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October 24, 1985
ST-HL-AE-1436
File No.: G9.17

Mr. George W. Knighton, Chief
Licensing Branch No. 3
Division of Licensing
U. S. Nuclear Regulatory Commission
Washington, DC 20555

South Texas Project
Units 1 and 2
Docket Nos. STN 50-498, STN 50-499
Responses to DSER/FSAR Items
Regarding Pipe Break Analysis

Dear Mr. Knighton:

The discussion below provides STP's response to Draft Safety Evaluation Report (DSER) or Final Safety Analysis Report (FSAR) items.

The item number discussed below corresponds to those assigned on STP's internal list of items for completion which includes open and confirmatory DSER items, STP FSAR open items and open NRC questions. This list was given to your Mr. N. Prasad Kadambi on October 8, 1985 by our Mr. M. E. Powell.

Concerning DSER Item Number 3.6-1, "More Information and Clarification are required in the criteria used for selecting postulated break locations and break types in ASME Class 1, 2 and 3 Piping - Associated with Q210.20 (3.6.2)", Amendment 50 to the STP FSAR (ST-HL-AE-1318, 8/19/85) and Meeting Notes for the NRC MEB Audit Question Review portion (ST-HL-AE-1296, 7/1/85) provided the needed information. As stated in ST-HL-AE-1296, no open item regarding pipe break analysis remained, and only one confirmatory item remained. As follow up to that item, specific initial stress summaries, break types and locations were provided via letter ST-HL-AE-1389, dated 10/14/85 and will be incorporated in a future FSAR amendment.

Further clarification concerning break exclusion zone criteria, which is pertinent to DSER item 3.6-1, are contained in the attached markups of FSAR pages which will be incorporated in a future FSAR amendment. The Additional revisions enclosed reflect the elimination of arbitrary intermediate breaks (AIB's) including the feedwater system AIB's.

L1/DSER/ar

B001
1/1

If you should have any questions concerning this matter, please contact Mr. Powell at (713) 993-1328.

Very truly yours,

M. R. Wisenburg
Manager, Nuclear Licensing

CAA/bl

Attachments: FSAR mark-ups for Sections 6.6.8, 3.6, Q210.19N, Q210.33N and Q210.34N

L1/DSER/ar

cc:

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Revised 9/25/85

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Attachment 1

This Attachment includes:

<u>Break Exclusion Clarifications</u>:

- o pg. 6.6-3
- o pg. 3.6-11
- o pg. 3-6-12 (Insert #1b and #5)
- o pg. 3-6-21 (Insert #3)
- o pg. Q&R 3.6-21N (Q210.33N)
- o pg. Q&R 3.6-24N (Q210.34N)

<u>AIB Deletions</u>:

- o pg. 3.6-9
- o pg. 3.6-10
- o Tbl. 3-6.2-1 sh. 1A thru 1D, 2A thru 2D
- o Fig. 3.6.1-1 sh. 1A thru 1D, 2A thru 2D
- o pg. Q&R 3.6-7N (Q210.19N)

<u>Editorial</u>: Delete Figures 3.6-4 thru 3.6-13.

L1/DSER/ar

6.6.6 Evaluation of Examination Results

Articles IWC-3000 and IWD-3000 of the 1977 edition of Section XI with addenda through the summer of 1979, concerning evaluation of examination results for Class 2 and 3 components, have not been prepared. These articles will be replaced in this section with Article IWB-3000 as required. 24

The evaluation of examination results for Class 2 and 3 components will be performed in accordance with Articles IWA-3000 and IWB-3000 of Section XI.

Repairs of unacceptable indications will be in accordance with the requirements of Articles IWC-4000 and IWD-4000. Replacements of components containing unacceptable indications will be in accordance with IWC-7000 and IWD-7000. 31

6.6.7 System Pressure Tests 24

Class 2 systems subject to hydrostatic tests will be tested in accordance with Articles IWA-5000 and IWC-5000 of Section XI. Class 3 systems subject to hydrostatic tests will be tested in accordance with the requirements of Articles IWA-5000 and IWD-5000 of Section XI. 31 31

6.6.8 Augmented Inservice Inspection

High-energy piping (as defined by Standard Review Plans 3.6.1 and 3.6.2) ~~Revision 3)~~ will be included under an augmented ISI program when appropriate.

All ~~such~~ welds located in appropriate high-energy piping for which no breaks are postulated will be examined using volumetric examination techniques. This examination will apply to all piping circumferential butt welds ~~in nominal pipe sizes exceeding 1 inch~~ and longitudinal butt welds. ~~in~~ nominal pipe sizes 4 inches and larger. Under this augmented scope, ~~including the branch to main run welds in nominal pipe sizes exceeding 1 inch to the first isolation valve,~~ 100 percent volumetric examination will be performed during the PSI and once in each 10-year interval. Exceptions to the 100 percent volumetric weld examination (e.g., due to excess limitations) will be described in the ISI program. 31 13

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(10) and either Equations (12) or (13) of subarticle NB-3653 of ASME Code Section III, under loadings associated with the OBE and normal and upset plant conditions, exceeds 2.4 S_m, or 40

b) The cumulative usage factor exceeds 0.1

45

3) As a result of piping reanalysis, the highest stress locations may be shifted. However, once a high-energy piping system has been analyzed and break locations have been identified and evaluated, the original break locations are <u>not</u> changed unless one of the following conditions exist: 40 45

a) Maximum stress ranges or cumulative usage factors exceed the threshold levels specified in 2) a) and 2) b) above;

b) A change is required in pipe parameters such as major differences in pipe size, wall thickness, and routing.

4) In the absence of an ASME Code Class 1 stress analysis, breaks are postulated at all fittings, valves, or welded attachments. 40

2. ASME Code Section III Class 2 and 3 piping, breaks are postulated to occur at the following locations in each run or branch run:

a. The terminal ends.

b. At all intermediate locations between terminal ends where the primary plus secondary stresses under normal and upset conditions and an OBE event, as calculated on an elastic basis by the sum of Equations (9) and (10) (subarticle NC-3652 of the ASME Code, Section III), exceed 0.8 ($1.2S_H + S_A$).

c. For the Main Feedwater System only, there shall be a minimum of two intermediate separated break locations selected for each ASME Section III Code Class 2 Main Feedwater piping run. Where at least two intermediate break locations cannot be determined based upon the above stress criteria (see 2.b. above) additional break locations based on highest relative stress as calculated from Equations (9) and (10) shall be selected as necessary to satisfy the requirement for a minimum of two intermediate break locations for each piping run. When stresses are less than the 2.b limits above limit and the stresses differ by less than 10 percent, the two selected intermediate break locations shall be separated by a change of direction of the pipe run. 45 40 45 40

However, if the piping run has only one change or no change in direction, only one intermediate break location need be postulated.

Where a network involving several branches is modeled as a common piping system for stress analysis purposes, only two intermediate break points are required based on the highest stress within the common piping system.

c ~~d.~~ As a result of piping reanalysis, the highest stress locations may be shifted. However, once a high-energy piping system has been analyzed and break locations have been identified and evaluated, the original intermediate break locations ~~(selected based on the methodology specified in 2.c above)~~ are not ~~be~~ changed unless one of the following conditions exist:

1) Maximum stresses exceed the threshold level specified in 2.b above. 40

2) A change is required in pipe parameters such as major differences in pipe size, wall thickness, and routing.

3. <u>System Where a Combination of ASME Code Section III Class 1 and Class 2 High-energy Piping Exists</u>

In cases where both ASME Code Class 1 and Class 2 piping exist between terminal ends, the following apply:

a. If the stress levels and the cumulative usage factor in the ASME Code Class 1 portion and the stress levels in the Class 2 portion exceed the limits specified in 1. and 2. above, then the breaks are postulated at each of these locations. 45

b. As a result of piping reanalysis, the highest stress locations may be shifted. However, the original break locations may be used unless one of the appropriate conditions of 1.b.2) above for the Class 1 portion or 2.c for the Class 2 portion exist. 40 45

4. <u>Non-nuclear High-energy Piping</u>

a. Breaks are postulated to occur in non-nuclear piping in the same manner as specified for ASME Code Section III Class 2 and 3 piping if the non-nuclear piping is analyzed and supported to withstand Operating Basis Earthquake (OBE) and Safe Shutdown Earthquake (SSE) loadings. 40Q 110.07

b. In the absence of a dynamic seismic analysis, breaks in non-nuclear piping are postulated at the following locations in each run or branch run:

1) Terminal ends

2) Each intermediate fitting (e.g., short- and long-radius elbows, tees and reducers, welded attachments, and valves).

5. <u>Containment Penetration Piping</u>

a. Main Steam and Feedwater Piping

1) The main steam and feedwater system containment penetration piping including branch connections which are short in length and have no significant restraint to thermal expansion and the 40Q 110.08

preheat feedwater bypass piping branch meet the "break exclusion" requirements of b. below. In addition, mechanistic breaks are postulated in other branches off the main steam and feedwater lines in accordance with 1., 2., 3., and 4. above. 45

2) The isolation valve cubicle housing the break-exclusion portion of main steam and feedwater piping and any safety-related components are designed for nonmechanistic break occurring anywhere within the break-exclusion zone piping. 40Q 110.08

3) The nonmechanistic break is equivalent to one full cross sectional area of undefined type.

4) The penetration structure is capable of withstanding the pressure, temperature, and humidity and flooding transients from the nonmechanistic break.

b. <u>Other Containment Penetration Piping</u>

Containment penetration piping between the penetration flued head and containment isolation valves, up to and including the restraints that define the terminal ends for the run as stated in 6) below, may be excluded from postulated breaks (i.e., may be treated as a 40

except in piping and fittings which are associated with the bending and tortional restraints.

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break-exclusion zone) when all of the following design requirements are met:

1) ASME Code Section III Class 2 Piping: if the following conditions are not met, then requirements listed in Section 3.6.2.1.1.2 above apply.

   a) The maximum stress ranges as calculated by the sum of Equations (9) and (10) in ASME Section III, subarticle NC-3652, considering operational plant conditions (i.e., sustained loads, occasional loads, and thermal expansion and an OBE event) do not exceed 0.8 (1.2 S_h + S_A).

   b) The maximum stress, as calculated by Equation (9) in subarticle NC-3652 under the loadings resulting from a postulated piping failure of fluid system piping beyond these portions of piping, does not exceed $1.8S_h$.

Insert #1b

2) Welded attachments, for pipe supports or other purposes, to these portions of piping are avoided except where detailed stress analyses or tests are performed to demonstrate that the maximum stresses do not exceed the limits defined in 1) above.

3) The number of circumferential and longitudinal piping welds and branch connections are minimized. 40

4) The length of these portions of piping is reduced to the minimum length practical.

5) Pipe anchors or restraints (e.g., connections to containment penetrations and pipe whip restraints) are not welded directly to the outer surface of the piping (e.g., flued integrally forged pipe fittings may be used) except where all such welds are 100 percent volumetrically examinable as part of the Inservice Inspection Program (Section 6.6) and a detailed stress analysis is performed to demonstrate that the maximum stresses do not exceed the limits defined in 1) above.

Insert # 5

6) When a break-exclusion zone is established, the terminal end for piping in the zone is consequently extended away from the containment anchor. The terminal end is located adjacent to the restraints that limit the bending and torsion moments exerted on the isolation valve as a consequence of pipe break. These piping restraints are:

   a) Located reasonably close to the isolation valves and located to optimize overall piping design.

   b) Located, as necessary, to prevent formation of a plastic hinge, following a piping failure, anywhere within the established break exclusion zone.

   c) Capable of withstanding the loadings resulting from a postulated pipe rupture beyond this portion of the piping

Insert #1b

except that, following a piping failure in the Containment penertation areas, the pipe between the isolation valves and the first restraint is permitted higher stresses provided that a plastic hinge is not formed and operability of the valves which with such stress is assured in accordance with the requirements of FSAR Section 3.9.3.

Insert 5

Exceptions to the 100 percent volumetric weld examinations (e.g., due to access limitations) are documented in the ISI program.

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The restraint structure is typically a structural steel frame or truss and the energy-absorbing element is usually either stainless steel U-bars or energy-absorbing material as described below:

1. Stainless Steel U-Bar

This type consists of one or more U-shaped, upset-threaded rods of stainless steel looped around the pipe but not in contact with the pipe to allow unimpeded pipe motion during seismic and thermal movement of the pipe. At rupture, the pipe moves against the U-bars, which absorb the kinetic energy of the pipe motion by yielding plastically. A typical example of a U-bar restraint is shown in Figure 3.6.2-3.

2. Energy Absorbing Material 40

This type of restraint consists of a crushable, stainless steel, internally honeycomb-shaped element designed to yield plastically under impact of the whipping pipe. A design hot position gap is provided between the pipe and the energy-absorbing material to allow unimpeded pipe motion during seismic and thermal pipe movements. A typical example of an energy-absorbing material restraint is shown in Figure 3.6.2-4.

3. 5-Way Restraint

A five-way restraint is utilized to protect the main steam isolation valves (MSIVs) and main feedwater isolation valves in the event of a postulated pipe rupture outside the Containment. This restraint is designed so that postulated pipe breaks beyond the five way restraint will not result in stresses greater than 1.8 S_h being transmitted to the piping between the five way restraint and the containment penetration. 45 40

Insert B

3.6.2.3.3.2 Restraints for RCL - Pipe restraint types and locations are discussed in Section 5.4.14. Loading combinations and stress limits are discussed in Section 3.9.1. 45

3.6.2.3.4 Analytical Methods:

3.6.2.3.4.1 Pipe Whip Restraints Other than RCL Restraints -

1. Location of Restraints 40Q 110.II

a. For purposes of determining pipe hinge length and thus locating the pipe whip restraints, the plastic moment of the pipe is determined in the following manner:

$$M_p = 1.1\, z_p S_y$$

where:

z_p = Plastic section modulus of pipe $D^2_m t$

D_m = Mean piping diameter

t = Wall thickness

Insert 3 to SAR CR 726

This restraint is designed so that postulated pipe breaks beyond the five-way restraint will not result in stresses greater than 1.8 S_h being transmitted to the piping between the isolation valve and the containment penetration or formation of a plastic hinge between the isolation valve and the restraint.

4. Containment Main Steam Line Restraints

The main steam line restraints inside containment are designed using nonlinear, inelastic methods with allowable ductilities given in FSAR Table 3.5-13. The anchorages to the internal structure are designed to the restraint backup structure using standard elastic design methods to ensure sufficient anchorage.

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TABLE 3.6.2-1

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Steam System (Inside Containment) Problem No.: MS-01 40
Revision: ~~0~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 1A)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
1	~~20883~~ 13449	0.~~552~~ 356	SG Nozzle	TE/C
~~56~~ 60	~~26757~~ 14898	0.~~708~~ 394	Containment Penetration (M-2)	TE/C
C02	16223	0.429	Elbow	(3)

45

(1) Ratio = Total stress/37,800 psi

(2) TE = Terminal End

C = Circumferential

L = Longitudinal

(3) Highest Relative Stress Point: no break Postulated

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TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Steam System (Inside Containment)

Problem No.: MS-02
Revision: ~~0~~ 1 40

FSAR Figure: Figure 3.6.1-1 (Sheet 1B)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
1	~~20883~~ 13805	0.~~352~~ 365	SG Nozzle	TE/C
~~54~~ 60	~~26757~~ 14694	0.~~708~~ 389	Containment Penetration (4-3)	TE/C
C02	16180	0.428	Elbow	(3)

45

(1) Ratio = Total stress/37,800 psi

(2) TE = Terminal End

C = Circumferential

L = Longitudinal

(3) Highest relative stress point: no break postulated

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TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Steam System (Inside Containment) Problem No.: MS-03 40

Revision: ~~0~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 1C)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
.1C	~~22311~~ 15623	0.~~590~~ 413	SG Nozzle	TE/C
~~23C~~ M4	~~19548~~ 13379	0.~~517~~ 354	Containment Penetration (M-4)	TE/C
B7	17029	0.451	Elbow	(3)

(1) Ratio = Total stress/37,800 psi 45

(2) TE = Terminal End

C = Circumferential

L = Longitudinal

(3) Highest Relative Stress Point: No break ~~point~~ postulated

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TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Steam System (Inside Containment)

Problem No.: MS-04

Revision: ~~0~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 1D)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
1D	~~22311~~ 15359	0.~~590~~ 406	SG Nozzle	TE/C
~~23~~ M1	~~19549~~ 13042	0~~.517~~ .345	Containment Penetration (M-1)	TE/C
B7	17224	0.456	Elbow	(3)

(1) Ratio = Total stress/37,800 psi

(2) TE = Terminal End

C = Circumferential

L = Longitudinal

(3) Highest Relative Stress Point: No break Postulated

TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Feedwater System (Inside Containment) — Problem No.: FW-01, Revision: ~~0~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 2A)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
~~1~~ 5	~~35601~~ 30255	~~1.098~~ 0.934	S/G Nozzle	TE/C
~~1~~ 10	~~35631~~ 28741	~~1.099~~ 0.887	Elbow	~~IM/C/L~~ (3)
~~3~~	~~28955~~	~~0.893~~	~~Same as 2~~	~~IM/C/L~~
~~4~~	~~27914~~	~~0.861~~	~~Elbow~~	~~(3)~~
~~31~~	~~23973~~	~~0.739~~	~~Elbow~~	~~IM/C~~
~~32~~	~~26075~~	~~0.804~~	~~Same as 31~~	~~IM/C~~
~~38~~ 110	~~25389~~ 17014	~~0.783~~ 0.525	Containment Penetration (M-6)	TE/C

40

(1) Ratio = Total stress/stress limit = $\frac{\text{Total stress}}{.8\ (1.2\ S_h + S_A)}$ = $\frac{\text{Total stress}}{32{,}400\ \text{psi}}$

(2) TE = Terminal End — C = Circumferential

IM = Intermediate — L = Longitudinal

~~(3) Node close to Node 3, no break postulated.~~

(3) Highest relative Stress Point other than terminal ends: no break postulated

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TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Feedwater System (Inside Containment) Problem No.: FW-02
Revision: ~~0~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 2B)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
5+a	~~35601~~ 30222	~~1.098~~ 0.933	S/G Nozzle	TE/C
10 ~~2~~a	~~25031~~ 26644	~~1.099~~ 0.822	Elbow	~~IM/C/L~~ (3)
~~3~~	~~28955~~	~~0.893~~	~~Same as 2~~	~~IM/C/L~~
~~31~~	~~23973~~	~~0.739~~	~~Elbow~~	~~IM/C~~
~~32~~	~~26075~~	~~0.804~~	~~Same as 31~~	~~IM/C~~
~~85~~ 110	25389 ~~[illegible]~~ 15735	0.~~285~~ 486	Containment Penetration (M-7)	TE/C

40

(1) Ratio = Total stress/stress limit = $\frac{\text{Total stress}}{.8\ (1.2\ S_h + S_A)} = \frac{\text{Total stress}}{32{,}400\ \text{psi}}$

(2) TE = Terminal End C = Circumferential

IM = Intermediate L = Longitudinal

(3) Highest Relative Stress Point; No break postulated

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TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Feedwater System (Inside Containment) — Problem No.: FW-03

Revision: ~~0~~ ~~2~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 2C)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
5 ~~2~~	25~~622~~027	0.7~~91~~72	S/G Nozzle	TE/C
10 ~~3~~	23754 ~~25434~~	0.7~~85~~33	Elbow	~~IM/C~~ (3)
~~5~~	~~21413~~	~~0.660~~	~~Same as 3~~	~~IM/C~~
~~80~~	18676	0.576	Elbow	IM/C
81	27182	0.839	Same as 80	IM/C 40
~~90~~ 110	~~25756~~ 17978	~~0.800~~ 0.555	Containment Penetration (M-8)	TE/C

(1) Ratio = Total stress/stress limit = $\frac{\text{Total stress}}{.8\ (1.2\ S_h + S_A)} = \frac{\text{Total stress}}{32{,}400\ \text{psi}}$

(2) TE = Terminal End C = Circumferential

IM = Intermediate L = Longitudinal

(3) Highest Relative Stress Point; no break postulated

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TABLE 3.6.2-1 (Continued)

HIGH-ENERGY PIPE BREAK INITIAL STRESS SUMMARY RESULTS

System: Main Feedwater System (Inside Containment) Problem No.: FW-04

Revision: ~~0~~ ~~[illegible]~~ 1

FSAR Figure: Figure 3.6.1-1 (Sheet 2D)

NODE	TOTAL STRESS (psi)	RATIO(1)	LOCATION	TYPE OF POSTULATED BREAKS(2)
~~2~~ 5	[illegible] ~~25622~~ 25457	0.~~791~~ 786	S/G Nozzle	TE/C
~~3~~ 10	~~25434~~ 24132	0.7~~85~~ 45	Elbow	~~IM/C~~ (3)
~~9~~	~~21413~~	~~0.660~~	~~Same as 3~~	~~IM/C~~
~~80~~	~~18676~~	~~0.576~~	~~Elbow~~	~~IM/C~~
~~81~~	~~27182~~	~~0.839~~	~~Same as 80~~	~~IM/C~~
~~90~~ 110	~~20754~~ 18219	0.~~800~~ 562	Containment Penetration (M-5)	TE/C

40

(1) Ratio = Total stress/stress limit = $\frac{\text{Total stress}}{.8\ (1.2\ S_h + S_A)} = \frac{\text{Total stress}}{32{,}400\ \text{psi}}$

(2) TE = Terminal End C = Circumferential

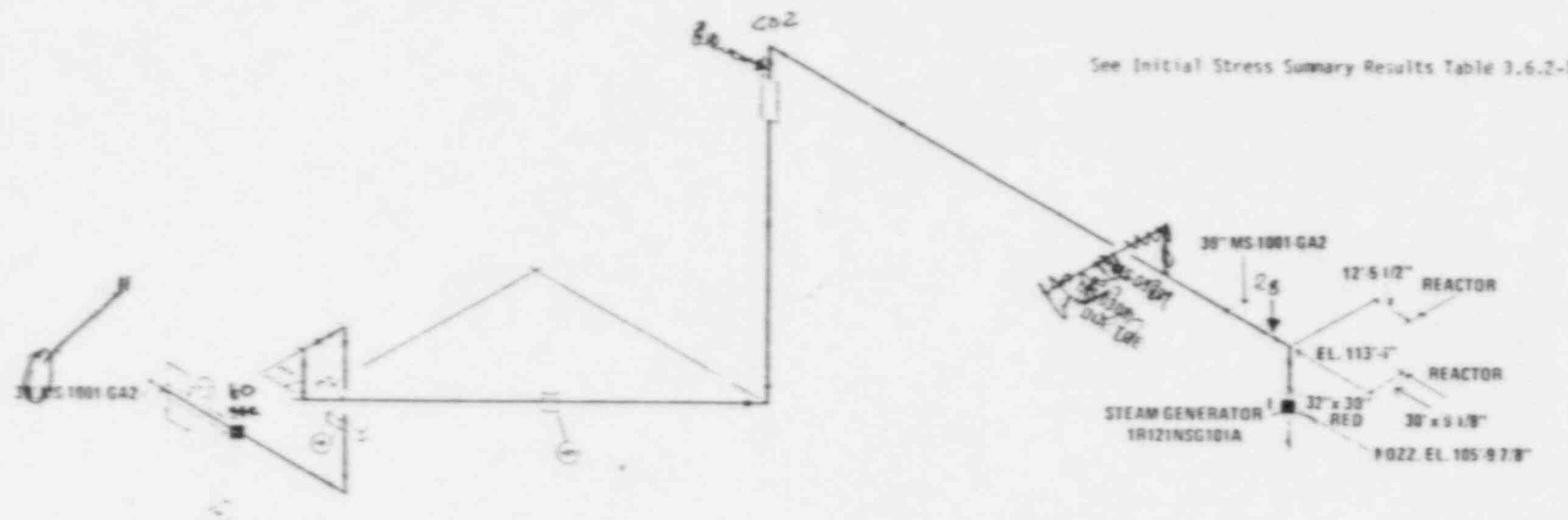
IM = Intermediate L = Longitudinal

(3) Highest Relative Stress Point: No break postulated

RESTRAINT LOAD SUMMARY

RESTRAINT NUMBER	RESTRAINT DESCRIPTION	DESIGN LOAD (KIPS) BREAK LOCATION
R_8 (0°)	Rigid U-Bar Restraint	819.6
R_9 (90°)	U-Bar Restraint	±100
R_{10} (0°)	U-Bar Restraint	172
R_{10} (90°)	U-Bar Restraint	±18

See Initial Stress Summary Results Table 3.6.2-1, SH 1A



LEGEND

- ■ POSTULATED BREAK POINT
- → ENERGY ABSORBING RESTRAINT
- ⇒ RIGID GUIDE

SOUTH TEXAS PROJECT UNITS 1 & 2

POSTULATED BREAK POINTS AND RESTRAINT LOCATIONS MAIN STEAM LOOP 1 30" MS 1001 GA2
Sheet 1A

Figure 3.6.1.1

Amendment

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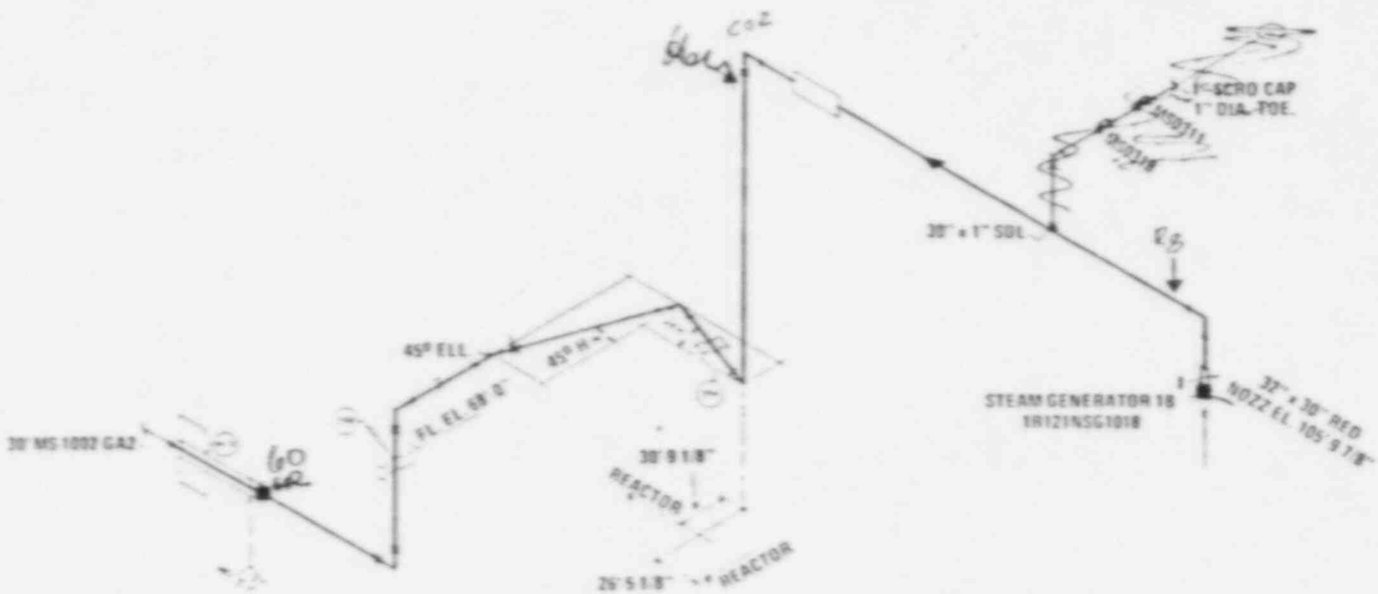
RESTRAINT LOAD SUMMARY

RESTRAINT NUMBER	RESTRAINT DESCRIPTION	DESIGN LOAD (KIPS) BREAK LOCATION
R_8 (0°)	Rigid ~~U-Bar~~ Restraint	817
~~R_9 (90°)~~	~~U-Bar Restraint~~	~~+106~~
R_{10} (0°)	U-Bar Restraint	172
R_{10} (90°)	U-Bar Restraint	+18 -142

See Initial Stress Summary Results Table 3.6.2-1, SH 18



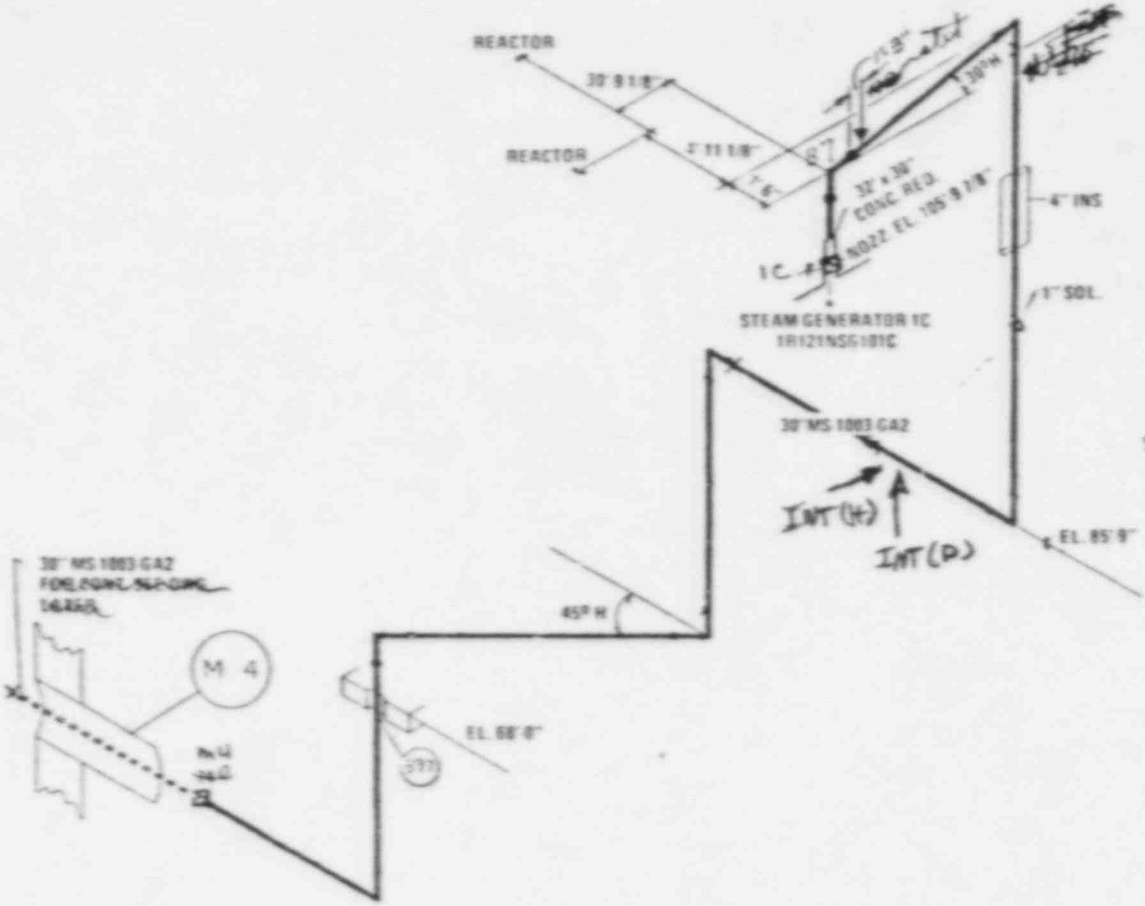
LEGEND

- ■ POSTULATED BREAK POINT
- ➞ ENERGY ABSORBING RESTRAINT
- —▷ RIGID GUIDE

SOUTH TEXAS PROJECT
UNITS 1 & 2

POSTULATED BREAK POINTS AND
RESTRAINT LOCATIONS
MAIN STEAM LOOP 2
30" MS 1002 GA2
Sheet 1B

Figure 3.6.1.1 Amendment 45



RESTRAINT LOAD SUMMARY

RESTRAINT NUMBER	RESTRAINT DESCRIPTION	DESIGN LOAD (KIPS) BREAK LOCATION
87	U-Bar Restraint	1031
~~P_8 (90°)~~	~~U-Bar Restraint~~	
P_{10} (0°)	U-Bar Restraint	172
P_{10} (90°)	U-Bar Restraint	528 / 140
INTERMEDIATE (DOWN)	Rigid Restraint	334
" (HORIZ)	"	195

See Initial Stress Summary Results Table 3.6.2-1, SH 1C

LEGEND

■ POSTULATED BREAK POINT

→ ENERGY ABSORBING RESTRAINT

⇾ RIGID GUIDE

SOUTH TEXAS PROJECT
UNITS 1 & 2

POSTULATED BREAK POINTS AND RESTRAINT LOCATIONS
MAIN STEAM LOOP 3
30" MS 1003 GA2
Sheet 1C

Figure 3.6.1.1

Amendment 45

ATTACHMENT 1
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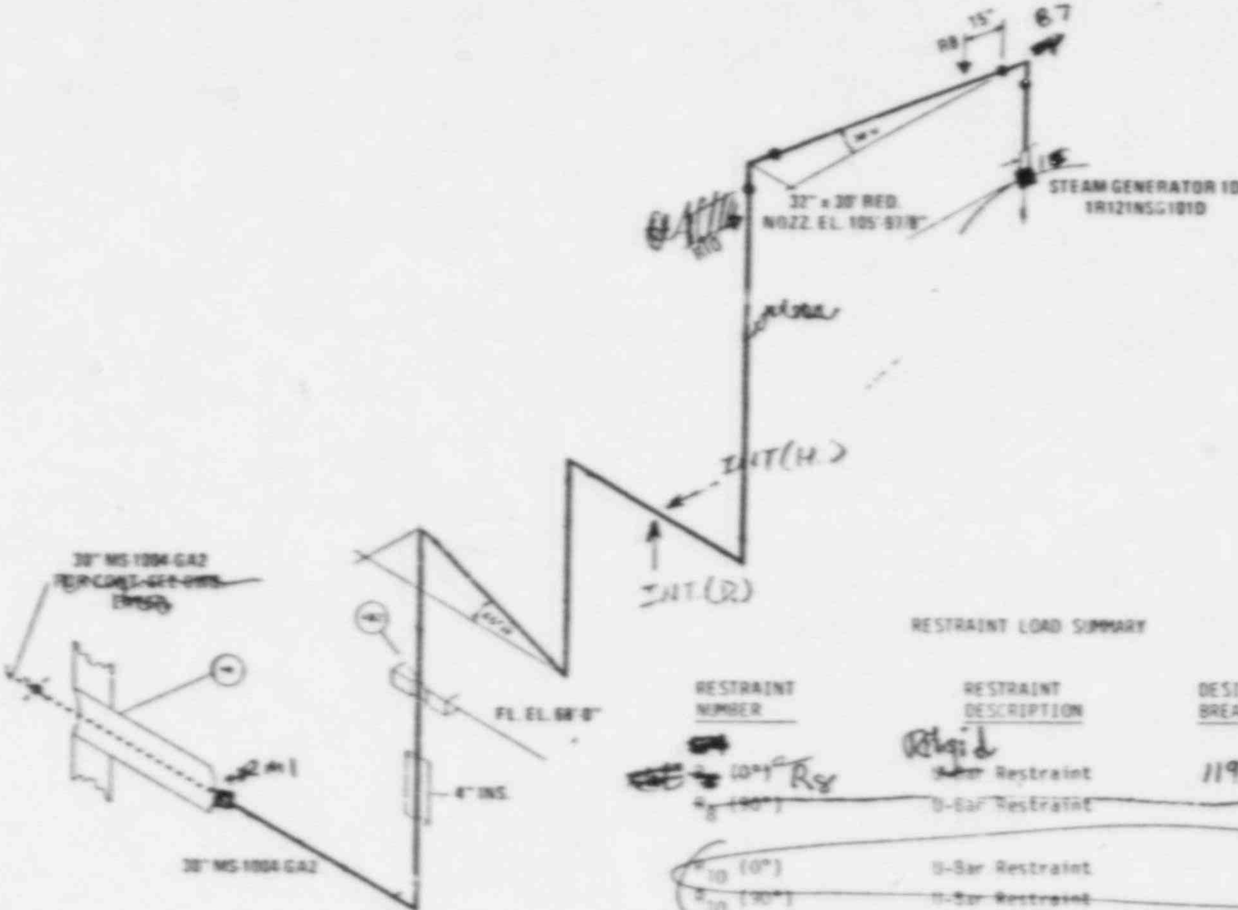

LEGEND

- ■ POSTULATED BREAK POINT
- → ENERGY ABSORBING RESTRAINT
- ⇾ RIGID GUIDE

RESTRAINT LOAD SUMMARY

RESTRAINT NUMBER	RESTRAINT DESCRIPTION	DESIGN LOAD (KIPS) BREAK LOCATION
8 (0°) R8	Rigid ~~U-Bar~~ Restraint	1191.7 ~~990~~
~~8 (90°)~~	~~U-Bar Restraint~~	~~1100~~
10 (0°)	U-Bar Restraint	172
~~10 (90°)~~	~~U-Bar Restraint~~	~~212~~
		-140
INTERMEDIATE (DOWN)	Rigid Restraint	1334
(HORIZ.)	"	195

See Initial Stress Summary Results Table 3.6.2-1, SH 10

SOUTH TEXAS PROJECT
UNITS 1 & 2

POSTULATED BREAK POINTS AND
RESTRAINT LOCATIONS
MAIN STEAM, LOOP 4
30" MS-1004-GA2
Sheet 1D

Figure 3.6.1.1 Amendment 45

ATTACHMENT 1
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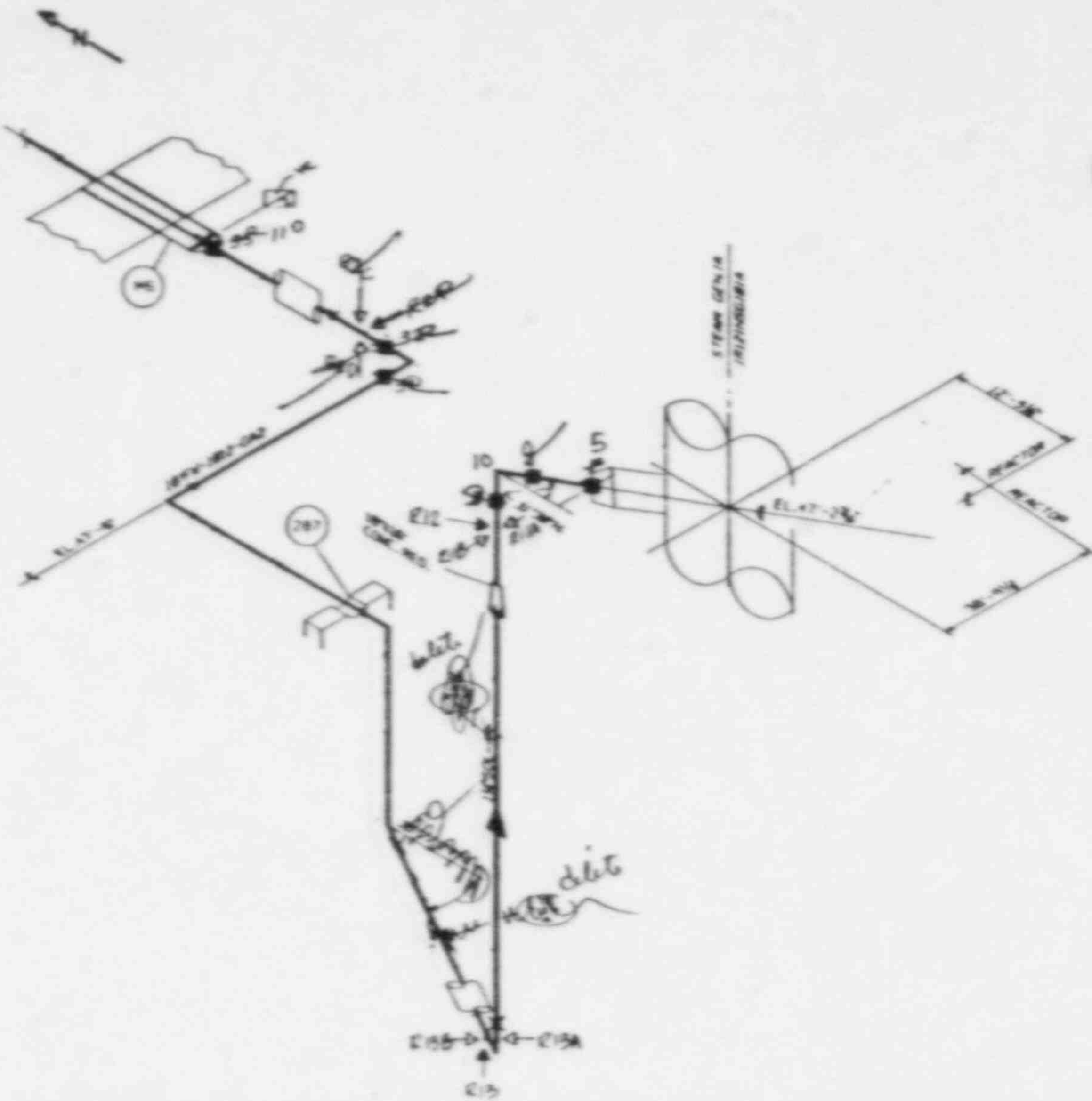
PAGE 21 OF 38

Restraint Load Summary

Restraint Number	Restraint Description	Design Load (Kips) Break Location
		5 [illegible]
~~2a~~	~~Rigid Restraint~~	~~350~~
~~2c~~	~~Rigid Guide~~	~~23~~
~~2d~~	~~Rigid Guide~~	~~23~~
11a	Rigid Guide	18
11b	Rigid Guide	18
12 ✓	Crush Pad Restraint	200 ✓
13 ✓	Crush Pad Restraint ✓	200 [200]
13a ✓	Rigid Guide	40
13b ✓	Rigid Guide	18

See Initial Stress Summary table 3.6.2-1 Sh. 2A



LEGEND

■ POSTULATED BREAK POINT

➞ ENERGY ABSORBING RESTRAINT

—▷ RIGID GUIDE

SOUTH TEXAS PROJECT
UNITS 1 & 2

POSTULATED BREAK POINTS AND
RESTRAINT LOCATIONS
FEED WATER, LOOP 1
16", 18" FW-1012-GA2
Sheet 2A

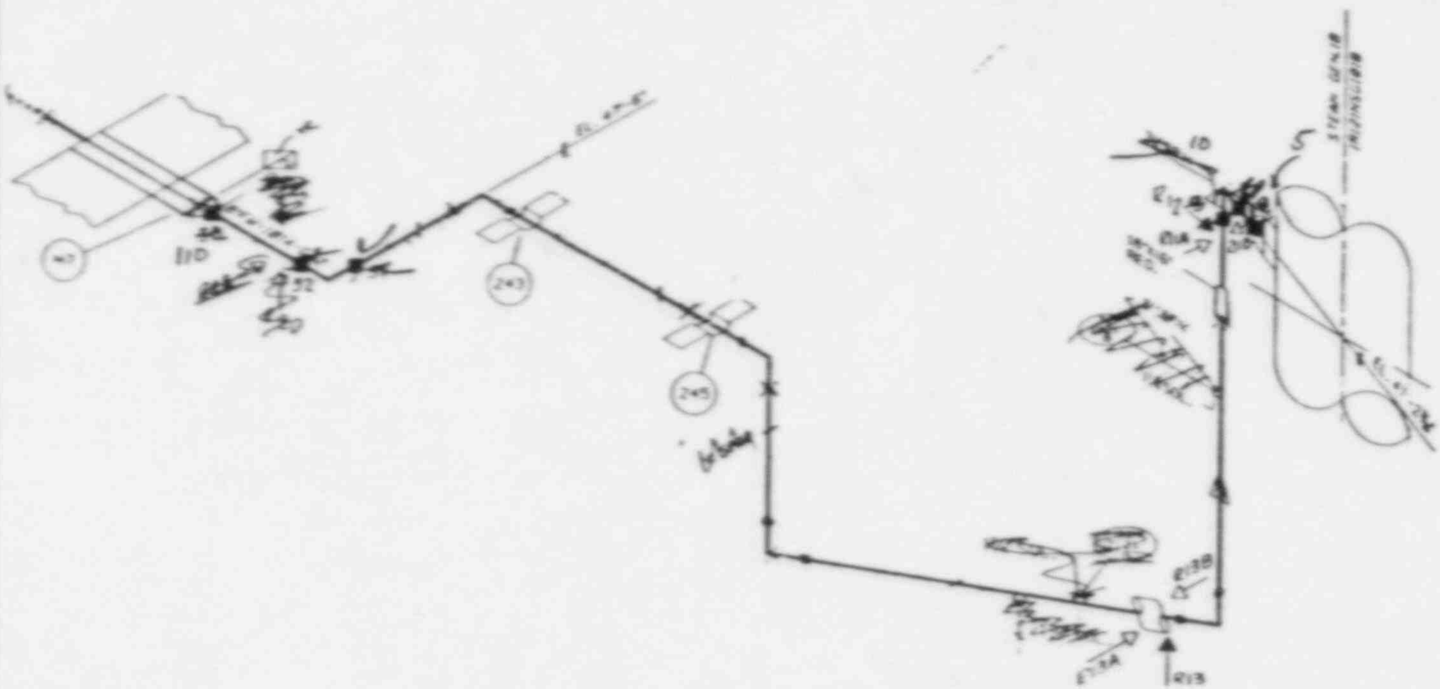
Figure 3.6.1-1

Amendment

Restraint Load Summary

Restraint Number	Restraint Description	Design Load (Kips) Break Location	
		5	110
~~2B~~	~~Rigid Restraint~~		~~350~~
~~2c~~	~~Rigid Guide~~		~~23~~
~~2d~~	~~Rigid Guide~~		~~23~~
11a	Rigid Guide	18	
11b	Rigid Guide	18	
12	Crush Pad Restraint	200	
13	Crush Pad Restraint	200	200
13a	Rigid Guide	40	27
13b	Rigid Guide	18	21

See Initial Stress Summary table 3.6.2-1 Sh. 2B



LEGEND

■ POSTULATED BREAK POINT

→ ENERGY ABSORBING RESTRAINT

→▷ RIGID GUIDE

SOUTH TEXAS PROJECT
UNITS 1 & 2

POSTULATED BREAK POINTS AND
RESTRAINT LOCATIONS
FEED WATER, LOOP 2
16", 18" FW-1014-GA2
Sheet 2B

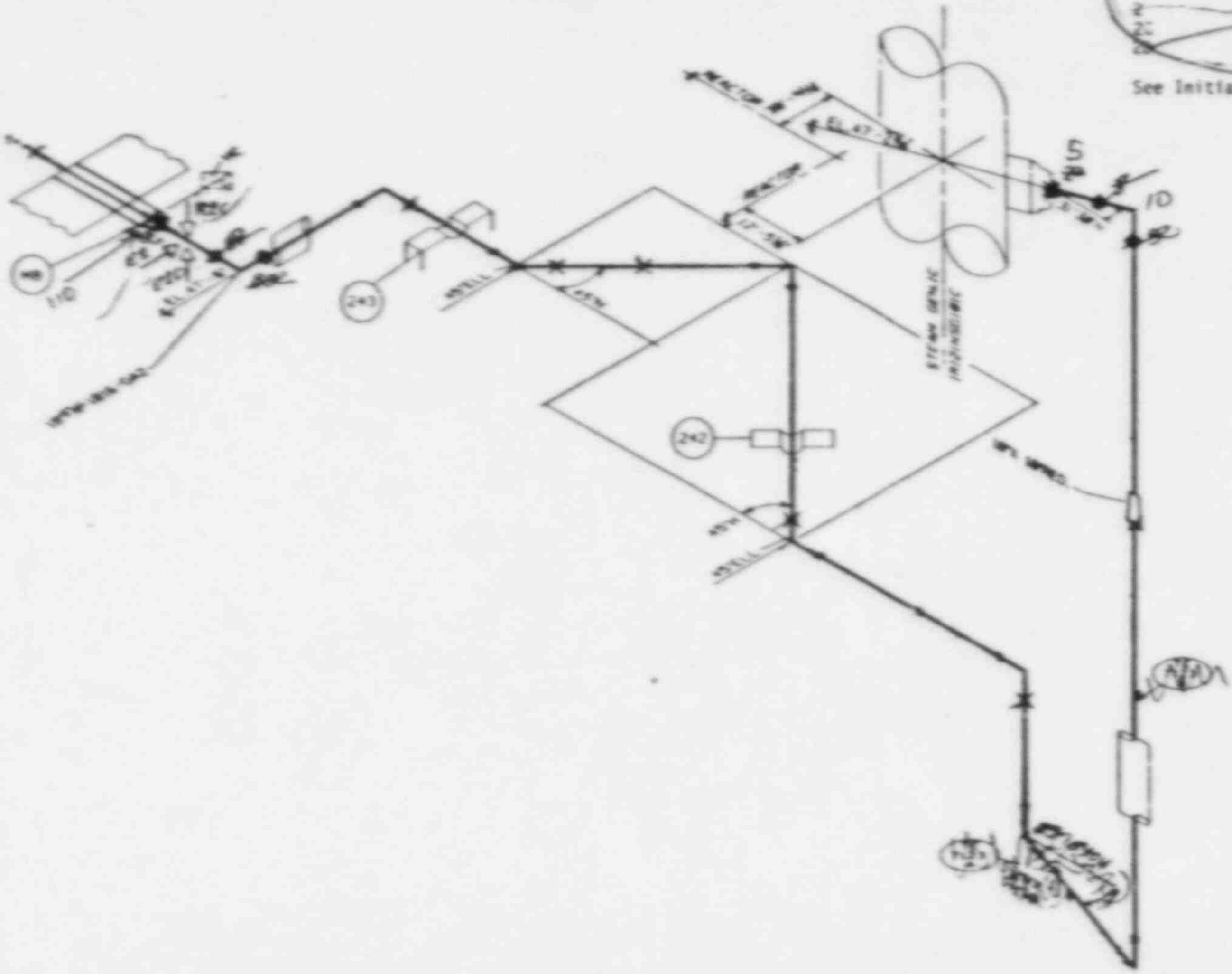
Figure 3.6.1-1 Amendment

Restraint Load Summary

Restraint Number	Restraint Description	Design Load (Kips) Break Location
		80
2	Rigid Restraint	320
2C	Rigid Guide	23
2[illegible]	Rigid Guide	23

See Initial Stress Summary Table 3.6.2-1 Sh. 2C

NONE



LEGEND

- ■ POSTULATED BREAK POINT
- → ENERGY ABSORBING RESTRAINT
- —▷ RIGID GUIDE

SOUTH TEXAS PROJECT
UNITS 1 & 2

POSTULATED BREAK POINTS AND
RESTRAINT LOCATIONS
FEED WATER, LOOP 3
16", 18" FW-1016-GA2
Sheet 2C

Figure 3.6.1-1

Amendment 4[illegible]

ATTACHMENT 1
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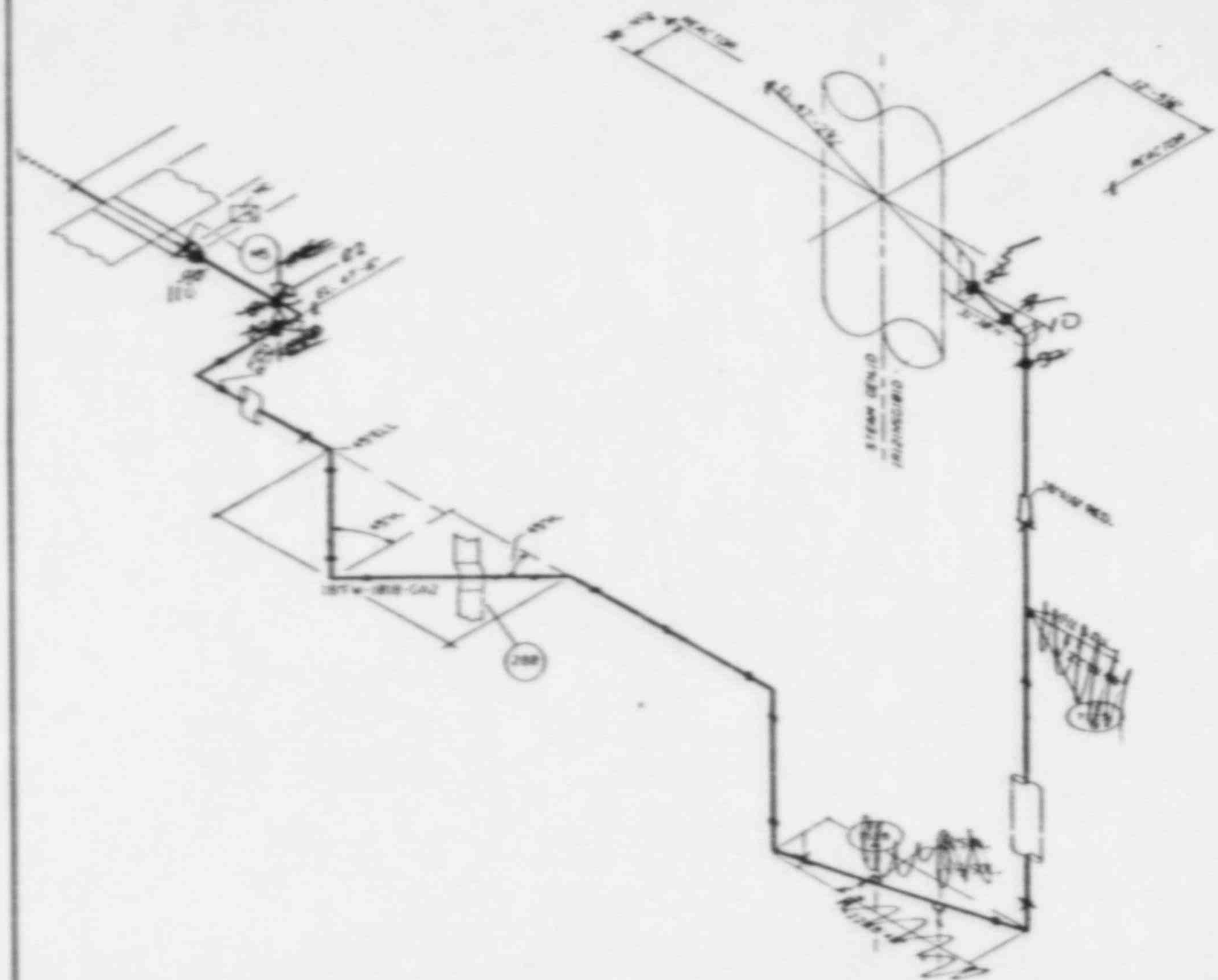
PAGE 24 OF 38



Restraint Load Summary

Restraint Number	Restraint Description	Design Load (Kips) Break Location 20a
[illegible]	Rigid Restraint	320
2C	Rigid Guide	23
[illegible]	Rigid Guide	23

See Initial Stress Summary Table 3.6.2-1 Sh. 2D

None

LEGEND

■ POSTULATED BREAK POINT

→ ENERGY ABSORBING RESTRAINT

⇾ RIGID GUIDE

**SOUTH TEXAS PROJECT
UNITS 1 & 2**

POSTULATED BREAK POINTS AND
RESTRAINT LOCATIONS
FEED WATER, LOOP 4
16", 18" FW-1018-GA2
Sheet 2D

Figure 3.6.1-1 Amendment [illegible]

ATTACHMENT 1
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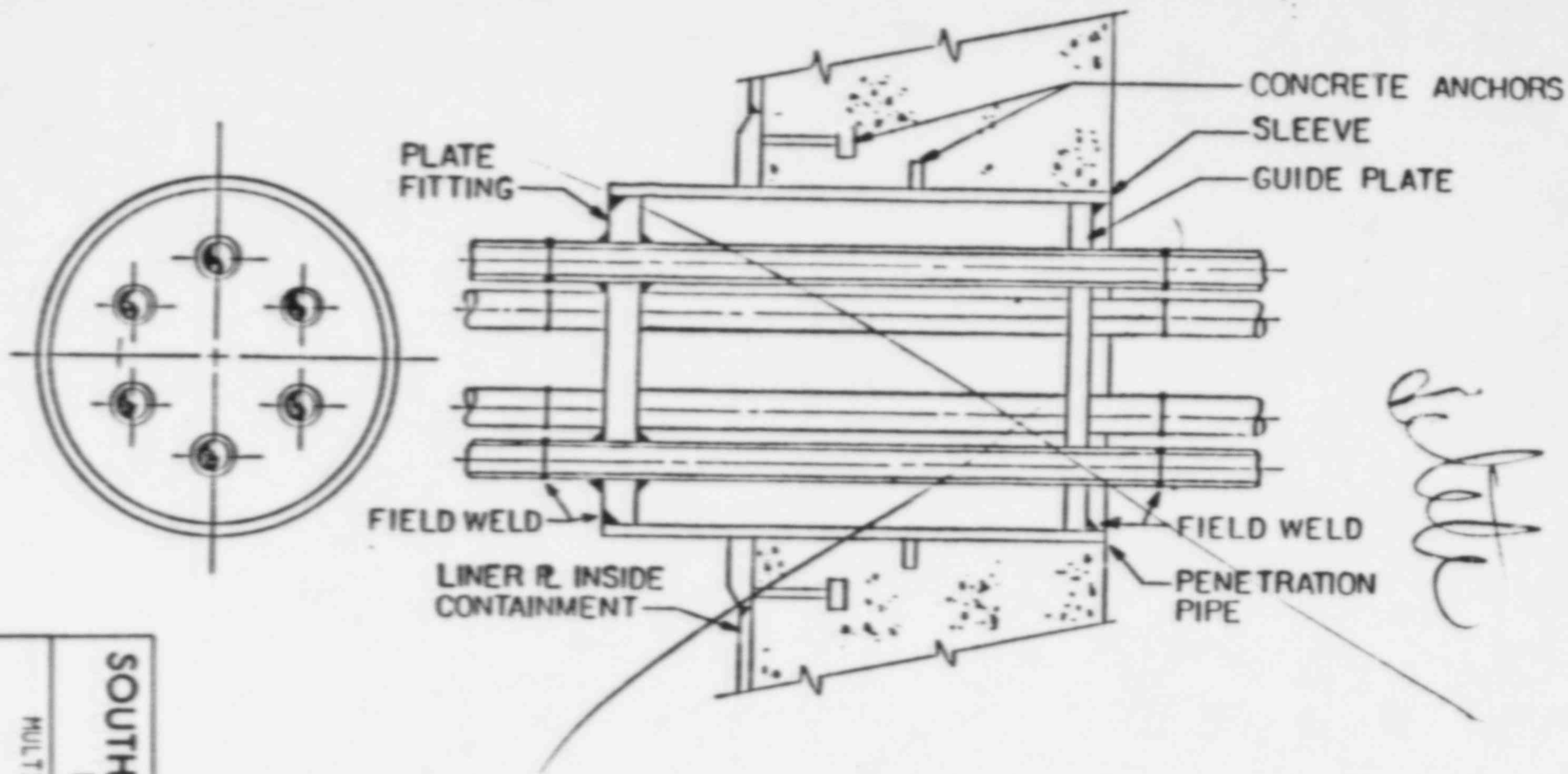
PAGE 25 OF 38

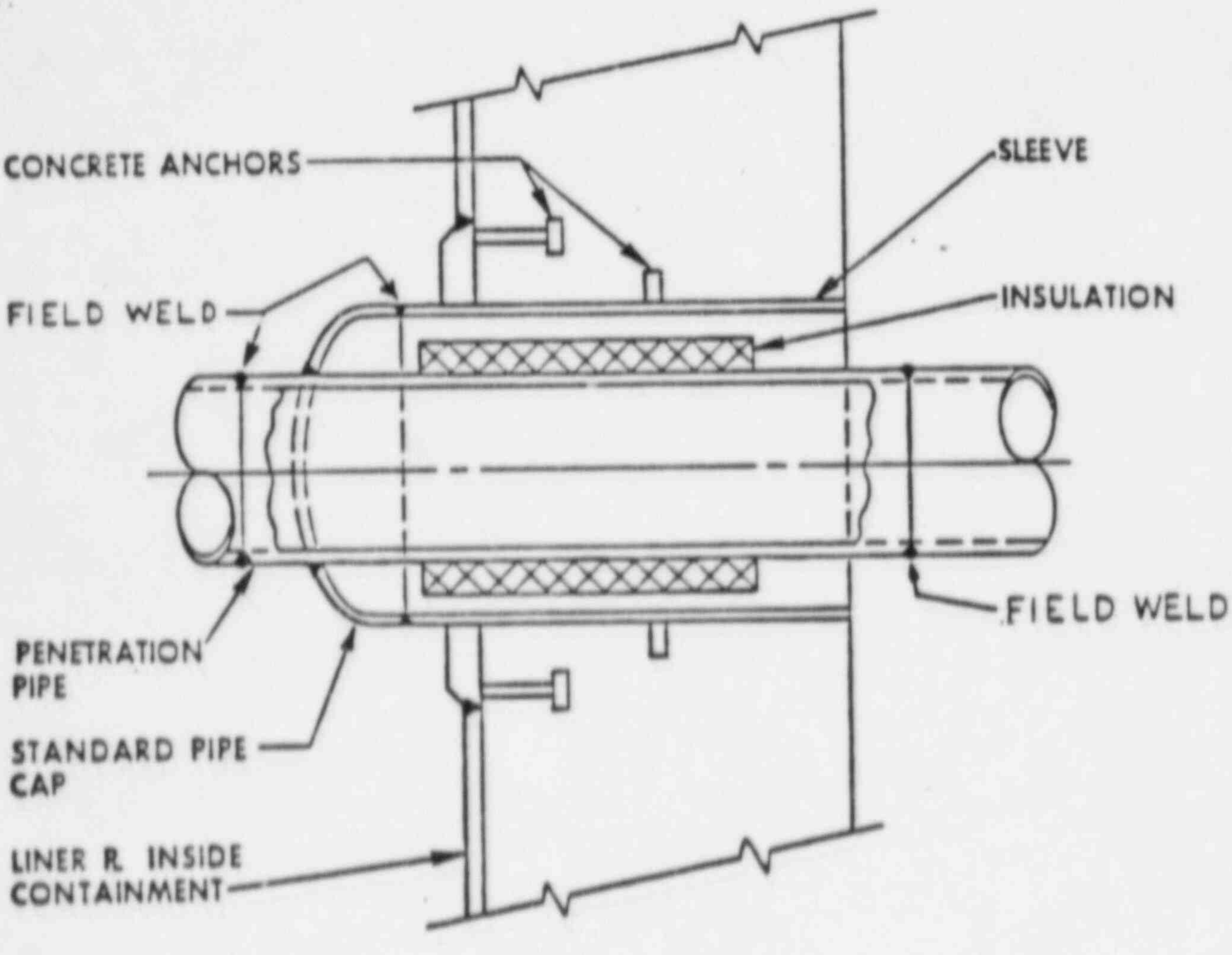


SOUTH TEXAS PROJECT
UNITS 1 & 2

MULTIPLE PIPE PENETRATION

FIGURE 3.6-4

delete



SOUTH TEXAS PROJECT
UNITS 1 & 2

SINGLE PIPE PENETRATION
FOR MODERATE ENERGY LINES

FIGURE 3.6-5

ATTACHMENT 1
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PAGE 27 OF 38

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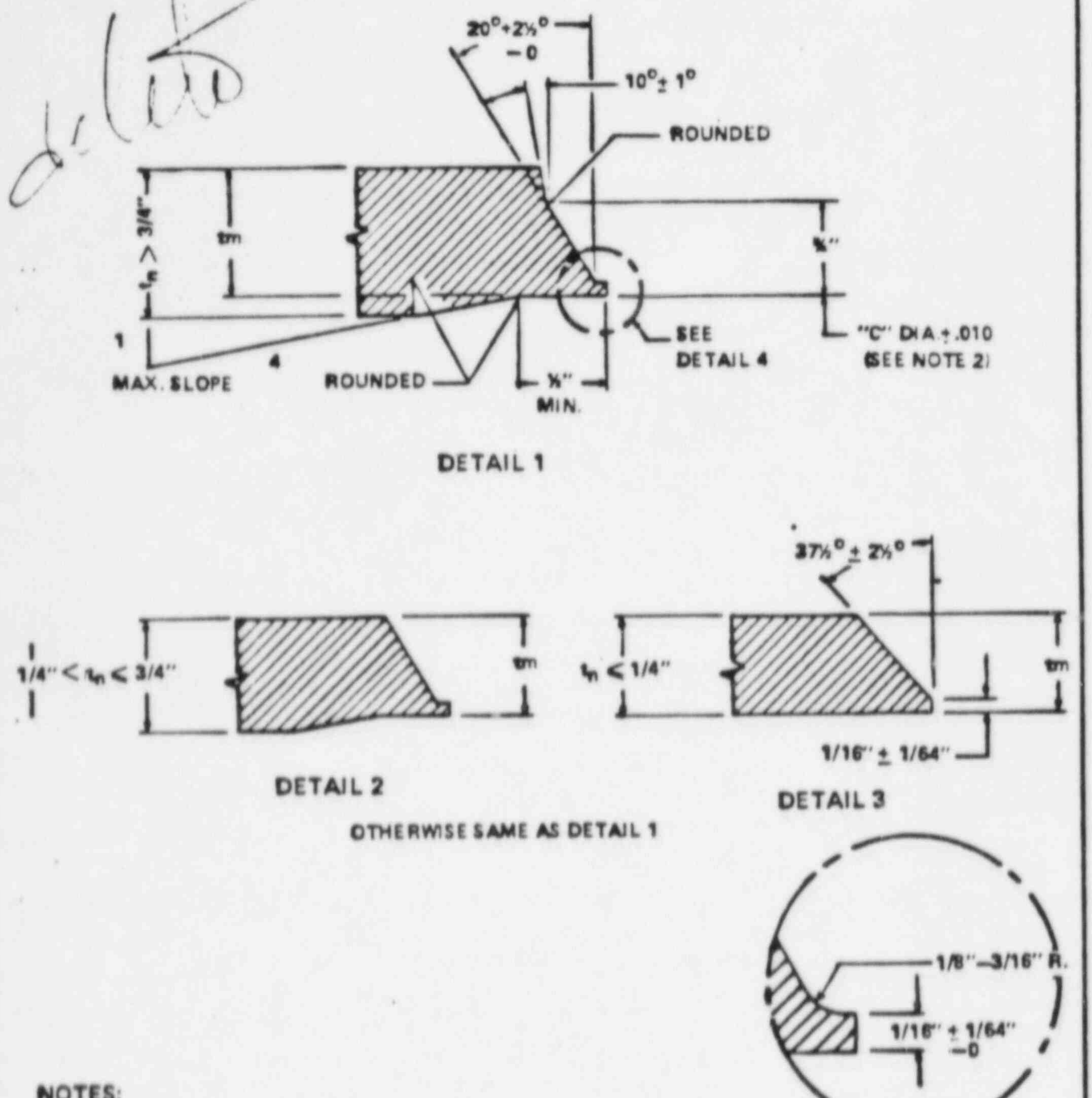


NOTES:

1. tm = MINIMUM THICKNESS OF WALL
   tn = NOMINAL THICKNESS OF WALL
2. "C" DIMENSION IN ACCORDANCE WITH STANDARD PIPE DIMENSIONS

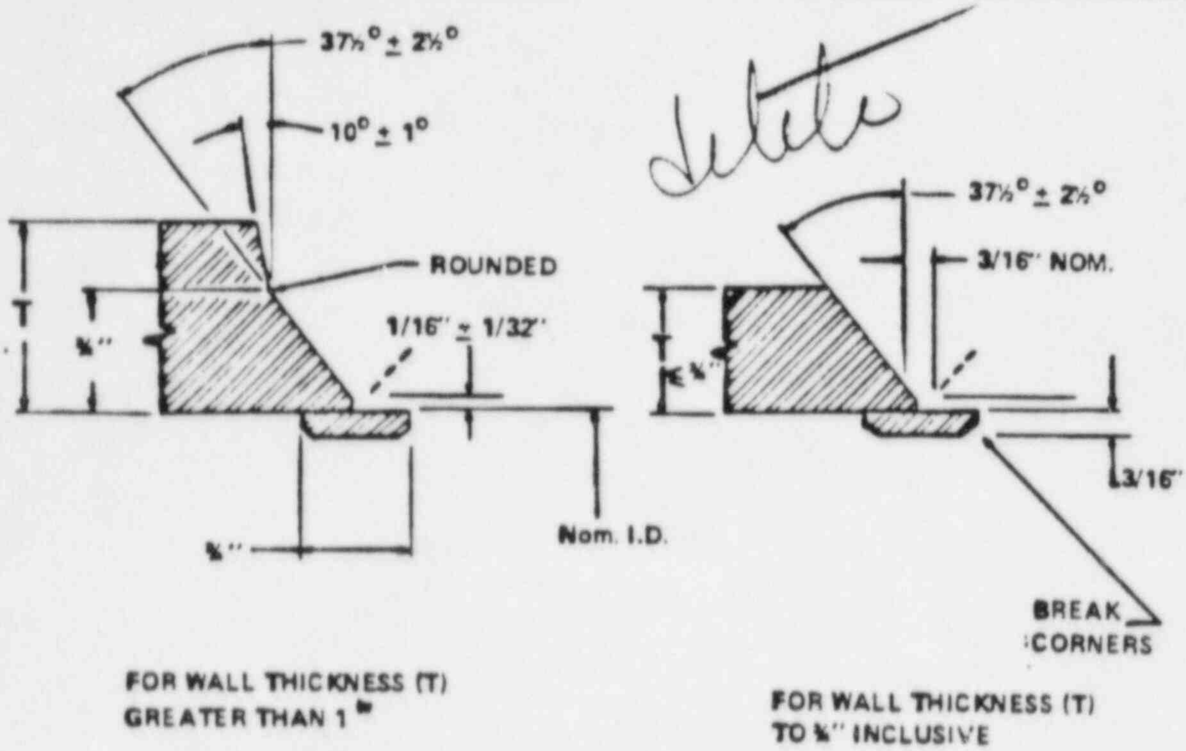
(ALL DIMENSIONS TYPICAL UNLESS INDICATED OTHERWISE)

Amendment 2, 10/9/78

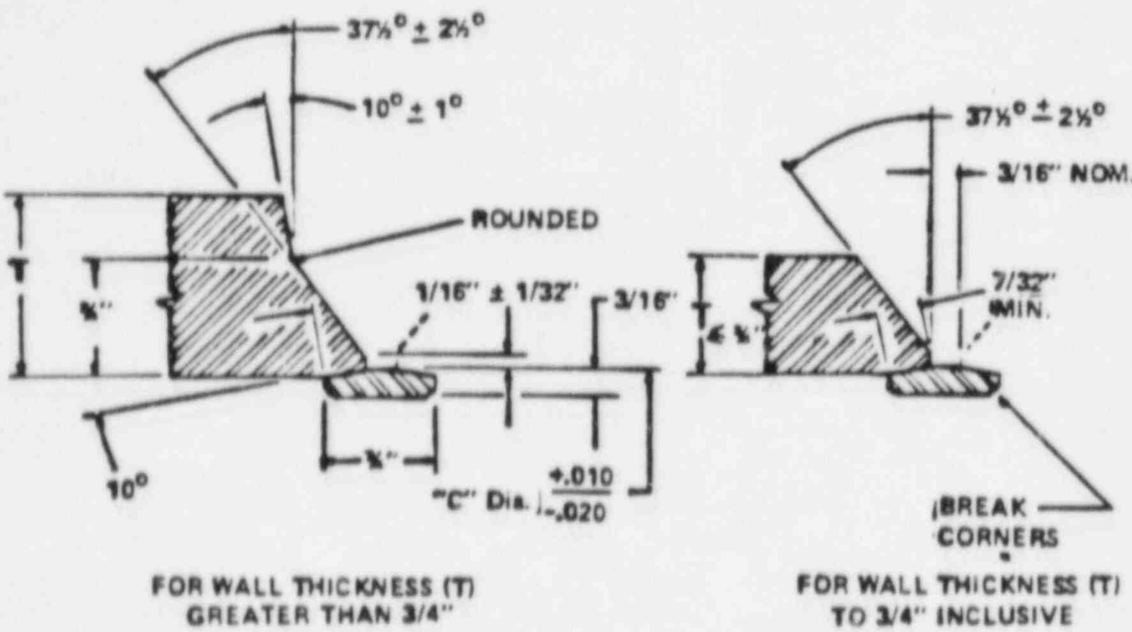
SOUTH TEXAS PROJECT
UNITS 1 & 2

ALL AUSTENITIC STAINLESS STEEL & NONFERROUS PIPING & ALL ASME SECT. III FERRITIC STEEL PIPING

FIGURE 3.6-6



DETAIL 1 FLAT RING JOINT DETAIL

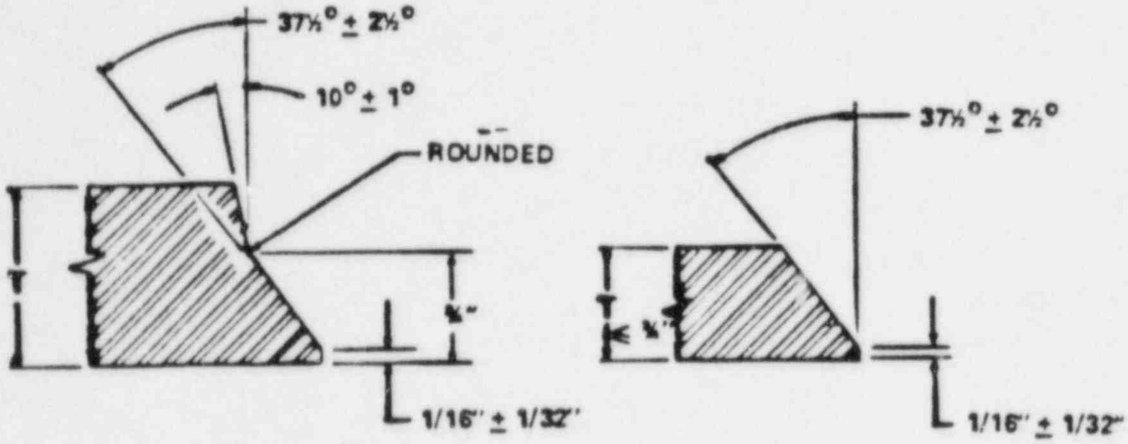


DETAIL 2 TAPERED RING JOINT DETAIL

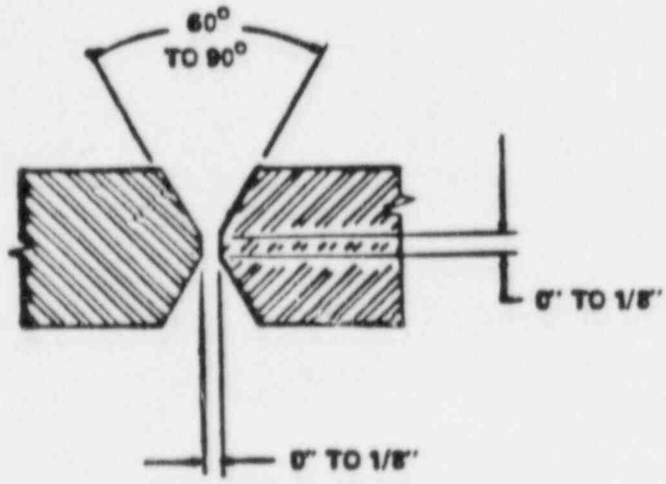
(ALL DIMENSIONS TYPICAL UNLESS INDICATED OTHERWISE)

SOUTH TEXAS PROJECT
UNITS 1 & 2

BACKING STRIP WELD PREP DETAILS
(PIPE)
FIGURE 3.6-7



OPEN BUTT PIPE JOINTS



OPEN BUTT PLATE JOINTS

(ALL DIMENSIONS TYPICAL UNLESS INDICATED OTHERWISE)

SOUTH TEXAS PROJECT UNITS 1 & 2
OPEN BUTT WELD END PREP (NON-NUCLEAR FERRITIC STEEL PIPE OR PLATE) FIGURE 3.6-8

ATTACHMENT 1
ST-HL-AE-1436
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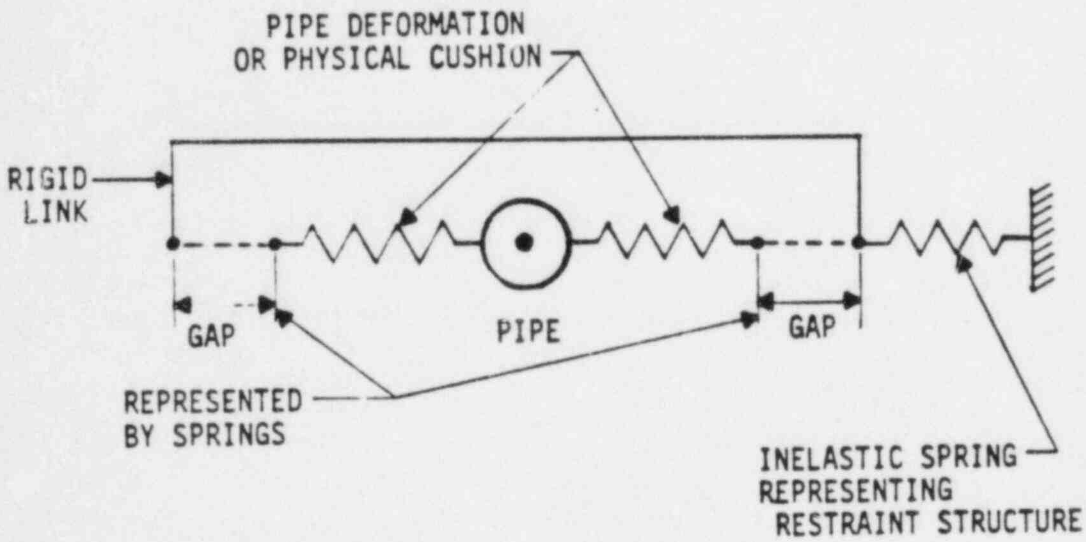

SOUTH TEXAS PROJECT
UNITS 1 & 2

MATHEMATICAL MODEL OF STRUCTURE

FIGURE 3.6-9

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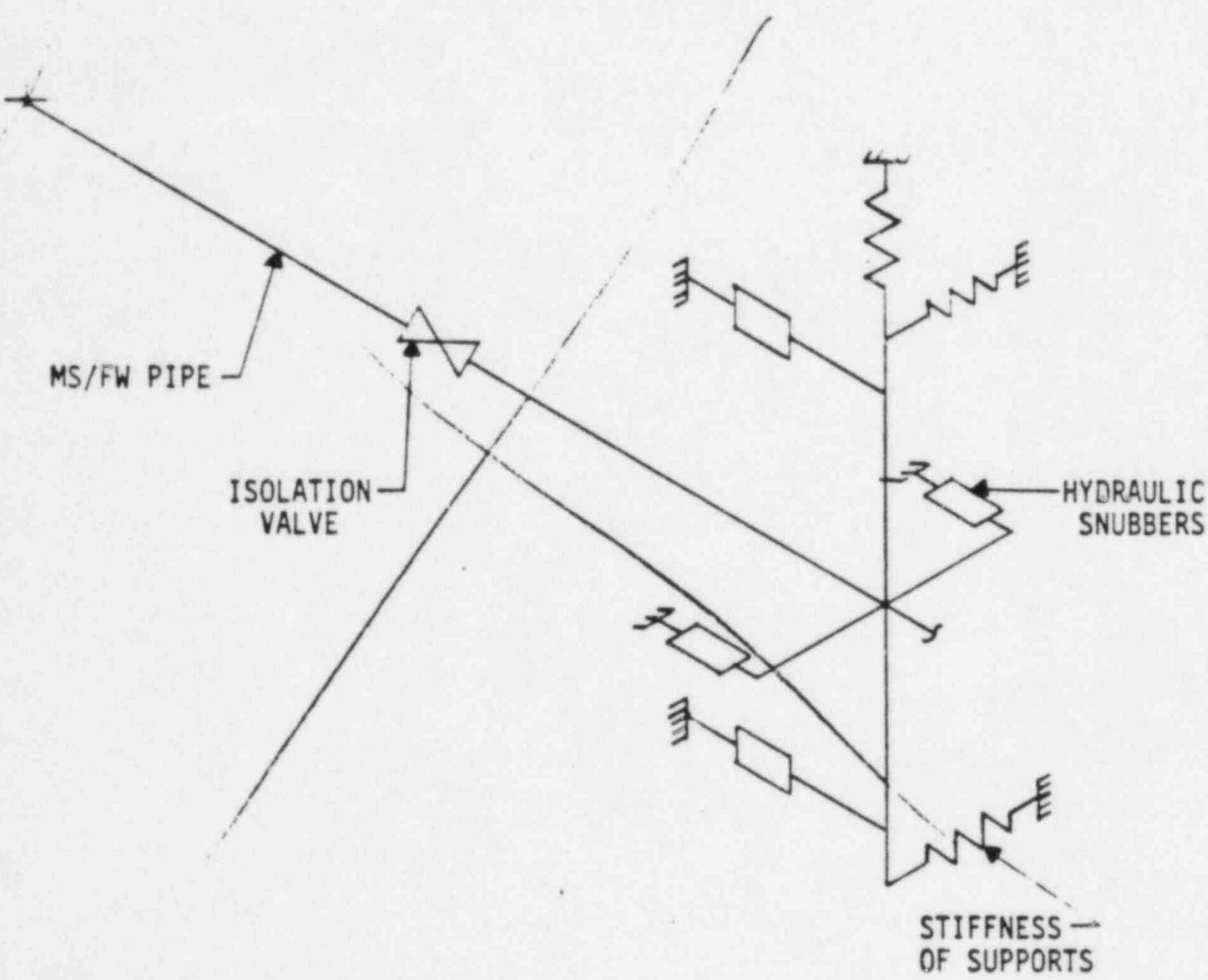

SOUTH TEXAS PROJECT UNITS 1 & 2

MATHEMATICAL MODEL FOR MS & FW PIPE RUPTURE RESTRAINTS

FIGURE 3.6-10

ATTACHMENT I
ST-HL-AE-1436
PAGE 32 OF 38

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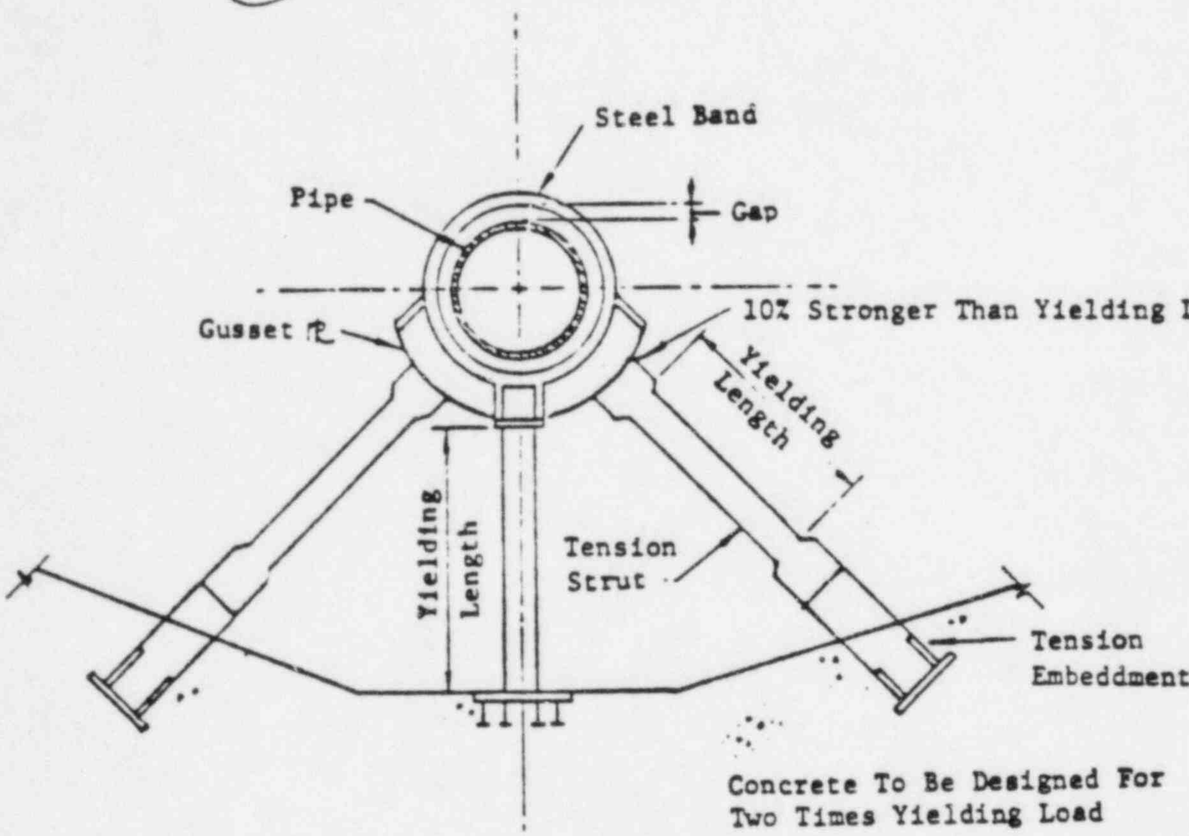
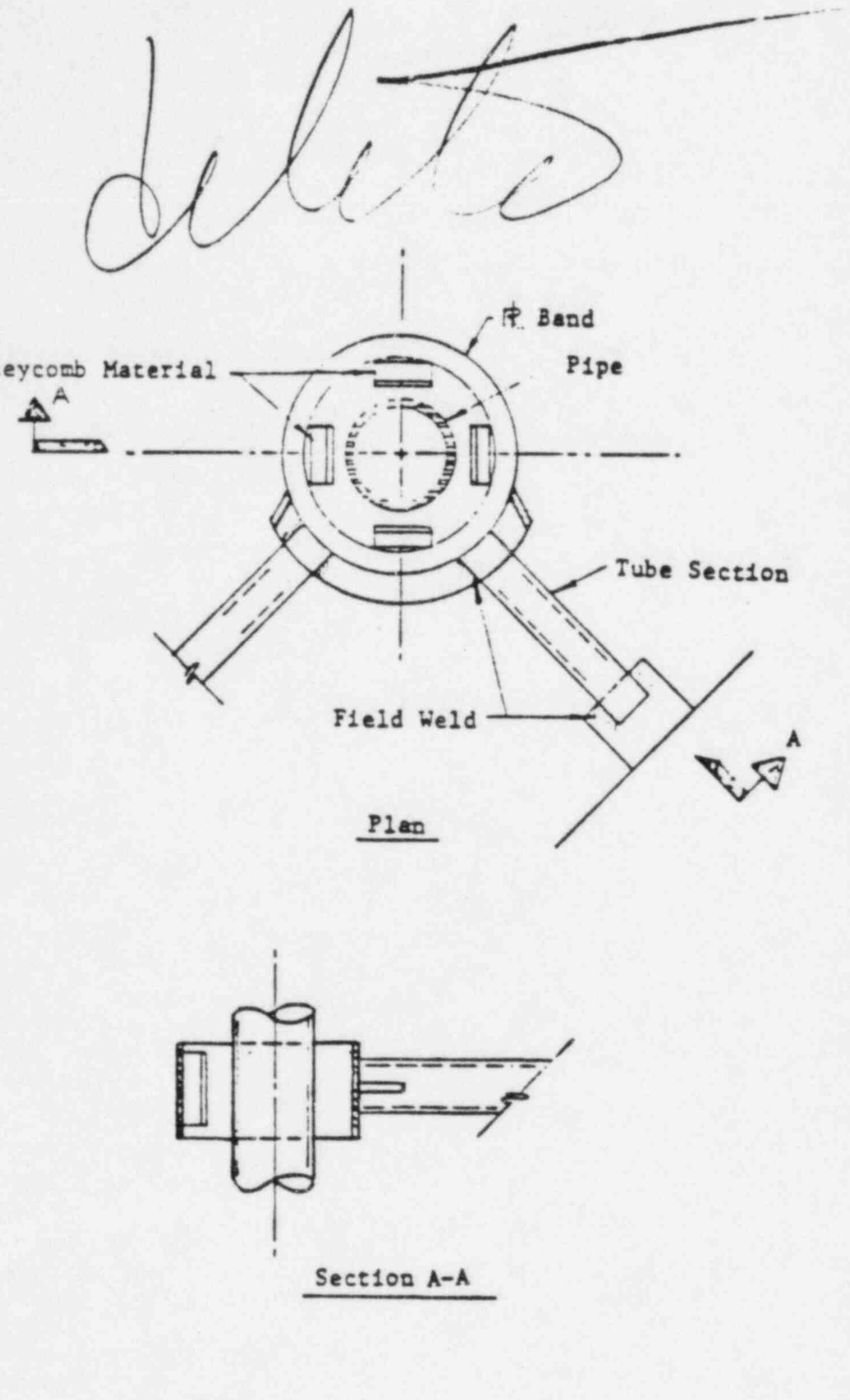


SOUTH TEXAS PROJECT
UNITS 1 & 2

TYPICAL PIPE RESTRAINT
(YIELDING MEMBER TYPE)

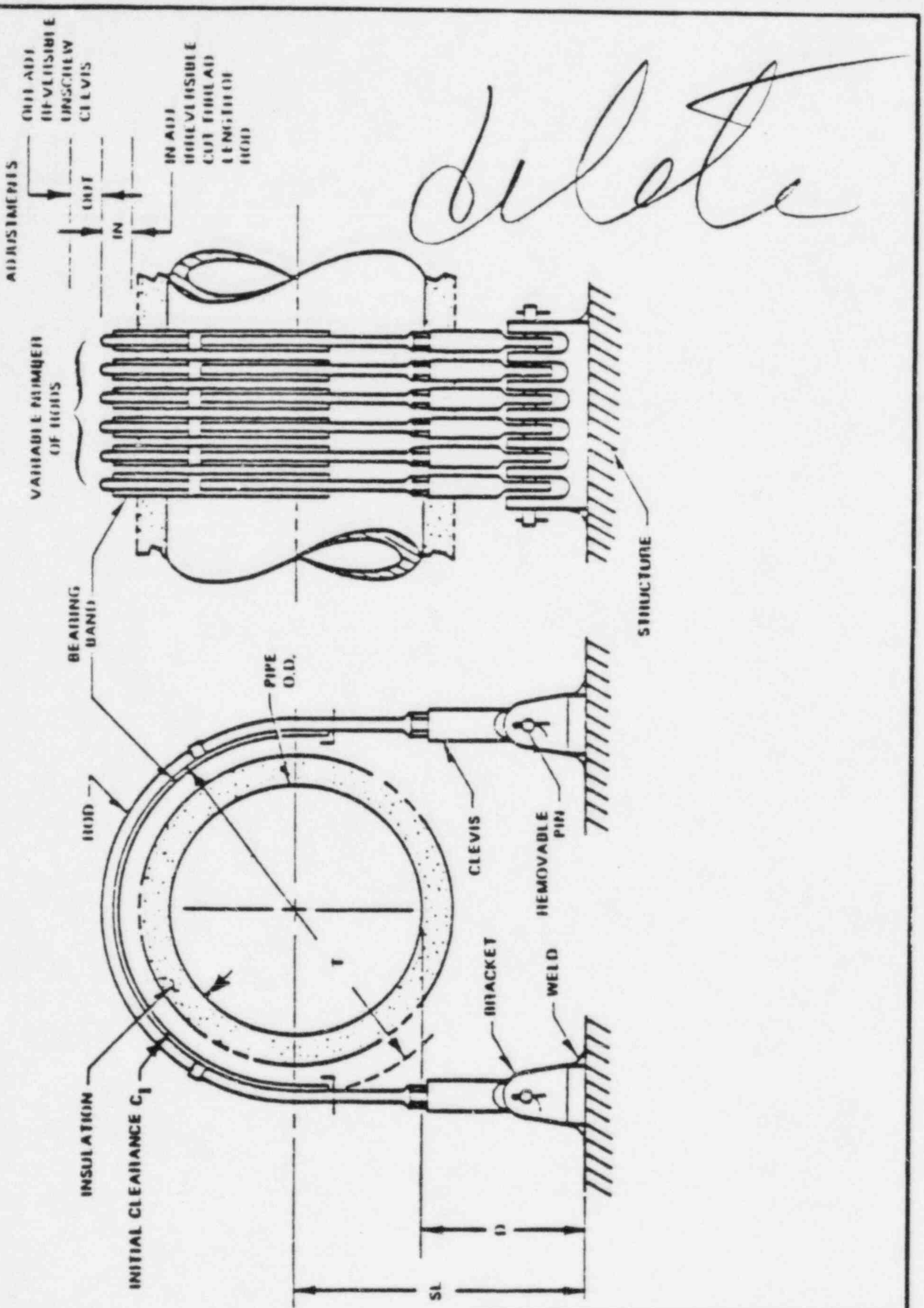
FIGURE 3.6-11



SOUTH TEXAS PROJECT
UNITS 1 & 2

TYPICAL PIPE RESTRAINT
(CRUSHABLE PAD TYPE)

FIGURE 3.6-12



SOUTH TEXAS PROJECT
UNITS 1 & 2

TYPICAL PIPE WHIP
RESTRAINT CONFIGURATION

FIGURE 3.6-13

Question 210.19N

Provide assurance that the guidance stated in BTP MEB 3-1, Section B.1.C. (1) (d) (iii) concerning changes of new highest stress locations as a result of piping reanalysis has been used in STP high energy line break location postulation.

Response

BTP MEB 3-1, Section B.1.C(1)(d)(iii) is complied with to the extent that new high stress locations exceeding the break location criteria described below are considered as break locations regardless of the degree of remoteness from previous high stress points.

Section 3.6.2.1.1 specifies the criteria for postulating pipe break locations. It states that breaks are postulated at terminal ends and at intermediate locations based on stresses and cumulative usage factors. Arbitrary intermediate breaks are not postulated in high energy piping in accordance with the letters to the NRC ST-HL-AE-1115 dated August 20, 1984, and ST-HL-AE-1202 dated March 8, 1985. Section 3.6.2.1.1.2, Tables 3.6.1-2, 3.6.1-3, and 3.6.2-1 have been revised to reflect elimination of arbitrary intermediate breaks in HE piping.

The exception to the above criteria is the feedwater system, as stated in Section 3.6.2.1.1.2(c), where a minimum of two intermediate break locations are postulated based on the stress analysis results.

In response to NRC letter ST-AE-HL-90534, January 29, 1985 we have provided additional design information via ST-HL-AE-1202, March 8, 1985, concerning the feedwater system provisions to minimize waterhammer. Hence, pending NRC favorable review, the feedwater arbitrary intermediate break locations may be eliminated prior to final stress analysis. ~~Alternatively,~~ As the stress analysis is finalized, it is anticipated that changes in intermediate break locations, if any, would be due to the criterion contained in BTP MEP 3-1, Section B.1.C(1)(d) (i) and (ii) and thus enveloping criterion B.1.C(1)(d) (iii).

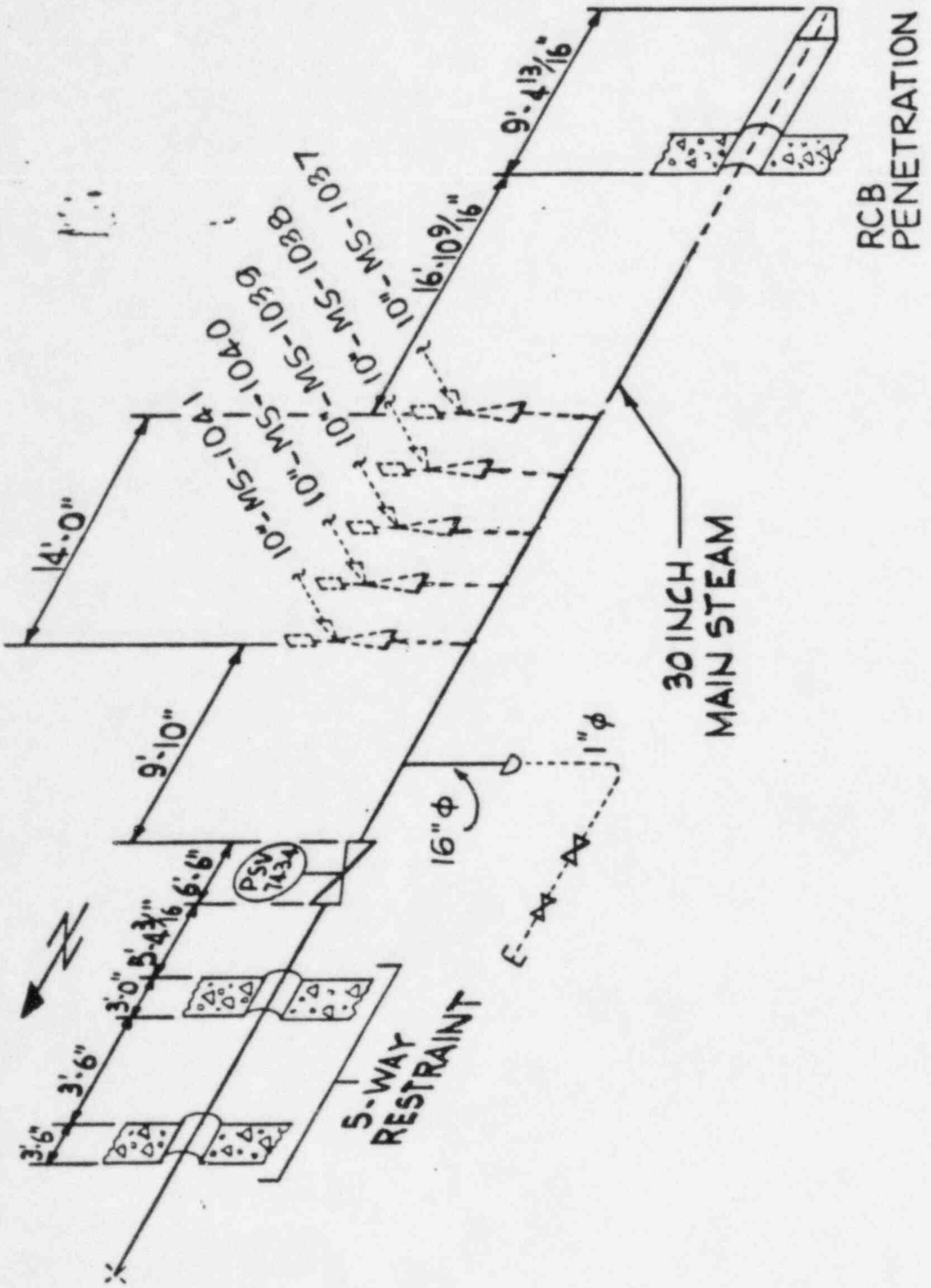
Question 210.33N

The criteria in the FSAR for designating the break exclusion zones on piping in the containment penetration areas require further justification. Identify all branch lines that are considered as part of the break exclusion zone. Provide drawings and/or other information quantifying the lengths of pipe for all systems including branch lines defined by criteria of Section 3.6.2.1.1.5 of the FSAR.

Response

The only lines that are designated as "break exclusion zones" are the main steam and feedwater main runs in the isolation valve cubicle (IVC) as shown on Figures Q210.33-1 and 2. The break exclusion area extends from the containment penetrations through the five-way restraints at the IVC north walls. The only branche~~s included are the safety relief valve lines and~~ the short 16 in. diameter stubs for main steam drain and instrumentation.

included



DIMENSIONS ARE APPROXIMATE

SOUTH TEXAS PROJECT
UNITS 1 & 2

PIPE BREAK EXCLUSION
ZONE FOR MAIN STEAM
(TYPICAL)

Figure Q210.33N-1 Amendment 50

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Question 210.34N

Provide assurance that 100 percent volumetric inservice examination of all pipe welds in the break exclusion zone will be conducted during each inspection interval as defined in IWA-2400, ASME Code, Section XI.

Response

As discussed in Section 6.6.8, circumferential and longitudinal pipe welds within the break exclusion zone of high energy fluid system piping at containment penetrations will either be 100 percent volumetrically examined during the preservice examination and during each inspection interval of the inservice inspection program in accordance with ASME Code Section XI and SRP 6.6 or exceptions (e.g. due to access limitations) will be documented in the ISI program.