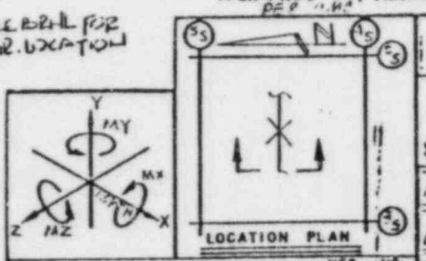


NOTE
Locking devices for high strength bolts are not required per AISC 7th Ed.

BRHL Iso. CT-1-SB-023E R.1
B.H.I. Iso. CT-1-SP-5 REV. 3
Data Point
Pipe Mat'l. SA-376-CL.1 TP304
Insul. ____ Bldg. 56

★ CHANGES NOT MADE PER M.H.

SEE BRHL FOR HKR. LOCATION



ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PBS	L	CSS	PRIM.	SEC.	AISC.
	SEISMIC MECHANICAL SNUBBER ASSEMBLY CONSISTING OF:									
10	STAT 2-BOLT TRAVEL ±2" +0.5"+0.0" 1¼" PCA SETTING	1								
7	PWC 1108 U-BOLT (5" x 3½")	1								
6	SEE DETAIL 'A'	1								
5	TS 4"x4"x¼"x3'-5¼" LG (A-500 GR. B)	1								
11	TS 4"x4"x¼"x0'-5" LG (A-500 GR. B)	1								
11	W 8 S.R. SEE SECTION C-C (SA-36/SA36 GR. 60)	1								
12	W 8 S.R. SEE SECTION D-D (SA-36/SA515 GR. 60)	1			X				X	
13	¾"x10" HILTI-KWIK BOLTS	4					X	X		
14	⅝" x 5½" HILTI-KWIK BOLTS	4					X	X		
15	SWF-1-50 SHIMPAK	1					X			
16	XRB-08 REAR BRKT.	2					X			
18	PBS-160 U BOLT, R=14"	1					X			
19	RWP-07 WASHER PL	2					X			
20	TS 3½"x 3½" x ¾" PER DETAIL A	1			X			X		

REV	DATE	DESCRIPTION
3	3/23/81	VENDOR CERTIFICATION; REF GTN 162726
4	3/27/81	REVISED VENDOR CERTIFICATION

FOR OFFICE AND ENGINEERING USE ONLY

SEISMIC ASSEMBLY SKETCH AND ENGINEERING
BUNDLE AND TAG
MARK # CT-1-013-008-S22K

Apply Carbo Zinc #11 to above mat'l. except threads which shall be treated with a rust preventative

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		PBS	L	CSS	PRIM.	SEC.	AISC.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. ____ SHEET ____ OF ____

Brown & Root, Inc.

REF. DRAWING NUMBERS
PIPE: MI-0600 REV 13 ELECT: E1-0600 R12
STEEL: SI-0600 REV 17 H.V.A.C.: MI-0650 R6

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL & UPSET	±503					
EMERGENCY	±753					
FAULTED						

REV	DATE	DWN	CHK	APP	DESCRIPTION
2	11-26-80				ISSUE FOR CONST. REFIELDINDED HANGER SKETCHES (1-A, C-1, K-1
ON1	2	2	2	2	
1	2-1-81	JTR		LM	REV AS NTD. REF FIELD MODIFIED HANGER SKETCH #1
4	7-30-72	LN			NEW ASSEMBLY IS SEISMIC

THIRD PARTY INSPECTION YES ☐ NO ☐
CODE CLASS: ASME III-2

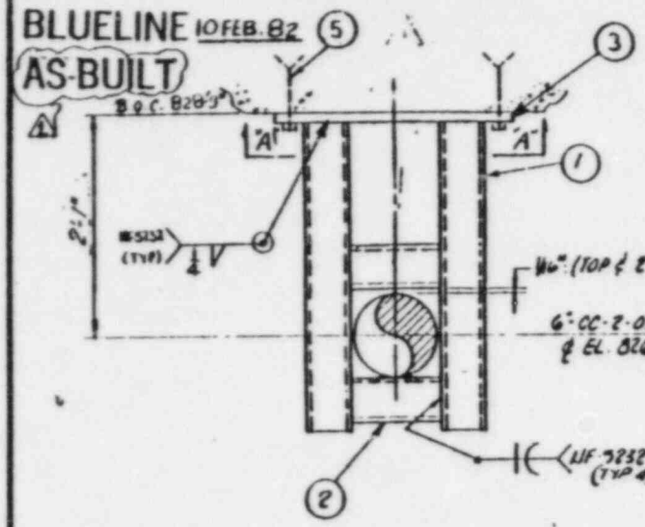
CUSTOMER TEXAS UTILITIES SERVICE INC.
ORDER OR CONT. NO. CP-0046
JOB NAME COMANCHE PEAK 1&2
MARK NO. CT-1-013-003-S22K
SKETCH NO. —
SHEET 1 OF 2 REV. 4

FOR OFFICE AND

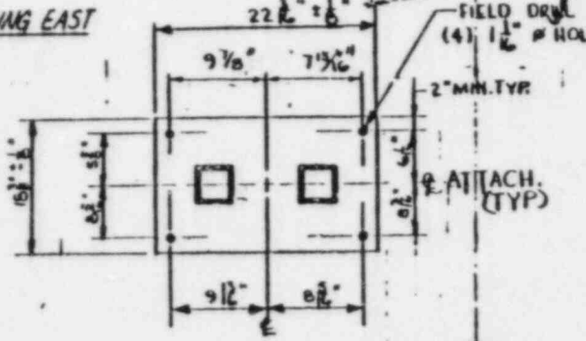
BLUELINE 10FEB.82

AS-BUILT

FOR ENGINEERING & OFFICE USE ONLY



ELEVATION LOOKING EAST



SECTION "A-A"

℄ OF ATTACH. MAY VARY ± 1/4"

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	P&S	L	CLS	FR'M	SEC.	AISC
1	2	3X3X1/4X [illegible] TUBE A500 GR.B.		X		X		
2	2	5X3X1/4X 6'-4" TUBE A500 GR.B		X		X		
3	1	1/2" CSIP SEE SECTION A-A SA36/SA515GR.65	X			X		
4	4	1" x 9" HILTI-KWIK CONCRETE ANCHORS			X	X		
5	4	1" x 9" HILTI-KWIK CONCRETE ANCHORS MIN EMB=6"			X	X		

REV	DESCRIPTION	DATE	DWN.	CHK'D.	APP'D.
2	AS BUILT PER CONFIRMATION REPORT	7	7	7	7

CPSES 35-1195 CONTROL COPY DOCUMENT CONTROL CENTER

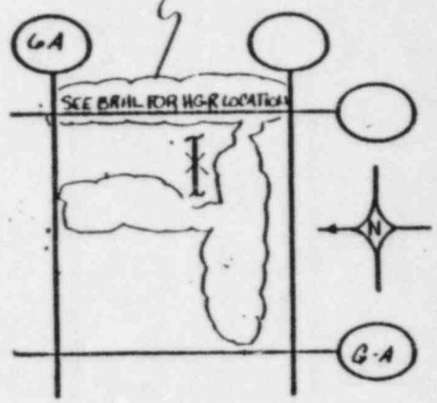
PROBLEM # AB-1-660 REV.0

ASME CODE EDITION: 1974

ADDENDA: WINTER

DESIGN SPEC: MS-46A

P.E. CERTIFICATION



LOCATION PLAN

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY BH DATE 12/7/82

NOTE:
1. Locking devices for high strength bolts are not required per DCA 7607

TO # 21101

MVTS 2.00

DATE PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	SERVICE LEVEL B	SERVICE LEVEL C	SERVICE LEVEL D	PIPE MVTS (INCHES)
2015						
VERT.	—	1359	1359	1359	1359	—
N-S	—	6235	6235	6235	6235	—
E-W	—	1	1	1	1	—

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐

ASME CODE CLASS 3

REF. DWGS	BRW. ISO	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-004	—	MH0703	12	EL0701-02	3
	FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C	REV
	CC-2-AB-004	2	8-0713	3	MH0753	6

CPSES 35-1195

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-721-A13R
SHEET 1 OF 1 REV. 12

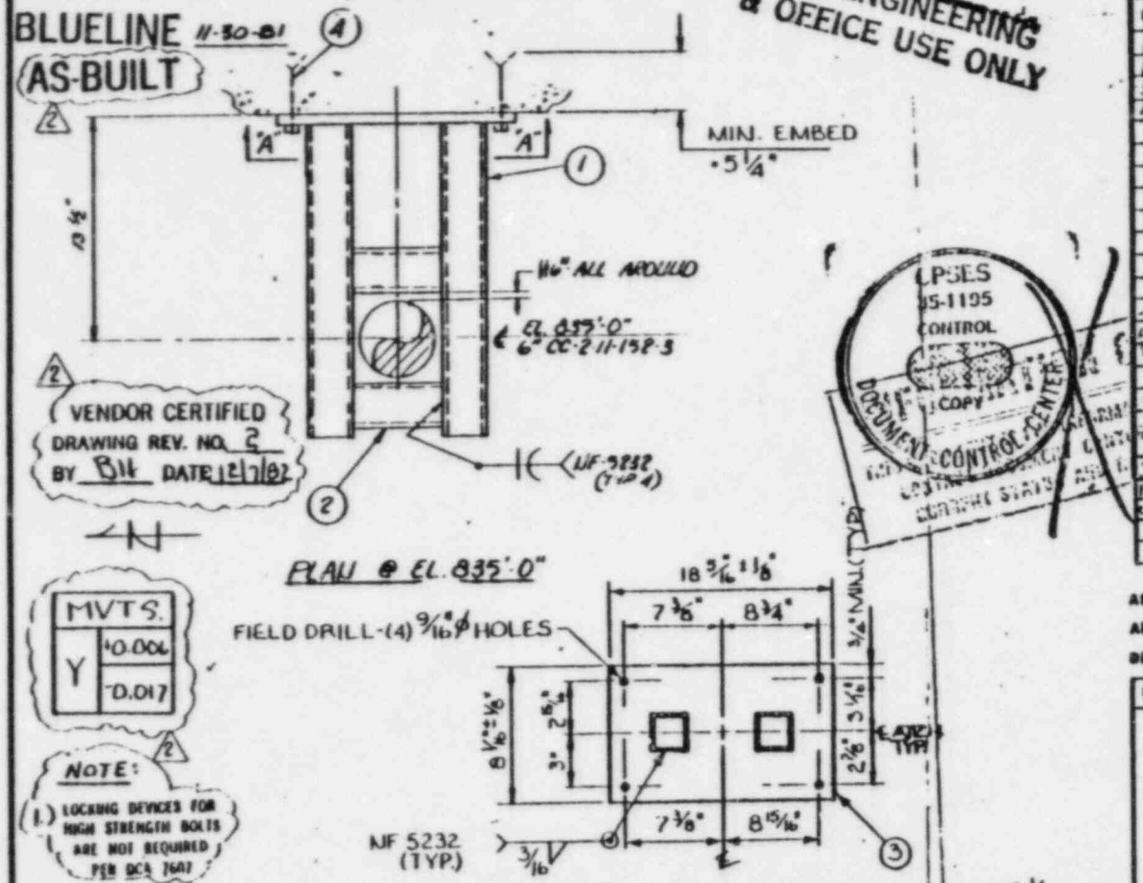
REV	DESCRIPTION	DATE	DWN.	CHK'D.	APP'D.
2	REVISED AS NOTED PER F.C.N.S.	12-27-82	C.A.T.	DF	[illegible]
1	REVISED AS NOTED PER F.C.N.S.	2-10-82	A.H.	DF	[illegible]
0	I.F.C.	12-27-79	C.A.T.	[illegible]	[illegible]

FOR OFFICE AND

ENGINEERING OFFICE ONLY

FOR ENGINEERING & OFFICE USE ONLY

BLUELINE 11-30-81
AS-BUILT



MVTS.	
Y	+0.006
	-0.017

NOTE:
1. LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

CPSES 85-1195 CONTROL COPY DOCUMENT CONTROL CENTER

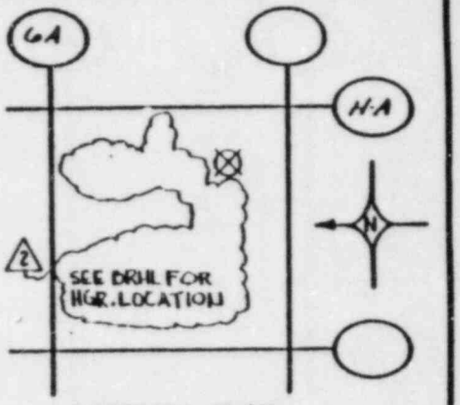
ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	P&S	L	SUS	PIPING	SEC.	AISC
1	8	5X3X1/4X 20 1/4" TUBE, A500 GR B.		X		X		
2	8	5X3X1/4X 6 3/4" TUBE A500 GR B		X		X		
3	1	1/2" C2R PER SECT "A-A" SA37/SA515 GR 65	X			X		
4	4	1/2 Ø 7" HILTI-KWIK CONCRETE ANCHORS			X	X		

APPLY ONE COAT OF CARBO ZINC #11 TO ABOVE PARTS EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
2 (CAT)	VENDOR CERTIFICATION REF. QTL # 55 TMD	~	~	~	~

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

P.E. CERTIFICATION



LOCATION PLAN

TD # 21101

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	B	C	D	PIPE MVTS DIRECTION
2090						
VERT.	—					—
N-S	—					—
E-W	—					—

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐
ASME CODE CLASS 3

REF. DWGS

DRWG	REV	MECHANICAL	REV	ELECTRICAL	REV
PRIM. 150		MI-702	6	EI-701-02	3
CC-2-AB-031	REV	STRUCTURAL	REV	H.V.A.C.	REV
FAB. 150					
CC-2-AB-031	0	S-718	3	MI-753	6

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
2	Rev As Noted, Per DCA R107 (NT. 1) 75 Bwt	12/7/82	CBH	JP	BE
1	Rev'D AS NT'D, R&F. FMMS	11-30-81			
0	I.F.C.	12-27-79			

CPSES 85-1195

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

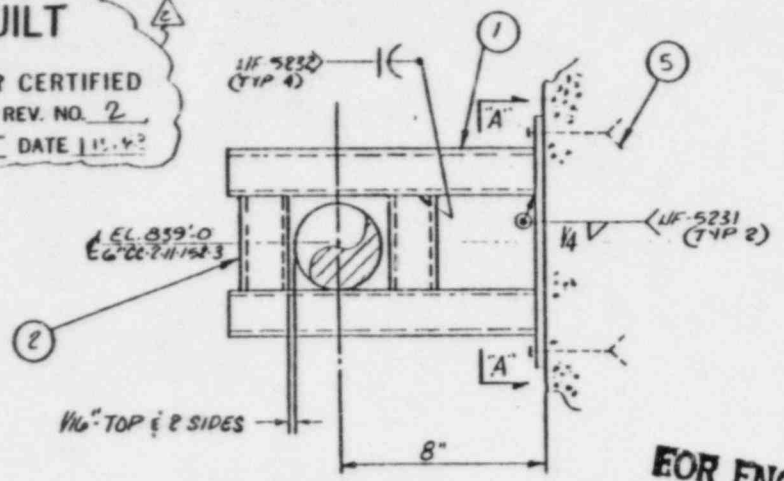
SUPPORT NO. CC-2-011-720-A15R
SHEET 1 OF 1 REV. 2

FOR OFFICE AND

FIELD OFFICE USE ONLY

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY: [illegible] DATE 11-4-82



ELEVATION LOOKING NORTH

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	PBS	L	CES	SEC	ASC
1	2	3X3X1/4X1'-2 3/4" TUBE, A500 GR.B.		X			
2	2	3X3X1/4X0'-6 1/8" TUBE, A500 GR.B.		X			
3	1	PL 5/16" SA-36 SEE SECTION "A-A"	X				
4	4	7/16"X2" MULTI-KWIK CONCRETE			X		
5	4	3/4" x 7" HILTI KWIK CONC. ANCHOR			X		
6	1	C.S.R. 3/4" x 20" x 21" / SECT. A-A (SA 36 / SA-515 GR 65)	X				

PAINT: CARBO ZINC #11

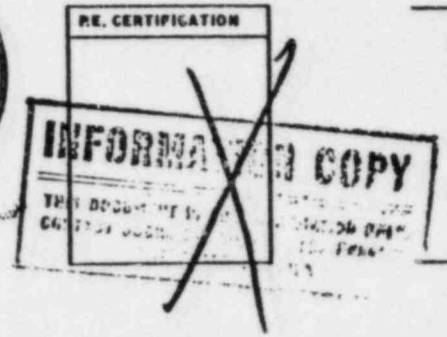
REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
A	VENDOR CERTIFICATION; REF CPP. 8122	11/4/82	GLL	Q	CBD

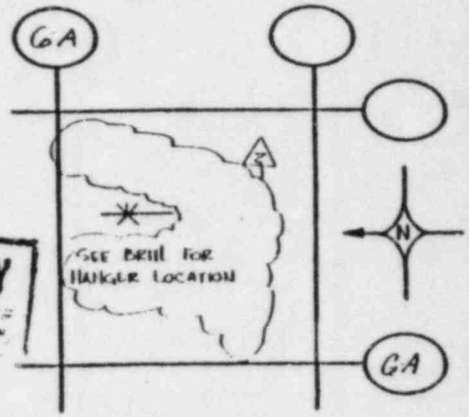
FOR ENGINEERING & OFFICE USE ONLY

PROBLEM # AB-1-66c R.D

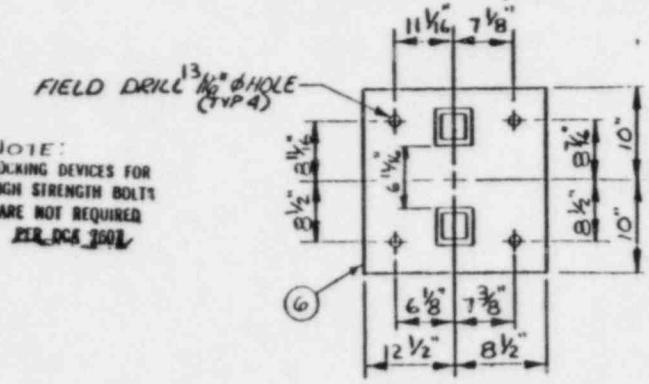
ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

P.E. CERTIFICATION





LOCATION PLAN



SECTION "A-A"

T.O. 21100

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL LIMITS A	B	C	D	PIPE MVTS INCHES
208						
VERT.						
N-S						
E-W						

NOTE: +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES [X] NO [ ]
ASME CODE CLASS 3

REF DWGS		REV		REV		REV
	BRHL ISO.	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2 AB-031	0	M10102	8	E10102	8
	FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C	REV
	CC-2-A2-031	0	S1183	3	M10155	6

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD
1	REVISED PER DCA 7107 (SEE NT. 1); WELDS, DELETED FIG. 6, CHG. 32932; AS-BUILT	6-11-81	DMH	[illegible]	RMD
0	I.F.C.	12-20-79	C.A.T.	[illegible]	[illegible]

CPSES 35-1125

Brown & Root, Inc
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.E.I.
PLANT COMANCHE PEAK
JOB NO. 2223

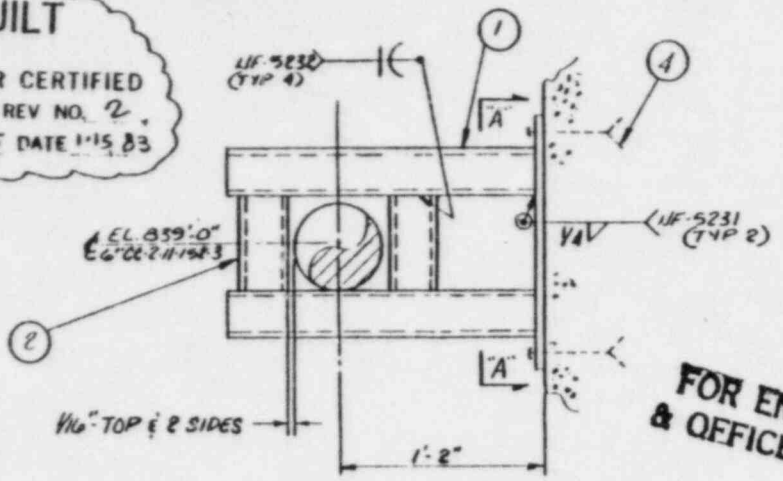
SUPPORT NO. CC-2-011-718-A53R
SHEET 1 OF 1 REV. 2

FOR OFFICE AND

[illegible]

AS-BUILT

VENDOR CERTIFIED
DRAWING REV NO. 2
BY [illegible] DATE 1-15-83



FOR ENGINEERING & OFFICE USE ONLY

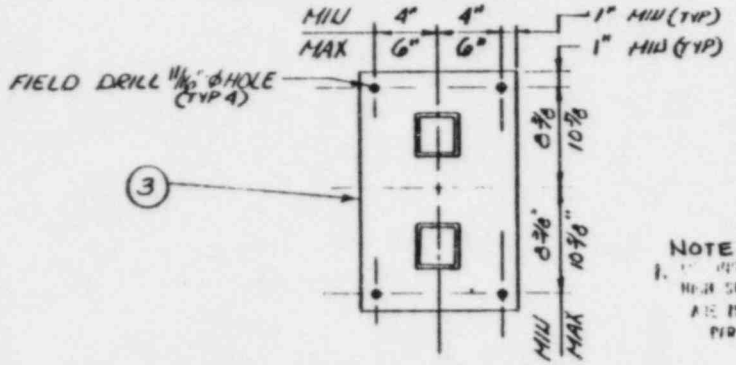
ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	P&S	L	OSS	PRIM	SEC.	AISC
1	2	3X3X1/4X1'-8 1/16" TUBE A500 GR.B.		X		X		
2	2	5X3X1/4X6 1/16" TUBE A500 GR.B.		X		X		
3	1	PL 3/8" SA-36 SEE SECTION "A-A"	X			X		
4	4	5/8"X6" HILTI-KWIK CONCRETE ANCHORS			X			

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
6	VENDOR CERTIFICATION, REF. GTN 59790	1/15/83	[illegible]	[illegible]	C.P.D.

APPLY ONE COAT OF ZINC-RICH PAINT TO ABOVE PARTS EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE.

PROBLEM # AB-1-66C

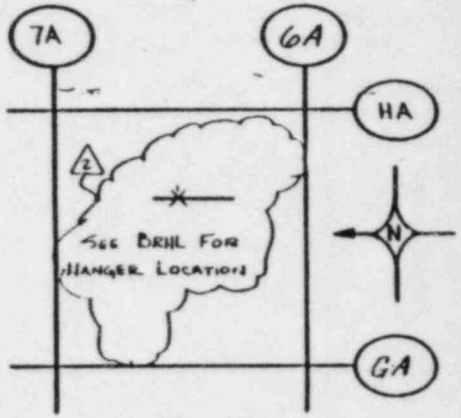
ELEVATION LOOKING NORTH



NOTE:
1. [illegible] BEAMS FOR HIGH SLIP-RESISTANCE BOLTS ARE NOT PERMITTED PER DCA 7407

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

P.E. CERTIFICATION



LOCATION PLAN

SECTION "A-A"

T.O. 21100

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	LEVEL B	LEVEL C	LEVEL D	LIMITS	PIPE MVTS INCHES
2086							
VERT.	—	21.5	22.32	23.30	—	—	—
N-S	—	—	—	—	—	—	—
E-W	—	—	—	—	—	—	—

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES [X] NO [ ]
ASME CODE CLASS 3

REF DWGS	BRHL	ISO	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-031		8	M-0102	8	E-0102	8
	FAB. ISO.		REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-031		0	S0148	3	M-0255	6

REV	DESCRIPTION	DATE	DWN	CHKD.	APPVD.
1	REV AS NT'D, REF. DCA 7407 (SEE NT 1); WELDS [illegible]	12-18-81	DMH	JW	[illegible]
0	WELD FAB & CHK 32942; AS-BUILT	12-20-79	C.A.T.	[illegible]	[illegible]

CPSES 35-1195

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

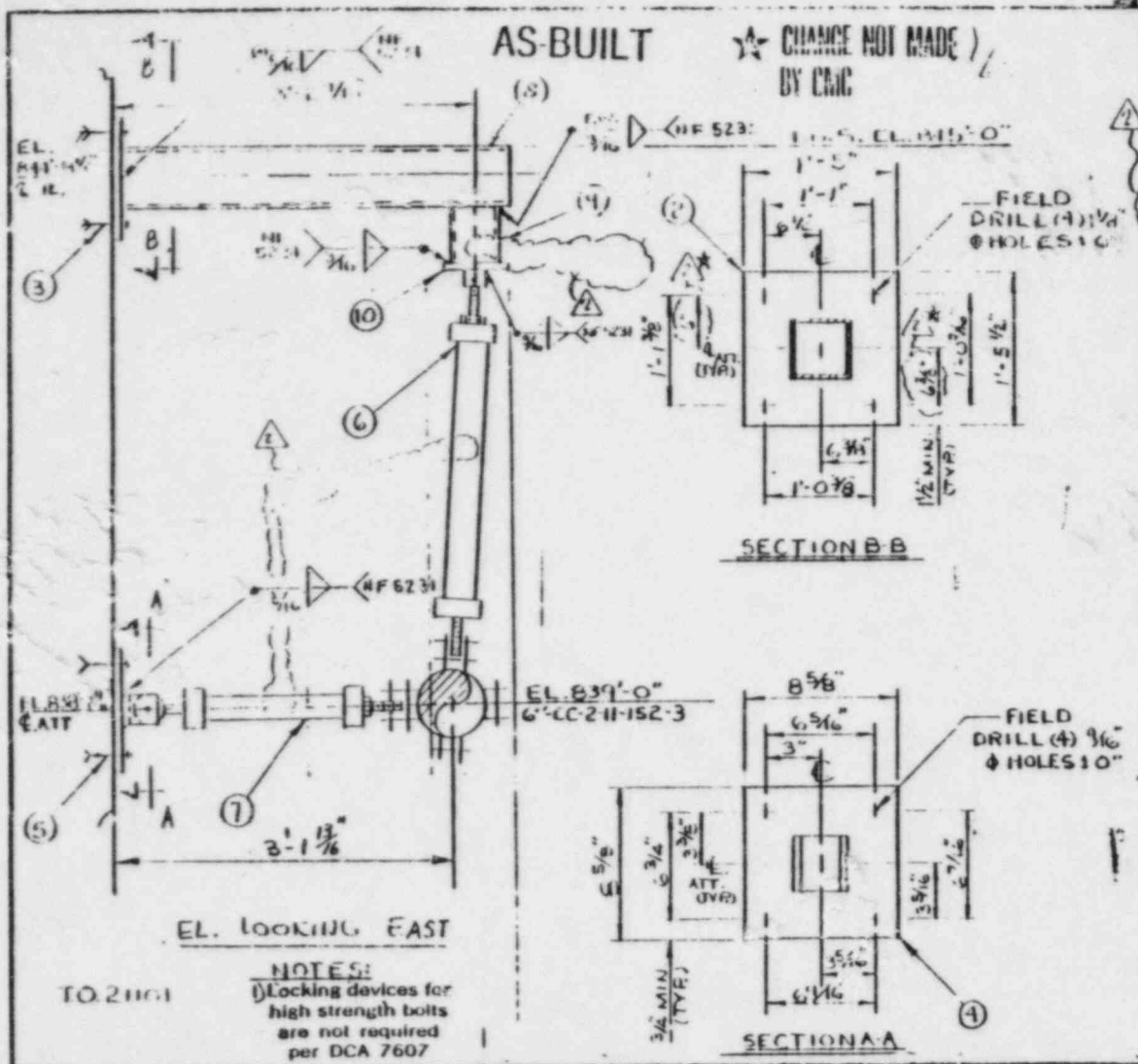
SUPPORT NO. CC-2-011-717-A53R
SHEET 1 OF 1 REV. 2

FOR OFFICE AND

FOR OFFICE AND ENGINEERING USE ONLY

ENGINEERING USE ONLY

AS-BUILT ☆ CHANGE NOT MADE BY CMC



NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION
1	1	T... 3/4" [illegible]
2	1	W 11"x4" SA 36 - SEE SECTION F
3	4	1" x [illegible] HILTI KWIK CONCRETE ANCHOR
4	1	PL 1/2" SA 36 - SEE SECTION "F"
5	4	1/2" x 3 3/4" HILTI KWIK CONCRETE ANCHOR
6	1	SRS-08-PC; SPC-08-060
7	1	SRS-08-PC; SPC-08-060
8	1	L 6" x 6" x 3/8" x 1'-3" LG (ASTM A 36 GR 50)
9	1	L 3" x 3" x 3/8" x 0'-5 1/2" LG (ASTM A 36 GR 50)
10	1	PL 1/2" x 7" x 7" (ASTM A 36 GR 50)

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY [illegible] DATE 7-21-83

REV	DESCRIPTION	DATE	BY/M	CHKD	APVD
2	VENDOR CERTIFICATION, GIN # 59790	~	~	~	~
1	REVD. VENDOR CERTIFIED REF. HER. M. 2609	7-21-83	GLL	P.T.	Q

PROB. AB 1 66C REV. 1
ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: N.S. -46A

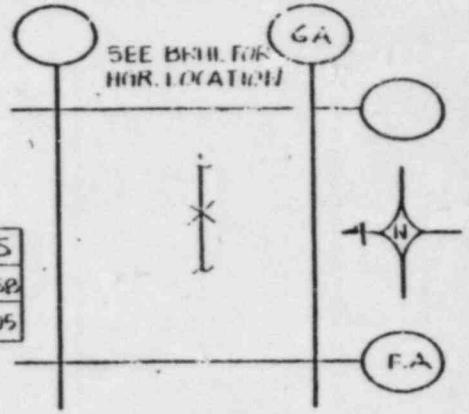
P.E. CERTIFICATION

N/A

CP5ES 35-1193 CONTROL COPY

MVT'S

Z	.0058
	.0105



LOCATION PLAN

DATA PT 2091	SUPPORT LOADS (LBS) DESIGN	A	C	L	M	PIPE NYTS GIN #
VERT	—	CK.				
N-S	—					
E-W	—					

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES [V] NO [ ]
ASME CODE CLASS 3

REF DWGS		REV		REV		REV
STRESS ISO	M2-3231-83	C	MECHANICAL M1-0702	8	ELECTRICAL E1-0702	8
BRHL ISO	CC-2-AB-031	REV 0	STRUCTURAL S-0718	REV 3	HVAC M1-0755	REV 6

REV	DESCRIPTION	DATE	BY/M	CHKD	APVD
0	IFC	11-30-71			
1	REVAS NOTED PER CMC 36181, 31922 & DCA 7607. SEE NTL AS BUILT	11-4-82			

CP5ES 35-1193

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

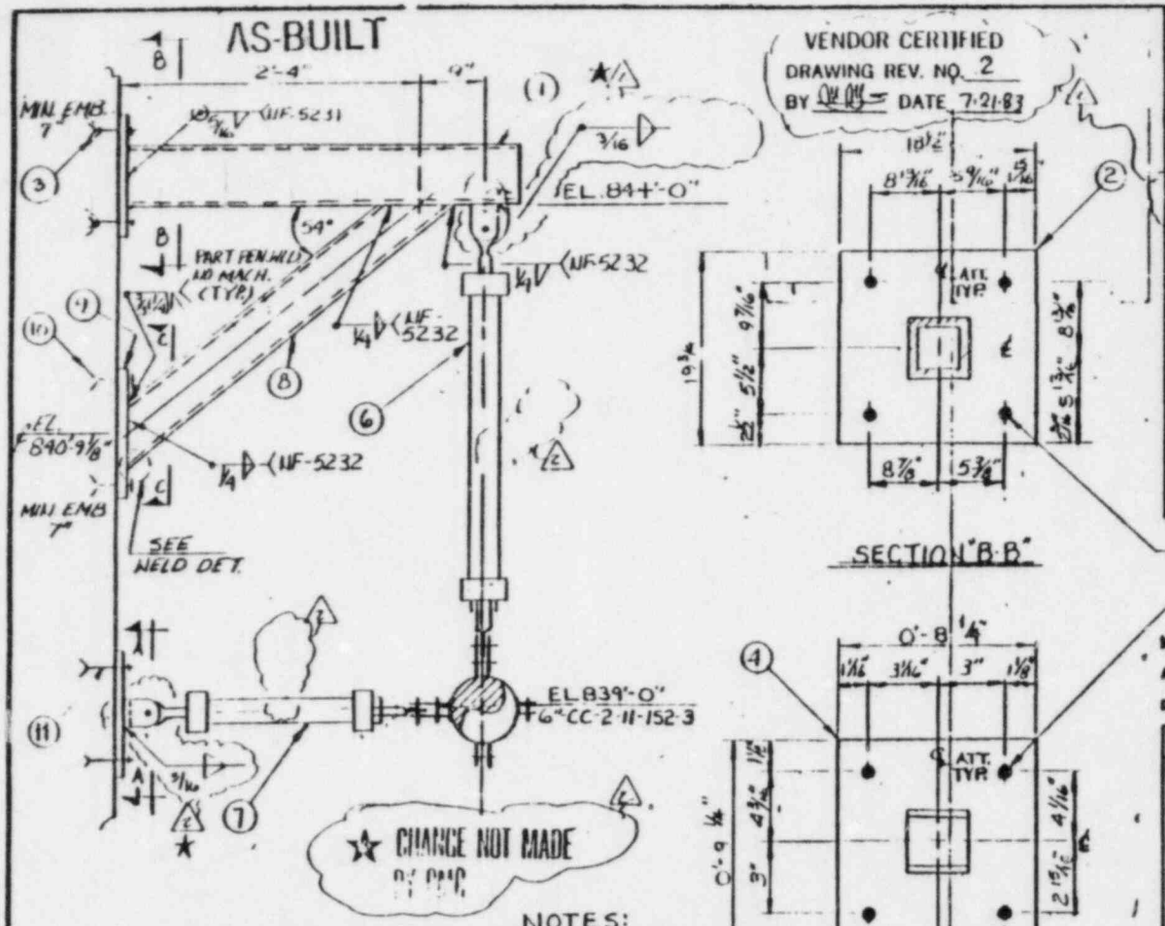
CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO 2323

SUPPORT NO. CC-2-011-115-A53R
SHEET 1 OF 1 REV. 2

FOR OFFICE AND ENGINEERING USE ONLY

FOR OFFICE AND ENGINEERING USE ONLY

AS-BUILT



ELEV. LKG EAST

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY [illegible] DATE 7-21-83

SECTION "B-B"

SECTION A-A

ITEM NO	QTY REQ'D	MATERIAL DESCRIPTION	P.B.S	A.S.S	A.R.M	S.E.C	A.I.S.C
1	1	T.S. 6"x6"x3/8"-3'-3 13/16"-A-500 GR B		X	X	X	
2	1	PL 1¼" SA-36, SEE SECTION "B-B"	X		X	X	
3	4	1" x 12" SUPER HILTI KWIK CONCRETE ANCHOR			X	X	
4	1	PL ⅜" SA-36, SEE SECTION "A-A"	X			X	
5	4	~~⅝"x3¼" HILTI KWIK CONCRETE ANCHOR~~			X	X	
6	1	SRS-08-PC SPC-08-060			X	X	
7	1	SRS-08-PC SPC-08-060			X	X	
7A	1	1¼" THK. C.S. PLATE PER SECT. B-B (SA-36 OR SA-516 GR. 65)	X		X		
9A	1	1" THK. C.S. PLATE PER SECT. A-A (SA-36 OR SA-516 GR. 65)	X		X		
8	1	TS 5"x5"x½"x4'-10" LG (A-500 GR B) FIELD CUT TO SUIT		X		X	
9	1	PL ¾" THK. PER SECT. "C-C" (SA-36 OR SA-515 GR 65)	X		X	X	
10	4	¾"x10" HILTI KWIK BOLTS			X	X	
11	4	⅝"x5½" HILTI KWIK BOLTS			X	X	
		Paul Carew Enk "11					

REV	DESCRIPTION	DATE	DWN.	CHK'D.	APP'VD.
2	REVD VENDOR CERTIFIED PE 11-9200	7-21-83	GLC	[illegible]	[illegible]

PROBLEM AB-1-166C, R.O.

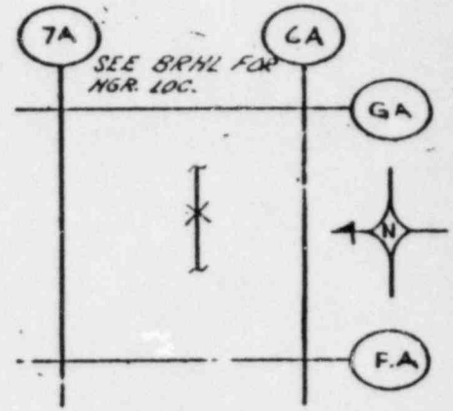
FIELD DRILL (4) 1 1/16" Φ HOLES

FIELD DRILL (4) 9/16" Φ HOLES

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: M.S.-46A

P.E. CERTIFICATION

N/A



LOCATION PLAN

NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607

T.O. 21101

DATA PT	SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
2013	DESIGN	SERVICE LEVEL LIMITS A	B	C	D		
VERT.	—	-359 / 323	-1068 / +403	-1149 / +907	—		—
N-S	—	-2064 / 1176	-2628 / 1741	-2776 / [illegible]	—		—
E-W	—	—	—	—	—		+ 0.22 DOWN

NOTE: 4 N.E. AUTHORIZED NUCL. INSP. YES ☑ NO ☐
LIFT-SUPPORT ASME CODE CLASS

REF DWGS	P&ID ISO	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-031	0	M1-0702	8	E1-0702	8
	FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-031	0	S-0218	3	M1-0755	6

CPSES 35-1155

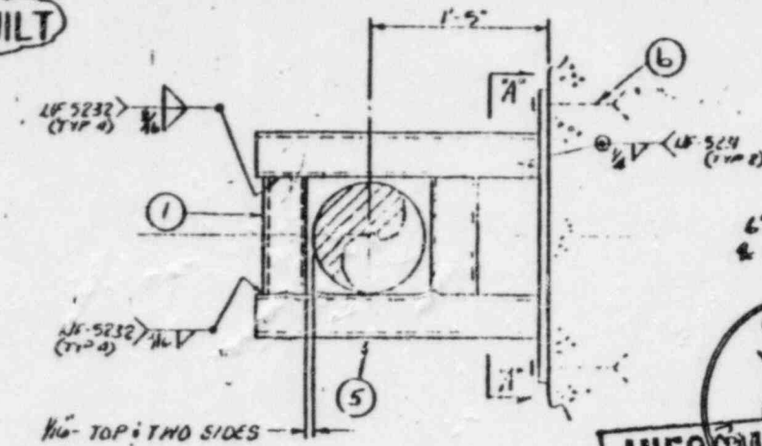
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT TUSI
PLANT COMANCHE PEAK
JOB NO. 2323

REV	DESCRIPTION	DATE	DWN	CHK'D	APP'VD
0	I.F.C.	10-14-83	[illegible]	[illegible]	[illegible]
1	REVISED PER DCA 7726 R1 & DCA 7607 (SEE NOTE 1) "AS BUILT" CONFORMS TO VENDOR CERTIFICATION REVD 7-21-83	5-21-84	B	[illegible]	[illegible]

SUPPORT NO. CC-2-011-714-A53R
SHEET 1 OF 2 REV. 2

AS-BUILT

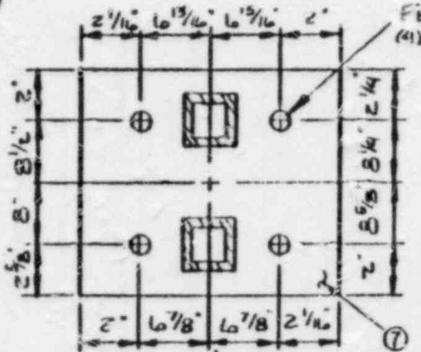


ELEVATION LOOKING NORTH

ITEM NO	QTY REQ'D	MATERIAL DESCRIPTION	PBS	L	PIPE	STRUCT	SEC	AISC
1	2	3"X3"X4"X0'-6 7/8" LONG ASTM A-36		X				
2	2	6"X4"X1/2"X1'-11" LONG ASTM A-36		X				
3	1	12"I [illegible]		X				
4	4	[illegible]						
5	2	1/4"X4"X4" TUBE STEEL 1'-11" LG. (A500 GRB)	X		X			
6	9	1"X12" SUPER HILTI CONCRETE ANCHORS			X			
7	11	1"X1 1/16"X2 1/8" CS PLATE (SA515 GR 65 OR A36)	X			X		

REV	DESCRIPTION	DATE	DWN	CHKD	APVD
2	VENDOR CERTIFICATION FOR CPSES	12/7/84	RB	Q	CBD

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY BH DATE 12-3-84



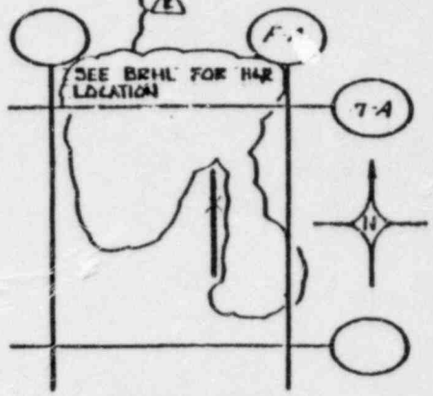
SECTION "A-A"

TO 21100

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: AISC-7TH A

PE CERTIFICATION

PROBLEM AB-1-66c R-0



LOCATION PLAN

DATA BY	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	SERVICE LEVEL B	PIPE NVTP ORCHES
VERT	—	570	1425	FINAL
N-S	—	1140	2850	
E-W	—	1140	2850	

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐

ASME CODE CLASS 2

REF DWGS	BRHL	SO	REV
	CC-2-AB-32		1
	FAB. ISO		REV
	CC-2-AB-C55		1

	MECHANICAL	REV	ELECTRICAL	REV
	[illegible]	3	[illegible]	4
	STRUCTURAL	REV	H.V.A.C	REV
	[illegible]	1	[illegible]	2

REV	DESCRIPTION	DATE	LDN	CHKD	APPD
2	REV ASME REF LOCATION NOTE NUMBERS	12-20-84	R.M.D.	W.P.	
1	REF DWG NOTE 2 (AS BUILT)	12-19-78	C.A.T.	M.G.	W.P.D.
0	IFC				

CPSES 1 32-11

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

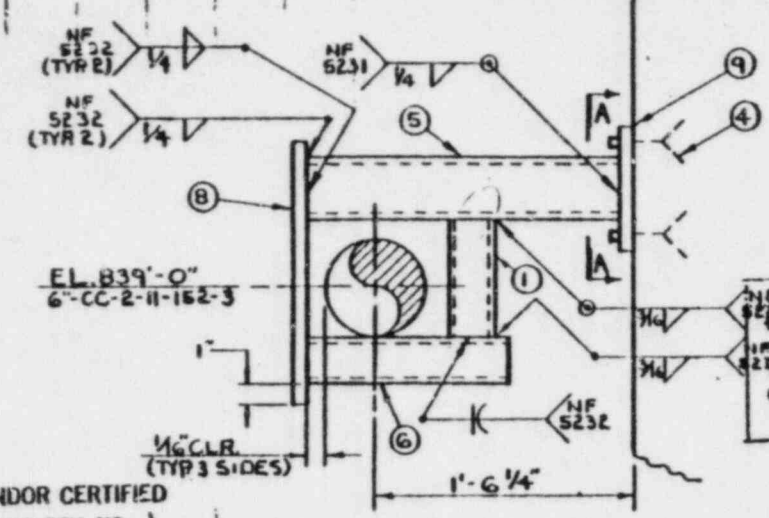
CLIENT T.U.E.S.I.
PLANT COMANCHE PEAK
JOB NO. 6323

SUPPORT NO. CC-2-AB-73-A53R
SHEET 1 OF 1 REV. 2

FOR OFFICE AND

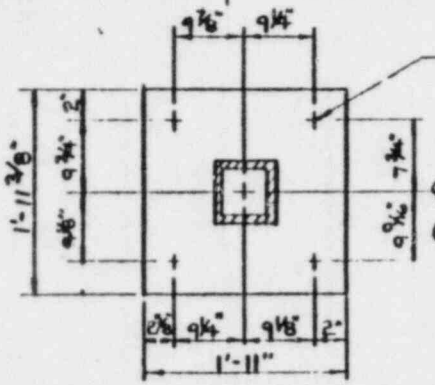
FOR ENGINEERING & OFFICE USE ONLY

AS BUILT



ELEV. VIEW LKG. NORTH

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY BH DATE 12/6/82



SECTION A-A

MVTS.	
X	10.035
	0.030

NOTES:
1. Locking devices for high strength bolts are not required per DCA 7607

T.O. 21100

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	PBS	SUPT	DRWG SEC	AISC
1	1	T.S. 4"x3"x3"x0'-6 1/2" (A-500, GR. B)		X		
4	4	1"x9" HILTI KWIK CONCRETE ANCHORS		X		
5	1	T.S. 1/4"x6"x6"x2'-0" LG. (A-500, GR. B) FIELD TRIM TO SUIT		X	X	
6	1	T.S. 1/4"x3"x3"x1'-2" LG. (A-500, GR. B) FIELD TRIM TO SUIT		X		X
8	1	PL 1"x8"x1'-5 1/16" LG. (SA-515 GR 65 OR SA-36)	X			X
9	1	PL 1"x1'-11"x1'-11 3/8" LG. (SA-515 GR 65 OR SA-36)	X			X

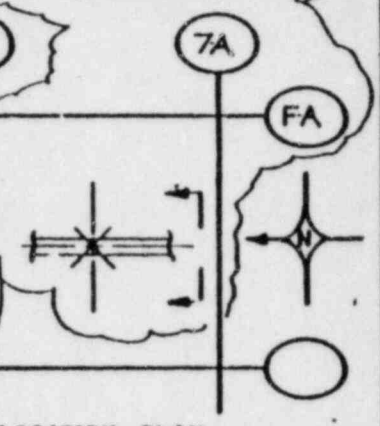
APPLY ONE COAT OF CARBO ZINC 11 TO ABOVE MATL EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE.

PROBLEM 18-1-66C/80

SEE BRUL FOR HGR LOCATION

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

RE. CERTIFICATION



LOCATION PLAN

REV	DESCRIPTION	DATE	DWN.	CHK'D.	APP'VD.
GTN	8 59790, AS BUILT	~	~		

DATA PT	SUPPORT LOADS (LBS) DESIGN	VERTICAL	LEVEL	LATERAL	PIPE MVTS & ANCHOR
2099					
VERT.		510			
N-S					
E-W					

NOTE +N,S,UP -S,N,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐
ASME CODE CLASS 3

REF DWGS	BRUL 150	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-032	~	MI-0702	8	EI-0711	9
	FAB. 150	REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-032	1	S-0121	4	MI-0756	5

REV	DESCRIPTION	DATE	DWN.	CHK'D.	APP'VD.
1	REV AS NTD REF CMC 5294L R 6 + DCA 7207	12/19/79	C.A.T.		
0	IFC				

CPSES 35-195

Brown & Root, Inc
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-712-A52R
SHEET 1 OF 1 REV. 1

FOR OFFICE AND

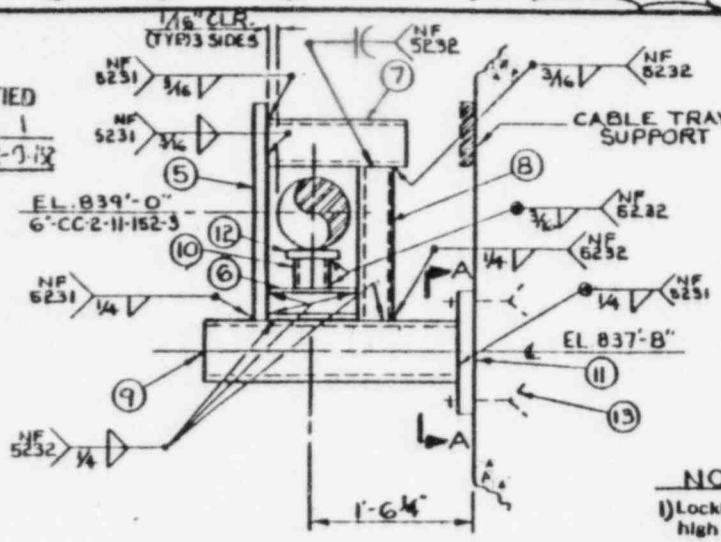
ENGINEERING USE ONLY

FOR OFFICE AND

FIELD FABRICATION USE ONLY

AS BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY PJW DATE 12-3-82



ELEV. LKG NORTH

NOTES

1) Locking devices for high strength bolts are not required per DCA 7607

T.O. 21100

ITEM NO	QTY REQ'D	MATERIAL DESCRIPTION	PBS	L	CBS	PRIM	SEC	AISC
5	1	1"x 4 1/2"x 1'-8 1/2" LG. C.S.PL. (SA-36 OR SA-515, GR.65)	X			X		
6	1	W6x12x0'-6 3/4" LG. (SA-36)		X		X		
7	1	T.S. 1/4"x4"x4"x0'-11" LG. (A-500, GR.B)		X		X		
8	1	T.S. 1/4"x4"x4"x1'-4 1/8" LG. (A-500, GR.B)		X		X		
9	1	T.S. 1/4"x6"x6"x2'-0 1/2" LG. (A-500, GR.B)		X		X		
10	1	T.S. 4"x3"x3"x0'-2 1/16" LG. (A-500, GR.B)		X		X		
11	1	1" THK. C.S.PL. SECT. A-A (SA-36 OR SA-515, GR.65)	X			X		
12	1	1"x4"x4" LG. C.S.PL. (SA-36 OR SA-516, GR.65)	X			X		
13	4	1"Φx9" LG. HILTI KWIK CONCRETE ANCHORS			X			
		APPLY ONE COAT OF CARGO ZINC 311 TO ABOVE MATL EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE						

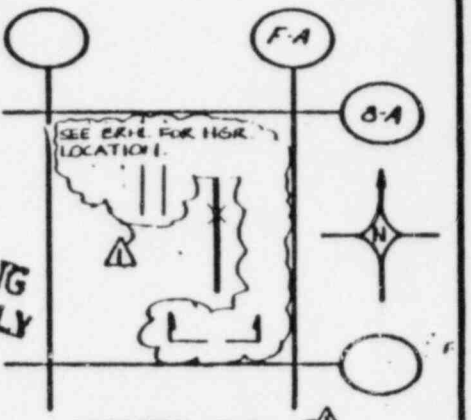
REV	DESCRIPTION	CATE	DATE	CHKD.	APVD.
1	VENDOR CERT. REF. GTI # 52720				

PROB.# AB-1-66C, R-0 ⚠1

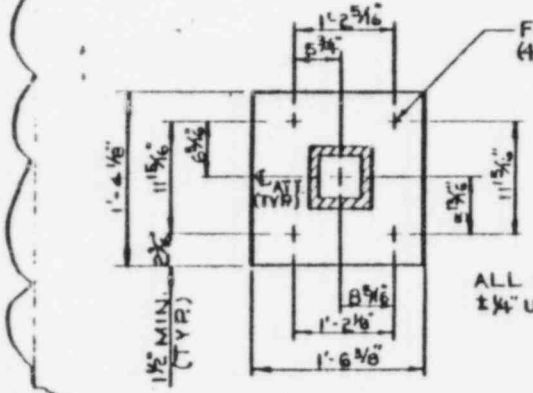
ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: HS-46A

P.E. CERTIFICATION

FOR ENGINEERING & OFFICE USE ONLY



LOCATION PLAN ⚠1



SECTION A-A

ALL IR. DIMS. ±1/4" U.N.O.

DATA PT	SUPPORT LOADS (LBS) DESIGN	LEVEL A	LEVEL B	LEVEL C	LEVEL D	PIPE MVTS (INCHES)
R101						
VERT.	—	+1867 -3117	+1867 -3117	+1867 -3117	—	+0.18 -0.20
N-S	—	—	—	—	—	—
E-W	—	+1178 -1178	+1178 -1178	+721 -721	—	—

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐

ASME CODE CLASS 3

REF DWGS	PSAR 130	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-032	1	MI-0702	4	EI-0711	0
	PAB 130	REV	STRUCTURAL	REV	H.V.A.C	REV
	CC-P-AB-032	1	S-0721	4	MI-0756	5

CPSES 33-1195

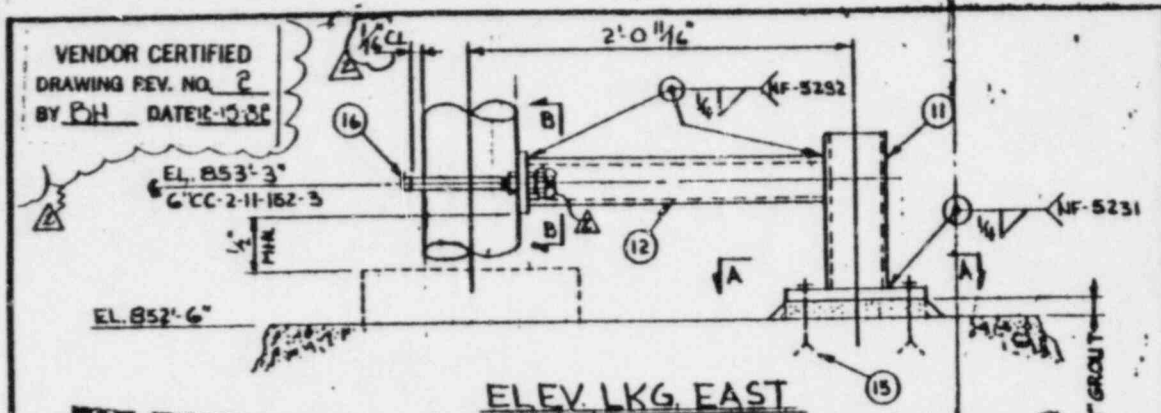
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
⚠1	REV. AS NOTED, REF. CMC-32943R5 & DCA 7607-SEE NT-AS BUILT	12/1/82	EWY	CBD	
0	I.F.C.	12-19-79	C.A.F.	[illegible]	TMA

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 5383

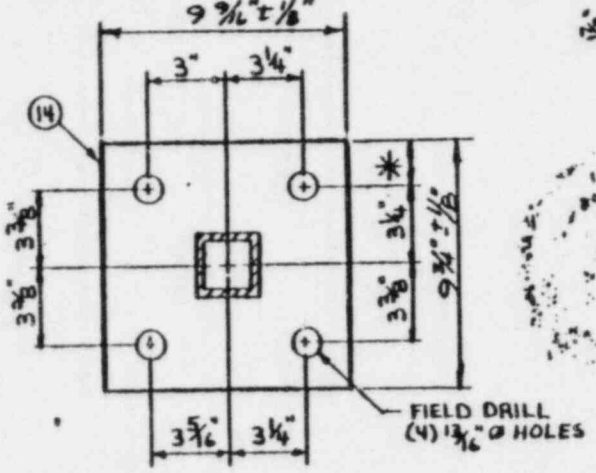
SUPPORT NO. CC-2-AB-711-A23R
SHEET 1 OF 1 REV. 1

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY PJH DATE 5-12-82

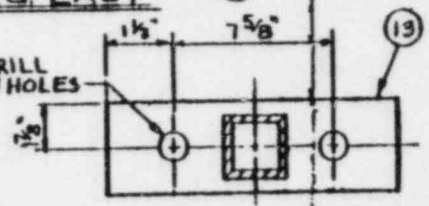


ELEV. LKG. EAST

FOR ENGINEERING
& OFFICE USE ONLY



SECTION A-A



SECTION B-B

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	PBS	AISC
1	1	PUH-060		
2	1	6" × 3" × 1/2" × 1'-0" ANGLE SA 36 SEE DETAIL A		
3	1	6" × 6" × 1/2" × 8" ANGLE SA 36		
4	1	1/2" PL SA 36 SEE DETAIL A		
5	AR	1/2" × 3" LONG HILTI KWIK CANTILEVER ANCHOR		
11	1	T.S. 4×4×1/4×10" (A500 GR.B) TRIM AS REQ'D		
12	1	T.S. 3×3×1/4×1'-7 7/8" (A 500 GR.B)		
13	1	C.S.P. 1/2"×4"×10 5/8" (SA-36/SA-515 GR.65)		
14	1	C.S.P. 1/4"×9 3/4"×9 1/4" (SA 36/SA-515 GR.65)		
15	4	1/4"×7" HILTI KWIK CONC. ANCHOR		
16	1	PUH-060 H-BOLT		
		APPLY ONE COAT OF CARBO ZINC #11 TO ABOVE MAT'L EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE.		

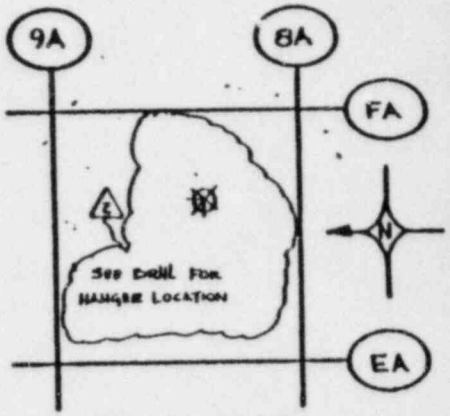
REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
1	VENDOR CERTIFICATION, BILLET SIZE	11/17/81	G.L.	Q	CBO

PROBLEM # AB-1-CCC R.0

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

RE. CERTIFICATION

N/A



LOCATION PLAN

NOTE:
1. LOCATING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED (TYP.)

PK. # 11 * EDGE DISTANCE ≥ 1 1/2 × BOLT DIA. (TYP.) T.O. 21100

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	B	C	D	PIPE MVTS. ENGINEERING (+ ABOVE - BELOW)
2107						
VERT.						
N-S						
E-W						

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☒ NO ☐
ASME CODE CLASS 3

REF. DWGS		REV
BRHL ISO.	CC-2-AB-032	D
FAB. ISO.	CC-2-AB-032	1

	REV		REV		REV
MECHANICAL		ELECTRICAL			
M1-0701	6	E1-0710-01	7		
STRUCTURAL		H.V.A.C.			
S-0728	2	M1-0718	4		

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
0	IFC	11/30/81	[illegible]	RKB	[illegible]
1	REV AS NTD; REF. CMC 4361 T.R. 2 & DCA 7401 (NT.1) "AS BUILT"	6/11/81	DMH	RKB	[illegible]

CPSES 38-1198

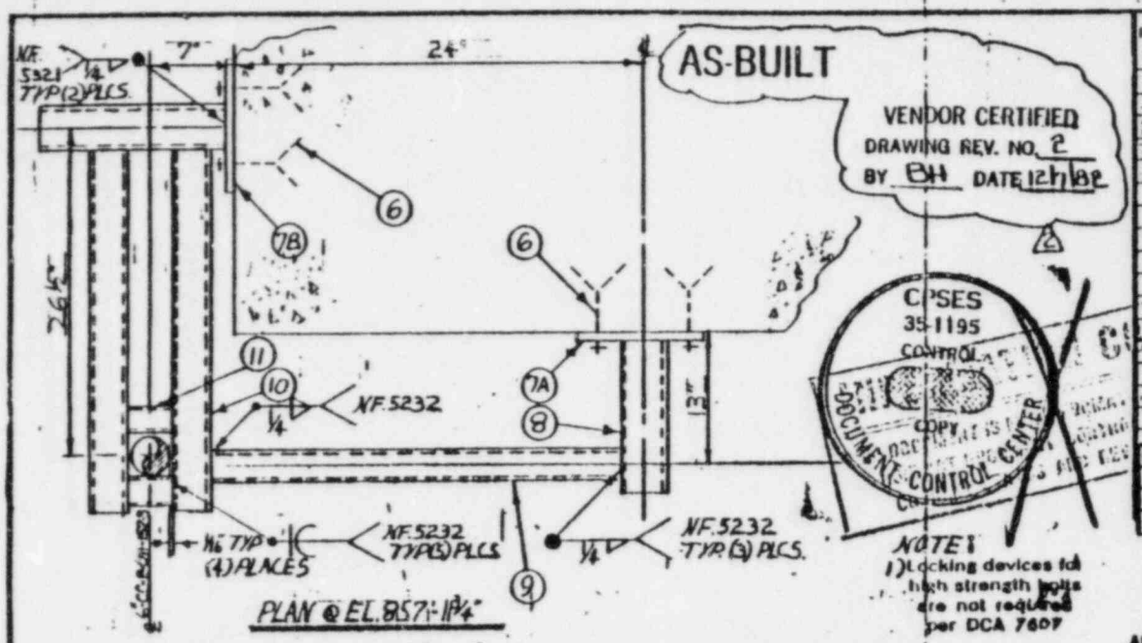
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-708-A63R
SHEET 1 OF 1 REV. 2

FOR OFFICE AREA

ENGINEERING USE ONLY



ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	PBS	L	CBS	PRIM	SEC	AISC
1	2	SAE GR. B, C.C. x 20 1/2", SAE GR. B GR.			X	X	X	
2	8	1/4 x 3" WIDE KNOX CONCRETE ANCHOR			X	X	X	
3	1	6" x 1'-3" x 6" TUBE A-500 GR. B		X	X	X	X	
4	6	6" x 8" x 1/2" x 1'-3" PLATE A-500 GR. B		X	X	X	X	
5	7	3/4" Ø SEE SECTION 4-4	X		X	X	X	
6	8	1/4 Ø X 7" HILTI KWIK BOLT			X	X	X	
7A	1	1/4" R. SEE DTL. 7A (SA-36 OR SA515)	X			X	X	
7B	1	1/4" R. SEE DTL. 7A (SA-36 OR SA515)	X			X	X	
8	2	3" x 3" x 1/4" x 1'-3" LG. TS (A-500 GR. B)		X	X	X	X	
9	1	2" x 2" x 1/4" x 2'-2 1/2" LG. TS (A500 GR. B)		X	X	X	X	
10	2	2" x 2" x 1/4" x 2'-9 7/8" LG. TS (A500 GR. B)		X	X	X	X	
11	2	2" x 2" x 1/4" x 6 1/4" LG. TS (A500 GR. B)		X	X	X	X	
		APPLY ONE COAT OF CARBOLINE PAINT #11 TO ABOVE MATL EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE						

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
2	VENDOR CERTIFICATION, REF. GDI #59790	12/1/82	JD	Q	[illegible]

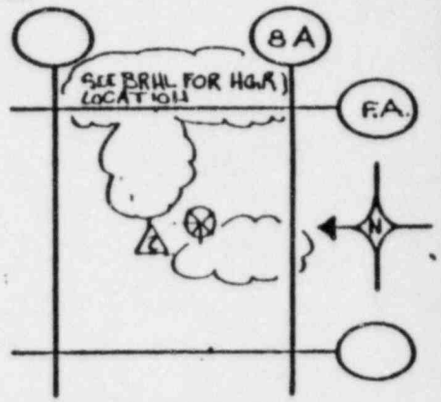
PROBLEM #AB-1-66C

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

RE. CERTIFICATION

N/A

FOR ENGINEERING & OFFICE USE ONLY



LOCATION PLAN

DATA PT	SUPPORT DESIGN	LOADS SERVICE LEVEL A	LOADS SERVICE LEVEL B	PIPE MVTS INCHES
2108				
VERT.				
N-S				
E-W				

NOTE: N, S, E, W, UP - U, DN - D

AUTHORIZED NUCL. INSP. YES [V] NO [ ]

ASME CODE CLASS 3

REF DWGS		REV	MECHANICAL	REV	ELECTRICAL	REV
BRHL-150	CC-2-AB-032	0	M1-0701	6	E1-0710-01	7
FAB. 130	CC-2-AB-032	REV 1	STRUCTURAL S-0728	REV 2	HVAC M1-0758	REV 4

REV	DESCRIPTION	DWN.	CHKD.	APPVD.
0	IFC	[illegible]	[illegible]	[illegible]
1	REV. DASNT'D. REF CMC 59446 & LETTERS DTD 12/8	S.W.L.	[illegible]	[illegible]
2	DCA 7607 (SECT. D) (AS BUILT)	[illegible]	~	[illegible]

CPSES 35-1195

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-707-AG3R
SHEET 1 OF 1 REV. 2

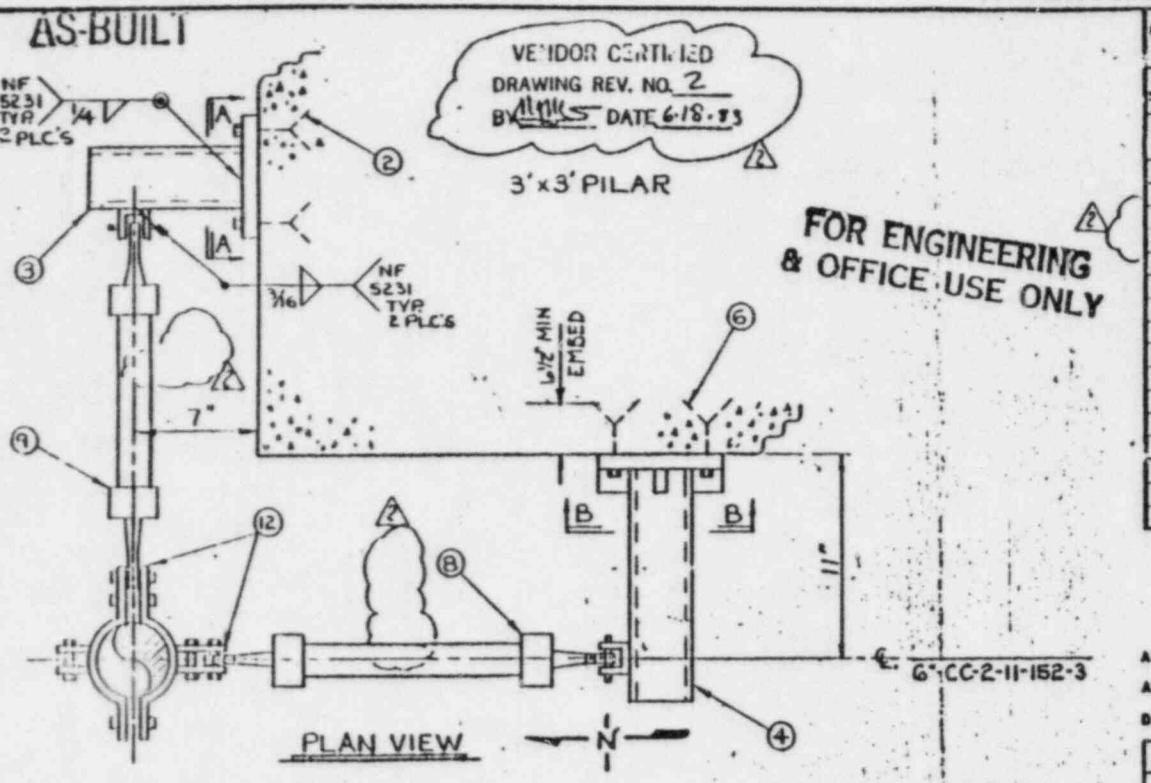
FOR OFFICE AND ENGINEERING USE ONLY

FOR CONSTRUCTION

ENGINEERING COPY ONLY

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY [illegible] DATE 6-18-93



3'x3' PILAR

PLAN VIEW

FOR ENGINEERING & OFFICE USE ONLY

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	PBS	L	CSS	DRAW	CSC
2	4	3/4"x7" HILTI KWIK CONCRETE ANCHORS			X		
3	1	T.S. 1/4"x3"x3"x8 1/4" LG. (A-500-Gr.B, GR.B)		X		X	
4	1	T.S. 1/4"x3"x3"x1'-2 1/4" LG. (A500-Gr.B, GR.B)		X		X	
6	4	5/8"x8 1/2" HILTI KWIK CONCRETE ANCHORS			X		
7	4	1/2"x4"x3 1/4" LG. STIFFENER PLATE (SA-36 OR SA-515, GR.65)	X			X	
8	1	SRF-08-RO SWAY STRUT [illegible]			X		
9	1	SRF-08-RO SWAY STRUT [illegible]			X		
10	1	3/4" C.S. PLATE PER SECT. A-A (SA-36 OR SA-515, GR.65)	X			X	
11	1	3/4" C.S. PLATE PER SECT. B-B (SA-36 OR SA-515, GR.65)	X			X	
12	2	SPC-08-060 C.S. PIPE CLAMP (SA-36			X		
		PAINT: CARBO ZINC. 11					

REV	DESCRIPTION	DATE	DWN.	CHKD.	APPVD.
2	REVD. VENDOR CERTIFICATION REF. NCR 11-RC-12	7-6-93	SL	RD	[illegible]

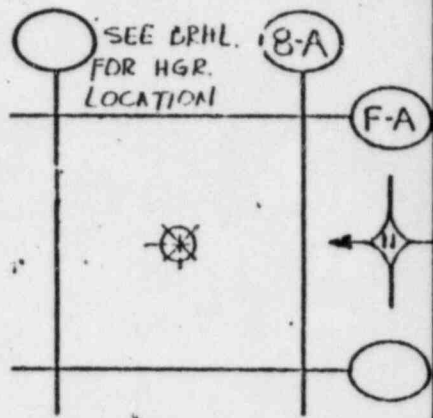
ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

P.E. CERTIFICATION

N/A

PROJ# AB1-66CRO

SEE DRWG. 8-A FOR HGR. LOCATION



LOCATION PLAN

NOTES:

1) Locking devices for high strength bolts are not required per DCA 7607

T.O. 21101

INFORMATION COPY

THIS DOCUMENT IS [illegible] ONLY. FOR [illegible]

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	LEVEL B	LEVEL C	LIMITS D	PIPE MVTS (INCHES) OPS	COLD
2109							
VERT.	—	—	—	—	—	—	—
N-S	—	[illegible]	[illegible]	[illegible]	—	—	—
E-W	—	[illegible]	[illegible]	[illegible]	—	—	—

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☑ NO ☐

ASME CODE CLASS 3

REF. DWGS.	BRHL ISO.	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-032	1	MI-0701	6	EI-0710-01	7
	FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-032	2	S-0728	2	MI-0758	4

REV	DESCRIPTION	DATE	DWN.	CHKD.	APP'D
0	I.F.C.	11-30-71	[illegible]	[illegible]	[illegible]
1	REVISED AS-BUILT PER SMC 25157 & SMC 76963	12-14-76	[illegible]	[illegible]	[illegible]
2	DCA 7607 (CCANTI) ADDED SWAY & AS-BUILT CONTRACTOR CERTIFICATION REF. STN 29750	[illegible]	[illegible]	[illegible]	[illegible]

CPSES 20-1106

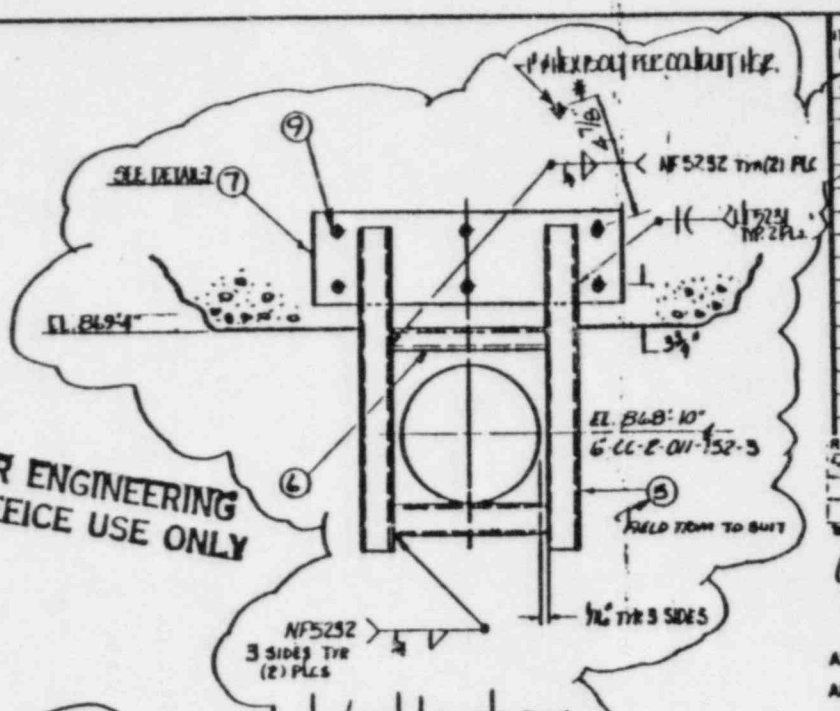
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

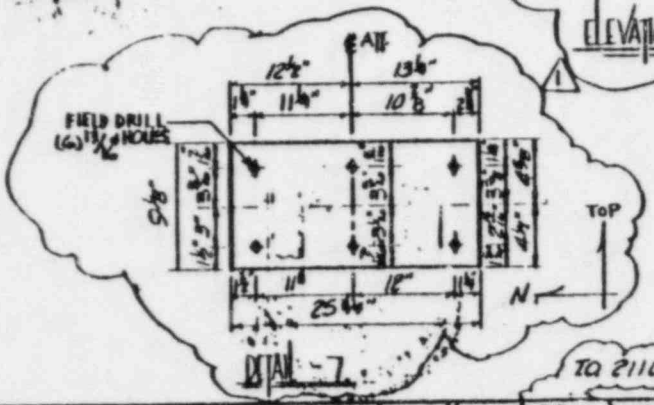
CLIENT T.U.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-706-A65R
SHEET 1 OF 2 REV. 2

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 1
BY RW DATE 12-3-82





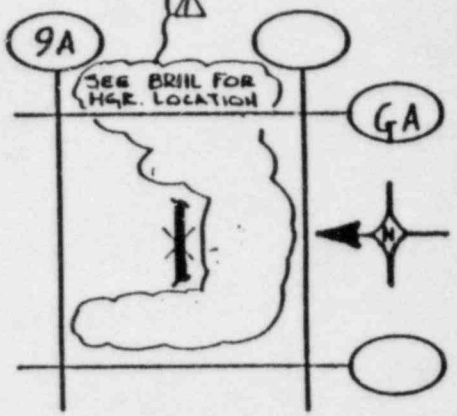
ITEM NO.	QTY. REQ'D.	MATERIAL DESCRIPTION	PAT	L	CHM	PMI	REC	UTC
5	2	PL 1"x 14"x 14"x 48"Lg A-500 GRB		X		X		
6	2	PL 3"x 3"x 14"x 6'-8" Lg A500 GRB		X		X		
7	1	C3 x 8 3/4" (SEE DET 7) SA-36 GR 65/SA-36	X			X		
9	6	HILTI KWIK BOLTS 3/4"x 7"			X			

PAINT: CARBO ZINC #11

REV	DESCRIPTION	DATE	DSN	CHKD.	APPVD.
1	Vendor Certification for CPP 8112	—	—	—	—

Field Violation 1 PROC# AB-1-66C R-0

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MB-46A



LOCATION PLAN

FOR ENGINEERING & OFFICE USE ONLY

NOTE:
1) Locking devices for high strength bolts are not required per DCA 7607

TQ 21101

DATA PT.	SUPPORT LOADS (lbs) DESIGN	SERVICE LEVEL A	LEVEL B	LEVEL C	LIMITS D	PIPE MVTS (INCHES)
ETZD						
VERT.	—				—	
N-S	—				—	
E-W	—				—	

NOTE: PIPE MVTS ARE FOR SSE ONLY

AUTHORIZED NUCL. INSP. YES ☒ NO ☐
ASME CODE CLASS 3

REF. DWGS

BRHL ISO.	REV.	MECHANICAL	REV.	ELECTRICAL	REV.
CC-2-AB-32	1	M1-0757	6	E1-0703	6
PAR. ISO.	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
CC-2-AB-032	1	S-0735	2	M1-0757	4

REV	DESCRIPTION	DATE	DWN.	CHK'D.	APP'VD.
0	IFE	9-20-79	MMW	MG	
1	REV AS NTD REF DWG 9062 R-9	12/1/82	RB	G	
[illegible]	DCR R-01 W/I AS-BUILT cont.	—	—	—	—

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

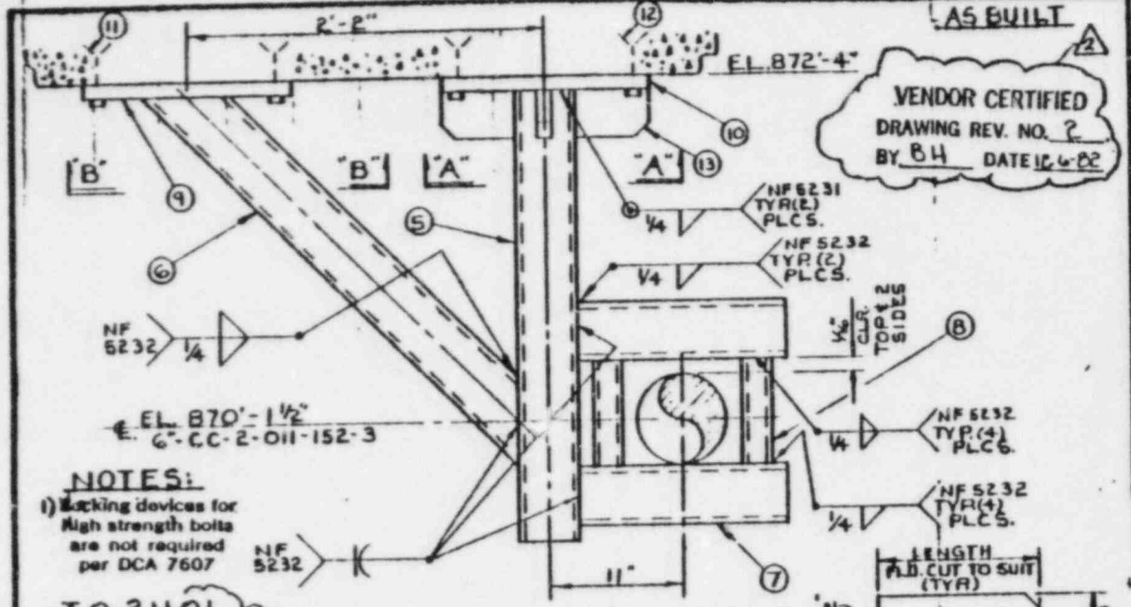
CLIENT TUSI
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-11-702-AL93R
SHEET 1 OF 1 REV. 1

FOR OFFICE ONLY

AS BUILT

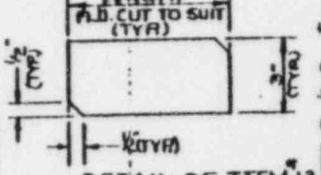
VENDOR CERTIFIED
DRAWING REV. NO. 2
BY BH DATE 12-6-82



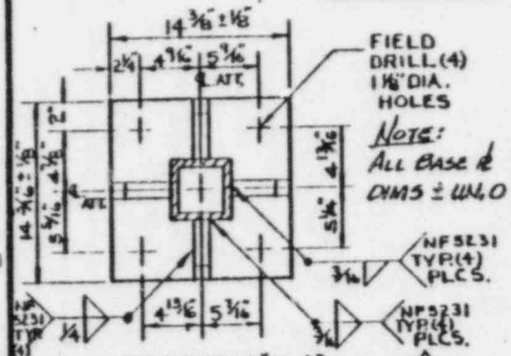
NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607

T.O. 21101

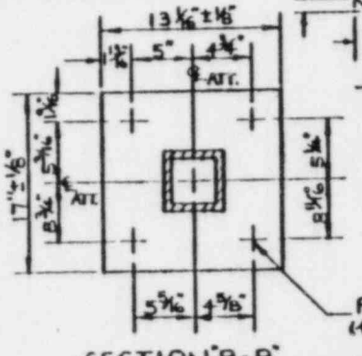
ELEVATION LOOKING WEST



DETAIL OF ITEM 13 (TYP.)



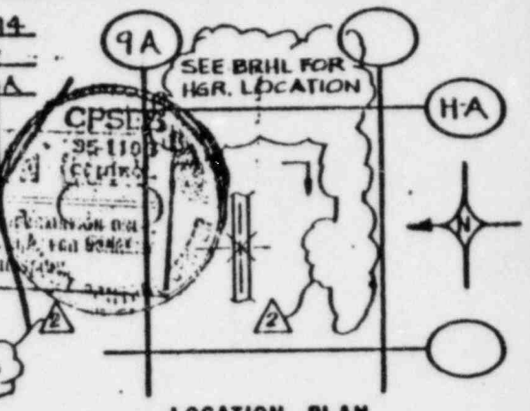
SECTION "A-A"



SECTION "B-B"

MVT'S	
"Z"	+.049
	-.082

PROB # AB-1-UC-R-0



LOCATION PLAN

ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	P&S	L	SS	PIPING	SEC	AISC
5	1	T.S. ¼" x 4" x 4" x 2'-9 ¾" LG. (A-500, GR.B)		X		X		
6	1	T.S. ¼" x 4" x 4" x 3'-8" LG. (A-500, GR.B) FIELD CUT TO SUIT		X		X		
7	2	T.S. ¼" x 4" x 4" x 1'-2 ½" LG. (A-500 GR.B)		X		X		
8	2	T.S. ¼" x 2" x 2" x 0'-6 11/16" LG. (A-500 GR.B)		X		X		
9	1	¾" THK. C.S. PLATE PER SECT. B-B (SA-515 GR.65 OR SA-36)	X			X		
10	1	¾" THK. C.S. PLATE PER SECT. A-A (SA-515 GR.65 OR SA-36)	X				X	
11	4	¾" Ø x 10" LG. HILTI KWIK CONCRETE ANCHORS			X			
12	4	1" Ø x 12" LG. HILTI KWIK CONCRETE ANCHORS			X			
13	4	½" THK. C.S. PLATE (SA-36 OR SA-515 GR.65) x 0'-3" WIDE x LENGTH TO BE FURNISHED BY FIELD	X				X	

REV	DESCRIPTION	DATE	DWN.	CHK'D.	APPVD.
2	VENDOR CERTIFICATION REF O/N # 39190	12/6/82	JF	KF	HH

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-49A

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LVL	SERVICE LVL	SERVICE LVL	PIPE MVTS INCHES
2122					
VERT.	-	-462	862	1192	991
N-S	-	96	1112	4965	5500
E-W	-			6564	
NOTE +N,E,UP -S,W,DN					

AUTHORIZED NUCL. INSP. YES ☒ NO ☐
ASME CODE CLASS 3

REF DWGS	STRESS ISO.	REV	MECHANICAL	REV	ELECTRICAL	REV
	MC-3231-36	A	MI-0701	6	EI-0703	6
2	BRHL ISO.	REV	STRUCTURAL	REV	H.V.A.C.	REV
2	CC-2-AB-03E	1	S-0735	2	MI-0757	4

CPSES 95-1103

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

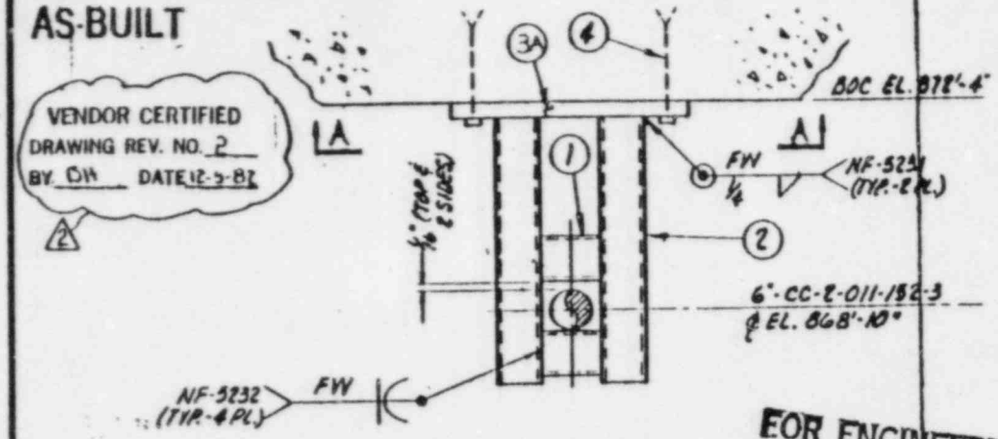
SUPPORT NO. CC-2-11-701-A63R
SHEET 1 OF 1 REV. 2

FOR ENGINEERING AND OFFICE USE ONLY

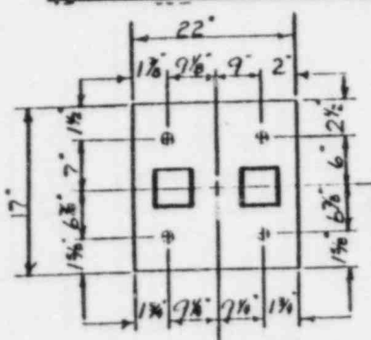
FOR ENGINEERING USE ONLY

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY GW DATE 12-3-87



ELEVATION LOOKING EAST



SECTION A-A

NOTES:
1. LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER DCA 7607

T.O. 21100

ITEM NO	QTY REQ'D	MATERIAL DESCRIPTION	P.S.I.	L	S	WELD	SEC.	I.S.I.
1	2	4"x4"x1/4"x6 3/4" TUBE A-500-GR B		X				
2	2	4"x4"x1/4"x1'-1" TUBE A-500-GR B		X				
3A	1	1/4" C.S.R. PER SECTION A-A (SA-36 OR SA-515 GR 60)	X			X		
4	4	1"x9" HILTI KWIK CONCRETE ANCHOR				X		

APPLY ONE COAT OF CARBO ZINC #11 TO ABOVE MATL EXCEPT THREADS WHICH SHALL BE TREATED WITH A RUST PREVENTATIVE.

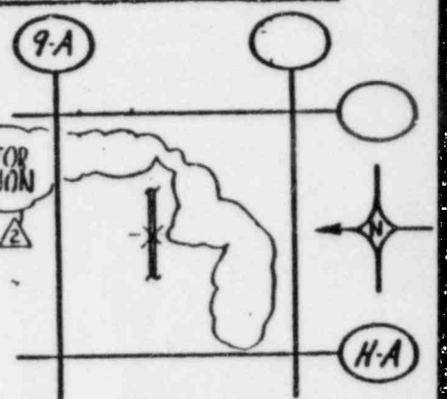
REV	DESCRIPTION	DATE	CHK'D.	APV'D.
2	VENDOR CERTIFICATION PER GTN# 39790	12/3/87		CBD

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

P.E. CERTIFICATION

SEE DRWG FOR HGR LOCATION

PROBLEM# AD-166C-RO



LOCATION PLAN

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	LEVEL B	LEVEL C	LEVEL D	PIPE NYTO INCHES
1124						
VERT.						
N-S						
E-W						

NOTE: +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES ☒ NO ☐
ASME CODE CLASS 3

REF DWGS

DRWG. NO.	REV	MECHANICAL	REV	ELECTRICAL	REV
CC-2-AB-032	1	MI-0701	6	EI-0703	6
FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C.	REV
CC-2-AB-032	1	S-0735	2	MI-0757	4

CPSES 35-1195

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT: T.U.S.I.
PLANT: COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-11-700-A63R
SHEET 1 OF 1 REV. 2

REV	DESCRIPTION	DATE	DWN	CHK'D	APV'D
0	I.F.C.	9-30-87	M.M./R.C.	H.M.	
1	REVISED PER CMC 45450 & 2	6-10-88	BT		
2	DLT EMS 1-16 PER CMC 47107 (SEE NOTE A)	12-3-87	GW		

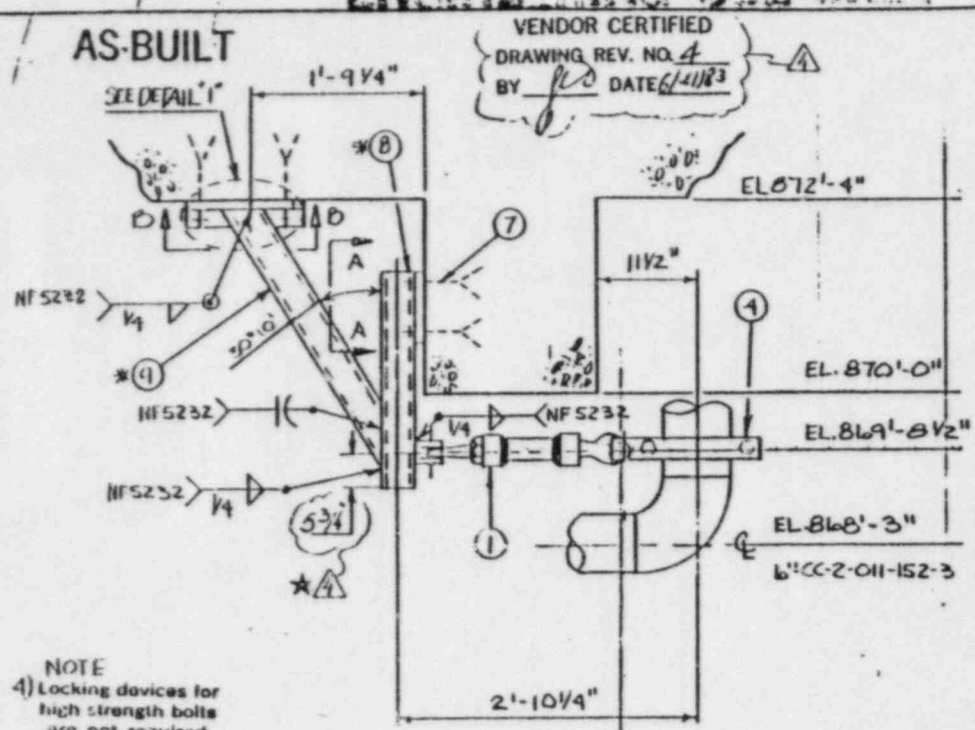
FOR OFFICE AND
ENGINEERING USE ONLY

FOR DATA AND

ENGINEERING ONLY

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 4
BY [illegible] DATE 6/21/83



NOTE
4) Locking devices for high strength bolts are not required per DCA 7607

CHANGE NOT MADE BY CMC

* FIELD TRIM TO SUIT

OBTUSE OR ACUTE ANGLE WELD NOT USED FOR ENGR. EVALUATION

REROUTE 2"-CH-X-40-152-S DUE TO INTERFERENCE

TO # 21101

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		P&S	L	CSS	PRIM.	SEC.
1	SRS-10-RO SWAY STRUT C-C = 1'-8 1/4"	1					X		
2	SPC-10-000 PIPE CLAMP SA36	1					X		
6	3/4" CS TP PER SECT. A-A SA36/SA515GR60	1			X			X	
7	3/4"Ø X 10" LG HILTI PVAT CLAMP PTFE ANCHORS	4							
8	T.S. 3/8" X 4" X 4" X 2'-8 1/2" LG A-500GR B	1				X	X	X	
9	T.S. 3/8" X 4" X 4" X 3'-0" LG A-500GR B	1				X	X	X	
10	3/4" CS. PP. PER SECT "B-B" SA36/SA515GR60	1			X			X	
11	3/4" CS TP PER DETAIL "4" SA36	1			X			X	
12	3/4" CS PP PER DETAIL "3" SA36	1			X			X	

FOR ENGINEERING & OFFICE USE ONLY

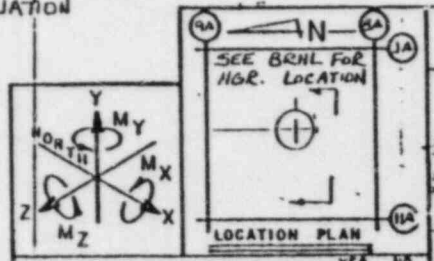
REV	DATE	DWN	CHK	APP	DESCRIPTION
4	6/21/83	FS	RGT	RW	ADDED SHT 2 AS BUILT VENDOR CERTIFICATION, REF: NCR 11-8043
3	5/26/83	FS	RGT	RW	REVD VENDOR CERTIFICATION
2	5/6/83	FS	RGT	RW	REF NCR-11-8043

MARK # CC-2-011-002-A63R
PAINT: CARBO ZINC # 11

ITEM NO.	MATERIALS & OPERATIONS	QUAN.	SHIP.		P&S	L	CSS	PRIM.	SEC.

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. ____ SHEET ____ OF ____

BRHL Iso. CC-2-AB-50-R-1
I.P.D. Iso. CC-2-AB-50-R-0
Data Point CALC/ANALYSIS
Pipe Mat'l. SA106GR.B
Insul. Y2 Bldg. A



THIRD PARTY INSPECTION YES NO
CODE CLASS: ASME III - 3

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

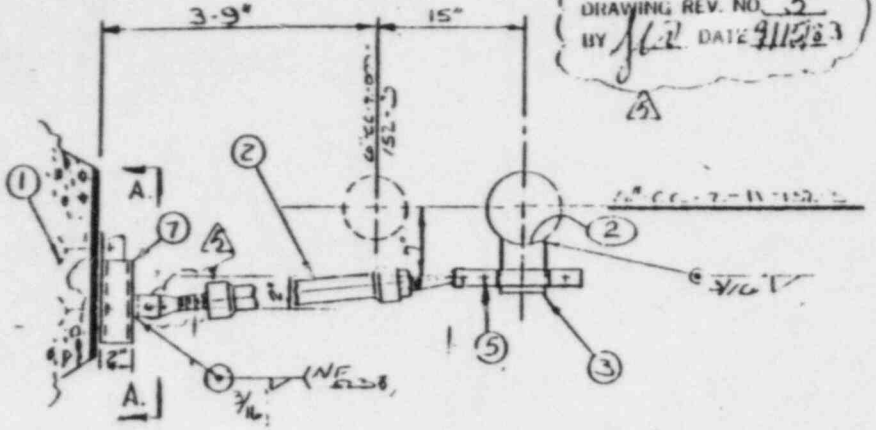
REF. DRAWING NUMBERS
PIPE: MI-0701-R7 ELECT: E10703-R5
STEEL: S-0735-R2 H.V.A.C.: MI-0757-R4

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN	—	—	—	—	—	—
NORMAL & UPSET	—	—	5093 -3069	—	—	—
EMERGENCY	—	—	5237 -3752	—	—	—
FAULTED	—	—	—	—	—	—

REV	DATE	DWN	CHK	APP	DESCRIPTION
0	6-5-81	JW	[illegible]	[illegible]	ISSUE FOR CONST. FW 1
1	[illegible]	ER	[illegible]	[illegible]	REV PER NPSI REV 0A
2	4-11-83	[illegible]	[illegible]	[illegible]	REV. PER PIBP #326.
3	5-26-83	[illegible]	[illegible]	[illegible]	REV AS NOTED PER F. CMC 10518 W/ LOCATION SEE NT #1 CONT. REROUTE

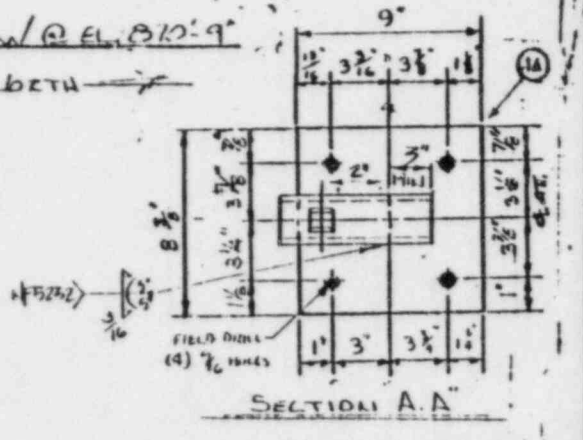
CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CC-2-011-002-A63R
SKETCH NO. ____
SHEET 1 OF 2 REV. 4

AS-BUILT



VENDOR CERTIFIED
DRAWING REV. NO. 5
BY [illegible] DATE 9/11/87

PLAN VIEW @ EL. 8'-9"



SECTION A.A"

NOTES:
4.) LOCKING DEVICES FOR HIGH STRENGTH BOLTS ARE NOT REQUIRED PER UCA 7187

ITEM NO.	NO REQ'D	PART CALLOUT	DESCRIPTION	MATERIAL	MIC. NO.	WT.	PBS	L	CSS	PRIM	SEC	AISC
1	4	[illegible]	COIL ANCHOR		—							
2	1	[illegible]	SWAY STRUT		678	20			X			
3	1	[illegible]	STANCHION	A106 GR B	D	9		X		X		
4	1	[illegible]	C9 PLATE	SA36	D	7	X			X		
5	1	[illegible]	PIPE CLAMP	SA36	D	7				X		
6	1	PIPE 2.0 DIA	ASME III PIPE									
7A	1	[illegible]	C3 PLATE	SA36			X			X		
7	1	[illegible]	PIPE SPOOL	A106 GR B								

SEISMIC ASSEMBLY SKETCH AND ENGINEERING BUNDLE AND TAG
MARK # CC-2-011-001-A63R

Apply Carbo-Zinc #11 to above mat'l except th'ds which shall be treated with a rust preventative

No Mat'l By Grinnell

REV	DATE	DWN	CHK	APP	DESCRIPTION
	~	~	~	~	ISSUE CERTIFICATED 9/11 S1110
1	7-1	MC	[illegible]	[illegible]	REV VENDOR CERTIFICATION. CERT CHK 9140de.
2	[illegible]	[illegible]	[illegible]	[illegible]	REV'D VENDOR CERT.

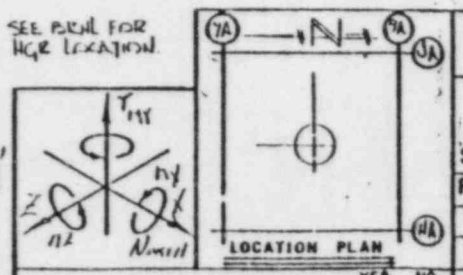
Approved By: C.F.C.
Date: 4-23-89

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. _____ SHEET _____ OF

FOR OFFICE AND ENGINEERING USE ONLY

PRNL Iso CC-2-AD-50 R.1
I.P.D. Iso. CC-2-BR-50 K.D
Data Point: [illegible]
Pipe Mat'l. SA106 GR.B
Insul. ½" Bldr. A

SEE PRNL FOR HGR LOCATION



THIRD PARTY INSPECTION YES ☒ NO ☐
CODE CLASS: ASME III-3

Brown & Root, Inc.

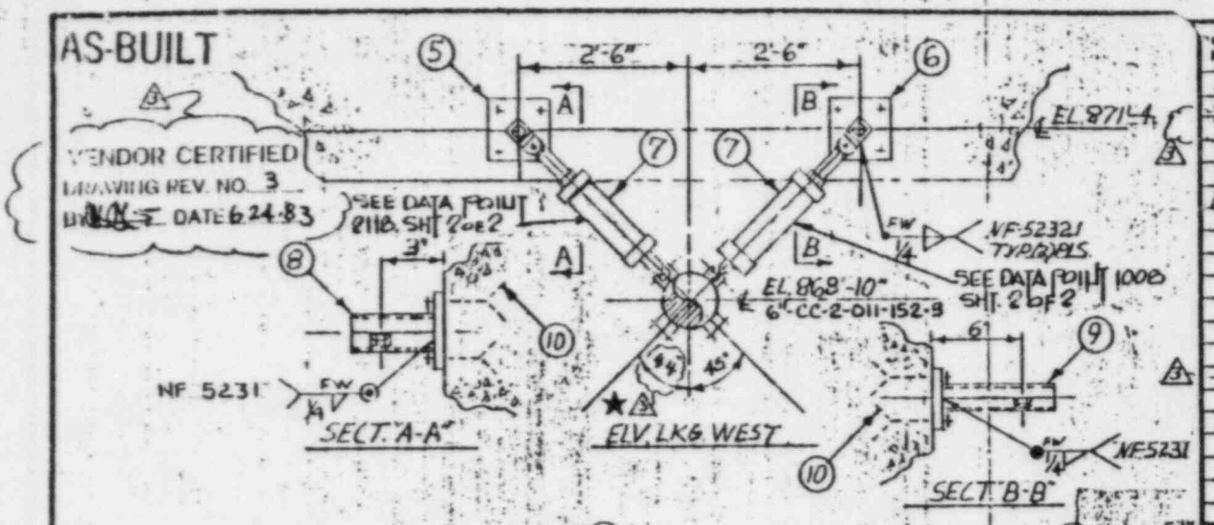
REF. DRAWING NUMBERS
PIPE: PP-010 1 - Rel 1 ELECT: E-010 3 L.S
STEEL: S-01 28 - Rel 2 H.V.A.C.: PP-015 7 R.

CONDITIONS	Fx	Fy	Fz	Mx	My	M
DESIGN						
NORMAL & UPSET	1386 -424					
EMERGENCY	[illegible]					
FAULTED						

F	REV	DATE	DWN	CHK	APP	DESCRIPTION
	2	6 5 87	JW			ISSUE FOR CONST FW 1-2
	1	2-22-88	R	M		REV AS R NIST REV CA
	2	[illegible]	[illegible]	[illegible]		REV AS U/DRL F: CPE-3101.2 PHER 2.6CB
	3	5-11-89	[illegible]	[illegible]		REV AS U/CPE-3101.2 R2 (SEE 1)(4) AS BUILT CHANGE

CUSTOMER Texas Utilities Service.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1 & 2
MARK NO. CC-2-011-001 A63R
SKETCH NO.
SHEET 1 OF 1 REV. 4

AS-BUILT



ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	P&S	ASS	SKTH
5	1	½" R. C.S. (SA-515 OR SA-36)	X		
6	1	½" R. C.S. (SA-515 OR SA-36)	X		
7	2	3x3-08 TYPE R.C.			
8	1	T.S. 3½"x3½"x½"x 2'-6" LG. A500-74A-GR.B			
9	1	T.S. 4"x2½"x¼"x 8½" LG. A500-74A-GR.B			
10	8	HILTI KWIK BOLTS ½"x5½"			

PAINT: CARBO ZINC 11

REV	DESCRIPTION	DATE	DWN.	CHK'D	APP'VD.
/3	VENDOR CERTIFICATION, REF. GIL 59790	7-7-83	JP	BC	[illegible]
com'l	ADDED SH 2. CMC 76965	~	~	~	~
/3	REV'D VENDOR CERT. REF. AIC.P.* M-8041	CMG	KM	TS	Q

FIELD DRILL (4) 11/16" ø HOLES
UP
WALL R. FACING WEST

FIELD DRILL (4) 11/16" ø HOLES
UP
WALL R. FACING WEST

NOTE:
1) Locking devices for high strength bolts are not required per DCA 7607

★ CHANGE NOT MADE BY CMC

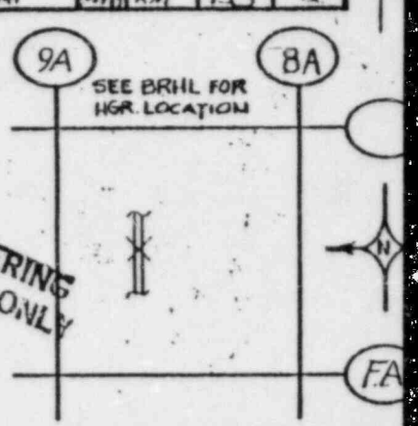
PROBLEM # AB-1-66C

T.02/101

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

P.E. CERTIFICATION

FOR ENGINEERING & OFFICE USE ONLY



LOCATION PLAN

DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL LIMITS A	B	C	D	PIPE MVTS (INCHES)
VERT.	SEE SHEET 2 OF 2					
N-S						
E-W						

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES [X] NO [ ]
ASME CODE CLASS 3

REF. DWGS		REV		REV		REV
	STRESS ISO. M2-3237-36	A	MECHANICAL MI-0701	6	ELECTRICAL E1-0703	6
	ISO. CC-2-AB-032	1	STRUCTURAL S-0735	2	H.V.A.C. MI-0757	4

CPSES 88-1188

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011-703-A63R
SHEET 1 OF 2 REV. 3

FOR OFFICE AND ENGINEERING USE ONLY

AS-BUILT

VERIFIED
DRAWING REV. NO. 3
BY WAM DATE 6-24-83

DATA PT.	SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
2118	DESIGN	SERVICE LEVEL LIMITS A	B	C	D		
VERT.		-197	225 / 323	313 / 805			
N-S		+215	-335 / 740	419 / 1231			
E-W							
NOTE +N,E,UP -S,W,DN	AUTHORIZED NUCL. INSP. YES ☒ NO ☐						
	ASME CODE CLASS 3						

DATA PT.	SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
1008	DESIGN	SERVICE LEVEL LIMITS A	B	C	D		
VERT.		-270	342 / 847	591 / 1176			
N-S		-270	-542 / 847	591 / 1176			
E-W							
NOTE +N,E,UP -S,W,DN	AUTHORIZED NUCL. INSP. YES ☒ NO ☐						
	ASME CODE CLASS 3						

MVT'S	
Z	+.104
	-.185

MVT'S	
Z	+.103
	-.184

FOR ENGINEERING & OFFICE USE ONLY

10" B10! -SR

DATA PT.	SUPPORT LOADS (lbs)						PIPE MVTS (INCHES)
	DESIGN	SERVICE LEVEL LIMITS A	B	C	D		
VERT.							
N-S							
E-W							
NOTE +N,E,UP -S,W,DN	AUTHORIZED NUCL. INSP. YES ☒ NO ☐						
	ASME CODE CLASS 3						

REF. DWGS.	STRESS ISO.	REV.	MECHANICAL	REV.	ELECTRICAL	REV.
	M2-3231-36	A				
	BRHI. ISO.	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
	CC-2-AB-032	1				

REV	DESCRIPTION	DATE	DWN.	CHKD.
4	VERIFICATION PER CCI 59190	6-24-83	JP	JSC
Comp.	CMC 76965	~	~	~
3	R/D Visual Certification per ISO #1	1-11-83	WM	RTS

CPSES 88-1186

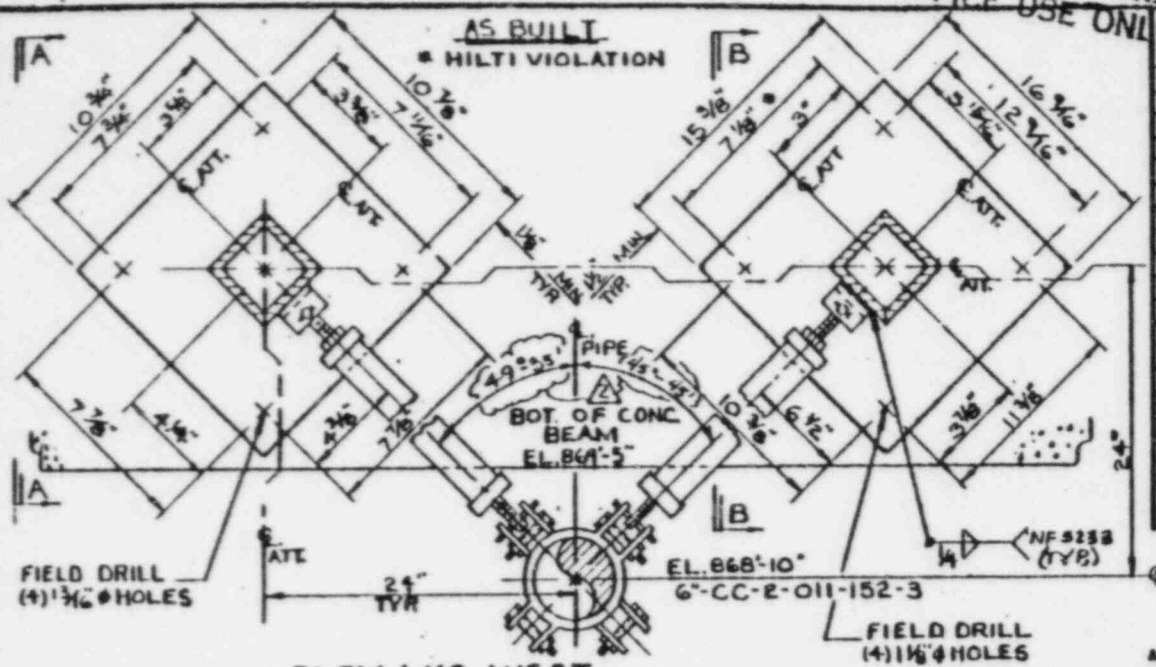
Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-011703-A63R
SHEET 2 OF 2 REV. 3

FOR CPSES AND

FOR ENGINEERING & OFFICE USE ONLY



ITEM NO.	QTY REQ'D	MATERIAL DESCRIPTION	POS	L	BOLTED	FIELD WELD	SHOP WELD	AISC
5	2	SRS-08-PC SWAY STRUT W/ SPC-08-060 PIPE CLAMP			X			
6	1	3/4" THK. C.S. PLATE (SA-36 OR SA-515 GR. 65)	X			X		
7	1	3/4" THK. C.S. PLATE (SA-36 OR SA-515 GR. 65)	X			X		
8	1	T.S. 3/8" x 4" x 4" x 0'-7" LG. (A-500 GR. B)		X	X		X	
9	1	T.S. 3/8" x 4" x 4" x 0'-11" LG. (A-500 GR. B)		X	X		X	
10	4	3/4" ϕ x 10" LG. HILTI KWIK CONCRETE ANCHORS			X			
11	4	1" ϕ x 9" LG. HILTI KWIK CONCRETE ANCHORS			X			

REV	DESCRIPTION	DATE	ENGR.	CHKD.	APPVD.
A	VENDOR CERTIFICATION, RE: GTH 59780 & CMC 76364 * ADDED SHT. 2 OF 2.	12/6/80	JE	Q	JRE

ASME CODE EDITION: 1974
ADDENDA: WINTER
DESIGN SPEC: MS-46A

R.E. CERTIFICATION

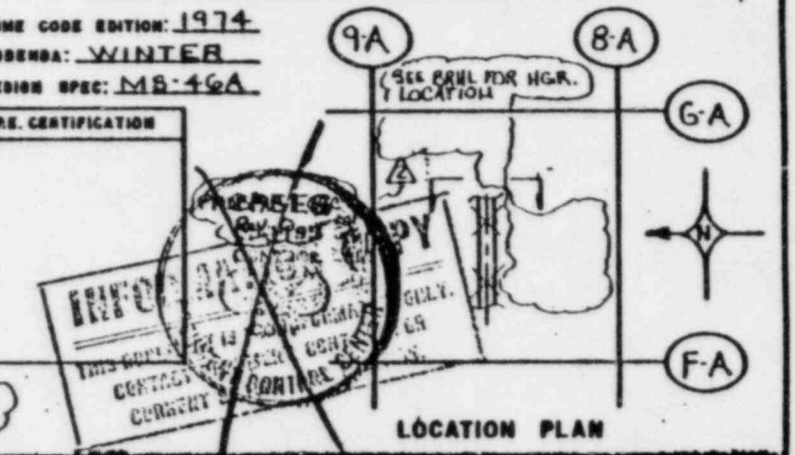
NOTES:
1) Locking devices for high strength bolts are not required per DCA 7607
2) ALL R. DIM ± 1/4" U.N.O.

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY BH DATE 12-6-80

SECTION A-A

SECTION B-B

T.O. 21101



DATA PT	SUPPORT LOADS (LBS) DESIGN	SERVICE LEVEL A	SERVICE LEVEL B	SERVICE LEVEL C	SERVICE LEVEL D	PIPE HYD. INCHES
VERT.						
X-X						
Z-Z						

NOTE: AUTHORIZED NUCL. INSP. YES [X] NO [ ]
ASME CODE CLASS 3

REF DWGS	DRILL ISO.	REV	MECHANICAL	REV	ELECTRICAL	REV
	CC-2-AB-032	0	ME-0701	6	EE-0703	6
	FAB. ISO.	REV	STRUCTURAL	REV	H.V.A.C.	REV
	CC-2-AB-032	1	S-0735	2	ME-0757	4

GPSES 35-1155

Brown & Root, Inc
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

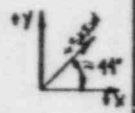
CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

SUPPORT NO. CC-2-11-104-A63R
SHEET 1 OF 2 REV. 2

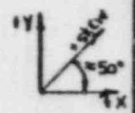
FOR OFFICE AND

AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY BH DATE 12-6-82

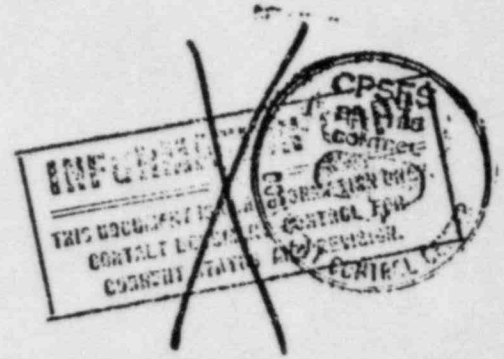


DATA PT.	SUPPORT LOADS (lbs)					MVTS	
	DESIGN	SERVICE LEVEL LIMITS					
		A	B	C	D		
1006						X	0
VERT.		-371	-630	-952	0		
		+335	+533	+776		Y	0
LI-S		-30	-695	-970	0		
		+335	+697	+1324		Z	+.123 -.219
E-W		0	0	0	0		



DATA PT.	SUPPORT LOADS (lbs)					MVTS	
	DESIGN	SERVICE LEVEL LIMITS					
		A	B	C	D		
2116						X	0
VERT.		-192	-327	-352	0		
		+225	+384	+1314		Y	0
LI-S				-30	0		
E-W		0	0	0	0	Z	+.125 -.219

FOR ENGINEERING & OFFICE USE ONLY



TQ# 21101

DATA PT.	SUPPORT LOADS (lbs) DESIGN	SERVICE LEVEL LIMITS A	B	C	D	PIPE MVTS (INCHES)
VERT.						
N-S						
E-W						

NOTE +N,E,UP -S,W,DN

AUTHORIZED NUCL. INSP. YES [X] NO [ ]
ASME CODE CLASS 3

REF. DWGS.

BRHL ISO.	REV.	MECHANICAL	REV.	ELECTRICAL	REV.
CC-2-AB-032	0	MI-0701	6	EI-0703	6
FAB. ISO.	REV.	STRUCTURAL	REV.	H.V.A.C.	REV.
CC-2-AB-032	1	S-0735	2	MI-0757	4

REV	DESCRIPTION	DATE	DWN.	CHKD.	APP'D
2 (last)	VENDOR CERTIFICATION, REF. GILBERT/COMMONWEALTH PO# 76964	12/6/82	TRI	Q	JAS

CPSES 88-1186

Brown & Root, Inc.
ENGINEERS AND CONSTRUCTORS
HOUSTON, TEXAS

CLIENT T.U.S.I.
PLANT COMANCHE PEAK
JOB NO. 2323

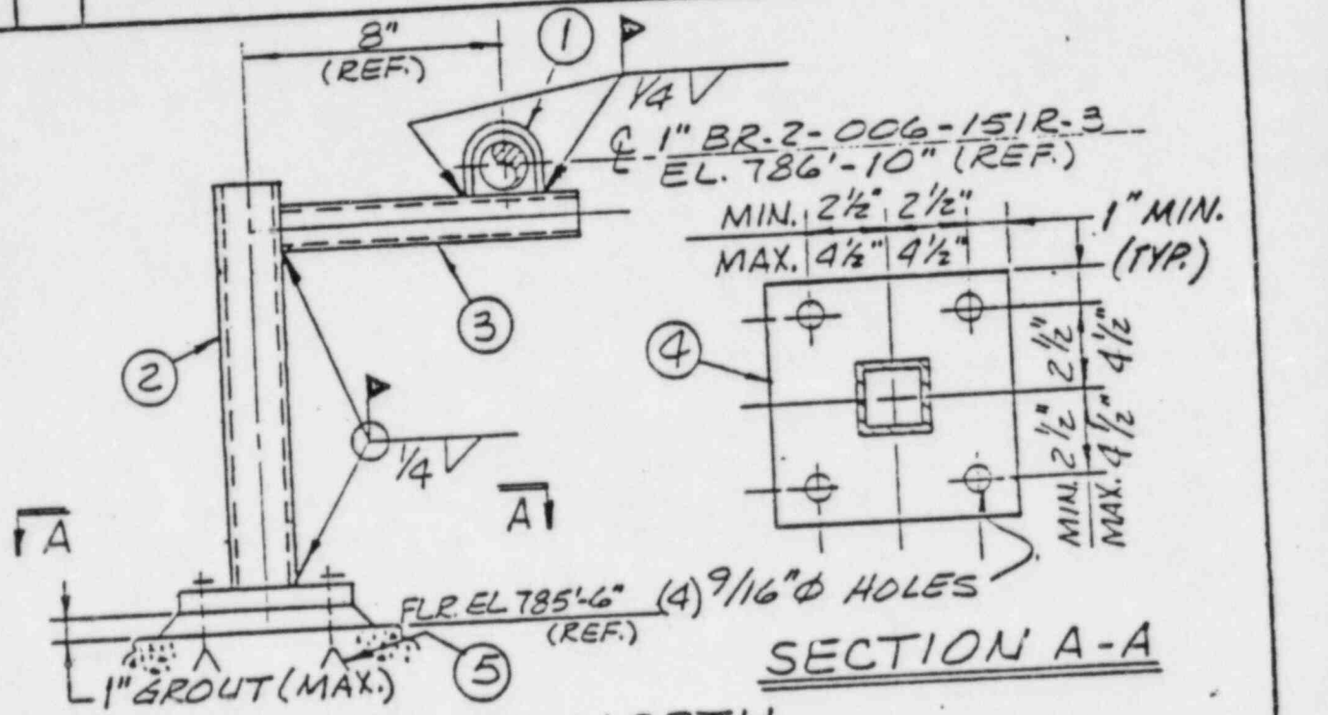
SUPPORT NO. CC-2-011-704-A63R
SHEET 2 OF 2 REV. 2

FOR OFFICE AND

ITEM NO.	QTY REQD	MATERIAL DESCRIPTION	MATERIAL DESIG.
1	1	WELDED U-GUIDE - PUG - 010	SA-36
2	1	TS. 3 x 3 x .250 x 1'-4½" LG. (CUT TO SUIT)	A500, GR.B
3	1	TS. 2 x 2 x .250 x 1'-1½" LG. (CUT TO SUIT)	A500, GR.B
4	1	PL 5¾" THK. (SEE SECTION A-A)	SA-36
5	4	½" x 9" HILTI-KWIK BOLT (5½" MIN. EMB.)	

'84

FOR OFFICE AND ENGINEERING USE ONLY



SECTION A-A

ELEVATION LKG NORTH

NOTE!
FOR GEN. NOTES, SEE CP-AA-001.

MAX. MVMTS. (IN.)
$\Delta x = -.11$
$\Delta y = .00$
Δz [illegible]

REV	DATE	DWN	CHKD	APPR	DESCRIPTION
0	11-16-83	E.C.	[illegible]	[illegible]	RELEASED FOR CONSTRUCTION

PROB.#	DATA PT.	DESIGN LOADS (LBS) SERVICE LEVEL LIMITS A	B	C	PIPE MVMT (INCHES)
—	—				
	VERT.	21	34	47	0
+N, E, UP	N-S	—	—	—	-.10
-S, W, DN	E-W	5	11	17	0

TEXAS UTILITIES SERVICES INC.
COMANCHE PEAK STEAM ELECTRIC STATION
PIPE SUPPORT ENGINEERING

DRAWING NO. H-BR-2-SB-001-009-3 | REV. 0 | SHT 1 OF 1

H'BR-2-SB-001-009-3

MATERIAL IDENTIFICATION FOR

	Mat'l Spec	Material Description	Quantity	Heat/ID Number	Salvaged Hanger (where applicable)	QC Verification Init. & Date	Notes
#1	SA-36	U-Guide AU6-010	1				
50 #2	A500GRB	T.S. 3"x3"x1/4"x1'-4 1/2"	1	W73541		9 JKnuth 6-6-84	
50 #3	A500GRB	T.S. 2"x2"x1/4"x1'-1 1/2"	1	Y52430		9 JKnuth 6-6-84	
9 55 #A	SA-36	R 3/4" x 10 1/4" x 9"	1	H30882	N/A	9 JKnuth 6-6-84	

QTQ-652

ATTACHMENT D

TEXAS UTILITIES GENERATING COMPANY

OFFICE MEMORANDUM

To Distribution

Dallas, Texas March 9, 1984

Subject Resolution of QAI-0001

'84 AGO 15 P12:15

The Quality Assurance Investigation listed above has been resolved to the satisfaction of the Manager, Quality Assurance. No further action is necessary at this time. Please contact the undersigned at 214-979-8890 if there are any questions on this matter.

Thank you.

Jerry C. Walker

Jerry C. Walker

JCW:ln

Distribution: D. N. Chapman/QE File
D. L. Andrews/Corporate Security
Boyce Grier/CPSES QA
Initiator (A. Vega)

CONFIDENTIAL

TEXAS UTILITIES GENERATING COMPANY

OFFICE MEMORANDUM

To A. Vega Glen Rose, Texas February 22, 1984

Subject Investigation of Allegations
QAI #0001

In response to your request of 12/20/83 I have investigated the allegations forwarded with QAI #0001. This is the report of my findings.

I interviewed the alleger, [redacted], at his home to obtain additional information on the matters alleged in his letter to Doug Frankum. A copy of this letter is attached (Attachment A). My report of the interview is contained in Attachment B. During the interview I was given additional allegations as indicated in the interview report. These additional matters have also been investigated where practicable.

In the investigation, I interviewed two persons named by [redacted] in his allegations--a QC inspector, [redacted], and a General Foreman, [redacted]. My reports of these interviews are contained in Attachment C and Attachment D. I also reviewed various procedures, records and documentation as appropriate. I have summarized the results of these activities and have developed my evaluation and conclusion for each allegation. These are discussed below.

1. Improper Marking of Hilti Bolts

The information regarding improper marking of Hilti bolts provided by [redacted] in the interview was essentially the same as that contained in his letter to Frankum. It should be noted that [redacted] had no first hand knowledge of this matter but was reporting what he was told. I interviewed [redacted] the QC inspector named by [redacted] as having received the star stamp found by the laborer, and she told me essentially the same story. She did state that the star stamp found and given to her was different from that used by QC to mark Super Hilti's and she felt if the stamp had been used the different marking would have been noticed on the Hilti. She had never noticed any evidence that the stamp was used by the craft. I interviewed [redacted], the General Foreman named by [redacted] who knew that a star stamp had been found and turned in to QC but he had not seen the stamp. [redacted] stated that he had no knowledge of the star stamp being used by craft personnel under his supervision.

The allegation of a star stamp being found and turned in to QC was confirmed. The allegation of it being used for improper marking of Hilti bolts was not confirmed.

2. Improper Welding

Based on additional information provided by [redacted] during the interview, I visited the area and identified the pipe support in question to be

BR-X-056-726-A53A. A copy of the as-built drawing for this support is attached (Attachment D). I reviewed the weld records for the saddle weld in question and found everything in order. This information was reviewed during my interview with [redacted] It should be noted that the welding procedure specified in this case was WPS-18010 which provides for using "heliarc" procedure for the root and hot pass. After these first two passes it is optional whether "heliarc" or "stick" welding is used to complete the weld. Thus completing the entire weld in question using "heliarc" procedure as alleged by [redacted] is not improper. This is what was done according to the welding records. The records show the welding was done by [redacted] There is no indication of any involvement by a welder named [redacted]

The allegation that the saddle for the pipe hanger in question was welded by heliarc procedure was confirmed and the procedure used was found to be proper. The allegation that the weld was improperly made by [redacted] was not confirmed.

3. Oversize Holes for Hilti Bolts

During the interview [redacted] made an allegation regarding an oversize hole (1½") being drilled in the floor for a 1¼" Hilti bolt in a hanger base plate. Based on information provided I visited the area and identified the support in question as CC-2-070-002-A33R. A copy of the as-built drawing for this support is attached (Attachment F). There is nothing in the documentation package for this pipe support to indicate a requirement for or the approval of an oversize hole. I reviewed the reports of the QC inspections for the Hilti installation for this support. These are contained in the following:

IRMH-19682, dated 7/1/81
IRMH-53200, dated 2/15/83
IRMH-53257, dated 2/22/83

These reports do not indicate any nonconforming or unsatisfactory conditions. [redacted] stated during his interview that he had no knowledge of oversize holes ever being drilled for Hilti bolts.

I made inquiry of pipe support engineering (Jay Ryan) as to whether an oversize hole for a Hilti bolt in the support in question would be of concern. I was told that it would not be a problem.

The allegation that an oversize hole had been drilled for a Hilti bolt could neither be confirmed or dismissed. It appears that physical inspection of the holes for the support in question would be the only way to resolve this matter. In view of the response from Engineering regarding the significance of this matter, it does not appear necessary to pursue the matter further.

4. Torqueing of Hilti Bolts in Ceiling

It is my understanding that the allegation regarding QC inspectors relying on craft personnel to check the torqueing of Hilti bolts in places where access is limited has been investigated previously. This matter has been discussed in the Licensing Hearings before the ASLB and is recorded in the transcript for September 14, 1982, on pages 4537-4539 (Attachment G). In view of this, no further investigation of this matter was made.

5. Damaged Threads on 1/2" Hilti Bolt

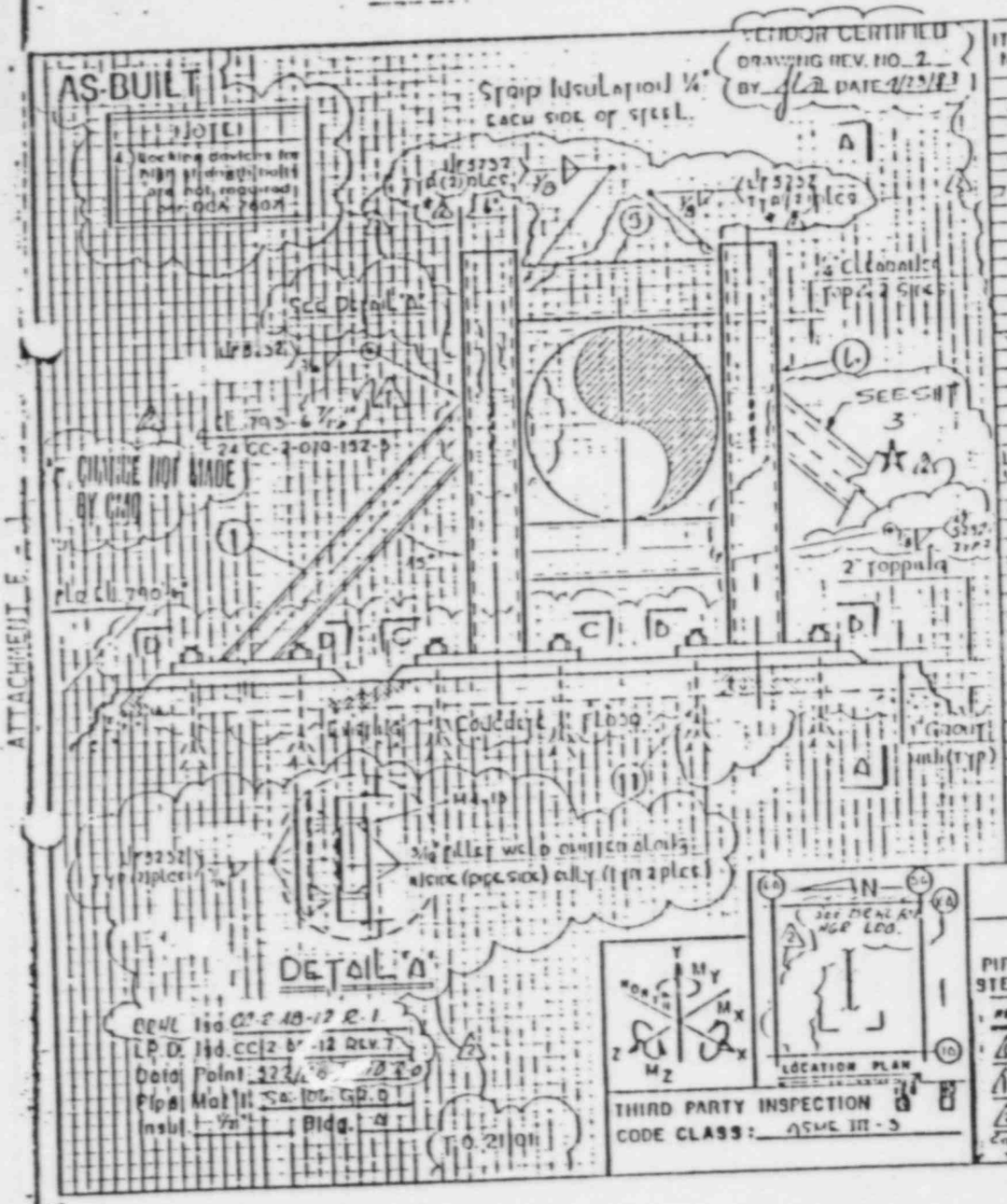
[redacted] did not provide sufficient information on the location of this problem to enable the matter to be investigated. Since it was described as an isolated case, it does not appear that further action is warranted at this time to resolve safety concerns. Of more concern is the alleged deliberate act for fraudulent purposes.

If you have questions or comments regarding any of the above matters or if you wish me to pursue anything further, please let me know.

Boyce H. Grier

BHG/bll
Attachments: A - Letter to Frankum from [redacted]
B - Interview with [redacted]
C - Interview with [redacted]
D - Interview with [redacted]
E - Drawing BR-X-056-728-A33A
F - Drawing CC-2-070-002-A33R
G - Hearing Transcript pp. 4537-4539

cc: D. N. Chapman
D. L. Andrews
R. G. Tolson



ITEM NO	MATERIALS & OPERATIONS	QUAN	SHIP
1		1	
2		2	
3		2	
4		2	
5		10	
6			
7			
8			
9			
10			
11		1	
12		4	
13			

FOR OFFICE AND ENGINEERING USE ONLY

MARK NO. CC-2-070-002-0554
PAINT: CARBO ZINC II

	QUAN	SHIP

PASS | L | CSS | MTR | SEC | AISC

FOR MATERIALS AND OPERATIONS SEE SKETCH NO. SHEET OF

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: MI-0104 REV 11
STEEL: S-0100 REV 11
ELECT: 2323M-01-
H.V.A.C.: [illegible]

REV	DATE	DWN	CHK	APP
3			R.	
2				
1				
0				

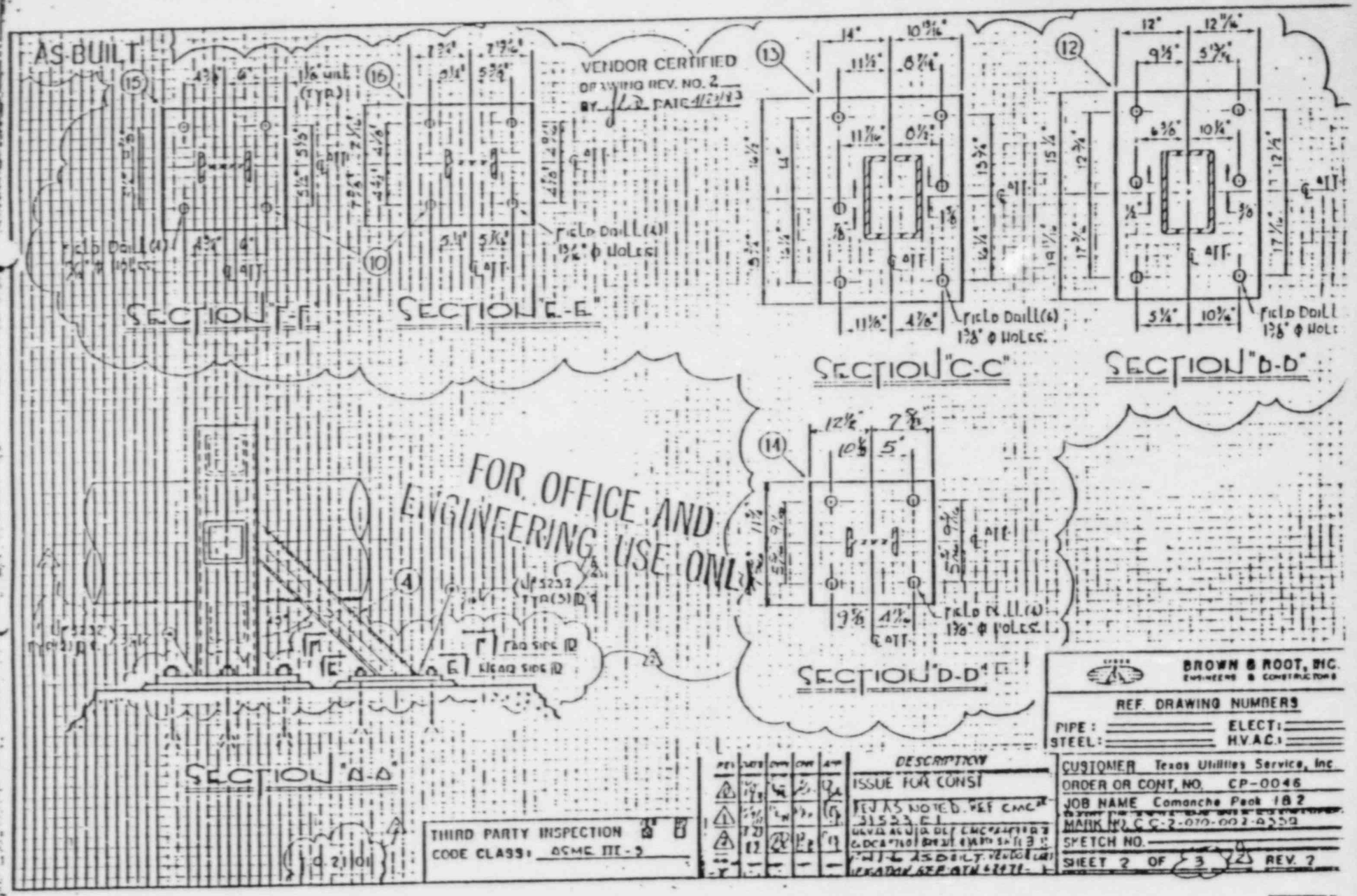
DESCRIPTION
ISSUE FOR CONST
REV. AS NOTED REF CMC
31533.56

CONDITIONS	Fx	Fy	Fz	Mx	My	Mz
DESIGN						
NORMAL OPER.						
EMERGENCY						
FAULTED						

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 1&2
MARK NO. CC-2-070-002-0554
SKETCH NO.
SHEET 1 OF 3 REV. 2

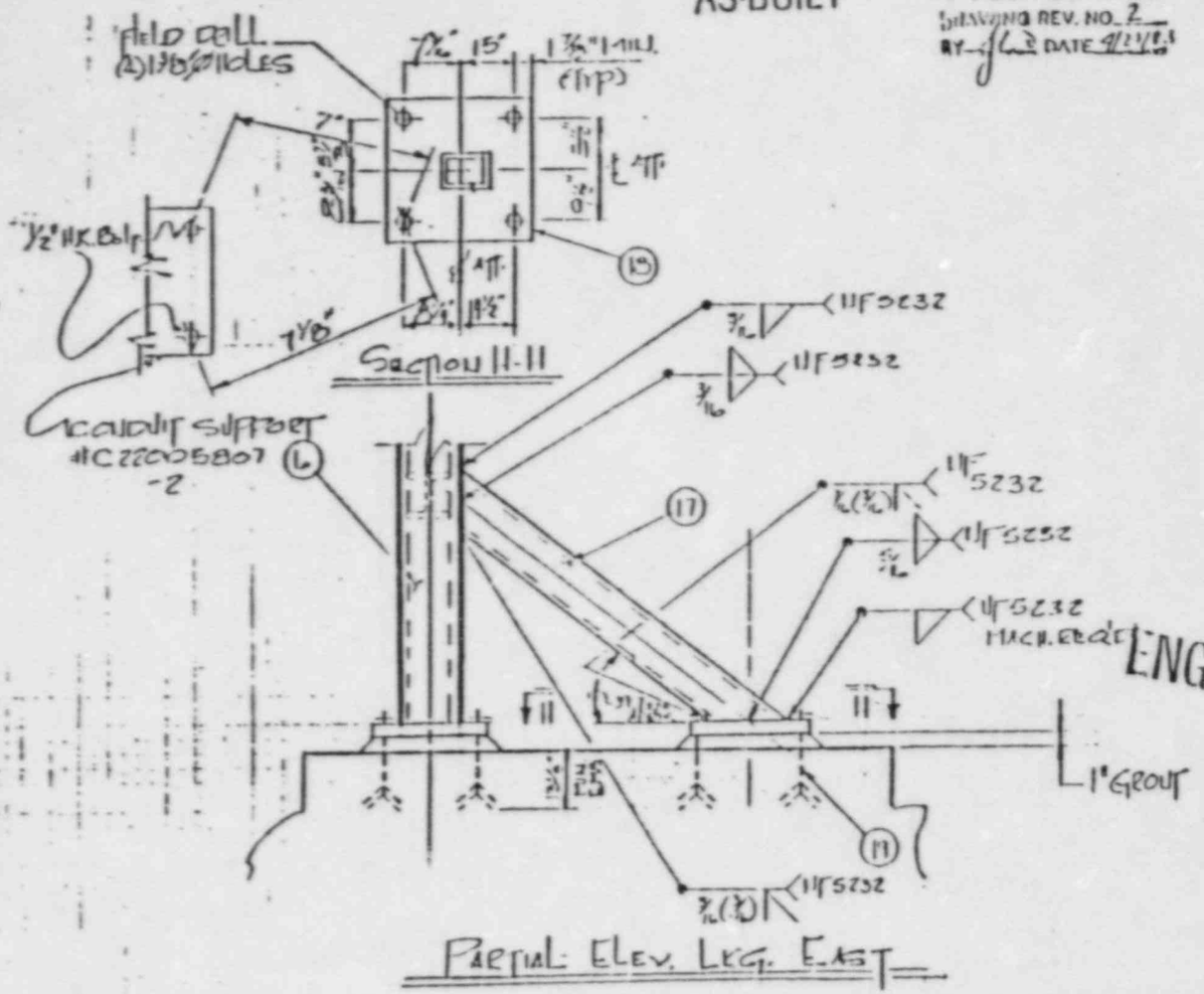
ATTACHMENT F - 2

AS-BUILT



AS-BUILT

VENDOR CERTIFIED
DRAWING REV. NO. 2
BY JLS DATE 9/23/85



FOR OFFICE AND ENGINEERING USE ONLY

Partial Elev. Lkg. East

ATTACHMENT F - 3

J.O. 21101

THIRD PARTY INSPECTION
CODE CLASS: ASME III-3

REV	DATE	DWN	CHK	APP	DESCRIPTION
2					

BROWN & ROOT, INC.
ENGINEERS & CONSTRUCTORS

REF. DRAWING NUMBERS
PIPE: ELECT:
STEEL: H.V.A.C.:

CUSTOMER Texas Utilities Service, Inc.
ORDER OR CONT. NO. CP-0046
JOB NAME Comanche Peak 182
MARK NO. CC-2-010-002-ASSA
SKETCH NO.
SHEET 3 OF 3 REV. 2

ATTACHMENT E

TEXAS UTILITIES SERVICES INC.		REV.	ISSUE DATE	PAGE
ENGINEERING GUIDELINE TITLE	COVER SHEET FOR GUIDELINE REVISIONS	0	1-8-82	1 OF 1
SECTION V HILTI CONCRETE ANCHOR BOLTS		APPROVED: John C. Finneran, Jr. PSE PROJ ENGR.		

I. INSTRUCTIONS FOR FILING GUIDELINE PAGES

1. Remove Section V in it's entirety from the engineering manual and replace with the enclosed pages 1 thru 10.

2. Place this cover sheet directly in front of page 1, Rev. 4.

II. STATUS OF GUIDELINE PAGES

PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV	PAGE	REV
1	4	8	3								
2	5	9	3								
3	3	10	2								
4	3										
5	3										
6	4										
7	3										

SECTION V

FIGURE 6

TEXAS UTILITIES SERVICES INC.
Agent For
DALLAS POWER & LIGHT COMPANY
TEXAS ELECTRIC SERVICE COMPANY
COMANCHE PEAK S.E.S.

ALLOWABLE LOADS FOR HILTI KWIK AND SUPER HILTI KWIK BOLTS USING 4000 PSI CONCRETE, 5:1 SAFETY FACTOR, A.A. HANKS TESTING LAB REPORT NO. 873R AND HILTI LETTER DATED OCT. 27, 1980 & CPPA-7419 COVER LETTER

HILTIS

BOLT DIA	EMB LENGTH	TENSION	SHEAR
1/2"	2¼"	1102	1663
	2¾"	1440	↓
	3½"	1890	↓
	4½"	2245	2046
	5½"	2410	↓
	6"	2460	↓
5/8"	2¾"	1320	2312
	3½"	1820	↓
	4½"	2400	↓
	5½"	2860	3087
	6½"	3200	↓
	7½"	3400	↓
¾"	3¼"	2030	3427
	4"	2680	↓
	5"	3300	↓
	6"	3600	3693
	7"	4200	↓
	8"	4600	↓
	9"	4700	↓
1"	4½"	3200	5375
	5"	3780	↓
	6"	4688	↓
	7"	↓	
	8"		6898
	9"		↓
	10"	↓	↓
1¼"	5½"	4600	7136
	6½"	5420	↓
	7½"	6220	↓
	8½"	6920	↓
	9½"	7560	↓
	10½"	8180	↓

SUPER HILTIS

BOLT DIA.	EMB. LENGTH	TENSION	SHEAR
½"	3¼"	1997	2288
	4¼"	2956	↓
	5¼"	2956	↓
	6¼"	3029	↓
1"	6½"	6993	5507
	8½"	9951	↓
	10½"	9951	↓
1¼"	8⅛"	8540	8296
	10⅝"	10736	↓
	13⅛"	12984	↓

ATTACHMENT F

TEXAS UTILITIES GENERATING COMPANY
P. O. BOX 1002 · GLEN ROSE, TEXAS 76043

April 19, 1984

CYGNA	
JOB NO:	84042
DATE LOGGED:	5/14/84
LOG NO.:	#9
FILE:	2.1.1 Inc. CR
CROSS REF. FILE	2.1 Inc. Corr Log

Cygna Energy Services
101 California Street
Suite 1000
San Francisco, California 94111

Attention: Ms. Nancy Williams
Project Manager

COMANCHE PEAK STEAM ELECTRIC STATION

Gentlemen:

In response to your handwritten questions provided to TUGCO on March 16, 19, 20, 21 and 22, enclosed is a copy of the questions followed by TUGCO's response. Several questions are still under review and will be answered shortly. In addition, questions asked via telephone to Dave Rencher on March 30, 1984, are presently being reviewed and responses will be forwarded by April 27th.

If there are any further questions or comments, please contact me or George Grace (Site Ext. 500).

Very truly yours,

TEXAS UTILITIES GENERATING COMPANY
ENGINEERING DIVISION

L. M. Popplewell
Project Engineering Manager

LMP/cp

Distribution
NH Williams
J. C. Minichiello
L. Weigart
C. Wang
M. Shulman
84042 Project File (T. Acuna)

working range (generally near mid-travel); a minimum ¼" travel exists beyond working range limits to reach a fully extended or retracted position. For most springs, more than ¼" is available. This is sufficient to account for the small seismic displacements. For box frames, the seismic movements for the supports listed were checked against the designs. In all cases, adequate clearance existed to allow combined thermal and seismic displacements.

CYGNA COMMENT:

3. In reviewing certain MS supports, CYGNA has noted instances where beams with small gaps are used to provide stability, instead of tightening U-bolts (supports MS-1-004-003-S72R, for example). In these cases, no analysis is done on the "stability bumpers." CYGNA has performed calculations which show that the load on these "supports" could be quite high, assuming one accepts the instability of this structure during dynamic loading. Has TUSI used this design for any supports with static compressive loads? Also, where is the documentation for the integrity of this support arrangement in general?

TUGCO RESPONSE:

3. The "bumpers" supplied on MS-1-004-003-S72R (in lieu of a snug U-bolt) for stability are designed to take an oscillating, momentary load (for a system at 20Hz, the applied load onto the bumpers will act less than 0.05 seconds). Hence, the nature of the cyclic load assures stability in that there is not sufficient time for a constant applied force to push the bumpers back and allow the pipe to lift up. The calculations which consider a static upward load are therefore erroneous. The stress in the bumper steel stays within its elastic limit under the impact load and hence will return to its original position when the load reverses and pushes down. This design has not been used on any supports which would experience a static compressive load. Structural acceptability of the bumpers is based on the momentary load of less than 0.05 second duration. Size of the members, welds, were judged adequate by inspection.

March 21, 1984

CYGNA COMMENT:

1. In reviewing MS-1-004-001-C72S, CYGNA had the following questions:

   a) There appears to be a 7/16" flare bevel weld between items 15 and 22. This does not seem possible due to Item 34. Does TUSI have documentation conforming the size and configuration of this weld? Likewise, the weld (5/16") between 26 and 15?

b) The model uses a fixed point at the embed plates (3, 6, 12, 15 joints). Spec. 2323-SS-30, Rev. 1, requires these to be treated as pin joints, unless the embedment is stiffened. Where is the stiffener in this calc, and has structural accepted this configuration?

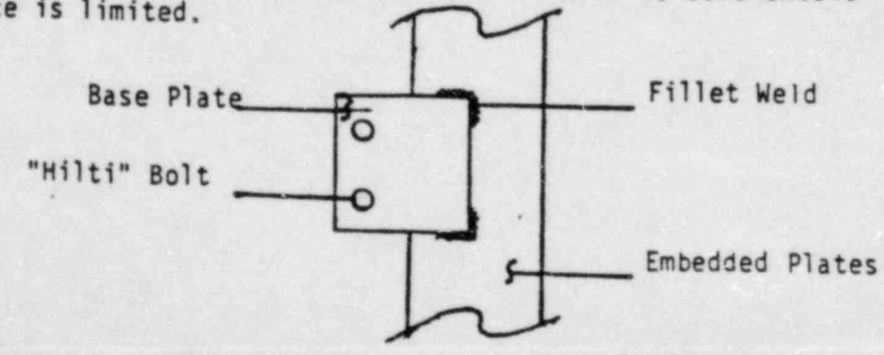
c) Per ASME Appendix XVII, Para. 2442, shear loads on connections with both welds and bolts must be taken by the welds alone. Item 16 is attached to Beam #21 with both welds and Hilti's. The weld sizing calculations done use the bolts to share the shear load. What is TUSI's standard practice in this type of connection? Is this weld acceptable?

d) The weight of the constant support itself is not included in the support design load for the frame. A #53 constant weighs - 600 lb, or 5% of the design load.

What is TUSI's standard practice for spring anchorage design?

TUGCO RESPONSE:

1. (a) In the NPSI original design, ½" wall tube steel was used and the 7/16" flare bevel weld was possible. Modifications made at the site changed most of the steel members to 3/8" wall tube. The weld between items 15 and 22 is a flare bevel weld such that the groove is filled and ground flush to facilitate installation of Item 34. CYGNA is correct in their observation that a 7/16" flare bevel weld does not exist, the size was inadvertantly not removed during the revision process. The stiffening effect of Item 34 on this joint assures structural acceptability. The 5/16" flare bevel weld between items 26 and 15 is an acceptable weld since the tube steel thickness is 3/8" (greater than 5/16"). Documentation confirming the size of these welds is on file with QC in their inspection package. (b) See comments dated 3/22, response 1. (c) (Editorial: Items 15 and 19 are connected to beam 21, not item 16.) The connection to the beam via embedded plate (i.e., by welding) and via baseplate (i.e., by bolting) is at separate locations. As such, each is capable of resisting shear. It should be noted that Hilti joints are designed using bolt shear allowables based on ultimate test loads divided by 5. This is not the standard engineering approach to design a bearing or friction joint using code allowables for the bearing or friction condition. Using our design approach, the Hilti joints, since they are pre-torqued, would perform as a friction joint within their working loads. At ultimate loads all joints (bearing or friction) would act as bearing joints (i.e., slip would occur in the friction connection). (Following comments, in response to CYGNA's comment on TUSI's standard practice are provided here for information only). Connections of the type shown below have been used to some extent where space is limited.



UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY AND LICENSING BOARD

In the Matter of	}{	
	}{	
TEXAS UTILITIES ELECTRIC	}{	Docket Nos. 50-445-1
COMPANY, et al.	}{	and 50-446-1
(Comanche Peak Steam Electric	}{	
Station, Units 1 and 2)	}{	

CERTIFICATE OF SERVICE

By my signature below, I hereby certify that true and correct copies of CASE's 8/13/84 Answer to Applicants' Motion for Summary Disposition Regarding the Effects of Gaps on Structural Behavior Under Seismic Loading Conditions

have been sent to the names listed below this 13th day of August, 1984, by: Express Mail where indicated by * and First Class Mail elsewhere.

* Administrative Judge Peter B. Bloch
U. S. Nuclear Regulatory Commission
4350 East/West Highway, 4th Floor
Bethesda, Maryland 20814

* Ms. Ellen Ginsberg, Law Clerk
U. S. Nuclear Regulatory Commission
4350 East/West Highway, 4th Floor
Bethesda, Maryland 20814

* Dr. Kenneth A. McCollom, Dean
Division of Engineering,
Architecture and Technology
Oklahoma State University
Stillwater, Oklahoma 74074

* Dr. Walter H. Jordan
881 W. Outer Drive
Oak Ridge, Tennessee 37830

* Nicholas S. Reynolds, Esq.
Bishop, Liberman, Cook, Purcell
& Reynolds
1200 - 17th St., N. W.
Washington, D.C. 20036

* Geary S. Mizuno, Esq.
Office of Executive Legal
Director
U. S. Nuclear Regulatory
Commission
Maryland National Bank Bldg.
- Room 10105
7735 Old Georgetown Road
Bethesda, Maryland 20814

Chairman, Atomic Safety and Licensing
Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Chairman
Atomic Safety and Licensing Appeal
Board Panel
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

John Collins
Regional Administrator, Region IV
U. S. Nuclear Regulatory Commission
611 Ryan Plaza Dr., Suite 1000
Arlington, Texas 76011

Lanny A. Sinkin
114 W. 7th, Suite 220
Austin, Texas 78701

Dr. David H. Boltz
2012 S. Polk
Dallas, Texas 75224

Michael D. Spence, President
Texas Utilities Generating Company
Skyway Tower
400 North Olive St., L.B. 81
Dallas, Texas 75201

Docketing and Service Section
(3 copies)
Office of the Secretary
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Renea Hicks, Esq.
Assistant Attorney General
Environmental Protection Division
Supreme Court Building
Austin, Texas 78711

Juanita Ellis

(Mrs.) Juanita Ellis, President
CASE (Citizens Association for Sound Energy)
1426 S. Polk
Dallas, Texas 75224
214/946-9446