ERRATA

DESCRIPTION					REPLACE	ADD	DELETE
Title Sheet					X		
Appendix B				5 pages	X		
Appendix C	List of Documents Reviewed			Page 13	X		
Appendix D	TUSI QA Program Matrix SAR & QAP			5 pages	X		
	TUGCO QA Program Matrix Engineering & QA procedures			4 pages	X		
Appendix E	DC-1		Rev. 2	15 pages			X
	DC-1		Rev. 3	15 pages		X	
	DC-2		Rev. 2	27 pages			X
	DC-2		Rev. 3	27 pages		X	
Appendix F	PFR-02		Rev. 0	3 pages			X
	PFR-02		Rev. 1	3 pages		X	
Appendix G	PI-00-01	Attach. A	Rev. 0	2 pages			X
	PI-00-01	Attach. A	Rev. 1	2 pages		X	
	PI-00-02	Attach. A	Rev. 2	2 pages			X
	PI-00-02	Attach. A	Rev. 1	2 pages		X	
	PI-00-07	Attach. A	Rev. 0	3 pages			X
	PI-00-07	Attach. A	Rev. 1	3 pages		X	
	PS-01	Attach. A	Rev. 0	Sheet 1 of 1			X
	PS-01	Attach. A	Rev. 1	Sheet 1 of 1		X	
	PS-02		Rev. 0	Sheet 1 of 1			X
	PS-02		Rev. 1	Sheet 1 of 1		X	
	PS-05	Attach. A	Rev. 0	Sheet 1 of 1			X
	PS-05	Attach. A	Rev. 1	Sheet 1 of 1		X	
	PS-08		Rev. 0	Sheet 1 of 1			X
	PS-08		Rev. 1	Sheet 1 of 1		X	
	DC-01-03	Attach. A	Rev. 0	3 pages			X
	DC-01-03	Attach. A	Rev. 1	3 pages		X	
	DC-02-01	Attach. A	Rev. 0	Sheet 1 of 1			X
	DC-02-01	Attach. A	Rev. 1	Sheet 1 of 1		X	
	DC-02-03	Attach. A	Rev. 0	Sheet 1 of 1			X
	DC-02-03	Attach. A	Rev. 1	Sheet 1 of 1		X	
Appendix I	PI-01			Sheet 1 of 14	X		
	PI-01			Sheet 13 of 14	X		

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Appendix I (Continued)	PI-06	Sheet 15 of 16	X		
	PI-06	Sheet 16 of 16	X		
	PI-07	Sheet 2 of 19	X		
	PI-07	Sheet 16 of 19	X		
	PI-07	Sheet 19 of 19	X		
	PI-08	Sheet 1 of 18	X		
	PI-08	Sheet 2 of 18	X		
	PI-08	Sheet 3 of 18	X		
	PI-08	Sheet 4 of 18	X		
	PI-08	Sheet 5 of 18	X		
	PI-08	Sheet 6 of 18	X		
	PI-08	Sheet 7 of 18	X		
	PI-08	Sheet 8 of 18	X		
	PI-08	Sheet 9 of 18	X		
	PI-08	Sheet 10 of 18	X		
	PI-08	Sheet 11 of 18	X		
	PI-08	Sheet 12 of 18	X		
	PI-08	Sheet 13 of 18	X		
	PI-08	Sheet 14 of 18	X		
	PI-08	Sheet 15 of 18	X		
	PI-08	Sheet 16 of 18	X		
	PI-08	Sheet 17 of 18	X		
	PI-08	Sheet 18 of 18	X		
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Appendix J General Notes to Pipe Support Checklist					
		Page 1 of 9	X		
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		Page 4 of 9	X		
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		Page 6 of 9	X		
		Page 7 of 9	X		
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		Page 9 of 9	X		
Pipe Support Checklist Index		2 pages		X	
	PS-002	Sheet 4 of 9	X		
	PS-004	Sheet 1 of 9	X		
	PS-004	Sheet 5 of 9	X		
	PS-005	Sheet 8 of 9	X		

ERRATA

DESCRIPTION			REPLACE	ADD	DELETE
Appendix J (Continued)	PS-005	Sheet 9 of 9	X		
	PS-006	Sheet 8 of 9	X		
	PS-007	Sheet 5 of 9	X		
	PS-007	Sheet 8 of 9	X		
	PS-009	Sheet 7 of 8	X		
	PS-011	Sheet 8 of 9	X		
	PS-011	Sheet 9 of 9	X		
	PS-013	Sheet 4 of 9	X		
	PS-016	Sheet 1 of 9	X		
	PS-019	Sheet 7 of 8	X		
	PS-020	Sheet 8 of 9	X		
	PS-022	Sheet 1 of 10	X		
	PS-022	Sheet 5 of 10	X		
	PS-022	Sheet 8 of 10	X		
	PS-023	Sheet 1 of 9	X		
	PS-024	Sheet 1 of 10	X		
	PS-024	Sheet 2 of 10	X		
	PS-024	Sheet 6 of 10	X		
	PS-024	Sheet 9 of 10	X		
	PS-026	Sheet 3 of 9	X		
	PS-028	Sheet 4 of 8	X		
	PS-036	Sheet 1 of 10	X		
	PS-036	Sheet 2 of 10	X		
	PS-036	Sheet 3 of 10	X		
	PS-036	Sheet 4 of 10	X		
	PS-036	Sheet 6 of 10	X		
	PS-037	Sheet 1 of 9	X		
	PS-039	Sheet 1 of 9	X		
	PS-040	Sheet 8 of 9	X		
	PS-041	Sheet 1 of 10	X		
	PS-042	Sheet 5 of 10	X		
	PS-042	Sheet 8 of 10	X		
	PS-042	Sheet 9 of 10	X		
	PS-044	Sheet 3 of 9	X		
	PS-044	Sheet 4 of 9	X		
	PS-046	Sheet 1 of 9	X		
	PS-048	Sheet 1 of 8	X		
	PS-048	Sheet 4 of 8	X		
	PS-052	Sheet 1 of 8	X		
	PS-052	Sheet 6 of 8	X		
	PS-054	Sheet 7 of 8	X		
	PS-059	Sheet 4 of 10	X		
	PS-059	Sheet 9 of 10	X		

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DESCRIPTION			REPLACE	ADD	DELETE
Appendix J (Continued)	PS-060	Sheet 5 of 8	X		
	PS-061	Sheet 4 of 8	X		
	PS-062	Sheet 4 of 8	X		
	PS-062	Sheet 5 of 8	X		
	PS-065	Sheet 1 of 8	X		
	PS-068	Sheet 8 of 8	X		
	PS-069	Sheet 1 of 10	X		
	PS-069	Sheet 2 of 10	X		
	PS-069	Sheet 9 of 10	X		
	PS-070	Sheet 1 of 9	X		
	PS-070	Sheet 6 of 9	X		
	PS-070	Sheet 8 of 9	X		
	PS-071	Sheet 6 of 10	X		
	PS-071	Sheet 8 of 10	X		
	PS-071	Sheet 9 of 10	X		
	PS-072	Sheet 6 of 9	X		
	PS-072	Sheet 9 of 9	X		
	PS-073	Sheet 6 of 9	X		
	PS-074	Sheet 1 of 9	X		
	PS-075	Sheet 1 of 9	X		
	PS-075	Sheet 8 of 9	X		
	PS-076	Sheet 1 of 9	X		
	PS-076	Sheet 6 of 9	X		
	PS-077	Sheet 1 of 9	X		
	PS-080	Sheet 1 of 8	X		
	PS-080	Sheet 2 of 8	X		
	PS-081	Sheet 6 of 9	X		
	PS-081	Sheet 9 of 9	X		
	PS-082	Sheet 5 of 9	X		
	PS-083	Sheet 10 of 10	X		
	PS-086	Sheet 1 of 9	X		
	PS-087	Sheet 8 of 10	X		
	PS-087	Sheet 9 of 10	X		
	PS-088	Sheet 9 of 9	X		
	PS-089	Sheet 4 of 9	X		
	PS-089	Sheet 5 of 9	X		
	PS-089	Sheet 7 of 9	X		
	PS-089	Sheet 8 of 9	X		
	PS-090	Sheet 1 of 9	X		
	PS-090	Sheet 2 of 9	X		
	PS-090	Sheet 3 of 9	X		
	PS-090	Sheet 4 of 9	X		
	PS-090	Sheet 5 of 9	X		

ERRATA

DESCRIPTION			REPLACE	ADD	DELETE
Appendix J (Continued)	PS-091	Sheet 8 of 9	X		
	PS-092	Sheet 3 of 10	X		
	PS-093	Sheet 5 of 8	X		
	PS-093	Sheet 6 of 8	X		
	PS-093	Sheet 8 of 8	X		
	PS-094	Sheet 7 of 9	X		
	PS-095	Sheet 1 of 9	X		
	PS-095	Sheet 3 of 9	X		
	PS-095	Sheet 5 of 9	X		
	PS-099	Sheet 1 of 8	X		
	PS-099	Sheet 5 of 8	X		
	PS-099	Sheet 6 of 8	X		
	PS-100	Sheet 1 of 9	X		
	PS-100	Sheet 4 of 9	X		
	PS-101	Sheet 8 of 9	X		
	PS-101	Sheet 9 of 9	X		
	PS-102	Sheet 8 of 8	X		
	PS-103	Sheet 1 of 9	X		
	PS-103	Sheet 5 of 9	X		
	PS-104	Sheet 1 of 9	X		
	PS-106	Sheet 1 of 9	X		
	PS-106	Sheet 7 of 9	X		
	PS-107	Sheet 1 of 8	X		
	PS-107	Sheet 2 of 8	X		
	PS-107	Sheet 3 of 8	X		
	PS-107	Sheet 4 of 8	X		
	PS-107	Sheet 5 of 8	X		
	PS-107	Sheet 6 of 8	X		
	PS-107	Sheet 7 of 8	X		
	PS-107	Sheet 8 of 8	X		
	PS-111	Sheet 2 of 9	X		
	PS-111	Sheet 8 of 9	X		
	PS-111	Sheet 9 of 9	X		
	PS-113	Sheet 1 of 9	X		
	PS-113	Sheet 8 of 9	X		
	PS-115	Sheet 3 of 9	X		
	PS-115	Sheet 5 of 9	X		
	PS-116	Sheet 1 of 9	X		
	PS-118	Sheet 1 of 8	X		
	PS-119	Sheet 1 of 9	X		
	PS-119	Sheet 4 of 9	X		
	PS-119	Sheet 8 of 9	X		
	PS-120	Sheet 8 of 9	X		

ERRATA

DESCRIPTION			REPLACE	ADD	DELETE
Appendix J (Continued)	PS-123	Sheet 1 of 10	X		
	PS-123	Sheet 2 of 10	X		
	PS-124	Sheet 2 of 9	X		
	PS-124	Sheet 3 of 9	X		
	PS-125	Sheet 1 of 9	X		
	PS-126	Sheet 1 of 10	X		
	PS-126	Sheet 5 of 10	X		
	PS-126	Sheet 7 of 10	X		
	PS-126	Sheet 9 of 10	X		
	PS-126	Sheet 10 of 10	X		
	PS-127	Sheet 1 of 9	X		
	PS-127	Sheet 8 of 9	X		
	PS-129	Sheet 1 of 9	X		
	PS-129	Sheet 8 of 9	X		
	PS-130	Sheet 1 of 9	X		
	PS-131	Sheet 8 of 8	X		

No. TR-84042-01
Rev. 1

FINAL REPORT

INDEPENDENT ASSESSMENT PROGRAM

OF

COMANCHE PEAK STEAM ELECTRIC STATION

(PHASE 3)

Prepared for
Texas Utilities Generating Company
2001 Bryan Tower
Dallas, Texas 75201

Prepared By
Cygna Energy Services
101 California Street, Suite 1000
San Francisco, California 94111

Approved by N.H. Williams 11/20/84
Project Manager Date

Approved by [signature] 11/20/84
Senior Review Team Date

November 20, 1984

CYGNA

NOMENCLATURE

A/E Or A-E -	Architect Engineer (Gibbs & Hill)
AD -	Administrative (Procedure)
AEG -	Analytical Engineering Guide
AISC -	American Institute of Steel Construction
ANI -	Authorized Nuclear Inspector
ANSI -	American National Standards Institute
ARS -	Amplified Response Spectra
ASLB -	Atomic Safety and Licensing Board
ASME -	American Society of Mechanical Engineers
ASTM -	American Society for Testing and Materials
B&PV -	Boiler and Pressure Vessel
B&R -	Brown & Root
BRH -	Hanger Sketches (Brown & Root)
BRHL -	Hanger Isometric (Brown & Root)
BRP -	Brown & Root Piping Isometric
C/A -	Corrective Action
CALCS or Calcs -	Calculation(s)
CAR -	Corrective Action Report
CAT -	Construction Appraisal Team
CCW -	Component Cooling Water
CFR -	Code of Federal Regulations
CHN -	Construction Hold Notice
CMC -	Component Modification Card
CP or CPSES -	Comanche Peak Steam Electric Station
CP-EI -	Comanche Peak Engineering Instruction
CP-EP -	Comanche Peak Engineering Procedure
CP-PF -	Comanche Peak Project Function
CP-PP -	Comanche Peak Project Procedure
CP-QP -	Comanche Peak Quality Procedure
CPP -	Comanche Peak Project
CPP-EP -	Comanche Peak Engineering Procedure
CPPE -	Comanche Peak Project Engineering
Cps -	Cycles per second
CQAM -	Corporate QA Manual (NPSI)
CQI-CS -	Comanche Peak Quality Instruction
CVC -	Change Verification Checklist
D&DR -	Deficiency & Disposition Report (Brown & Root)
DC-DDA -	Design Change/Design Deviation Authorization
DC-X -	Design Control Procedure (Gibbs & Hill)
DC/DDR -	Design Change/Design Deviation Request

NOMENCLATURE (continued)

DCA -	Design Change Authorization
DCC -	Document Control Center
DCRP -	Design Change Request to Proceed
DCTG -	Design Change Tracking Group
DECD -	Design Engineering Change/Deviation
DEP -	Design Engineering Package
DLF -	Dynamic Load Factor
DPF -	Definite Potential Finding
DQI-CS -	Comanche Peak Quality Instruction
DQP-CS -	Comanche Peak Quality Procedure
DRC -	Design Review Checklist
DRR -	Deficiency Review Report
DRS -	Design Report Summary
DVR -	Design Verification Report
DW -	Dead Weight
DWG or Dwg -	Drawing
ECN -	Engineering Change Notice
ECR -	Engineering Change Request
EDP -	Electrical Data Processing Group (ITT Grinnell)
EESV -	Engineering Evaluation of Separation Variance
ENG or ENGR -	Engineering
EQAP -	Engineering QA Procedure (ITT Grinnell)
EQN -	Equation
ESQAM -	Engineering Services Quality Assurance Manual (ITT Grinnell
FCN -	Field Change Notice (Westinghouse)
FDSG -	Field Damage Study Group
FES -	Field Electrical Sketch
FIRC -	Field Information Request Clarification
FMHS -	Field Modified Hanger Sketch
FP -	Field Procedure
FPSD -	Field Analyzed Piping & Support Division
FS -	Factor of Safety
FSAR -	Final Safety Analysis Report
FSDG -	Field Support Design Group
FSEG -	Field Structural Engineering Group
g -	Acceleration Due to Gravity
G&H -	Gibbs & Hill
GHH -	Pipe Support Location Drawing (Gibbs & Hill)
HHL -	Hanger Hold List
HITS -	Hanger Installation Tracking System
HVAC -	Heating Ventilating & Air Conditioning

NOMENCLATURE (continued)

Hx -	Heat Exchanger
Hz -	Hertz
I&C -	Instrumentaion & Control
IAP -	Independent Assessment Program
IR -	Inspection Report
ISO -	Isometric Drawing
ITTG -	ITT Grinnell
KIPS or Kips -	Kilo Pounds (1000 pounds)
Ksi -	Kips Per Square Inch
LCD -	Load Capacity Data
LCDS -	Load Capacity Data Sheet
LOCA -	Loss of Coolant Accident
MED -	Mechanical Engineering Design
MRR -	Material Receipt Report
MS -	Main Steam
N -	No
N/A or NA -	Not Applicable
NCR -	Nonconformance Report
NDE -	Non-Destructive Examination
NNS -	Non-Nuclear Safety
NOE -	Nuclear Operations Engineering
NPS-QA -	NPSI QA Procedure
NPSI -	NPS Industries Inc.
NR -	Not Required
NRC -	Nuclear Regulatory Commission
OD -	Outside Diameter
OSD -	Over/Short/Damaged (Report)
P-X -	TUSI Engineering Procedure
PA -	Project Administration Procedure (Gibbs & Hill)
PC -	Project Control Procedure (Gibbs & Hill)
PDRF -	Piping Deviation Record Form
PE -	Project Engineering
PFR -	Potential Finding Report
PG -	Project Guide (Gibbs & Hill)
PITS -	Pipe Installation Tracking System
PPRV -	Permanent Plant Records Vault
PPSE -	Pipe Support Engineer
PR -	Purchasing (Procedure)

NOMENCLATURE (continued)

PSAR -	Preliminary Safety Analysis Report
PSDG -	Pipe Support Design Group
PSE -	Pipe Support Engineering
psi (g) -	Pounds per square inch (gage)
PSS -	Penetration Seal Schedule
PSSF -	Penetration Seal Schedule Final
PVRC -	Pressure Vessel Research Council
QA -	Quality Assurance
QA-I -	QA Instruction
QA-X -	QA Procedure (Gibbs & Hill)
QAABC -	QA As Built Coordinator
QAM -	Section of Hanger Division QA Manual (ITT Grinnell)
QAM -	QA Manual (NPSI)
QAP -	Quality Assurance Plan (TUSI)
QAP -	Quality Assurance Procedure (ITT Grinnel)
QC -	Quality Control
QCDR -	Quality Control Deficiency Report (TUSI)
QCE -	Section of Engineering Services QA Manual (ITT Grinnell)
QCEA -	Section of Engineering Services QA Manual (ITT Grinnell)
QCES -	Section of ESQAM (ITT Grinnell)
QCH -	Section of Hanger Division QA Manual (ITT Grinnell)
QI-QP -	Comanche Peak Quality Instruction
R or Rev -	Revision
RE -	Responsible Engineer
RHR -	Residual Heat Removal
RJ -	Reject
RP -	Repair
RV -	Relief Valve (or Safety Valve) Thrust Load
RW -	Rework
S_A -	Allowable Stress Range for Expansion Stresses
SAM -	Seismic Anchor Movement
SAT or Sat -	Satisfactory
SCH -	Schedule
SDAR -	Significant Deficiency Analysis Report
SG -	Steam Generator
S_h -	Basic Material Allowable Stress at High Temperature
SIF -	Stress Intensification Factor
SIT -	Special Investigation Team
SMCG -	Site Material Control Group
SOL -	Sockolet
SPEC -	Specification
SPG -	Special Projects Group

NOMENCLATURE (continued)

SR -	Short Radius
SRP -	Standard Review Plan
SSAG -	Site Stress Analysis Group
SSE -	Safe Shutdown Earthquake
T -	TUSI Engineering Procedure
TAM -	Thermal Anchor Movement
TDCR -	Tugco Design Change Request
TDR -	Test Deficiency Report
TFEG -	Task Force Evaluation Group
TH -	Thermal Expansion Load
TNE -	TUGCO Nuclear Engineering
TNEDG -	TUSI/TUGCO Nuclear Engineering Drafting Group
TNES -	TUSI/TUGCO Nuclear Engineering Specification
TS -	Technical Services
TSABC -	Technical Services As-Built Coordinator
TSABE -	Technical Services As-Built Engineering
TSDRE -	Technical Services Design Review Engineering Group
TSDRE -	Technical Services Design Review Engineering
TSG -	Technical Support Group
TSMD -	Technical Support Mechanical Drafting
TTJ -	Tapered Transition Joint
TUEC -	Texas Utilities Electric Company
TUGCO -	Texas Utilities Generating Company
TUSI -	Texas Utilities Services, Inc.
UAI -	Use As Is
UNSAT -	Unsatisfactory
VBR -	TUSI/TUGCO Vendor Document
VCDI -	Vendor Certification Drafting Instructions
VP -	Vice President
W/O -	Without
WP -	Work Procedure (NPSI)
WRC -	Welding Research Council
Y -	Yes
ZPA -	Zero Period Acceleration

LIST OF DOCUMENTS REVIEWED

206. TUGCO Letter to Cygna dtd. July 12, 1984, "CPSES Cygna Review Questions (Pipe Supports)"

207. USNRC Report NUREG/CR-2175, "Snubber Sensitivity Study," July 1981 - Prepared by Energy Technology Engineering Center

208. EBASCO Letter to Cygna dtd. June 16, 1984 regarding preliminary U-bolt Test Results

The following affidavits filed before the Atomic Safety and Licensing Board for CPSES:

a) Iotti, Finneran - Consideration of Force Distribution in Axial Restraints

b) Iotti, Finneran - Use of Generic Stiffnesses Instead of Actual Stiffnesses in Piping Analysis

c) Iotti, Finneran - Safety Factors

d) Iotti, Finneran - Differential Displacement of Large Frame Pipe Supports

e) Iotti, Finneran - Friction Forces in the Design of Pipe Supports With Small Thermal Movements

f) Finneran - Consideration of Local Displacements and Stresses

g) Finneran, Iotti, Deubler - Design of Richmond Inserts and Their Application to Support Design

h) Finneran, Iotti - CASE's Allegation Regarding Section Property Values

i) Iotti, Finneran - Effects of Gaps on Structural Behavior Under Seismic Loading Conditions

209. Gibbs & Hill calculation AB-1-23B Issue "Test" dated 9/28/84 and accompanying computer output.

210. Gibbs & Hill calculation AB-1-23D Issue "Test" dated 9/28/84 and accompanying computer output.

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

SAFETY ANALYSIS REPORT (SAR) AND QUALITY ASSURANCE PLAN (QAP)

NO.	BASE DOCUMENT ATTRIBUTE			DOCUMENT REVIEWED 1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	ANSI N45.2.11 Draft 2, Rev. 2, QA Requirements for Design of Nuclear Power Plants ORGANIZATION	N45.2.11 PARAGRAPH		PSAR					FSAR					
1	Do Program Documents Outline The Organizational Structure Within Which The Program is To Be Implemented?	2.1	SAR QAP	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1 1.4	17.1.1.1 1.0 1.1 1.3 1.4 1.5	17.1.1 1.0	17.1.1 1.0	17.1.1 1.0	17.1.1 1.0	17.1.1 1.0	17.1.1 1.0
2	Are Authority And Responsibility Of The Persons And Organizations Involved in Performing Design Activities Affecting The Quality Of Design Delineated in Program Documents?	2.1	SAR QAP	17.1.1.1	17.1.1.1 2.3	17.1.1.1 1.4 1.5 2.3	17.1.1.1 1.4 1.5 1.7	17.1.1.1 1.0 1.1 1.3 1.4 1.5	17.1.1 3.0	17.1.1 3.0	17.1.1 3.0	17.1.1 3.0	17.1.1 3.0	17.1.1 3.0
3	Are Design Responsibilities And Interfaces Among Contributing Organizations (Both Internal And External) Identified?	2.1	SAR QAP	17.1.1.1.5	17.1.1.1.5 2.3.5.3 2.3.4.4	17.1.1.1.5 1.7	17.1.1.1.5 1.7	17.1.1.1.5 3.0	17.1.1.5 3.0	17.1.1.5 3.0	17.1.1.5 3.0	17.1.1.5 3.0	17.1.1.5 3.0	17.1.1.5 3.0
4	Are Procedures Developed To Assure That Design Activities Are Carried Out in A Planned, Controlled, Orderly And Correct Manner?	2.2	SAR QAP	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3 3.C 5.0	17.1.3 3.0 5.0	17.1.3 3.0 5.0	17.1.3 3.0 5.0	17.1.3 3.0 5.0	17.1.3 3.0 5.0	17.1.3 3.0 5.0
5	Do Procedures Cover The Following:	2.2												

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

SAFETY ANALYSIS REPORT (SAR) AND QUALITY ASSURANCE PLAN (QAP)

NO.	BASE DOCUMENT ATTRIBUTE ORGANIZATION	N45.2.11 PARAGRAPH		DOCUMENT REVIEWED 1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
				PSAR					FSAR					
A.	Responsibilities within Design Organizations?		SAR	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3
			QAP		2.3	2.3	2.3	2.3 3.0	3.0	3.0	3.0	3.0	3.0 1.0 1.1 1.2	3.0
B.	Responsibilities of Organizations Involved in the Program, Such as Owner, A-E, NSSS Supplier, Etc.?		SAR	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3
			QAP		2.7	2.7	2.7	2.7 3.0	3.0	3.0	3.0	3.0	3.0	3.0
C.	Technical Information Exchanges Across External/Internal Interfaces?		SAR	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3	17.1.1 17.1.3
			QAP		2.3	2.3	2.3	2.3 3.0	3.0	3.0	3.0	3.0	3.0	3.0
D.	Management Review Of Status/Adequacy Of The Program?		SAR	17.1.1.1.3 17.1.1.10	17.1.1.1.3 17.1.1.10	17.1.1.1.3 17.1.1.10	17.1.1.1.3 17.1.1.10	17.1.1.1.3 17.1.1.10	17.1.1 17.1.3.5	17.1.1 17.1.3.5	17.1.1 17.1.3.5	17.1.1 17.1.3.5	17.1.1 17.1.3.5	17.1.1 17.1.3.5
			QAP		2.7.4.1	2.7.4.1	2.7.4.1	2.7.4.1 3.0	3.0	3.0	3.0	3.0	3.0	3.0
E.	Necessary Training Of Personnel?		SAR	17.1.1.2	17.1.1.2	17.1.1.2	17.1.1.2	17.1.1.2	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1	17.1.1.1
			QAP		1.5.5.1	1.5	1.8	1.8 2.0	2.0	2.0	2.0	2.0	2.0	2.0
F.	Identification Of Design Inputs?		SAR	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.3.4	17.1.3.4	17.1.3.4	17.1.3.4	17.1.3.4	17.1.3.4
			QAP					3.0	3.0	3.0	3.0	3.0	3.0	3.0
G.	Preparation Of Design Criteria Standards?		SAR	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3
			QAP					3.0	3.01	3.01	3.01	3.01	3.01	3.01
H.	Selection Of Design Verification Methods?		SAR	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3
			QAP		2.3	2.3	2.3	2.3 3.0	3.0	3.0	3.0	3.0	3.0	3.0

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COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

SAFETY ANALYSIS REPORT (SAR) AND QUALITY ASSURANCE PLAN (QAP)

NO.	BASE DOCUMENT ATTRIBUTE	N45.2.11 PARAGRAPH		DOCUMENT REVIEWED 1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	ORGANIZATION			PSAR					FSAR					
i.	Performance Of Design Verifications?		SAR	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3
			QAP		2.3	2.3	2.3	2.3 3.0	3.0	3.0	3.0	3.0	3.0	3.0
j.	Conducting Audits Of Design Activities (Including Reporting/Follow-up)?		SAR	17.1.1.18	17.1.1.18	17.1.1.18	17.1.1.18	17.1.1.18	17.1.3.6	17.1.3.6	17.1.3.6	17.1.3.6	17.1.3.6	17.1.3.6
			QAP		2.7.6.1	2.7.4.1	2.7.4.1 3.0	2.7.4.1 3.0 18.0	3.0 18.0	3.0 18.0	3.0 18.0	3.0 18.0	3.0 18.0	18.0
k.	Taking Corrective Action?		SAR	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16
			QAP		2.9	2.9	2.9	2.9 16.0	16.0	16.0	16.0	16.0	16.0	16.0
l.	Controlling Design Changes?		SAR	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3	17.1.3
			QAP		2.7	2.7	2.7	2.7 3.0	3.0	3.0	3.0	3.0	3.0	3.0
6	Are Internal/External Interfaces Between Organizations Performing Work Affecting Quality Of Design Identified In Writing?	5.1.1 5.2.1	SAR	17.1.1.1.5	17.1.1.1.5	17.1.1.1.5	17.1.1.1.5	17.1.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5
			QAP		2.3	2.3	2.3	2.3 3.0	3.0	3.0	3.0	3.0	3.0	3.0
7	Are Responsibilities For Organizations Defined/Documented In Sufficient Detail To Cover The Preparation, Review, And Approval Of Documents Involving Design Interfaces (Tabular Form, Flow Charts, Etc)?	5.1.2 5.2.2	SAR	17.1.1.5 17.1.1.1.5	17.1.1.5 17.1.1.1.5	17.1.1.5 17.1.1.1.5	17.1.1.5 17.1.1.1.5	17.1.1.5 17.1.1.1.5	17.1.1.5 17.1.1	17.1.1.5 17.1.1	17.1.1.5 17.1.1	17.1.1.5 17.1.1	17.1.1.5 17.1.1	17.1.1.5 17.1.1
			QAP		2.3 2.7	2.3 2.7	2.3 2.7	2.3 2.7 3.0	3.0	3.0	3.0	3.0	3.0	3.0

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

SAFETY ANALYSIS REPORT (SAR) AND QUALITY ASSURANCE PLAN (QAP)

BASE DOCUMENT				DOCUMENT REVIEWED										
NO.	ATTRIBUTE	GOVERNING DOCUMENT		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	ORGANIZATION	N45.2.11 PARAGRAPH		PSAR					FSAR					
8	Do Documents Identify The Positions And Titles Of Key Personnel In The Communication Channels And Their Responsibilities For Decision Making, For Resolution Of Problems, And For Taking Appropriate Action?	5.1.3 5.2.3	SAR	17.1.1.1.1	17.1.1.1.1	17.1.1.1.1	17.1.1.1.1	17.1.1.1.1	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5	17.1.1 17.1.1.5
			QAP		2.9	2.9	2.9	1.0 1.3 1.4 1.5 2.9	1.0	1.0	1.0	1.0	1.0 1.1 1.2	1.0 1.1 1.2
	CORRECTIVE ACTION													
9	Has A Corrective Action System Been Established And Documented To Address The Following:	9												
	A. Identification And Correction Of Design Deficiencies (errors)?		SAR	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16
			QAP					15.0 16.0	15.0 16.0	15.0 16.0	15.0 16.0	15.0 16.0	15.0 16.0	15.0 16.0
	B. Instituting Appropriate Changes In The Design Process To Correct Significant/Recurring Design Deficiencies?		SAR	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16
			QAP					16.0	16.0	16.0	16.0	16.0	16.0	16.0
	C. Reporting Deficiencies And Corrective Actions To Appropriate Levels Of Management?		SAR	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16
			QAP		2.9	2.9	2.9	2.9 16.0	16.0	16.0	16.0	16.0	16.0	16.0
	D. Instituting Measures To Follow-up Actions That Cannot Be Immediately Completed?		SAR	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16
			QAP		2.9	2.9	2.9							

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COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

SAFETY ANALYSIS REPORT (SAR) AND QUALITY ASSURANCE PLAN (QAP)

NO.	BASE DOCUMENT ATTRIBUTE	N45.2.11 PARAGRAPH		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	CORRECTIVE ACTION			PSAR					FSAR					
10	Have Measures Been Established To Assure That, When Design Changes Are Required Because Of An Incorrect Design, The Design Process And Verification Procedures Are Reviewed And Modified As Necessary?	9	SAR	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.1.16	17.1.16	17.1.16	17.1.16	17.1.16	17.1.16
			QAP					16.0	16.0	16.0	16.0	16.0	16.0	16.0

Legend: PSAR = Preliminary Safety Analysis Report
FSAR = Final Safety Analysis Report
QAP = Quality Assurance Plan

Note: Quality Assurance Plan sections were initiated beginning in 1975 and progressed in accordance with the work activity. In 1978, the QA Plan changed to a 10CFR50, Appendix B format.

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COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

ENGINEERING AND QUALITY ASSURANCE PROCEDURES

NO.	BASE DOCUMENT ATTRIBUTE	N45.2.11 PARAGRAPH	DOCUMENT REVIEWED 1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	ANSI N45.2.11 Draft 2, Rev 2 QA Requirements for Design of Nuclear Power Plants												
	ORGANIZATION												
1	Do Program Documents Define The Organizational Structure Within Which The Program Is To Be Implemented?	2.1					CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0
2	Are Authority And Responsibility Of The Persons And Organizations Involved In Performing Design Activities Affecting The Quality Of Design Delineated In Program Documents?	2.1					CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-[illegible].0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0	CP-EP-3.0 CP-QP-3.0
3	Are Design Responsibilities And Interfaces Among Contributing Organizations (Both Internal And External) Identified?	2.1					3-1 CPP-EP-1	CP-EP-4.2 CPP-EP-1 CP-EP-4.5	CP-EP-4.0 CP-EP-4.5 CP-EP-2.1	CP-EP-4.0 CP-EP-2.1	CP-EP-4.0 CP-EP-2.1	CP-EP-4.0 CP-EP-2.1	CP-EP-4.0 CP-EP-2.1
4	Are Procedures Developed To Assure That Design Activities Are Carried Out In A Planned, Controlled, Orderly And Correct Manner?	2.2					3-1 CPP-EP-1	CP-EP-12 CPP-EP-1 CP-EP-4.0 CP-EP-4.5	CP-EP-4.5 CP-EP-4.0 CP-EP-2.1	CP-EP-2.1 CP-EP-4.0	CP-EP-2.1 CP-EP-4.0	CP-EP-2.1 CP-EP-4.0	CP-EP-2.1 CP-EP-4.0
5	Do Procedures Cover The Following:	2.2											
	A. Responsibilities Within Design Organizations?							CP-EP-4.5 CP-EP-12 CP-EP-3.0	CP-EP-3.0 CP-EP-4.5 CP-EP-2.1	CP-EP-3.0 CP-EP-2.1	CP-EP-3.0 CP-EP-2.1	CP-EP-3.0 CP-EP-2.1	CP-EP-3.0 CP-EP-2.1
	B. Responsibilities of Organizations Involved In The Program, Such As Owner, A-E, NSSS Supplier, Etc.?						CP-QP-3.0	CP-QP-3.0	CP-EP-4.0 CP-QP-3.0	CP-EP-4.0 CP-QP-3.0	CP-EP-4.0 CP-QP-3.0	CP-EP-4.0 CP-QP-3.0	CP-EP-4.0 CP-QP-3.0
	C. Technical Information Exchanges Across External/Internal Interfaces?						3-1 CPP-EP-1	CPP-EP-1 CP-EP-4.2	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-[illegible]	CP-EP-4.0

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

ENGINEERING AND QUALITY ASSURANCE PROCEDURES

NO.	BASE DOCUMENT ATTRIBUTE	N45.2.11 PARAGRAPH	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	ORGANIZATION												
D.	Management Review Of Status/Adequacy Of The Program?							CP-QP-19.0	CP-QP-19.0	CP-QP-19.0	CP-QP-19.0	CP-QP-19.0	CP-QP-19.0
E.	Necessary Training Of Personnel?							CP-EP-2.0 CP-QP-3.0	CP-EP-2.0 CP-QP-3.0	CP-EP-2.0 CP-QP-3.0	CP-EP-2.0 QI-QP-2.1-16 CP-QP-3.0	CP-EP-2.0 QI-QP-2.1.16 CP-QP-3.0	CP-EP-2.0 QI-QP-2.1.16 CP-QP-3.0
F.	Identification Of Design Inputs?							CP-EP-4.3	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0
G.	Preparation Of Design Criteria Standards?							CP-EP-4.3	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0
H.	Selection Of Design Verification Methods?							CP-EP-4.5	CP-EP-4.5	CP-EP-4.5	CP-EP-4.5	CP-EP-4.5	CP-EP-4.5
I.	Performance Of Design Verifications?							CP-EP-4.5	CP-EP-4.5	CP-EP-4.5	CP-EP-4.5	CP-EP-4.5	CP-EP-4.5
J.	Conducting Audits Of Design Activities (including Reporting/follow-up)?							CP-QP-19.0	CP-QP-19.0	CP-QP-19.0	CP-QP-19.0	CP-QP-19.0	CP-QP-19.0
K.	Taking Corrective Action?								CP-QP-17.0	CP-QP-17.0	CP-QP-17.0 QI-QP-15.4.2	CP-QP-17.0 QI-QP-15.4.2 QI-QP-15.4.3	CP-QP-17.0 QI-QP-15.4.3
L.	Controlling Design Changes?					P-2	T-1 CPP-EP-1	CPP-EP-1 CP-EP-4.5 CP-EP-4.6	CP-EP-4.5 CP-EP-4.6	CP-EP-4.6 CP-QP-15.4	CP-EP-4.6 CP-QP-15.4	CP-EP-4.6 CP-QP-15.4	CP-EP-4.6 CP-QP-15.4
6	Are Internal/External Interfaces Between Organizations Performing Work Affecting Quality Of Design Identified In Writing?	5.1.1 5.2.1					T-1 CPP-EP-1	CPP-EP-1	CP-EP-2.1	CP-EP-2.1	CP-EP-2.1	CP-EP-2.1	CP-EP-2.1
7	Are Responsibilities For Organizations Defined/Documented In Sufficient Detail To Cover The Preparation, Review, and Approval of Documents Involving Design Interfaces (Tabular Form, Flow Charts, Etc)?	5.1.2 5.2.2						CP-EP-4.6 CP-EP-4.2	CP-EP-4.6 CP-EP-4.0	CP-EP-4.6 CP-EP-4.0	CP-EP-4.6 CP-EP-4.0	CP-EP-4.6 CP-EP-4.0	CP-EP-4.6 CP-EP-4.0

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COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

ENGINEERING AND QUALITY ASSURANCE PROCEDURES

NO.	BASE DOCUMENT ATTRIBUTE	N45.2.11 PARAGRAPH	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
	ORGANIZATION												
8	Do Documents Identify The Positions And Titles Of Key Personnel In The Communication Channels And Their Responsibilities For Decision Making, For Resolution Of Problems, And For Taking Appropriate Action.	5.1.3 5.2.3					CP-QP-3.0	CP-EP-4.6 CP-QP-3.0	CP-EP-4.6 CP-QP-3.0	CP-EP-4.6 CP-QP-3.0	CP-EP-4.6 CP-QP-3.0	CP-EP-4.6 CP-QP-3.0	CP-EP-4.6 CP-QP-3.0
	CORRECTIVE ACTION												
9	Has A Corrective Action System Been Established And Documented To Address The Following:	9.											
A.	Identification And Correction Of Design Deficiencies (Errors)?							CP-EP-4.5	CP-EP-4.5 CP-QP-17.0	CP-EP-16.2 CP-EP-4.5 CP-QP-17.0	CP-EP-16.3 CP-EP-16.2 CP-EP-4.5 CP-QP-17.0 CP-QP-15.6	CP-EP-16.3 CP-EP-16.2 CP-EP-4.5 CP-QP-17.0 CP-QP-15.6	CP-EP-16.3 CP-EP-16.2 CP-EP-4.5 CP-QP-17.0 CP-QP-15.6
B.	Instituting Appropriate Changes In The Design Process To Correct Significant/Recurring Design Deficiencies?								CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0
C.	Reporting Deficiencies And Corrective Actions To Appropriate Levels Of Management?						CPP-EP-5 CP-QP-16.1	CPP-EP-12 CP-EP-4.5 CP-QP-16.1	CP-EP-4.5 CP-EP-17.0 CP-QP-16.2	CP-EP-4.5 CP-EP-17.0 CP-QP-16.1	CP-EP-16.3 CP-EP-4.5 CP-QP-16.1 CP-QP-17.0 CP-QP-15.6	CP-EP-16.3 CP-EP-4.5 CP-QP-17.0 CP-QP-15.6	CP-EP-16.3 CP-EP-4.5 CP-QP-17.0 CP-QP-15.6
D.	Instituting Measures To Follow-up Actions That Cannot Be Immediately Completed?						CP-QP-16.0	CP-QP-16.0 CP-QP-15.2	CP-QP-16.0 CP-QP-15.2	CP-QP-16.0 CP-QP-15.2	CP-QP-16.0 CP-QP-15.2 CP-QP-15.7	CP-QP-16.0 CP-QP-15.2 CP-QP-15.7	CP-QP-16.0 CP-QP-15.2 CP-QP-15.7

COMANCHE PEAK STEAM ELECTRIC STATION

INDEPENDENT ASSESSMENT PROGRAM - PHASE 3 - TUGCO QA PROGRAM MATRIX - ORGANIZATION AND CORRECTIVE ACTION

ENGINEERING AND QUALITY ASSURANCE PROCEDURES

NO.	BASE DOCUMENT ATTRIBUTE		1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984
			DOCUMENT REVIEWED										
	ORGANIZATION	N45.2.11 PARAGRAPH											
10	Have Measures Been Established To Assure That When Design Changes Are Required Because Of An Incorrect Design, The Design Process And Verification Procedures Are Reviewed And Modified As Necessary?	9.							CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0	CP-EP-4.0

Legend:
1. CP-EP - Comanche Peak Engineering Procedure
2. CPP-EP - Comanche Peak Engineering Procedure
3. CP-QP - Comanche Peak Quality Procedure
4. I - Engineering Procedure
5. P - Engineering Procedure
6. QI-QP - Comanche Peak Quality Instruction

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Job No. 84042
Doc. No. DC-1
Rev. 3

INDEPENDENT DESIGN VERIFICATION

PIPE STRESS DESIGN REVIEW CRITERIA

FOR

COMANCHE PEAK STEAM ELECTRIC STATION

TEXAS UTILITIES ELECTRIC COMPANY

Prepared by L.J. Weingart 10/25/84
L.J. Weingart Date

Independent Review by R. BALIGA 10/30/84
R. Baliga Date

Approved by J.C. Minichiello 10/30/84
J.C. Minichiello Date

Cygna Energy Services
101 California Street, Suite 1000
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October 1984

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TABLE OF CONTENTS

Section		Page

1.0 INTRODUCTION

The purpose of this document is to provide the criteria to be used for the review of the Piping Stress Analyses for Comanche Peak Steam Electric Station (CPSES). This Design Criteria shall be used in conjunction with Work Instruction 1, "Assessment Procedures," for details on the review methodology and documentation requirements.

2.0 SCOPE

The scope of the pipe stress review includes the following portions of the Main Steam (MS) and Component Cooling Water (CCW) Systems:

- Class 2 Main Steam Piping from Steam Generator TBX-RCPCSG-01 to Containment Penetration MI-1 (Gibbs & Hill Stress Problem 1-001).
- Class 2 Main Steam Piping from Steam Generator TBX-RCPCSG-02 to Containment Penetration MI-2 (Gibbs & Hill Stress Problem 1-002).
- Class 2 Main Steam Piping from Steam Generator TBX-RCPCSG-03 to Containment Penetration MI-3 (Gibbs & Hill Stress Problem 1-003).
- Class 2 Main Steam Piping from Steam Generator TBX-RCPCSG-04 to Containment Penetration MI-4 (Gibbs & Hill Stress Problem 1-004).
- Class 2 Main Steam Piping from Containment Penetration MI-1 to Moment Restraint at Isolation Valve HV2333A (Gibbs & Hill Stress Problem 1-023A).
- Class 2 Main Steam Piping from Containment Penetration MI-2 to Moment Restraint at Isolation Valve HV2334A (Gibbs & Hill Stress Problem 1-023B).

- Class 2 Main Steam Piping from Containment Penetration MI-3 to Moment Restraint at Isolation Valve HV2335A (Gibbs & Hill Stress Problem 1-023C).

- Class 2 Main Steam Piping from Containment Penetration MI-4 to Moment Restraint at Isolation Valve HV2336A (Gibbs & Hill Stress Problem 1-023D).

- Class 3 Component Cooling Water Piping from CCW Heat Exchanger CP1-CCAHHX-01 to Residual Heat Removal Heat Exchanger TBX-RHAHRS-01 and Containment Spray Heat Exchanger CP1-CTAHCS-01 (Gibbs & Hill Stress Problem 1-061A).

3.0 CODES, STANDARDS AND REFERENCE DOCUMENTS

This section lists the industry standards and design basis that were applicable during the design period and should have been implemented. These codes, standards and references provide a criteria that the design can be evaluated against.

3.1 Piping

The design and stress analysis shall be reviewed for conformance with:

3.1.1 USNRC Standard Review Plan, Chapter 3 (NRC SRP).

3.1.2 ASME Boiler and Pressure Vessel Code Section III Subsections NA, NC and ND, 1974 Edition, including Summer 1974 addenda.

Note: Later editions of the ASME code may be used if the requirements of paragraph NA-1140 are met. If so, the analyses will be reviewed accordingly.

3.1.3 The following Gibbs and Hill, Inc. Project Design Specifications:

2323-MS-200 Revision 3. (ASME Section III, Code Class 2 and 3 piping), hereafter noted as Project Design Specification 2323-MS-200.

2323-MS-100 Rev 6 (Piping Erection), hereafter noted as Project Design Specification 2323-MS-100.

2323-MS-46A, Rev. 5 (Nuclear Safety Class Hangers and Supports), hereafter noted as Project Design Specification 2323-MS-46A.

3.1.4 CPSES Final Safety Analysis Report Amendment 38, dated 2/14/83.

4.0 DESIGN

4.1 General

All piping systems shall be reviewed for conformance with the requirements of the Code as stipulated in Subarticles NC-3600 for Nuclear Class 2 and ND-3600 for Nuclear Class 3 components. In addition, all analyses shall be reviewed to assure that they conform with sound engineering practice.

4.2 Classification of Piping Systems

4.2.1 Nuclear/Quality

Nuclear and quality system classifications are specified in Project Design Specification 2323-MS-200, Section 3.1.1, and Flow Diagrams

2323-M1-0202, Rev. CP-4, and 2323-M1-0229, Rev. CP-1, for the MS and CCW systems respectively.

4.3 Boundaries

4.3.1 Piping system boundaries are designated on the flow diagrams for Nuclear Class 1, 2 and 3 piping and are described in Project Design Specification 2323-MS-200.

4.3.2 The dimensional location of each piping boundary is shown on the Piping Isometric Drawings.

4.3.3 Piping Analyses may be decoupled when:

a. The ratio of the moments of inertia of the run and branch exceeds 10.0.

b. The restraint configuration and piping layout of the branch line is such that the effects of any large mass (e.g., valves) on the branch line will not change the response of the run pipe by more than 10%.

4.3.4 Flued Heads and major equipment nozzles (RHR pump, heat exchanger) shall be considered as anchor points in the piping analyses.

4.4 Design and Operating Conditions

Analysis data shall be reviewed for conformance with the following:

4.4.1 The design pressures and temperatures for each piping system tabulated in Project Design Specification 2323-MS-200, Appendices 7 and 8.

4.4.2 The operating pressures and temperatures tabulated in the Mechanical Systems Group transmittal which is referenced in the individual calculation packages.

4.5 Geometry and Computer Modeling

4.5.1 The piping geometry used as input data for computer analysis shall be reviewed for conformance with the latest revision of the Brown & Root "BRP" isometric drawings.

Analysis isometrics shall be compared to the Brown & Root as-built isometric drawings (BRP as-built drawings) for conformance with the following tolerances:

- Maximum centerline deviation is 2" as per Project Design Specification 2323-MS-100, Rev. 6, Section 4.9.6.

Geometries which do not conform to this tolerance shall be reviewed for impact upon the analytical results.

4.5.2 Restraint locations input for computer analysis shall be reviewed for conformance with the latest revision of the "BRHL" isometric drawings.

Restraint locations which do not conform with these drawings shall be reviewed for impact upon the analytical results.

4.5.3 Pipe properties shall be reviewed for conformance with Project Design Specification 2323-MS-200, Appendix 3.

4.5.4 Material properties shall be reviewed for conformance with Project Design Specification 2323-MS-200, Appendix 3, the associated piping isometric drawings and ASME B&PV Code, Section III, 1974, Appendix I.

4.5.5 Poisson's ratio shall be taken as 0.3 for all metals at all temperatures.

4.5.6 Mass point spacing shall be reviewed for adequacy of representing the dynamic behavior of the system up to 33 Hz for seismic analysis and 100 Hz for dynamic analysis of pressure wave effects.

4.5.7 Valve modeling shall be reviewed for conformance with the following conventions:

a. Weights and centers of gravity shall be as specified on the applicable vendor supplied valve assembly drawings, except as amended in 2323-MS-200, Appendix 10.

b. For extended operator valves, modeling of the operator shall be such that the first frequency of the valve stem equals or exceeds 33 Hz.

4.5.8 Flange modeling shall be reviewed for conformance with the following conventions:

a. Flanges shall be considered as additional lumped weights.

b. Flange thickness shall be assumed as the same thickness of the pipe for purposes of modeling stiffness.

4.6 Loading and Stress Requirements

Review to assure that each load case meets the general requirements as specified in the Code with emphasis placed upon the following particular items.

4.6.1 Stress intensification factors shall be reviewed for conformance with:

a. ASME B&PV Code, Section III subarticle NC/ND-3670.

b. Applicable Bonney Forge Reports for weldolets, sockolets and sweepolets.

4.6.2 Pressure Effect

The effect of internal pressure shall be considered in computing longitudinal stress per the Code.

4.6.3 Gravity Analysis

a. Review to assure that the weight of the pipe, fluid, insulation, fittings, flanges, valves (including actuators) and other in-line components have been considered.

4.6.4 Thermal Analysis

a. Review to assure that all thermal modes have been considered.

b. Review to assure that the effects of thermal movements from equipment nozzles have been considered.

4.6.5 Seismic Analysis

a. Review to assure that OBE and SSE spectra at appropriate damping values for all pertinent buildings at the proper elevations have been enveloped. Individual building response spectrum curves are provided in Appendix 5 of Project Design Specification 2323-MS-200.

b. Review to assure that damping values are consistent with CPSES-FSAR Table 3.7 B-1 i.e.,

	Damping Ratio (Percentage)	
Pipe Size	OBE	SSE
Pipe diameter greater than 12 inches	2	3
Pipe diameter less than or equal to 12 inches	1	2

The damping ratio is assumed to be the same for all modes.

c. Review to assure that the method used for combining modal responses conforms to NRC Regulatory Guide 1.92 revision 1.

d. Review to assure that analysis cut-off frequency used was at least 33 Hz.

e. Review to assure that piping is designed and supported such that the acceleration of the active valves does not exceed 3 g in any horizontal direction, 2 g in the vertical direction, or lower g values as required by the respective manufacturers. In addition, for valves supported on the yoke, review to ensure that the valve as tested is qualified for the applied loads from the latest analysis.

f. Review to assure that inclusion of additional modes would not increase the dynamic response by more than 10%. If this criterion is not met, the results will be evaluated on a case by case basis to assure that the calculated loads and stresses are acceptable.

4.6.6 Seismic Anchor Movement (SAM) Analysis

Review to assure that seismic differential anchor movements have been considered. If piping passes between buildings and is attached to components which may respond indpendently, proper phasing should be taken into account. Movements are provided in Gibbs & Hill Calculation No. AMS-RB-1-001-0, dated 9/30/82.

4.6.7 Restraint stiffness input shall be reviewed for conformance with Table 3.4-1 of Project Design Specification 2323-MS-200.

4.6.8 Design of flanged joints shall be reviewed for conformance with the stress requirements of the Code paragraph NC/ND-3647 and NC/ND-N3658.

4.6.9 Functional Capability

Review the maximum primary stress data to insure that the piping can deliver rated flow under all conditions as required in NRC SRP Section 3.9.3.

4.6.10 Turbine Stop Valve Closure Loading

Main Steam Piping upstream of the turbine stop valves shall be reviewed to assure that the pressure wave effects due to fast valve closure are properly considered.

a. Review to assure that time history forces, as developed in the appropriate RELAP calculations are properly input to the corresponding ANSYS analyses.

b. Review to assure that a damping ratio of 2% of critical damping has been considered. This damping is assumed to be the same for all modes.

c. Review to assure that the method used for combining modal responses conforms to NRC Regulatory Guide 1.92 revision 1.

d. Review to assure that analysis cut-off frequency used was at least 100 Hz or an equivalent time step if a direct integration analysis is used.

e. Review to assure that piping is designed and supported such that the acceleration of the active valves does not exceed 3 g in any horizontal direction, 2 g in the vertical direction, or lower g values as required by the respective manufacturers.

f. Review to assure that inclusion of additional modes would not increase the dynamic response by more than 10%. If this criterion is not met, the results will be evaluated on a case by case basis to assure that the calculated loads and stresses are acceptable.

g. Review support load summary to assure that the maximum input loads along the line of action of restraints have been taken into account.

4.6.11 Main Steam Piping, Outside of Containment, shall be reviewed to assure that effects of the opening of the main steam safety valves has been properly considered.

a. Calculations of Relief Valve Discharge Forces shall be reviewed for conformance with CPSES FSAR Section 3.9B.3.3 and Gibbs & Hill Specification 2323-MS-200, Section 6.3.

b. Pipe stress calculations shall be reviewed to assure that he worst case combination (for both support loads and pipe stress) of valves blowing has been considered and proper justification has been supplied.

c. Pipe stress calculations shall be reviewed to assure that the following items have been considered:

- SIF at branch connection of 32" main steam to 6" safety valve inlet.
- Flange evaluation at safety valve inlet and outlet per NC-3647.
- Stress evaluation of discharge piping (excluding the vent stacks).

4.6.12 LOCA Loads

Main Steam Piping, Inside of Containment, shall be reviewed to asssure that the effects of the displacement of the steam generator due to LOCA have been properly considered.

a. Steam generator nozzle connection displacements shall be reviewed for conformance with Westinghouse Report WPT-1938 dated 9/30/77, "TBX LOCA Loop Displacements".

b. Review analyses to assure that displacements in all 3 orthogonal directions have been considered and properly combined.

c. Review to ensure that the data is used in a manner consistent with that intended or directed by Westinghouse.

4.6.13 Jet Impingement Loads

Piping analyses shall be reviewed to assure that any jet loads, as indicated on Gibbs & Hill Drawing No. 2323-JIPM-1, Rev. 11, have been properly considered and are in conformance with NRC SRP Section 3.6.2 III.3

4.6.14 Pipe Whip Loads

Piping analyses shall be reviewed to assure that any pipe whip loads, as indicated on Gibbs & Hill Drawing No. 2323-DSPM-4, Rev. 2, have been properly considered and are in conformance with NRC SRP Section 3.6.2 III.2.

4.7 Loading Combinations

4.7.1 Load combinations for Nuclear Class 2/3 piping will be as specified in ASME Code Subarticle NC/ND-3650, Table 5.2-1 of Project Design Specification 2323-MS-200 and the CPSES FSAR Section 3.9B.3.1.1.

4.8 Stress Limits

4.8.1 Stress limits for the Class 2/3 piping shall be in accordance with the Code, except as modified in Table 5.2-1 of Project Design Specification 2323-MS-200 for essential piping.

4.9 Nozzle Load Check

4.9.1 Equipment nozzle loads shall be reviewed for conformance with the applicable data from Appendix 4 of Project Design Specification 2323-MS-200.

4.10 Sleeve Clearances

4.10.1 Sleeve clearances (piping passing thru floors or walls) shall be reviewed to insure no interference between the pipe and sleeve.

5.0 EXHIBITS

None.

Job No. 84042
Doc. No. DC-2
Rev. 3

INDEPENDENT DESIGN REVIEW

PIPE SUPPORT DESIGN REVIEW CRITERIA

FOR

COMANCHE PEAK NUCLEAR PLANT - UNIT 1

TEXAS UTILITIES ELECTRIC COMPANY

Prepared by C.K. Wong 10/30/84
C.K. Wong Date

Independent Review by R. BALIGA 10/31/84
R. Baliga Date

Approved by J. Minichiello 10/31/84
J. Minichiello Date

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October 1984

CYGNA

TABLE OF CONTENTS

1.0 INTRODUCTION

This document establishes general technical criteria to be used in the review of pipe supports, shock suppressors, and anchors associated with the Main Steam and Component Cooling Water piping systems described in Section 2.0, below. The purpose of this review is to ensure that the pipe supports are capable of supporting the piping system during all conditions of operation by transmitting the loads from the pipe to the building structural members. This document shall be used in conjunction with Work Instruction 1, "Assessment Procedures," for guidelines on the review methodology and documentation requirements.

2.0 SCOPE

This criteria document shall be used in the review of the pipe supports associated with the piping sub-systems defined as follows:

- Class 2 Main Steam piping from Steam Generator No. 1 (TBX-RCPCSG-01) to containment penetration M-I-1 (Gibbs & Hill Stress Problem No. 1-001).

- Class 2 Main Steam piping from Steam Generator No. 2 (TBX-RCPCSG-02) to containment penetration M-I-2 (Gibbs & Hill Stress Problem No. 1-002).

- Class 2 Main Steam piping from Steam Generator No. 3 (TBX-RCPCSG-03) to containment penetration M-I-3 (Gibbs & Hill Stress Problem No. 1-003).

- Class 2 Main Steam piping from Steam Generator No. 4 (TBX-RCPCSG-04) to containment penetration M-I-4 (Gibbs & Hill Stress Problem No. 1-004).

- Class 2 Main Steam piping from containment penetration MI-1 to the 5-way restraint near the Safeguard Building wall (Gibbs & Hill Stress Problem No. 1-023A).

- Class 2 Main Steam piping from containment penetration MI-2 to the 5-way restraint near the Safeguard Building wall (Gibbs & Hill Stress Problem No. 1-023B).

- Class 2 Main Steam piping from containment penetration MI-3 to the 5-way restraint near the Safeguard Building wall (Gibbs & Hill Stress Problem No. 1-023C).

- Class 2 Main Steam piping from containment penetration MI-4 to the 5-way restraint near the Safeguard Building wall (Gibbs & Hill Stress Problem No. 1-023D).

- Class 3 Component Cooling Water piping (Gibbs & Hill Stress Problem No. 1-061A) from component cooling water Heat Exchanger (CP1-CCA-HHX-01) tank nozzle to the containment spray heat exchanger (CP1-CTAHCS-01) and to the RHR Heat Exchanger (TBX-RHAHRS-01).

In addition, anchors located on the branch lines which define the stress analysis problem bounds shall be reviewed in accordance with this document.

In this design review, the pipe support structural elements up to the support attachment/connection point (e.g., anchor bolt, base plate and structural connections insert) are considered to be within Cygna's scope of work, whereas structural supporting member, steel liner plate, embedded plate, concrete wall/member, etc., are considered to be out of Cygna's scope of work.

3.0 CODES, STANDARDS AND REFERENCE DOCUMENTS

Based on industry standards and codes in effect at the time of the original design, as well as documents which form part of the licensing basis for Comanche Peak, the following list of reference documents shall be used for the review:

3.1 Codes, Standard and General Reference

3.1.1 ASME Boiler and Pressure Vessel Code, Section III, Sub-section NF, 1974 Edition through Winter 1974 Addenda (except as amended by CPSES Design Change Authorization; see Exhibit 3.1-1).

3.1.2 American Institute of Steel Construction, Inc., AISC Steel Construction Manual, 7th Edition.

3.1.3 American Welding Society, Structural Welding Code, AWS D1.1, 1979.

3.1.4 Kwik-Bolt Testing Summary Report, File No. H2189-S1, Report No. 8783R by Abbot A. Hanks, Inc., Testing Laboratories.

3.1.5 Catalog Data for Richmond Structural Concrete Inserts, Richmond Screw Anchor Company, Inc.

3.1.6 Applicable sections of the Comanche Peak Steam Electric Station (CPSES) FSAR, Amendment 22, June 12, 1981.

3.1.7 Specification No. 2323-MS-46A, Rev. 5, February 10, 1984. Gibbs & Hill, Inc., Nuclear Safety Class Pipe Hangers and Supports.

3.1.8 Specification No. 2323-SS-30, February 10, 1984. Gibbs & Hill, Inc., Structural Embedments:

Appendix 2 - Design Criteria for Hilti Kwik- and Super Kwik-Bolts

Appendix 3 - Design Criteria for Screw Anchors

Appendix 4 - Design Criteria for Embedded Plate Strips

Appendix 5 - Design Criteria for Embedded Large Steel Plates

3.1.9 Specification No. 2323-MS-200, Rev. 3, September 30, 1981, Gibbs & Hill, Inc. Design Specification for all ASME, Section III, Code Class 2 and 3 piping.

3.1.10 ASME B&PV Code, Code Case 1644 (N71), Rev. 9.

3.1.11 CPSES Instruction No. CEI-20, Rev. 8, January 26, 1983. Brown & Root, Inc., Installation of "Hilti" Drilled-In Bolts.

3.1.12 Letter from Kevin Ennis (ASME) to M.R. McBay (TUSI), dated November 18, 1983. Subject: Section III, Division 1 code case N-71-9 and N-71-10 ASTM A-500 Tubular Shapes.

4.0 DESIGN

4.1 Physical Requirements

4.1.1 Stiffness

When actual stiffness is not available, the estimated stiffness of a pipe support in the pipe's restrained direction must meet the required stiffness shown in Exhibit 4.1-1 according to the nominal size of restrained pipe. The minimum stiffness requirement may be waived when the actual computed stiffness is used. The final stiffness of the pipe support shall be based on the as-built configuration and properties of the support. Stiffness of the pipe support in the unrestrained direction shall have sufficient rigidity to provide a stable structure based on good engineering practice. The stiffness calculation shall consider the combined effects of the support frame and mechanical components. The flexibility of the building structure need not be included in the stiffness calculation.

4.1.2 Gaps

A gap shall be provided to accommodate radial expansion and construction tolerances. The maximum total gap allowed in the restrained direction is 1/8" (± 1/16" installation tolerance). In unrestrained directions, the support design shall allow clearance for the most severe thermal plus seismic movements of the pipe. Proper tolerances shall be provided where thermal movement cannot be accommodated within the specified gap minus 1/16".

4.1.3 (Deleted)

4.1.4 Spring Supports

Spring supports shall be capable of exerting a supporting force equal to the load, as determined by weight-balance calculations, plus the weight of all hanger parts, such as clamps and rods, that will be supported by the spring. The design shall be such as to prevent complete release of the component load in the event of spring failure or misalignment. Any variability of a supporting spring force resulting from movement of the component shall be considered in the loadings used in the stress analysis of the component. The spring's available travel shall be checked against all the thermal and seismic movements. Spring supports shall also be designed for a maximum load and variation of 12 percent for main steam and 25 percent for component cooling water due to thermal movement of the pipe.

4.1.5 Rod Hanger

Rod hangers shall be subjected to tensile loading only. Rod hanger assemblies shall be designed to allow anticipated thermal horizontal movement without subjecting the pipe to extraneous loads. The maximum swing angle due to horizontal pipe movement shall be less than 5°. If the swing angle of the rod is in excess of 5°, the hanger shall be offset two-thirds of the thermal movement towards the direction of movement. Rod hangers for piping with nominal diameter larger than 2-1/2 inches shall not be less than 1/2 inch diameter.

4.1.6 Snubbers

The snubber assembly shall be offset two-thirds of the thermal movement in the cold position if the swing angle exceeds 5°. In the initial design the midpoint of thermal travel for snubber strokes should be set at the midpoint of the total travel with hot and cold settings established accordingly. The maximum travel range of the snubber must be checked under maximum thermal movements. For the final design the stroke of the snubber shall have a margin of a 1/4" in excess of the anticipated thermal movement in the installed position.

4.1.7 Sway Struts

Sway Struts are used to restrain movement of piping in one direction while providing for thermal movement in the unrestrained direction. Functionally, the rigid sway struts are similar to snubbers except that the sway strut does not allow free thermal movement in the restrained direction. In other words, the sway strut takes up static and dynamic loading. The maximum swing angle due to misalignment or thermal movement shall be less than 5°.

4.1.8 Base Plates and Anchor Bolts

Base plate stiffness and prying effect shall be considered in the design review of the pipe supports. The Teledyne method, a finite element analysis, or any rational analysis may be used to check the adequacy of the base plate and anchor bolts.

4.1.9 Structural details shall conform to the requirements of the AISC Manual of Steel Construction.

4.1.10 For frame-type support members the design shall meet the requirements of Article XVII-2000 (Linear Elastic Analysis) of Appendix XVII of the ASME Code, Section III, Division 1 and shall be based on good engineering design practice. Consideration shall be given to reduced allowable stress due to temperature effect, laterally unbraced length, effective slenderness ratio and combined bending and compression. The design of welded joint and connection shall meet the minimum weld size requirements and shall be adequately designed for the intended load transfer. At regions of high concentrated load or points of load application, the effects of torsion or web crippling shall be considered and local stiffening shall be provided, if necessary, to ensure the proper transfer of loads.

For integral support connections welded to existing structural steel member, the attachment weld shall be made along the longitudinal axis of the existing structural steel. Any welding across the flange of existing structural steel shall have proper documentation of approval from the design supervisor.

4.1.11 All seismic supports should be plus and minus restraints. The pipe should be physically restrained in each direction along the restraining axis.

4.1.12 The support calculations shall reflect the actual support geometry and load distribution. Changes to the initial geometry, or use of one geometry to qualify a different geometry, shall be justified.

4.1.13 Welded attachments (i.e., lugs, anchors, etc.) are prohibited for piping in between the containment isolation valves or between the containment and the main steam stop valves, unless otherwise justified by detailed analysis of the piping.

4.2 Loads

The loadings that shall be taken into account in designing a component support include, but are not limited to, the following:

- Weight of the component, insulation, and normal contents (DL). Pipe and component weights from manufacturer's data.

- Loads generated by restrained thermal expansion. These include temperatures at normal operating conditions (TH).

- Friction loads (FL) are to be applied along the direction of thermal movement and in the worst sense (plus or minus). The magnitude of this load shall be the friction coefficient times the larger of a) the algebraic sum of the pipe's dead load and the maximum thermal load or b) the pipe's dead load. The friction coefficient for steel on steel shall be 0.3 and for steel on teflon 0.07.

- Safe Shutdown Earthquake, Inertia and anchor movement loads included (SSE).

- Pipe Impact Loads (PI)*
- Jet Impingement Loads (JI)*
- Steamhammer Loads (SHL)*
- Relief Valve Discharge Loads (RV)*

4.3 Load Combinations

The following loading conditions shall be used in the design review of Class 2 and 3 pipe supports.

1)	Testing condition	DL
2)	Design and normal operating condition	DL + TH + FL

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*Note: If applicable.

3) Upset operating condition — DL + TH + 1/2 (SSE)

4) Upset operating condition — DL + TH + 1/2 (SSE) + SHL

5) Upset operating condition — DL + TH + 1/2 (SSE) + RV

6) Emergency operating condition — DL + TH + SSE + $\left[\begin{matrix} JI \\ \text{or } PI \end{matrix} \right]$

7) Faulted operating condition — DL + TH + SSE + $\left[\begin{matrix} JI \\ \text{or } PI \end{matrix} \right]$

Loads from Plant Emergency Dynamic Events shall be included in the Emergency Condition combination as applicable. Loads from Plant Faulted Dynamic Events, including LOCA, shall be included in the Faulted Condition combination as applicable. Loads from steamhammer or relief valve opening can occur under all conditions, other than normal and testing.

All dynamic loads shall be combined by the absolute summation method with the exception of SSE and LOCA loads. The SSE and LOCA loads shall be combined by the square root of the sum of the squares (SRSS) method.

4.4 Allowable Stress

Allowable stresses shall meet the requirements of the ASME Boiler and Pressure Vessel Code, Section III, Subsection NF (including Appendix F); Section III, Division 1, Appendix XVII (2000); and the appropriate sections of American Institute of Steel Construction (AISC). Structural steel members shall meet all the AISC requirements. The allowable stress shall take into account the effect of ambient design temperature.

Exhibit 4.4-1 contains a table of allowable stresses to be used in the review for A36 steel, A307 bolt and E70 weld at room temperature. For steel other than A36 steel, (e.g., A500, GR.B) the appropriate coefficient, as specified in Exhibit 4.4-1, shall be used to obtain the appropriate allowable stress. Exhibit 4.4-2 gives the yield strength value for A36 and A500 Grade B at different metal temperatures.

4.5 Anchor Bolt Design

4.5.1 Applications

4.5.1.1 When embedded plates or cast-in-place inserts (see Section 4.6) are not available or not feasible for support attachment, expansion anchor bolts may be used for attachment connections. For this criteria, Hilti Kwik-Bolts and Hilti SuperKwik-Bolts are specified and the following requirements shall be met.

4.5.1.2 Anchors must be at least 1/2" diameter when used for structural connections or for anchorage of pipes greater than 2" diameter.

4.5.1.3 Embedded length of anchor shall be exclusive of thickness of grout pad or other overlay.

4.5.1.4 Minimum anchor bolt spacing shall be ten (10) bolt diameters.

4.5.1.5 Minimum spacing to a free edge of concrete shall be five (5) bolt diameters.

4.5.1.6 Minimum anchor embedment shall be four and one half (4 1/2) bolt diameters for Kwik-Bolts and six and one half (6 1/2) bolt diameters for Super Kwik-Bolts.

If the above requirements are not met, the support attachment shall be evaluated on a case-by-case basis to determine the resulting design impact.

4.5.2 Allowable Loads

4.5.2.1 Allowable loads for concrete expansion anchors shall be equal to those shown in Exhibit 4.5-1 with a minimum factor of safety of four (4) applied for the appropriate concrete strength. For this criteria, a concrete strength of 4000 psi is used. Effect of prying force shall be included.

4.5.2.2 For concrete strength other than those shown in Exhibit 4.5-1, appropriate values based on test data provided by manufacturer shall be used.

4.5.2.3 If the center-to-center spacing of anchors is less than ten diameters or the distance from the edge of concrete to the center of anchor is less than five diameters, the capacity of both anchors shall be reduced linearly to 50 percent at half the minimum distance between the bolts, but in no case shall the bolts be spaced closer than half of the minimum distance.

4.5.2.4 Allowable load values given in this criteria shall not be increased because of short duration of loading (e.g., for wind or seismic loads).

4.5.2.5 For anchors subjected to pullout and shear forces simultaneously, the straight line interaction equation based on pure shear and pure tension must be satisfied.

$$\frac{P_D}{P_A} + \frac{S_D}{S_A} < 1.0$$

Where:

P_D = Design pullout load

S_D = Design shear load

P_A = Allowable pullout load

S_A = Allowable shear load

4.6 Structural Connection Insert

4.6.1 Applications

4.6.1.1 Screw anchor inserts, unless otherwise specified, are assumed to be Richmond structural connection inserts (Types EC-2, EC-6, EC-2W or EC-6W).

4.6.1.2 The minimum center-to-center spacing of the structural connection inserts shall be two (2) times the insert length, L, or that specified in Appendix 3 of Gibbs & Hill Specification No. 2323-SS-30.

4.6.1.3 The minimum distance to the free edge of concrete shall be one (1) times the insert length, L, or that specified in Appendix 3 of Gibbs & Hill Specification.

If the above requirements are not met, the support attachment shall be evaluated on a case-by-case basis to determine the resulting design impact.

4.6.2 Allowable Loads

4.6.2.1 The allowable loads for Richmond structural connection inserts shall be as those shown in Appendix 3 of Gibbs & Hill Specification No. 2323-SS-30.

For inserts which do not meet the spacing requirements specified above, the allowable loads shall be substantiated by test data or appropriate calculations.

4.6.2.2 Inserts and A307, A325, A490 or A449 bolts or A36 threaded rods subjected to combined tension and shear loads should satisfy the following interaction formulas.

For Inserts:

$$\left(\frac{T}{T^1}\right)^{4/3} + \left(\frac{S}{S^1}\right)^{4/3} < 1$$

For Bolts: (Verified for specific type bolt materials T^1; S^1 different for each grade.)

$$\left(\frac{T}{T^1}\right)^{2} + \left(\frac{S}{S^1}\right)^{2} < 1$$

where

T - Design Tension Load

S - Design Shear Load

T^1 - Allowable Tension Load

S^1 - Allowable Shear Load

4.7 Embedded Plates

Structural embedment plates are considered to be the responsibility of the structural engineering group, they are, therefore, not within Cygna's scope of support review. The allowable load capacities of embedment plates shall be based on those given in Gibbs & Hill's specifications as listed below:

Specification No. 2323-SS-30, Structural Embedments, CPSES Units 1 and 2.

Appendix 4 - Design Criteria for Embedded Plate Strips

Appendix 5 - Design Criteria for Embedded Large Steel Plates

4.8 Civil Anchor Bolts and Grouted-In Anchor Bolts

These anchor bolts are considered to be the responsibility of the Civil/Structural engineering group, they are, therefore, not within Cygna's scope of support review. The allowable loads and spacing requirements shall be as those given in the following Gibbs & Hill documents:

- GTN-41315, Criteria for a Single Embedded Anchor Bolt Allowable Loads.
- GTN-52949, Allowable Loads for Pipe Supports in Emergency and Faulted Conditions.
- GTN-57677, Test Procedure, Test Results and Allowable Load Criteria for 1-1/2" ϕ-A193 Grouted-In Anchor Bolts.
- GTN-62137, Embedded Civil Anchors.

- GTN-64940, Allowable Loads for Pipe Supports in Normal and Upset Conditions - Reactor Building.

4.9 Thru-Bolts

The design of thru-bolts shall meet the allowable stress and design requirements of subsection NF of the 1980 edition, including the Winter 1982 addenda, of the ASME B&PV Code, Section III, Division 1. In particular, the design shall be evaluated with respect to paragraphs NF-3225.1, NF-3225.2 and NF-3324.6. The approximate stress limit factors given in Table NF-3225.2-1 shall be applied to the basic allowables in the evaluation of the different service conditions. For bearing type joints subjected to combined tension and shear stresses, the following interaction equation shall be satisfied:

$$\frac{f_t^2}{F_{tb}^2} + \frac{f_v^2}{F_{vb}^2} \leq 1$$

where,

f_t = computed tensile stress, ksi

f_v = computed shear stress, ksi

F_{tb} = allowable tensile stress at temperature, ksi

F_{vb} = allowable shear stress at temperature, ksi

The allowable tensile and shearing stress values shall be those derived from the equations given in XVII-2461.1 and XVII-2461.2.

The spacing, pattern and loads of the thru-bolt arrangement shall be transmitted to the appropriate Group for review. The design loads must be safely carried by the structural concrete element without creating an overstressed condition in the structural concrete element when stresses from other applied loads are considered.

5.0 AS-BUILT REVIEW AND VERIFICATION

The final as-built dimensions, section properties and configurations of the pipe support shall conform to the final design dimensions, section properties and configurations within allowable tolerances. If the as-built support has significant deviations from the final design, the as-built support shall be reviewed in detail and/or re-analyzed to ensure its adequacy and acceptability.

6.0 EXHIBITS

Exhibit 3.1-1	Table of Applicable Code Updates by DCA, CPSES
Exhibit 4.1-1	Spring Constants (Stiffness) of Pipe Supports
Exhibit 4.4-1	Allowable Stresses
Exhibit 4.4-2	Yield Strength
Exhibit 4.5-1	Allowable Loads for Expansion Anchors - Kwik-Bolt
Exhibit 4.5-2	Allowable Loads for Expansion Anchors - SuperKwik-Bolt
Exhibit 4.6-1	Allowable Loads for Richmond Structural Connection Inserts (Deleted)

EXHIBIT 3.1-1

TABLE OF APPLICABLE CODE UPDATES BY DCA, CPSES

DCA No.	Rev.	ASME, Sect. III Code Paragraph	Code Edition	Addendum
10,186	-	3.6.1.k* Concrete Anchor	N/A	N/A
11,308	3	NF-4721	1980	Winter, 1980
12,451	1	Code Case 1644 (N71), Rev. 10	Code Case	N/A
12,789	-	3.3.a(1)* Sect. II-Material Specification	1974	Winter, 1974 or later
13,037	-	XVII-2454(c) and Table XVII2452.1-1	1977	Winter, 1979
13,016	3	NF-3321.1	--	Winter, 1978
13,016	3	NF-3226.6 (deleted)	--	Winter, 1978
13,016	3	NF-3226.5 (deleted)	--	Winter, 1978
13,016	3	NF-3321.1-1(c)-1 (deleted)	--	Winter, 1978
13,016	3	NF-3391.1	--	Winter, 1980
13,016	3	NF-3392.1	--	Winter, 1980
13,016	3	XVII-2211	--	Winter, 1978
13,016	3	Fig. XVII-211(c)-1 (deleted)	--	Winter, 1978
14,889	-	Code Case N-249-2	Code Case	N/A
15,183	-	XVII-2462	1980	N/A
16,383	1	Table NF-3324.5(a)-1	1980	Winter, 1982
17,404	-	3.6.1.1* Shim Material	N/A	N/A
18,073	-	NF-3225.1, NF-3225.2	1980	Winter, 1982
18,073	-	NF-3222.1(d) (1)	1980	Winter, 1982
18,073	-	NF-3322.2(d), NF-3324.6a	1980	Winter, 1980
18073	-	NF-3225.2-1	1980	Winter, 1982
18,318	-	3.3.a.(6)(a)* Material A588	Code Case	N/A
8297	-	Materials referenced to Winter 1974 Addenda of ASME Code	1974	Winter 1974

EXHIBIT 3.1-1 (continued)

TABLE OF APPLICABLE CODE UPDATES BY DCA, CPSES

DCA No.	Rev.	ASME, Sect. III Code Paragraph	Code Edition	Addendum
9078	5	Add paragraph 7.1.13 to G&H Specification 2323-MS-100. Base Plate gaps.	N/A	N/A
11,193	2	3.6.1*, Class 3 component supports classified to a higher class	N/A	N/A
13,684	-	7.3.d to G&H specification 2323-MS-100. Clearance for axial restraints.	N/A	N/A
14,188	-	7.1.14 to G&H specification 2323-MS-100. Base metal damage/defects.	N/A	N/A
17,433	-	Paragraph 7.3.c.ii to G&H specification 2323-MS-MS-100. Gap tolerances.	N/A	N/A
17,472	-	Paragraph 7.3 to G&H specification 2323-MS-100. Plumbness tolerance.	N/A	N/A
18,453	-	CPSES Proposed Revisions to MS-46A	NA	NA

Note: An asterisk (*) indicates that the paragraph number referenced is from Gibbs & Hill Specification 2323-MS-46A.

EXHIBIT 4.1-1

SPRING CONSTANTS (STIFFNESS) OF PIPE SUPPORTS
(Application for Seismic and Thermal Analyses)

1) Rigid Restraints

Nominal Pipe Size (in.)	Translational Stiffness Kt (lb./in.)	Rotational Stiffness Kr (in.-lb./rad.)
Under 6	2×10^5	1×10^7
6 to 14	1×10^6	1×10^8
Over 14	5×10^6	1×10^9

2) Mechanical Shock Arrestor

Nominal Pipe Size (in.)	Rated Load (lbs.)	Stiffness K (lbs./in.)
Under 2	1,000	1×10^5
2 to 6	3,000	2×10^5
8, 10, 12	10,000	3×10^5
Over 12	35,000	1.35×10^6

Note: Stiffnesses shown here are obtained from the reference document, Gibbs & Hill, Inc. Specification No. 2323-MS-200, Revision 3, Table 3.4-1.

EXHIBIT 4.4-1

ALLOWABLE STRESSES

Stress	Load Case: Testing, Normal & Upset — Value	KSI[1]	Emergency	Faulted
Tension	0.6 F_y[2]	21.6		
Shear	0.4 F_y	14.4		
Web Crippling	0.75 F_y; F_a per ASME Appendix XVII-2213	27.0		
Bending	As per ASME Appendix XVII-2214		1.33 x Normal Allowable	As per ASME Code, Section III, App. F
Bearing	0.9 F_y	32.4		
Bolts Tension & Shear	Allowable Tension per ASME Appendix XVII-2460			
Anchor Bolt	(See Exhibit 4.5-1)			
Welds (Fillet, Full or Partial Penetration)	Per ASME III, NF Table NF-3292.1-1			
Combined Stress	Per ASME Appendix XVII-2215			
Catalog Items	Catalog Values		1.33 X Catalog Values[3]	1.5 X Catalog Values[3]

Note: Allowable stresses are for designs based on room temperature. Appropriate reduction shall be applied for design at higher ambient temperature.

(1) Values shown are for SA36 steel.

(2) Also see Appendix XVII-2211(a) and (b) of ASME Code.

(3) Or allowable values as specified by the manufacturer.

EXHIBIT 4.4-2

YIELD STRENGTH, S_Y, ksi

Product Form	Specification No.	Type or Grade	Min. Yield Strength (ksi)	Min. Ult. Tensile Strength (ksi)	Yield Strength, ksi (for metal temperatures, °F, not to exceed					
					100	200	300	400	500	600
Plate, Bar & Shapes	SA-36[1]	--	36	58	36.0	32.8	31.9	30.8	29.1	26.6
Tb. Shp.	A500-74[2]	B	42	58	42.0	38.3	37.2	35.9	33.9	31.0

Notes:

[1] Values are taken from Table I-13.1, ASME B&PV Code, Section III, Div. 1, Sub-Section NA (W75).

[2] Values are taken from Table 3, ASME Code Case 1644-6.

EXHIBIT 4.5-1
ALLOWABLE LOADS FOR EXPANSION ANCHORS
KWIK-BOLT
DESIGN ALLOWABLE TENSILE & SHEAR LOADS* (lbs.)

Factor of Safety		FS = 4.0		*FS = 5.0	
Diameter	Embedment	Tension	Shear	Tension	Shear
1/4"	1-1/8"	364	653	291	522
	1-1/2"	556	653	445	522
	1-3/4"	675	653	540	522
	2"	781	653	625	522
	2-1/4"	827	653	662	522
	2-1/2"	837	653	670	522
3/8"	1-5/8"	588	1276	471	1021
	2"	756	1276	605	1021
	2-1/2"	975	1276	780	1021
	3"	1075	1354	860	1083
	3-1/2"	1150	1354	920	1083
	4"	1187	1354	950	1083
	4-1/2"	1200	1354	960	1083
1/2"	2-1/4"	1377	2079	1102	1663
	2-3/4"	1800	2079	1440	1663
	3-1/2"	2362	2079	1890	1663
	4-1/2"	2806	2558	2245	2046
	5-1/2"	3012	2558	2410	2046
	6"	3075	2558	2460	2046
5/8"	2-3/4"	1650	2880	1320	2312
	3-1/2"	2275	2890	1820	2312
	4-1/2"	3000	2890	2400	2312
	5-1/2"	3575	3359	2860	3087
	6-1/2"	4000	3859	3200	3087
	7-1/2"	4250	3859	3400	3087

* Anchor bolt allowables are based on a factor of safety equal to 5 and f'_c equal to 4000 psi in the review.

EXHIBIT 4.5-1
(continued)
ALLOWABLE LOADS FOR EXPANSION ANCHORS
KWIK-BOLT
DESIGN ALLOWABLE TENSILE & SHEAR LOADS* (lbs.)

Factor of Safety		FS = 4.0		*FS = 5.0	
Diameter	Embedment	Tension	Shear	Tension	Shear
3/4"	3-1/4"	2537	4283	2030	3426
	4"	3350	4283	2680	3426
	5"	4125	4283	3300	3426
	6"	4500	4616	3600	3693
	7"	5250	4616	4200	3693
	8"	5750	4616	4600	3693
	9"	5875	4616	4700	3693
1"	4-1/2"	4000	6719	3200	5375
	5"	4725	6719	3780	5375
	6"	5860	6719	4688	5375
	7"	5860	6719	4688	5375
	8"	5860	8622	4688	6898
	9"	5860	8622	4688	6898
	10"	5860	8622	4688	6898
1-1/4"	5-1/2"	5750	8920	4600	7136
	6-1/2"	6775	8920	5420	7136
	7-1/2"	7775	8920	6220	7136
	8-1/2"	8650	8920	6920	7136
	9-1/2"	9450	8920	7560	7136
	10-1/2"	10225	8920	8180	7136

* Anchor bolt allowables are based on a factor of safety equal to 5 and f'_c equal to 4000 psi in the review.

EXHIBIT 4.5-2
ALLOWABLE LOADS FOR EXPANSION ANCHORS
SUPER KWIK-BOLT
DESIGN ALLOWABLE TENSILE & SHEAR LOADS* (lbs.)

Factor of Safety		FS = 4.0		*FS = 5.0	
Diameter	Embedment	Tension	Shear	Tension	Shear
1/2"	3-1/4"	2496	2860	1997	2280
	4-1/4"	3695	2860	2956	2280
	5-1/4"	3641	2860	2913	2280
	6-1/4"	3786	2860	3029	2280
1"	6-1/2"	8741	6884	6993	5507
	8-1/2"	12452	6884	9962	5507
	10-1/2"	12439	6884	9951	5507
1-1/4"	8-1/8"	10675	10369	8540	8295
	10-5/8"	13420	10369	10736	8295
	13-1/8"	16230	10369	12984	8295

Note: Refer to reference documents, Gibbs & Hill, Inc., Specification No. 2323-SS-30, Appendix 2, Pages 3 and 4, for these anchor bolt allowable loads.

*Anchor bolt allowables are based on a factor of safety equal to 5 and f'_c equal to 4000 psi in the review.

CYGNA

Potential Finding Report

PFR No.	02	Revision No.	1
Observation No.	PI-00-07	Sheet 1 of 3	

I Description

The Fisher Controls main steam relief valves have not been qualified for the as-built loads on the snubbers attached to the actuator.

Requirement

Cygna Review Criteria 84042-DC-1, Rev. 2, Section 4.6.5.e

Reference Documents

1. Gibbs & Hill Computer Output AB-1-23A, Rev. 0.
2. Gibbs & Hill Computer Output AB-1-23B, Rev. 0.
3. Gibbs & Hill Computer Output AB-1-23C, Rev. 0.
4. Gibbs & Hill Computer Output AB-1-23D, Rev. 0.
5. Fisher Controls Company Seismic Qualification Report FQP-5A-1, G&H Rev. 1.
6. Fisher Controls Company letter CVN-98M dated 12/6/79.
7. Fisher Controls Company letter dated 9/15/78.
8. Fisher Controls Company letter dated 10/4/78.
9. Gibbs & Hill letter GTN-27540 dated 6/8/78.

Extent

Isolated	Extensive	Other (Specify)
	X	

Potential Finding Report

PFR No.	02	Revision No.	1
Observation No.	PI-00-072	Sheet 2 of	3

Design Impact

Excessive loads placed on the valve actuator by the snubbers may prevent the valve from performing its intended function during a seismic event.

Potential Safety Impact

Inability of the valve to function may lead to loss of system function.

Originated By Cognizant Group Leader	L. J. Weingart	Date	11/5/84
Approved By Project Engineer	John C. Mancinelli	Date	11/5/84

CYGNA

Potential Finding Report

PFR No.	02	Revision No.	1
Observation No.	PI-00-07	Sheet 3 of	3

II Senior Review

	Yes	No
Further Review Required		X
Valid Observation	X	
Potential Safety Impact	X	

Comments

Per the July 9, 1984 letter from L. M. Popplewell/TUGCO to N. Williams/Cygna, TUGCO had committed to evaluate valve qualification considering the latest as-built snubber loads. This evaluation was to be performed by the valve vendor, Fisher Controls, using the latest loads. In addition to the four Main Steam Relief valves, TUGCO included a review of all other valves supplied by Fisher Controls with similar support configurations. Cygna's review of all valve specifications revealed that only the Fisher valve specifications had provisions for attaching supports to the actuator. Therefore, TUGCO's review of all Fisher valves has accounted for any plant wide implications of this finding.

Per the October 2, 1984 letter from L. M. Popplewell/TUGCO to N. Williams/Cygna, all main steam relief valves passed an operability test and no pipe support rework was required. Qualification of the remaining valves required the upgrading of five snubbers to a higher load capacity.

Based on TUGCO's fulfillment of their commitment to obtain the manufacturer's certification of the valves ability to withstand the latest snubber loads, there is no design or safety impact due to this finding at CPSES. Therefore this finding is closed.

Approved By Cognizant Senior Reviewer — Date 11-5-84

III Project Manager

Comments

Approved By Project Manager — Date 11/6/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	PI-01 through PI-09	Revision No.	1
Observation No.	PI-00-01	Sheet	1 of 2

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Design Oversight.

2.0 Resolution

Further review showed that for each of the individual points noted by Cygna, application of the proper SIF did not cause Code allowables to be exceeded. However, due to the large percentage of errors and omissions found, Cygna performed an expanded review to assess the impact of this observation on a more generic basis. Since the majority of the errors and omissions found in the review of the systems within the original scope were related to tapered transition joints and Bonney Forge Fittings, Cygna concentrated the expanded review in those two areas.

2.1 Tapered Transition Joints

A statistical sample of 32 Gibbs & Hill problems were randomly selected from a list of 264 large bore stress problems. The results of this review are as follows:

2.1.1 Over 1/3 of the equipment nozzles did not consider an SIF for a TTJ. In response to this observation, Gibbs & Hill has evaluated each of the nozzles noted in the expanded review. Based upon the results of that evaluation, Gibbs & Hill reviewed all large bore equipment nozzles to assess the impact of any neglected SIFs as noted in their letter GTN-69359 dated 8/17/84. Cygna has spot checked the calculations invoved and concurs that there is no design impact.

III Approvals

Originator	[signature]	Date	10/31/84
Project Engineer	John C. [signature]	Date	10/31/84
Project Manager	N. H. Williams	Date	11/5/84
Senior Review Team	[signature]	Date	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No. PI-01 through PI-09		**Revision No.**	1
Observation No PI-00-01		**Sheet** 2 **of**	2

	Yes	No
Valid Observation	X	
Closed	X	

Comments

2.2 Bonney Forge Fittings

Gibbs & Hill provided Cygna with a list of all stress problems which contained Bonney Forge fittings (i.e., weldolets, sockolets, sweepolets, etc.). From this list of 200 problems, Cygna randomly selected 36 for detailed review. These problems contained 176 node points with branch connections, of which 95 were unique, i.e., requiring separate calculations.

The review results are as follows:

2.2.1 In problem AB-1-09D, an SIF was not considered at the three sweepolets. Application of the proper SIF did not result in any impact on design.

2.2.2 In problem AB-1-61D, the proper SIF of 1.75 was shown in the calculation binder, but an SIF of 1.5 was input to the ADLPIPE analysis. Consideration of an SIF of 1.75 does not cause Code allowables to be exceeded.

2.2.3 In problem AB-1-61D, a conservative SIF of 7.9 was shown in the calculation binder, but an SIF of 1.5 was input to the ADLPIPE analysis. To account for this error, the output stresses were correctly multiplied by 7.9/1.5 in the calculation binder but this calculation used the section modulus of the weldolets. Use of this section modulus is not acceptable. Gibbs & Hill responded to this by presenting a calculation which used the correct SIF of 4.05, based upon information from Bonney Forge. These results show that the stresses at this weldolet are below Code allowables.

Based on the above expanded reviews, this observation does not have any impact on design or safety of CPSES and is considered closed.

III Approvals

Originator	[signature]	**Date**	10/31/84
Project Engineer	[signature]	**Date**	10/31/84
Project Manager	[signature]	**Date**	11-5-84
Senior Review Team	[signature]	**Date**	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	PI-05, PI-06, PI-07, PI-08	Revision No.	1
Observation No.	PI-00-02	Sheet	1 of 2

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Gibbs & Hill Standard Practice.

2.0 Resolution

Gibbs & Hill provided Cygna with a list of all welded attachments in break exclusion areas. Other than those already noted on the four Main Steam lines, there were only two additional welded attachments in break exclusion zones: FW-1-098-004-S62R (Stress Problem No. 1-10B) and AF-1-017-002-S62R (Stress Problem No. 1-10C). Cygna's evaluation of all the welded attachments in break exclusion areas showed two instances in which the requirements of the FSAR were not met. The first attachment, at MS-1-240-001-S72K and MS-1-240-002-S72K, can be qualified when the lower SAM loads explained in Observation PI-00-07 are considered. The second, at MS-1-003-006-S72R, can be qualified if the conservatism of the CYLNOZ local stress calculation is considered. This attachment configuration consists of a 50.27 inch by 3 inch pad which was conservatively analyzed in the CYLNOZ program using a pad length of 12 inches in order to satisfy CYLNOZ parameter requirements. Gibbs & Hill has rerun this calculation using a pad size of 17.2 inches by 4.3 inches. As stated by Gibbs & Hill:

> "Though the increase from 3 to 4.3 inches is unconservative, the 43% increase allows a circumferential dimension that is closer to reality, though still approximately 66% small on the conservative side. The total area of the pad used in the reanalysis is 4.3 x 17.2 = 74 in sq. The actual area is 50.27(3) = 150 sq. in. The load then is still being distributed on an area only one half of the real area which gives a ficticiously high stress. This justifies the dimensional change."

III Approvals

Originator	L J Weinmeister	Date	10/31/84
Project Engineer	John C Tapunchiello	Date	10/31/84
Project Manager	N H Williams	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	PI-05, PI-06, PI-07, PI-08	Revision No.	1
Observation No.	PI-00-02	Sheet 2 of	2

	Yes	No
Valid Observation	X	
Closed	X	

Comments

The results of this reanalysis indicate an overstress of 1% still exists. Gibbs & Hill provided the following response regarding the slight overstress:

> "This could be alleviated by further increasing the longitudinal pad dimension, but this is not advisable because the analysis should be kept as close to the real dimensions as possible. Another way to further reduce the stress would be to combine the general and local stresses acting at a point more precisely. ADLPIPE simply takes a vector sum of X and Y bending moments whose resultant will be on some plane other than the edges of the welded pad where CYLNOZ combines stresses. By combining the stresses accurately at the points of interest (i.e. locations A, B, C, D of CYLNOZ) a significant reduction in stress can be realized, often upwards of 20%."

Cygna agrees that additional conservatisms do exist in the use of the CYLNOZ program results such that a refined analysis would provide acceptable results. Since all welded attachments in break exclusion zones meet the requirements of the CPSES FSAR, Cygna considers this observation closed based on the fact that there is no impact on the design or safety of CPSES.

III Approvals

Originator	L. J. Weinert	Date	10/31/84
Project Engineer	John C. Ottaviano	Date	10/31/84
Project Manager	N. H. Williams	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	PI-05, PI-06, PI-07, PI-08	Revision No.	1
Observation No.	PI-00-07	Sheet 1 of	3

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Failure to follow up the plan of action as outlined in Reference 3.9, Item 4, when snubber loads increased as a result of the as-built piping analysis. This action required Gibbs & Hill to determine input forces to the valve actuator so that Fisher would be able to perform an analysis to assess valve operability.

2.0 Resolution

In reviewing the procedures for valve stem modeling and acceleration requirements, Cygna determined that the Gibbs & Hill pipe stress analysts model a valve as a rigid body with the actual weight at the center of gravity of the valve/operator assembly. Cygna then reviewed the purchase specifications to ensure that the valve vendors are, in fact, required to furnish valves with "rigid" (f_1 > 33 cps) extended structures. The results of this review are as follows:

a. Main steam safety valves (2323-MS-007, Rev. 2): Paragraph 3.7.7.4d has the 33 cps requirement.

b. Main steam isolation valves (2323-MS-0076, Rev. 2): DCA-2160, dated 7/24/78, adds allowable acceleration requirements (4g and 3g) and minimum frequency requirements (33 cps).

c. Main steam relief valves (2323-MS-0078, Rev. 2): There is no minimum frequency requirement, although there are acceleration requirements, in section 3.7.7.4.

d. Component Cooling Water butterfly valves (2323-MS-002C, Rev. 2): Paragraph 3.7.6.4e has the 33 cps requirement.

III Approvals

Originator	[signature]	Date	11/2/84
Project Engineer	[signature]	Date	11/5/84
Project Manager	[signature]	Date	11/5/84
Senior Review Team	[signature]	Date	11/5/84

Observation Record Review
Attachment A

Checklist No.	PI-05, PI-06, PI-07, PI-08	Revision No.	1
Observation No.	PI-00-07	Sheet 2 of 3	

	Yes	No
Valid Observation	X	
Closed	X	

Comments

Based on this review Cygna investigated the explanation for the lack of a minimum frequency requirement for the Main Steam relief valves. This investigation revealed that, as a result of a meeting between Gibbs & Hill and the valve vendor, Fisher Controls, all of the Main Steam relief valves have had two orthogonal snubbers attached to the actuator. The need for the additional supports was due to the low natural frequency of the yoke and actuator assembly (24 Hz).

As indicated in Reference 3.9, Item 4, both Fisher and Gibbs & Hill recognized the need to assure that the valve could withstand the loads transmitted from the piping to the snubbers and still maintain operability. Gibbs & Hill did transmit snubber loads from the original design analysis as evidenced by References 3.7 and 3.8.

Discussions with the Gibbs & Hill special analysis group revealed that an equipment qualification group had been formed at Comanche Peak which assumed the responsibilities of seismic qualification that had previously been the respo sibility of Gibbs & Hill, New York.

III Approvals	
Originator	Date
Project Engineer	Date
Project Manager	Date
Senior Review Team	Date

Observation Record Review
Attachment A

CYGNA

Checklist No.	PI-05, PI-06, PI-07, PI-08	**Revision No.**	1
Observation No.	PI-00-07	**Sheet** 3 **of**	3

	Yes	No
Valid Observation	X	
Closed	X	

Comments

This TUGCO site group was unable to produce any evidence that the later as-built loads were considered, even though a substantial increase existed. Further inquiries by Cygna revealed that the only other instance of "flexible" supported valves were those covered by Gibbs & Hill Specification MS-600 (which are also valves by Fisher). DCA No. 15870 to MS-600 states, "For active valves the vendor shall demonstrate operability, including the effect of the seismic restraints."

Due to the potential impact on safety, this observation has been raised to the level of a potential finding report. (See PFR 02)

III Approvals

Originator	Date
Project Engineer	Date
Project Manager	Date
Senior Review Team	Date

Observation Record Review
Attachment A

Checklist No.	PS-078	Revision No.	1
Observation No.	PS-01	Sheet	1 of 1

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Design oversight.

2.0 Resolution

Based on TUGCO's response, dated June 8, 1984, TUGCO has found the observations made by Cygna to be valid. TUGCO has reanalyzed this support with Cygna's comments incorporated and found that the frame needs strengthening at certain joints. Cygna has reviewed these calculations (Attachment EE to the referenced letter) and found them acceptable. TUGCO will issue Revision 6 of the support drawing.

In the sample of 131 supports reviewed in Phase 3, this is only example Cygna has found of a calculational error with design impact. Based on this sample, Cygna considers this an isolated case. Based on TUGCO's reanalysis and redesign, Cygna considers the support acceptable and the observation closed.

III Approvals

Originator	C.K. Wong	Date	10/30/84
Project Engineer	John C. [illegible]	Date	10/31/84
Project Manager	[illegible]	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Observation Record

Checklist No.	PS-069, PS-082, PS-099, PS-119	**Revision No.**	1
Observation No.	PS-02	**Sheet** 1 **of**	1
Originated By	C.K. Wong C.K. Wong	**Date**	10/30/84
Reviewed By	G. Bjorkman G. Bjorkman	**Date**	11/2/84

1.0 Description

The stability of two Main Steam supports is maintained by providing horizontal "bumper" frame members to limit the support horizontal movement to approximately 1/8". There was no derivation of design load for these "bumper" frame members, nor were there any design calculations. The remainder of the support was designed properly.

2.0 Requirement

2.1 Gibbs and Hill, Inc., Specification 2323-MS-46A, Rev. 5, for the Comanche Peak Steam Electric Station, paragraph 3.1.1.b, "Design and Engineering".

2.2 Good engineering practice.

3.0 Document Reference

3.1 TUGCO pipe support, MS-1-002-003-S72R, Drawing Revision 4, Calculation Revision 4.
3.2 TUGCO pipe support, MS-1-004-003-S72R, Drawing Revision 4, Calculation Revision 4.
3.3 Document TSBR #121A, dated July 20, 1983.

4.0 Potential Design Impact

Failure of the "bumper" frame members may prevent the support from performing its intended function.

Attachment

A. Observation Record Review

Extent		
Isolated X	**Extensive**	**Other (Specify)**

CYGNA

Observation Record Review
Attachment A

Checklist No.	General	**Revision No.**	1
Observation No.	PS-05	**Sheet** 1 **of** 1	

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Use of engineering judgment, rather than calculations, to estimate effects.

2.0 Resolution

In their letter dated June 8, 1984, item 32, TUGCO has responded that their designers use engineering judgement to determine if the eccentricity will have a significant impact on weld design.

> "In the majority of the calculation packages for hangers that have "C" shaped weld groups, the engineer did not consider eccentricity because the stresses [were] low and/or a conservative approach was used in sizing the weld".

Cygna has reviewed each "C" shaped weld in the 131 supports in Phase 3. While adding in the eccentricity obviously increased the weld stress, in no case were the stresses above the design allowable. Based on this, there is no design impact on these supports. In their review, Cygna found instances where appropriate calculations were done. In addition, Cygna also found instances where the designers conservatively used only the two parallel legs of the weld to check the stresses.

Cygna found that the maximum ratio of stress to allowable after including eccentricity was 0.7. This further supports TUGCO's statement on the use of judgment that stress levels were sufficiently small.

Based on this, Cygna considers the design of the 3-sided welds to be acceptable and, therefore, this observation is considered closed.

III Approvals

Originator	C.K. Wong	Date	10/30/84
Project Engineer	John C Aiamchiello	Date	10/31/84
Project Manager	[illegible] Williams	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Observation Record

Checklist No.	General	**Revision No.**	1
Observation No.	PS-08	**Sheet**	1 of 1
Originated By	C.K. Wong C K Wong	**Date**	10/30/84
Reviewed By	G. Bjorkman G Bjorkman	**Date**	11/2/84

1.0 Description

In supports designed by the CPSES Pipe Support Engineering (PSE) organization, loads due to friction are neglected if the piping thermal movement is less than 1/16".

2.0 Requirement

2.1 Paragraph NF-3111 of the ASME Boiler and Pressure Vessel Code, Section III, Subsection NF, "Loading Conditions."

3.0 Document Reference

TUGCO Pipe Support Calculation CC-1-028-044-S33R, Rev. 2.

4.0 Potential Design Impact

Failure to consider all applied loads may result in the inability of the support to perform its intended function.

Attachment

A. Observation Record Review

Extent		
Isolated	Extensive X	Other (Specify)

CYGNA

Observation Record Review
Attachment A

Checklist No.	DC-01-02B	Revision No.	1
Observation No.	DC-01-03	Sheet 1 of 3	

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 **Probable Cause**

Failure to maintain a status of corrective action verification and accurate audit files.

2.0 **Resolution**

The TUGCO Audit Group (Dallas) had recently performed a review of TUGCO audit files and established a manual Audit Finding Log which includes a status of all audit findings. The audit records were updated to accurrately reflect the status of corrective action of the following findings.

Audit No.	Finding	Status	Reference Document
TCP-18	2	Closed	Memo to TCP-18 file from Supervisor, QA Services (6/5/84) - QXX-1866
TCP-18	3	Closed	Memo to TCP-18 file from Supervisor, QA Services (6/5/84)-QXX-1866
TCP-18	4	Closed	Memo to TCP-18 file from Supervisor, QA Services (6/5/84)-QXX-1866
TCP-32	1	Closed	TUGCO Audit Finding Log-Procedure revised 7/21/82.
TCP-32	2	Closed	TUGCO Audit Finding Log-Review of Indoctrination and Training via Audit TCP-75.

III Approvals

Originator	D. Smulling	Date	11-1-84
Project Engineer	[illegible]	Date	11/1/84
Project Manager	[illegible]	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	DC-01-02B	Revision No.	1
Observation No.	DC-01-03	Sheet 2 of	3

	Yes	No
Valid Observation	X	
Closed	X	

Comments

Audit No.	Finding	Status	Reference Document
TCP-32	3	Closed	TUGCO Audit Finding Log-TXX-3497
TCP-32	4	Closed	TUGCO Audit Finding Log-Procedure revised.
TCP-43	1	Closed	TUGCO Audit Finding Log-closed via Audit TCP-74
TCP-43	3,4,5	Open	TUGCO Audit Finding Log-Corrective Action completed-awaiting QA verification
TCP-47	2,3	Closed	TUGCO Audit Finding Log-memo (10/22/82) from QA Manager to J.B. George, QTN-563 (Also refer to resolution of observation DC-01-02)
TCP-49	2	Closed	TUGCO Audit Finding Log-issued letter to G&H
TCP-49	3	Closed	TUGCO Audit Finding Log-QA verified file update
TCP-49	4	Closed	TUGCO Audit Finding Log-QA accepted position by Engineering
TCP-70	1	Closed	Memo from QA Manager (8/4/83) to J. Merritt-QTN-739
TCP-70	2	Closed	Memo from QA Manager (8/4/83) to J. Merritt QTN-739

III Approvals

Originator	D. Smallberg	Date	11-1-84
Project Engineer	[signature]	Date	11/1/84
Project Manager	[signature]	Date	11/5/84
Senior Review Team	[signature]	Date	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	DC-01-02B	**Revision No.**	1
Observation No.	DC-01-03	**Sheet** 3 **of**	3

	Yes	No
Valid Observation	X	
Closed	X	

Comments

As a result of Cygna's review of the formal logging system established by TUGCO QA and the additional documentation which was not originally included in the TUGCO audit files, adequate evidence exists indicating that corrective actions are being properly implemented with subsequent verification by TUGCO. This observation is considered closed.

III Approvals

Originator	[illegible]	Date	11-1-84
Project Engineer	[illegible]	Date	11/1/84
Project Manager	[illegible]	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

Texas Utilities Electric Company; 84042
Independent Assessment Program, Phase 3

CYGNA

Observation Record Review
Attachment A

Checklist No.	DC-02-02B	Revision No.	1
Observation No.	DC-02-01	Sheet 1 of	1

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Records of G&H surveillance activities for the period 1973 to 1977 were not maintained or retrievable.

2.0 Resolution

G&H was requested (reference Cygna letter 84042.007, 6/23/84) to produce documentation of surveillance activities between 1973 and 1977. G&H responded (reference G&H letter GTN-69190, 6/29/84) to the Cygna request by submitting a sample of surveillance reports for the years 1974 to 1977. Our review of these surveillance reports disclosed that surveillances were not an integral part of the G&H design control evaluation program prior to 1977, since they only documented the quality assurance department's review of drawings, specifications, and calculations. The G&H audits, by themselves, provided an adequate means of verifying the implementation of the design control program. This Observation is considered closed.

III Approvals

Originator	D. L. Smalley	Date	11-1-84
Project Engineer	[illegible]	Date	11/1/84
Project Manager	[illegible]	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Observation Record Review
Attachment A

Checklist No.	DC-02-02B	Revision No.	1
Observation No.	DC-02-03	Sheet 1 of 1	

	Yes	No
Valid Observation	X	
Closed	X	

Comments

1.0 Probable Cause

Failure to follow procedure.

2.0 Resolution

G&H was requested (reference Cygna letter 84042.007, 6/23/84) to confirm that audit finding 5A (Audit No. 9) was placed on the open audit findings list and provide, in detail, the steps taken or remaining to be taken to resolve the design reviewer's comments (the subject of audit finding 5A). G&H responded to the Cygna request (reference G&H letter GTN-69190, 6/29/84) by providing documented evidence that the design reviewer's comments had in fact been incorporated and signed off by the design reviewer. The apparent lack of documentation was caused by the subject calculation having been revised and renumbered. As a result of this, G&H QA closed the audit finding on 6/23/84. Based on the sample reviewed, Cygna believes that this is an isolated occurance. Therefore, this observation is closed.

III Approvals

Originator	D. L. Smedley	Date	11-1-84
Project Engineer	[illegible]	Date	11/1/84
Project Manager	[illegible]	Date	11/5/84
Senior Review Team	[illegible]	Date	11/5/84

CYGNA

Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart LJW Approver J. Minichiello JCM Checklist No. PI-01

Problem No. AB-1-001; Rev. 1 Date 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
1. System Boundaries				
a. Check that all required branch lines are included.	X			
b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Section 4.3.3.			X	
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Design & Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			Agrees with mechanical systems group operating modes summary in calculation binder.
4. Thermal Loading				
a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200.	X			
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200	X			Thermal Mode 4 with ambient temperature of 120°F not run. OK - enveloped by other modes.

CYGNA

Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-01

Problem No. AB-1-001; Rev. 1 **Date** 3/22/84

Item	Satisfactory: Yes	No	N/A	Comments
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7		X		The emergency condition does not consider LOCA loads (unbroken loop). However, emergency combination is still satisfactory when these loads are considered. **Eqn** **Max σ** **Allow** **Margin** 8 8392 17500 52% 9U 14461 21000 31% 9E 15553 31500 51% *9F 18726 42000 55% 10 15115 26250 42% 11 23395 43750 47% *Note: 9F meets emergency allowables with a margin of 41%. See Item 36 for local stress margins.
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.	X			
34. Valve Acceleration - Check against requirements in Cygna Criteria 84042-DC-1, Sect. 4.6.5.e.			X	

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-01

Problem No. AB-1-001; Rev. 1 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
35. Flanges - Refer to NC/ND-3647 and check that flange calculations include pipe load effects.			X	
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.	X			Eqn / Margin (at attachment locations) 8 / 56.3% 9U / 59.2% 9E / 59.1% 9F / 60.5% 11 / 50.3%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.

CYGNA

Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart LW **Approver** J. Minichiello JZM **Checklist No.** PI-02

Problem No. AB-1-002; Rev. 1 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
1. System Boundaries				
a. Check that all required branch lines are included.	X			
b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Section 4.3.3.			X	
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Design & Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			Agrees with mechanical systems group operating modes summary in calculation binder.
4. Thermal Loading				
a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200.	X			
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200	X			

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-02

Problem No. AB-1-002; Rev. 1 **Date** 3/22/84

Item	Satisfactory: Yes	No	N/A	Comments
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7	X			Eqn / Max σ / Allow / Margin 8 / 9067 / 17500 / 48% 9U / 12760 / 21000 / 39% 9E / 14757 / 31500 / 53% *9F / 18746 / 42000 / 55% 10 / 11709 / 26250 / 55% 11 / 19717 / 43750 / 55% *Note: 9F meets emergency allowables with a margin of 40%. These values do not include the effects of local stresses due to welded attachments. See Item 36 for results with local stress effects.
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.	X			
34. Valve Acceleration - Check against requirements in Cygna Design Criteria 84042-DC-1, Section 4.6.5.e.			X	

CYGNA

Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-02

Problem No. AB-1-002; Rev. 1 **Date** 3/22/84

Item	Satisfactory: Yes	Satisfactory: No	Satisfactory: N/A	Comments
35. Flanges - Refer to NC/ND-3647 and check that flange calculations include pipe load effects.			X	
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.	X			**Eqn** / **Margin** 8 / 50.6% 9U / 48.7% 9E / 39.2% 9F / 61.6% 11 / 57.6%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.

CYGNA

Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart LW **Approver** J. Minichiello JJM **Checklist No.** PI-03

Problem No. AB-1-003; Rev. 1 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
1. System Boundaries a. Check that all required branch lines are included.	X			
b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Section 4.3.3.			X	
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Design & Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			Agrees with mechanical systems group operating modes summary in calculation binder.
4. Thermal Loading a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200.	X			
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200	X			

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-03

Problem No. AB-1-003; Rev. 1 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7.	X			**Eqn / Max σ / Allow / Margin** 8 / 8847 / 17500 / 49% 9U / 15543 / 21000 / 26% 9E / 16111 / 31500 / 49% *9F / 19595 / 42000 / 53% 10 / 10627 / 26250 / 60% 11 / 18675 / 43750 / 57% *Note: 9F meets emergency allowables with a margin of 38%. See Item 36 for local stress margins.
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.	X			
34. Valve Acceleration - Check against requirements in Cygna Criteria 84042-DC-1, Section 4.6.5.e.			X	
35. Flanges - Refer to NC/ND-3647 and check that flange calculations include pipe load effects.			X	

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart Approver J. Minichiello Checklist No. PI-03

Problem No. AB-1-003; Rev. 1 Date 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.	X			MS-1-03-014-C72K pad dimension (projected) used 16" instead of 15.34". OK, since stress allowable margins greater than 50%. **Eqn** **Margin** 8 53.1% 9U 37.8% 9E 46.0% 9F 50.3% 11 71.9%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart LW Approver J. Minichiello JRM Checklist No. PI-04

Problem No. AB-1-004; Rev. 1 Date 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
1. System Boundaries a. Check that all required branch lines are included. b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Section 4.3.3.	X (a)		X (b)	
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			Agrees with the mechanical systems group operating modes summary in calculation binder.
4. Thermal Loading a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200	X			

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-04

Problem No. AB-I-004; Rev. 1 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.				
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7	X			see below

Eqn	Max σ	Allow	Margin
8	[illegible]151	17500	48%
9U	16235	21000	23%
9E	17460	31500	45%
*9F	20075	42000	52%
10	14560	26250	45%
11	22285	43750	49%

*Note: 9F meets emergency allowables with a margin of 36%.
See Item 36 for local stress margins.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Inside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-04

Problem No. AB-1-004; Rev. 1 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.	X			**Eqn** / **Margin** 8 / 53.1% 9U / 44.8% 9E / 43.7% 9F / 56.8% 11 / 66.8%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

ZjW

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello Jm **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. System Boundaries				
a. Check that all required branch lines are included.	X			
b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Section 4.3.3.	X			
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Design & Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			The maximum design pressure is 1185 psig (per Westinghouse). 1235 psig, the maximum operating pressure and the highest set pressure for safety valves, was used.
4. Thermal Loading				
a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200.	X			Conforms with modes of operation from Gibbs & Hill interoffice memorandum, Ref. No. MEAB-140, dated 6/28/82.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200	X			Considered modes at 100% load and at upset condition.
c. Check Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.	X			Movement at moment restraint acceptable.
d. Branch Attachment Point Movements - Refer to thermal calculation computer output for run pipe. - Ensure that radial expansion of the run is included.	X			
5. Dynamic Loading a. 1/2 SSE Spectra b. SSE Spectra - Check that the spectra for all pertinent building elevations have been enveloped/ interpolated that the proper damping values have been selected.		X X		Used 2% 1/2 SSE and 3% SSE curves which is incorrect for the 8" branch piping. The mode shapes printing in problem AB-1-23C) indicate that the primary response is in the 8" branch line. Using 1% 1/2 SSE and 2% SSE curves will increase the 1/2 SSE by a maximum of 1g and the SSE by 0.7 g in the frequency range of 22-50 Hz. This could effect the local stresses at weld attachments which have low margins to the allowable stress (see Item 36). See **Observation PI-00-03.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. Turbine Stop Valve Closure - Check that the appropriate time history forcing function has been properly applied (i.e., direction, magnitude, and duration). Refer to Cygna Criteria 84042-DC-1, Section 4.6.10.			X	
6. Safety Valve Opening Loads - Check force calculation per Cygna Criteria 84042-DC-1, Section 4.6.11.		X		Although the analyst did not follow Gibbs & Hill analytical engineering guide AEG-505, the force calculation is based on an acceptable alternative method.
- Check that worst case combination of valves blowing has been considered.	X			The calculation of the DLF (page 30) did not consider the weight of both discharges. This results in a 1.8% increase in DLF. The attachments to the QA package contain a telecon between Zahorsky/Crosby and Giden/Gibbs & Hill dated 10/21/76 which states that most A/E's assume a 60/40 discharge imbalance. The Gibbs & Hill calculation assumes a 55/45 imbalance. The net result of the above items is:

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				a) A total force increase of 1.89% for each valve. There is sufficient margin in pipe stress and support loads. b) A total imbalance increase of 217%. This increase is taken totally by the moment restraint and containment penetration, both of which are designed for plastic capacity. The above two items have negligible impact on main steam pipe stress (≈ 400 psi increase). All five safety valves were considered blowing simultaneously without any documentation assuring that Gibbs & Hill Specification No. 2323-MS-200, Sect. 6.3.bl had been satisfied. Cygna calculation Al of file 84042/5/F confirms that this is the worst case for support loads.

Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
7. LOCA - Check steam generator nozzle displacement input. Assure that all three orthogonal directions have been considered and properly combined. Review for possible dynamic amplification. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.12.			X	
8. Jet Impingement - Check to assure that all applicable jets with their appropriate signs have been considered. Assure that both dynamic and static load factors have been properly applied. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.13.	X			No impacting jets.
9. Pipe Whip - Check to assure that no unacceptable interactions from other piping are present. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.14.	X			No interactions.
10. Seismic Anchor Movement - Check movements to assure that proper buildings have been considered. If piping passes between buildings, check movements for proper phase.	X			

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
11. Section Properties				
a. Pipe OD	X			
b. Pipe Wall Thickness	X			
c. Insulation Thickness and Weight		X		Weight of 24" Sch 80 cap is approximately 145 lbs. plus insulation weight. The weight used in the analysis conservatively taken as 350 lbs. Weight of insulation is included for safety valve discharge lines (0.344 lbs/in), where no insulation exists. This has a minor effect on the analysis.
d. Weight of Contents - Refer to G&H Design Specification 2323-MS-200.	X			
12. Material Properties				
a. Sc (Material Stress at Minimum Temperature)	X			
b. Sh (Material Stress at Design Temperature)	X			
c. Ec (Youngs Modulus at Minimum Temperature)		X		The "E" values used for 32" MS-1-01-1303-2 are for a steel containing > 0.3% carbon; however, SA155 KCF 70 contains 0.28% carbon.
d. E_h (Youngs Modulus at Design Temperature)		X		

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				E_c for the line is 27.9 ksi. The E_c used in the analysis is 29.9 ksi, resulting in stresses which are 7% too high and displacements which are 7% too low. E_h for T=571°F should be 25.9 ksi, but 26.9 ksi is used. The above comments result in this following increases: Seismic-all results 3% DW, RV - displacements 3%; and the following decreases: TH, TAM - stress & loads 3.7% SAM - Stress & loads 4.5% Reference Cygna calculation 84042/5F Set A5. By comparison to margins listed in Item 32, these increases are acceptable.
e. α (Coefficient of Thermal Expansion)	X			
f. Poisson's ratio - Refer ASME B&PV, Sec. III, Appendix I and Cygna Criteria DC-1, Sec. 4.5.5.	X			

Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart	**Approver** J. Minichiello	**Checklist No.** PI-05	
Problem No. AB-1-23A; Rev. 0		**Date** 3/22/84	

Item	Satisfactory Yes	No	N/A	Comments
13. Geometry				
a. Computer Output Diagnostic Messages	X			
b. Element Data Table - Check lengths, pipe properties, material properties, code specification, bend radii and angles.	X			
c. Node Data Table - Check for consistency with input and isometric. - Check for nodes between supports in same direction.	X			
d. As-Built Tolerances - Check as built drawings versus Stress Report isometrics.	X			
14. Restraints				
a. Location, Type, and Orientation - Check for agreement with isometric and support detail drawing.	X			
b. Tolerances - Check for agreement with isometric & hanger details.	X			
c. Stiffness - Refer to G&H Design Specification 2323-MS-200, Table 3.4-1.		X		Restraint at Node 2350 modeled with stiffness of 10^6 lbs/in. Gibbs & Hill specification calls for 5×10^6 lbs/in.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				Snubbers at nodes 2347 and 2500 modeled as infinitely rigid. Gibbs & Hill Design Specification calls for a stiffness of 1.35×10^6 lbs/in. Moment restraint at nodes 1904 and 19029 modeled with an X-direction restraint stiffness of 14,000 kips/in. The specified minimum required stiffness is 7,000 kips/in. The actual stiffness for the moment restraint is 22500 kips/in (Ref. Gibbs & Hill Calc. SSB-122C, Set 2). See Pipe Support Checklists, Note 8.
15. Valves a. Location - Check for agreement with isometric.	X			
b. Modeling - Refer to valve drawing and Cygna Criteria 84042-DC-1 Section 4.5.7.		X		Weight of insulation not included in the weights of the following valves: 8" Control Valve 8" Gate Valve 32" Isolation Valve **See Observation PI-00-04.** The five safety valves have no insulation.

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Main Steam Outside Containment

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Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
				Weight of drip pans on relief and safety valve discharge lines not included (117 lbs/pan). This is negligible compared with the weight of the safety valve. Power relief valves with flexible yoke is modelled as a relatively stiff element. OK due to restraint on valve operator. However, as-built loads on snubbers attached to operator are not transmitted to vendor for valve qualification. **See Observation PI-00-07.**
16. Fittings				
a. Location and Type - Refer to Flow Diagrams and BRP's.	X			
b. Stress Intensification Factor (SIF) - Refer to ASME B&PV Sect. III, Subsection NC-3670, and computer input. - Insure proper weld mismatch assumed (1/32" max.) for SIF's at butt welds. - Check that as-built reducer angles are provided if default SIF (2.0) is not used.	X			The SIF's at the connection between the flange and the 8" SR elbow on the safety valve discharge can be reduced from 3.196 to 2.33 (27%) by use of the flange correction factor.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
17. Weldolets, Sweepolets, Sockolets, etc.				
a. Location - Refer to isometric.	X			
b. Stress Intensification Factor (SIF) - Refer to Bonney Forge Bulletins IW-1-1981 and 775.		X		No SIF was considered at the run end of the 4" sweepolet (Node 234) connection. Bonney Forge indicates a minimum of 1.5 (as shown on page 116 of QA package). **See Observation PI-00-01.** A conservative SIF=1.53 was used at the 2" sockolet connection on the drip pot. The branch connection equation in the Code allows use of an SIF=1.0. Incorrect SIF was considered at branch end of 24" sweepolet to drip pot (2.36 instead of 2.43 + 3%). This is due to improper interpolation in calculation (see page 13 of QA package).
18. Nozzle Flexibility - Check flexibility assumptions. - Refer to equipment drawings.			X	

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
19. Penetrations & Sleeves				
a. Modeling - Refer to Penetration Details.	X			Flued head modeled as completely restrained anchor.
b. Stress Intensification Factor (SIF) - Check details to determine proper SIF.		X		SIF = 1.0. SIF for TTJ not considered. See **Observation PI-00-01.**
c. Pipe Deflections - Check that deflections do not cause interference.	X			
20. Mass Point Spacing				
- Check for adequacy to 33 Hz (seismic).	X			
- Check for adequacy to 100 Hz (stop valve closure).			X	
21. Cut-off Frequency/No. of Modes				
- Ensure that all modes up to 33 Hz were considered (seismic).	X			The following modes below 33 Hz are excluded by the ADLPIPE (Rev. 1C) program due to a maximum modal displacement being less than 0.001" (SSE, 3%). **Mode** / **Frequency (Hz)** / **Direction** 1 / 21.747 / Z 3 / 28.220 / X 4 / 29.998 / Z
- Ensure that all modes up to 100 Hz were considered (stop valve closure).			X	

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Independent Design Review Checklist

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
22. Damping - Check for compliance with Cygna Criteria 84042-DC-1, Section 4.6.5.b (seismic) or Section 4.6.11.b (stop valve closure).		X		See comments under Item 5.
23. Modal Combination - Check compliance with NRC Regulatory Guide 1.92.	X			
24. Gravity Output a. Check displacements - Less than 0.1"	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Downward direction	X			
25. Thermal Output a. Check displacements - Less than 3" or consistent with temperature, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.

Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory: Yes	No	N/A	Comments
c. Check loads - Consistent with temperature, piping layout and restraint configuration.	X			
26. Seismic Output a. Check displacements - Less than 1" or consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See Comments under Item 32.
c. Check loads - Consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration.		X		No inertia mass point at drip pan on relief and safety valve discharge lines, so no seismic loads at nearby restraints. However thrust loads are the governing load. Therefore there is no design impact.
d. Check mass participation - Check that about 90% of total mass has been included		X		X direction = 36% Y direction = 0% Z direction = 89% **See Observation PI-00-05.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
27. SAM Output				
a. Check displacements - Consistent with input movements, piping layout, and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Consistent with input movements, piping layout, and restraint configuration.	X			
28. Turbine Stop Valve Closure Output			X	
a. Check displacements - Less than 1" or consistent with input forcing function, mass distribution, piping layout and restraint configuration.				
b. Check stresses - Satisfy Code equations (NC/ND-3600).				
c. Check loads - Consistent with input forcing function, mass distribution, piping layout and restraint configuration.				
29. Safety Valve Opening Output				
a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration.	X			

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Independent Design Review Checklist

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Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	No stress output for this load case.
c. Check loads - Consistent with input forces, piping layout and restraint configuration.	X			The comments noted in Item 6 will affect support loads, however, as noted there, effect is minor.
30. LOCA Output a. Check displacements - Less than 1" or consistent with input displacement, piping layout and restraint configuration. b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.			X	
31. Jet Impingement Output a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration. b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.			X	

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Independent Design Review Checklist

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7	X			**Eqn / Max σ / Allow / Margin** 8 / 6697 / 15000 / 55% 9U / 16325 / 18000 / 9% *9E/F / 16325** / 27000 / 40% 10 / 20763 / 22500 / 8% 11 / 27460 / 37550 / 27% 8 / 8769 / 17500 / 50% 9U / 15813** / 21000 / 25% *9E/F / 21863** / 31500 / 31% 10 / 21148 / 26250 / 19% 11 / 29144 / 43750 / 33% *Note: 9F meets emergency allowables. **Differs from value noted in QA package. See Item 36 for local stress margins.
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.			X	
34. Valve Acceleration - Check against requirements in Cygna Criteria 84042-DC-1, Section 4.6.5.e.	X			Reference Cygna calculation 48042/5/F Set A6.

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
35. Flanges - Refer to NC/ND-3647 and check that flange calculations include pipe load effects.	X			Used NC-3658 of the later Code, which was also used in original flange study. Maximum loads are not at node 23581, but 2354. Increase in load = 20%, however, present ratio = .4, therefore, design is okay.
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.	X			Eqn. 11 (all supports) stresses were obtained by summing Eqn. 8 and Eqn. 10 stresses. **Eqn** / **Margin** 8 / 50.6% 9U / 49.5% 9E / 12.5% 9F / 64.7% 11 / 30.0%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-05

Problem No. AB-1-23A; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
38. Break Exclusion Criteria - Check that stress levels meet the criteria in MEB-BTP 3-1 in piping between M-S penetration and moment restraint.		X		Local stresses not included in stress check. **See Observation PI-00-02.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart LGW Approver J. Minichiello JCM Checklist No. PI-06

Problem No. AB-1-23B; Rev. 0 Date 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. System Boundaries a. Check that all required branch lines are included. b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Section 4.3.3.	X X			
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Design & Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			The maximum design pressure of 1185 psig agrees with the value supplied by Westinghouse. The maximum operating pressure used in the analysis was 1235 psi, the highest set pressure for the safety valves.
4. Thermal Loading a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200.	X			Conforms with modes of operation in Gibbs & Hill interoffice memorandum, Ref. No. MEAB-140, dated 6/28/82.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200	X			Considered modes at 100% load and at upset condition.
c. Check Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.		X		Thermal displacements applied at Node 14 (end of moment restraint) not documented in QA package. Cygna verified the value by reviewing problem AB-1-100.
d. Branch Attachment Point Movements - Refer to thermal calculation computer output for run pipe. - Ensure that radial expansion of the run is included.			X	
5. Dynamic Loading				
a. 1/2 SSE Spectra		X		Used 2% 1/2 SSE and 3% SSE curves which is incorrect for the 8" branch piping. The mode shapes printed in problem AB-1-23C) indicated that the primary response is in the 8" branch line. Using 1% 1/2 SSE and 2% SSE curves will increase the 1/2 SSE by a maximum of 1g and the SSE by 0./ g in the frequency range of 22-50 Hz. This could affect the local stresses at weld attachments which have low margins to the allowable stress (Item 36). **See Observation PI-00-03.**
b. SSE Spectra - Check that the spectra for all pertinent building elevations have been enveloped/interpolated and that the proper damping values have beem selected.		X		

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. Turbine Stop Valve Closure - Check that the appropriate time history forcing function has been properly applied (i.e., direction, magnitude, and duration). Refer to Cygna Criteria 84042-DC-1, Section 4.6.10.			X	
6. Safety Valve Opening Loads - Check force calculation per Cygna Criteria 84042-DC-1, Section 4.6.11.		X		See comments on Checklist No. PI-05, under Item 6. Note that impact on main steam pipe stress is small (400 psi).
- Check that worst case combination of valves blowing has been considered.	X			
7. LOCA - Check steam generator nozzle displacement input. Assure that all three orthogonal directions have been considered and properly combined. Review for possible dynamic amplification. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.12.			X	
8. Jet Impingement - Check to assure that all applicable jets with their appropriate signs have been considered. Assure that both dynamic and static load factors have been properly applied. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.13.	X			No impacting jets.

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
9. Pipe Whip - Check to assure that no unacceptable interactions from other piping are present. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.14.	X			No interactions.
10. Seismic Anchor Movement - Check movements to assure that proper builaings have been considered. If piping passes between buildings, check movements for proper phase.	X			
11. Section Properties				
a. Pipe OD	X			
b. Pipe Wall Thickness	X			
c. Insulation Thickness and Weight		X		Insulation weight included for safety valve discharge lines; no insulation exists. See Checklist PI-05, Item 11.
d. Weight of Contents - Refer to G&H Design Specification 2323-MS-200.	X			
12. Material Properties				
a. Sc (Material Allowable Stress at Minimum Temperature)	X			
b. Sh (Material Allowable Stress at Design Temperature)	X			
c. Ec (Young's Modulus at Minimum Temperature)		X		The "E" values used for 32"

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Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
d. E_h (Youngs Modulous at Design Temperature)		X		MS-1-01-1303-2 are for a steel containing > 0.3% carbon; however, SA155 KCF 70 contains 0.28% carbon. E_c for 32" MS-1-02-1303-2 is 27.9 ksi. The E_c used in the analysis is 29.9 ksi. E_h for T=571°F should be 25.9 ksi, but 26.9 ksi is used. The above comments result in the following increases: Seismic - All results 3% DW, RV - Displacements 3% and the following decreases: TH, TAM - Stress & Loads 3.7% SAM - Stress & Loads 4.5% Reference Cygna calculation 84042/5F Set A5. These increases have minimal effect when compared against the margins in Item 32.
e. α (Coefficient of Thermal Expansion)	X			
f. Poisson's ratio - Refer ASME B&PV, Sec. III, Appendix I and Cygna Criteria DC-1, Sec. 4.5.5.	X			

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Independent Design Review Checklist

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
13. Geometry				
a. Computer Output Diagnostic Messages	X			
b. Element Data Table - Check lengths, pipe properties, material properties, code specification, bend radii and angles.	X			
c. Node Data Table - Check for consistency with input and isometric. - Check for nodes between supports in same direction.	X			
d. As-Built Tolerances - Check as built drawings versus Stress Report isometrics.	X			
14. Restraints				
a. Location, Type, and Orientation - Check for agreement with isometric and support detail drawing.	X			
b. Tolerances - Check for agreement with isometric and hanger details.	X			
c. Stiffness - Refer to G&H Design Specification 2323-MS-200, Table 3.4-1.		X		Restraint at Node 1011 modeled with a stiffness of 10^6 lbs/in. Gibbs & Hill specification calls for 5×10^6 lbs/in.

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart Approver J. Minichiello Checklist No. PI-06

Problem No. AB-1-23B; Rev. 0 Date 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				Snubbers at nodes 107 and 307 modeled as infinitely rigid. Gibbs & Hill design specification calls for a stiffness of 1.35×10^6 lbs/in. Moment restraint at nodes 2315 and 2325 modeled with an X-direction restraint stiffness of 14,000 kips/in. The specified minimum required stiffness is 7,000 kips/in. The actual stiffness for the moment restraint is 22500 kips/in (Ref. Gibbs & Hill Calc. SSB-122C, Set 2). These differences in stiffness do not impact design. **See Pipe Support Checklist Note 8.**
15. Valves a. Location - Check for agreement with isometric. b. Modeling - Refer to valve drawing and Cygna Criteria 84042-DC-1 Section 4.5.7.	X			Weight of drip pans on safety valve discharge lines not considered (117 lbs/pan), but is negligible.

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Independent Design Review Checklist

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				Power relief valve with flexible yoke modeled as a relatively stiff element. OK due to restraints on valve operator. However, as-built loads on snubbers attached to operator not transmitted to vendor for valve qualification. **See Observation PI-00-07.**
16. Fittings a. Location and Type - Refer to Flow Diagrams and BRP's.	X			
b. Stress Intensification Factor (SIF) - Refer to ASME B&PV Sect. III, Subsection NC-3670, and computer input. - Insure proper weld mismatch assumed (1/32" max.) for SIF's at butt welds. - Check that as-built reducer angles are provided if default SIF (2.0) is not used.		X		The flange correction factor was used at the wrong end of the 8" elbow on the safety valve discharge lines. The SIF at the end not welded to the flange should be increased from 2.33 to 3.196 (37%). The SIF at the end welded to the flange can be decreased from 3.196 to 2.33 (27%). This has no design impact since end of the elbow is a free end with negligible stresses.

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PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
17. Weldolets				
a. Location - Refer to isometric.	X			
b. Stress Intensification Factor (SIF) - Refer to Bonney Forge Bulletins IW-1-1981 and 775.	X			A conservative SIF=3.93 was used at the 24" sweepolet (Node 9). The correct SIF is 3.76 (4% increase).
18. Nozzle Flexibility - Check flexibility assumptions. - Refer to equipment drawings.			X	
19. Penetrations & Sleeves				
a. Modeling -Refer to Penetration Details.	X			Flued head modeled as completely restrained anchor.
b. Stress Intensification Factor (SIF) -Check details to determine proper SIF.	X			SIF = 1.0. SIF for TTJ not considered in analysis. **See Observation PI-00-01.**
c. Pipe Deflections - Check that deflections do not cause interference.	X			
20. Mass Point Spacing				
- Check for adequacy to 33 Hz (seismic).	X			
- Check for adequacy to 100 Hz (stop valve closure).			X	

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Independent Design Review Checklist

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Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
21. Cut-off Frequency/No. of Modes - Ensure that all modes up to 33 Hz were considered (seismic). - Ensure that all modes up to 100 Hz were considered (stop valve closure).	X		X	The following modes below 33 Hz are excluded by the ADLPIPE (Rev. 1C) program due to a maximum modal displacement being less than 0.001": **Mode** **Frequency (Hz)** **Direction** 3 29.898 X 4 31.767 Y, Z
22. Damping - Check for compliance with Cygna Criteria 84042-DC-1, Section 4.6.5.b (seismic) or Section 4.6.11.b (stop valve closure).		X		See comments under Item 5.
23. Modal Combination - Check compliance with NRC Regulatory Guide 1.92.	X			
24. Gravity Output a. Check displacements - Less than 0.1" b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Downward direction	X (a) X (c)		X (b)	See comments under Item 32.

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PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
25. Thermal Output				
a. Check displacements - Less than 3" or consistent with temperature, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Consistent with temperature, piping layout and restraint configuration.	X			
26. Seismic Output				
a. Check displacements - Less than 1" or consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration.		X		No inertia mass point at drip pan on relief and safety valve discharge lines, so no seismic loads (negligible impact since mass is small).
d. Check mass participation - Check that about 90% of total mass has been included		X		X-direction 50% Y-direction 0% Z-direction 90% See **Observation PI-00-05.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
27. SAM Output				
a. Check displacements - Consistent with input movements, piping layout, and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See Load Combination (Item 32).
c. Check loads - Consistent with input movements, piping layout, and restraint configuration.	X			
28. Turbine Stop Valve Closure Output a. Check displacements - Less than 1" or consistent with input forcing function, mass distribution, piping layout and restraint configuration. b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forcing function, mass distribution, piping layout and restraint configuration.			X	

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
29. Safety Valve Opening Output a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration. b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.	a. X c. X		b. X	No stress output for this load case; see Load Combination (Item 32). The comments noted in Item 6 will affect support loads, However, impact will be minor.
30. LOCA Output a. Check displacements - Less than 1" or consistent with input displacement, piping layout and restraint configuration. b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.			X	
31. Jet Impingement Output a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration.			X	

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.				
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7		X		**Eqn** **Max σ** **Allow** **Margin** 8 8455 17500 52% 9U 14518** 21000 31% *9E/F 15570** 31500 51% 10 20205 26250 23% 11 27878** 43750 36% 8 6636** 15000 56% 9U 16315 18000 9% *9E/F 12367** 27000 54% 10 22085 22500 2% 11 28720 37500 23% *Note: 9F meets emergency allowables. **Different values than those shown in QA package. See Item 36 for local stress margins.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-06

Problem No. AB-1-23B; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				Emergency/faulted combination does not include safety valves blowing loads. **See Observation PI-06-02.**
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.			X	
34. Valve Acceleration - Check against requirements in Cygna Criteria 84042-DC-1, Section 4.6.5.e.	X			Reference Cygna calculation 84042/5/F Set A6.
35. Flanges - Refer to NC/ND-3647 and check that flange calculations include pipe load effects.	X			Used NC-3658 of the later Code, which was also used in original flange study. Maximum inlet flange loads do not occur at node 2002, but rather 3002 (2% difference). Present ratio to allowable = 0.17; OK.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart   Approver J. Minichiello   Checklist No. PI-06

Problem No. AB-1-23B; Rev. 0   Date 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions. - Refer to WRC Bulletins 107 and 198.		X		Did not combine loads from MS-1-240-001-S72K and MS-1-240-002-S72K at welded attachment. **See Observation PI-06-01.** Eqn. 11 (all supports) stresses were obtained by summing Eqn. 8 and Eqn. 10 stresses. **Eqn** / **Margin** 8 / 51.1% 9U / 49.6% 9E / 15.1% 9F / 64.8% 11 / 1.0%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.
38. Break Exclusion Criteria - Check that stress levels meet the criteria in MEB-BTP 3-1 in piping between M-S penetration and moment restraint.		X		Local stresses not included in stress check. **See Observation PI-00-02.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-07

Problem No. AB-1-023C; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
4. Thermal Loading				
a. Maximum Temperature - Check for consistency with G&H Design Specification 2323-MS-200.	X			Conforms with modes of operation in Gibbs & Hill interoffice memorandum, Ref. No. MEAB-140, dated 6/28/82.
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200	X			Considered modes at 100% load and at upset condition.
c. Check Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.	X			The thermal rotations at Node 910 on page 13 of the QA package are given in degrees rather than radians as the anchor movement table implies. The analysis uses the correct values (Ref. Stress Problem 1-100).
d. Branch Attachment Point Movements (if applicable) - Refer to thermal calculation computer output for run pipe. - Ensure that radial expansion of the run is included.			X	
5. Dynamic Loading				
a. 1/2 SSE Spectra		X		Used 2% 1/2 SSE and 3% SSE curves

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart Approver J. Minichiello Checklist No. PI-07

Problem No. AB-1-023C; Rev. 0 Date 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. Check loads - Consistent with input forces, piping layout and restraint configuration.				
31. Jet Impingement Output a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration. b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.			X	
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7	X			see table below

Eqn	Max σ	Allow	Margin
8	8455	17500	52%
9U	15098	21000	28%
*9E/F	20866	31500	34%
10	21501	26250	18%
11	29173	43750	33%
8	6420	15000	57%
9U	16325	18000	9%
*9E/F	19857**	27000	26%
10	17379**	22500	23%
11	23459**	37500	37%

*Note: 9F meets emergency allowables.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-07

Problem No. AB-1-023C; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3].	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.
38. Break Exclusion Criteria - Check that stress levels meet the criteria in MEB-BTP 3-1 in piping between M-S penetration and moment restraint.		X		Local stresses rot included in stress check. **See Observation PI-00-02.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

JW

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello JRM **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory: Yes	No	N/A	Comments
1. System Boundaries				
a. Check that all required branch lines are included.	X			
b. Check that, if system starts at a branch attachment point, the attachment point is justified as an anchor. - Refer to Flow Diagrams and Cygna Criteria 84042-DC-1 Sect. 4.3.3.	X			
2. Piping Classification - Check for consistency with Flow Diagrams and G&H Piping Design Specification 2323-MS-200.	X			
3. Design & Maximum Pressure - Check for consistency with G&H Design Specification 2323-MS-200, Appendix 7.	X			The maximum design pressure is 1185 psig (Westinghouse). 1235 psig was used, resulting in conservative pressure stresses. The maximum operating pressure used in the analysis was 1235 psig, the highest set pressure for the safety valves.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
4. Thermal Loading				
a. Maximum Temperature - Check for consistency with G&H Design Specification	X			Conforms with modes of operation in Gibbs & Hill interoffice memorandum, Ref. No. MEAB-14-0, 2323-MS-200, dated 6/28/82.
b. Check if Operational Modes Considered - Refer to Appendix 8 in G&H Design Specification 2323-MS-200.	X			Considered modes at 100% load and at upset condition.
c. Check Equipment Nozzle Movements - Refer to equipment drawings and check any hand calculations.	X			The thermal rotations at Node 1700 that are listed on page 11 of the QA package are given in degrees rather than radians as the anchor movement table implies. The input to the analysis uses the correct values (Ref. stress problem 1-100).
d. Branch Attachment Point Movements - Refer to thermal calculation computer output for run pipe. Ensure that radial expansion of the run is included.			X	
5. Dynamic Loading				
a. 1/2 SSE Spectra		X		Used 2% 1/2 SSE and 3% SSE curves which is incorrect for the 8" branch piping. The mode shapes (printed for problem AB-1-23C) indicate that the primary response is in the 8" branch line. Using 1% 1/2 SEE and 2% SSE curves will increase the 1/2 SSE by a maximum of 1g and the SSE by 0.7 g in the
b. SSE Spectra - Check that the spectra for all pertinent building elevations have been enveloped /interpolated and that proper damping values have been selected.		X		

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				frequency range of 22-50 Hz. This could affect the local stresses at weld attachments which have low margins to the allowable stress (Item 36). **See Observation PI-00-03.**
c. Turbine Stop Valve Closure - Check that the appropriate time history forcing function has been properly applied (i.e., direction, magnitude and duration). Refer to Cygna Criteria 84042-DC-1, Section 4.6.10.			X	
6. Safety Valve Opening Loads - Check force calculation per Cygna Design Criteria 84042-DC-1, Section 4.6.11.		X		See comments on Checklist No. PI-05, under Item 6.
- Check that worst case combination of valves blowing has been considered.	X			
7. LOCA - Check steam generator nozzle displacement input. Assure that all three orthogonal directions have been considered and properly combined. Review for possible dynamic amplification. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.12.			X	

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
8. Jet Impingement - Check to assure that all applicable jets with their appropriate signs have been considered. Assure that both dynamic and static load factors have been properly applied. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.13.	X			No impacting jets.
9. Pipe Whip - Check to assure that no unacceptable interactions from other piping are present. - Refer to Cygna Criteria 84042-DC-1, Section 4.6.14.	X			No interactions.
10. Seismic Anchor Movement - Check movements to assure that proper buildings have been considered. If piping passes between buildings, check movements for proper phase.	X			
11. Section Properties				
a. Pipe OD	X			Weight of 24" SCH 80 cap is approximately 145 lbs plus insulation weight. The weight used in the analysis conservatively taken as 350 lbs.
b. Pipe Wall Thickness	X			
c. Insulation Thickness and Weight		X		

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
d. Weight of Contents - Refer to G7H Design Specification 2323-MS-200				Weight of insulation is conservatively included for safety valve discharge lines (0.344 lbs/in); no insulation exists.
12. Material Properties				
a. Sc (Material Allowable Stress at Minimum Temperature)	X			The "E" values used for 32" MS-1-04-1303-2 are for a steel containing >0.3% carbon; however, SA155 KCF 70 contains 0.28% carbon.
b. Sh (Material Allowable Stress at Design Temperature)	X			E_c for the line is 27.9 ksi. The E_c used in the analysis is 29.9 ksi.
c. Ec (Young's Modulus at Minimum Temperature)		X		E_h for T=571°F should be 25.9 ksi, but 26.9 ksi is used.
d. E_h (Young's Modulus at Design Temperature		X		The above comments result in the following increases: Seismic - All results 3% DW, RV - Displacements 3%

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
				And the following decreases: TH, TAM - Stress & Loads 3.7% SAM - Stress & Loads 4.5% Reference Cygna calculation 84042/5F Set A5. The increases are acceptable when compared with the margins in Item 32.
e. α (Coefficient of Thermal Expansion)	X			
f. Poisson's ratio - Refer to ASME B&PV, Sec. III, Appendix I and Cygna Criteria DC-1, Sec. 4.5.5.	X			
13. Geometry				
a. Computer Output Diagnostic Messages	X			
b. Element Data Table - Check lengths, pipe properties, material properties, code specification, bend radii and angles.	X			
c. Node Data Table - Check for consistency with input and isometric. - Check for nodes between supports in same direction.	X			
d. As-Built Tolerances - Check as built drawings versus Stress Report isometrics.	X			

Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
14. Restraints				
a. Location, Type, and Orientation - Check for agreement with isometric and support detail drawing.	X			
b. Tolerances - Check for agreement with isometric & hanger details.	X			
c. Stiffness - Refer to G&H Design Specification 2323-MS-200, Table 3.4-1.		X		Restraint at Node 15901 modeled with a stiffness of 10^6 lbs/in. Gibbs & Hill specification calls for 5 x 10^6 lbs/in. Snubbers at nodes 5797 and 1587 were modeled as infinitely rigid. Gibbs & Hill design specification calls for a stiffness of 1.35 x 10^6 lbs/in. Moment restraint at nodes 5000 and 7035 modeled with an X-direction restraint stiffness of 14,000 kips/in. The specified minimum required stiffness is 7,000 kips/in. The actual stiffness for the moment restraint is 22500 kips/in (Ref. Gibbs & Hill Calc. SSB-122C, Set 2). See Pipe Support Checklist Note 8.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
15. Valves				
a. Location - Check for agreement with isometric.	X			
b. Modeling - Refer to valve drawing and Cygna Criteria 84042-DC-1 Section 4.5.7.		X		Weight of insulation not included in the weights of the following valves: 8" Control Valve, 8" Gate Valve, 32" Isolation Valve. The five safety valves have no insulation. **See Observation PI-00-04.** Weight of drip pans on relief and safety valve discharge lines not included (117 lbs/pan). (Negligible Impact.) Power relief valves with flexible yoke modeled as a relatively stiff element. OK due to restraints on valve operator. However, as-built loads on snubbers attached to operator not transmitted to vendor for valve qualification. **See Observation PI-00-07.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
16. Fittings				
a. Location and Type - Refer to Flow Diagrams and BRP's.	X			
b. Stress Intensification Factor (SIF) - Refer to ASME B&PV Sect. III, Subsection NC-3670, and computer input. - Insure proper weld mismatch assumed (1/32" max.) for SIF's at butt welds. - Check that as-built reducer angles are provided if default SIF (2.0) is not used.		X		The SIF calculation for the 6" sweepolet to flange connections (Nodes 1591, 1601, 1611, 1621 and 1631) assume a mismatch (∂) = 0. This yields an SIF = 1.4; using ∂ = 1/32" gives an SIF = 1.49 (6-1/2%). **See Observation PI-00-01.** The SIF at the connection between the flange and the 8" SR elbow on the safety valve discharge can be reduced from 3.196 to 2.33 (27%) by use of the flange correction factor. No SIF was considered at the 6" sweepolet to RV inlet flange connection. SIF_{TTJ} = 1.49 (49%). **See Observation PI-00-01.**
17. Weldolets, Sweepolets, Sockolets, etc.				
a. Location - Refer to isometric.	X			

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Stress Intensification Factor (SIF) - Refer to Bonney Forge Bulletins IW-1-1981 and 775.		X		No SIF was considered at the run end of the 4" sweepolet connection. Bonney Forge indicates a minimum of 1.5 (as shown on page 116 of QA package). **See Observation PI-00-01.** A conservative SIF=1.53 was used at the 2" sockolet connection on the drip pot. The branch connection equation in the Code allows use of an SIF=1.0. Incorrect SIF was considered at branch end of 24" sweepolet to drip pot (2.36 instead of 2.43 + 3%). This is due to improper interpolation in calculation (see page 13 of QA package).
18. Nozzle Flexibility - Check flexibility assumptions. - Refer to equipment drawings.			X	

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	No	N/A	Comments
19. Penetrations & Sleeves				
a. Modeling - Refer to Penetration Details.	X			Flued head modeled as completely restrained anchor.
b. Stress Intensification Factor (SIF) - Check details to determine proper SIF.	X			SIF = 1.0. SIF for TTJ not considered in analysis.
c. Pipe Deflections - Check that deflections do not cause interference.	X			**See Observation PI-00-01.**
20. Mass Point Spacing				
- Check for adequacy to 33 Hz (seismic).	X			
- Check for adequacy to 100 Hz (stop valve closure).			X	
21. Cut-off Frequency/No. of Modes				
- Ensure that all modes up to 33 Hz were considered (seismic).	X			The following modes below 33 Hz are excluded by the ADLPIPE (Rev. 1C) program due to a maximum modal displacement being less than 0.001".
- Ensure that all modes up to 100 Hz were considered (stop valve closure).			X	

Mode	**Frequency (Hz)**	**Direction**
1	21.476	Z
2	25.706	Y
4	29.009	X
5	32.055	Y, Z
6	32.719	X, Y, Z

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
22. Damping - Check for compliance with Cygna Criteria 844042-DC-1, Section 4.6.5.b (seismic) or Section 4.6.11.b (stop valve closure).		X		See comments under Item 5.
23. Modal Combination - Check compliance with NRC Regulatory Guide 1.92.	X			
24. Gravity Output				
a. Check displacements - Less than 0.1"	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Downward direction	X			
25. Thermal Output				
a. Check displacements - Less than 3" or consistent with temperature, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. Check loads - Consistent with temperature, piping layout and restraint configuration.	X			
26. Seismic Output a. Check displacements - Less than 1" or consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Consistent with spectra, mass distribution, mode shapes, piping layout and restraint configuration.		X		No inertia mass point at drip pan on relief and safety valve discharge lines, so no seismic loads. Impact is negligible since mass is small.
d. Check mass participation - Check that about 90% of total mass has been included.		X		X direction 29% Y direction 0% Z direction 83% **See Observation PI-00-05.**

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
27. SAM Output				
a. Check displacements - Consistent with input movements, piping layout, and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	See comments under Item 32.
c. Check loads - Consistent with input movements, piping layout, and restraint configuration.	X			
28. Turbine Stop Valve Closure Output			X	
a. Check displacements - Less than 1" or consistent with input forcing function, mass distribution, piping layout and restraint configuration.				
b. Check stresses - Satisfy Code equations (NC/ND-3600).				
c. Check loads - Consistent with input forcing function, mass distribution, piping layout and restraint configuration.				

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
29. Safety Valve Opening Output				
a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration.	X			
b. Check stresses - Satisfy Code equations (NC/ND-3600).			X	No stress output for this load case.
c. Check loads - Consistent with input forces, piping layout and restraint configuration.		X		The comments noted in Item 6 will affect support loads, but effect is small as noted therein.
30. LOCA Output			X	
a. Check displacements - Less than 1" or consistent with input displacement, piping layout and restraint configuration.				
b. Check stresses - Satisfy Code equations (NC/ND-3600).				
c. Check loads - Consistent with input forces, piping layout and restraint configuration.				
31. Jet Impingement Output			X	
a. Check displacements - Less than 1" or consistent with input forces, piping layout and restraint configuration.				

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Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-08

Problem No. AB-1-23D; Rev. 0 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Check stresses - Satisfy Code equations (NC/ND-3600). c. Check loads - Consistent with input forces, piping layout and restraint configuration.				
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7	X			Eqn / Max σ / Allow / Margin 8 / 8760 / 17500 / 50% 9U / 12746 / 21000 / 39% *9E/F / 17698 / 31500 / 44% 10 / 17741 / 26250 / 32% 11 / 25736 / 43750 / 41% 8 / 6741 / 15000 / 55% 9U / 17317 / 18000 / 4% *9E/F / 17979 / 27000 / 33% 10 / 20524 / 22500 / 9% 11 / 27265 / 37500 / 27% *Note: 9F meets emergency allowables. See Item 36 for local stress margins.

CYGNA

Independent Design Review Checklist

PIPE STRESS

Main Steam Outside Containment

Reviewer A. Cowell, M. Mani/L. Weingart Approver J. Minichiello Checklist No. PI-08

Problem No. AB-1-23D; Rev. 0 Date 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.			X	
34. Valve Acceleration - Check against requirements in Cygna Criteria 84042-DC-1, Section 4.6.5.e.	X			Reference Cygna Calculation 84042/5/F Set A6.
35. Flanges - Refer to NC/ND-3647 and check that flange calculations include pipe load effects.	X			Used NC-3658 of the later Code, which was also used in original flange study. Maximum stresses for upset occur at node 1622, not 1632 (2% error, ratio = .18); OK. Page 34, joint should be 6009, not 23851, but data is correct.
36. Welded Attachments - Check for consideration of local stresses at lugs and stanchions.	X			

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
- Refer to WRC Bulletins 107 and 198.				Eqn. 11 (all supports) stresses were obtained by summing Eqn. 8 and Eqn. 10 stresses. **Eqn** / **Margin** 8 / 49.3% 9U / 49.6% 9E / 13.1% 9F / 64.8% 11 / 22.8%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.
38. Break Exclusion Criteria - Check that stress levels meet the criteria in MEB-BTP 3-1 in piping between M-S penetration and moment restraint.		X		Local stresses not included in stress check. **See Observation PI-00-02.**

CYGNA

Independent Design Review Checklist

PIPE STRESS

Component Cooling Water

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-09

Problem No. 1-061A; Rev. 2 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
32. Load Combination - Check for consistency with Cygna Criteria 84042-DC-1, Section 4.7	X			**Eqn** **Max σ** **Allow** **Margin** 8 4901 15000 67% 9U 17558 18000 2% 9E 23770 27000 12% *9F 23770 36000 34% 10 10662 22500 53% 11 13515 37500 64% *Note: 9F meets emergency allowables with a margin of 12%. Support load combinations 61 and 62 incorrectly used summation of signed and unsigned values for maximum and minimum upset. However, these values were not used in support design. See Item 36 for local stress margins.
33. Equipment Nozzle Loads - Refer to the equipment data noted in Appendix 4 to G&H Specification 2323-MS-200.	X			

CYGNA

Independent Design Review Checklist

PIPE STRESS

Component Cooling Water

Reviewer A. Cowell, M. Mani/L. Weingart **Approver** J. Minichiello **Checklist No.** PI-09

Problem No. 1-061A; Rev. 2 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				Node 114 do not match current analysis results and drawings. See Attachment A. Eqn — Margin 8 — 72.8% 9U — 76.1% 9E — 68.9% 9F — 80.1% 11 — 82.1%
37. Functional Capability - Check that piping retains dimensional stability under all loadings (per NRC Standard Review Plan 3.9.3).	X			Faulted load combinations meet emergency stress allowables. This ensures maintaining functional capability as defined in the SRP.

GENERAL NOTES TO PIPE SUPPORT CHECKLISTS

1. Component Weights

As a matter of standard practice, the pipe support design organizations do not include standard component weights (i.e., strut, spring, snubber, clamp) as part of the pipe support design load. They normally consider the weight of the frame members when using the STRUDL program for design, however, they neglect the standard component effect. Since these components weights are typically small in comparison to the applied pipe load (5% or less), they will have little impact on design, even in the case of the weight being orthogonal to the applied load. In addition, it is common practice to neglect these weights for struts, snubbers, and rods. Cygna has seen examples in industry where the weight of large constant supports is included in the design of the wall or ceiling attachments but these are typically no more than 5% of the pipe load and can be considered negligible. Therefore, Cygna finds this procedure acceptable.

2. Pad/Trunnion Stresses on the Main Steam Line

In the pipe support calculations involving pads or trunnions welded to the Main Steam piping, Cygna did not find many examples of stress checks. Instead, the drawings carried the note "Pad (or trunnion) qualified per Appendix G of ASME B&PV Code." Per TUGCO document CPP 12978, attachments welded to the Main Steam and Feedwater lines require impact testing (per Subsection NC-2311 of the ASME B&PV Code) or assurance that the stress levels are low enough to preclude non-ductile failure. In order to qualify pads or trunnions already assembled, NPSI (Secaucus) performed detailed finite element analyses of each geometry and compared the maximum stresses to allowables derived from Appendix G (Prevention Against Non-Ductile Failure), which resulted in stresses much lower than standard Code allowables. Cygna reviewed two examples of the NPSI models/calculations and found their method acceptable, although one model contained input errors which did not impact the conclusions. Furthermore, as part of their normal design practice NPSI had previously committed to reviewing each welded attachment analysis against the final pipe support loads (refer to Communications Report dated 6/18/84). Thus, Cygna considers the approach acceptable.

3. Local Stress Effects

In reviewing the pipe supports for Phase 3, Cygna noted many instances of the following:

a) Use of wide flange or back to back channels without stiffener plates at connections and without calculations to show the joint is acceptable.

b) Use of tubesteel in frames without checking whether the webs of the tube are adequate to transmit the load, especially when the end is a load transfer point.

c) Use of composite sections, made up by welding a plate to a tube section, without considering the additional stress in the weld at the load transfer point **(see Observation PS-07).**

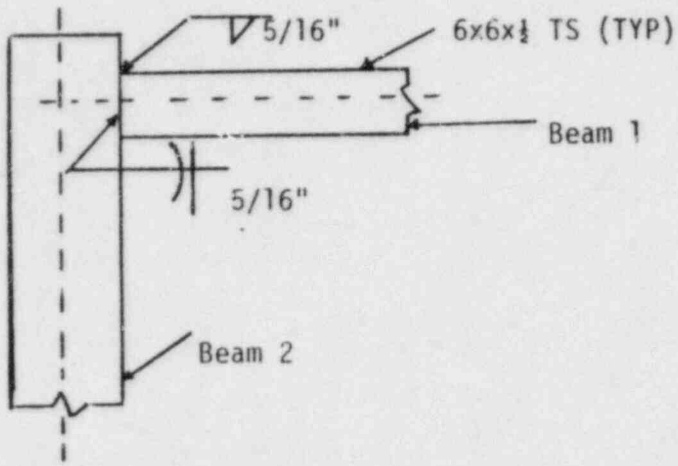
It is important to note that Cygna did see instances where each of these items were properly considered, either by calculation or good design practice. In response to Cygna's question on project guidance in this area, TUGCO stated in a 6/8/84 letter:

> "Although the various design guidelines may not require that specific calculations be performed on structural connections the effects of localized stress are often evaluated with approximate calculations. The individual design engineer assesses each situation on a case-by-case basis. From his inspection, he may judge the effects negligible or may add gussets or stiffeners; or he may elect to calculate the actual stresses and determine if there is a necessity for stiffening. In all cases, however, the designer is guided by the limits set forth in subsection NF and specification MS-46A. It has always been a matter of good engineering practice to make these considerations. It is not industry practice to provide guidelines to engineers for these considerations, nor is it necessary."

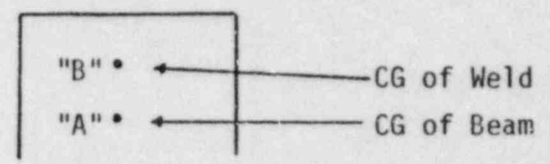
Cygna has reviewed each design in Phase 3 for the acceptability of the engineering judgment noted. In certain cases, Cygna was able to confirm that judgment since the applied loads were small. In other cases, Cygna performed their own calculations to determine the adequacy of the joint. In no case did Cygna find a design error, i.e., each joint would transfer the applied loads. It is the lack of calculations or notes in the design calculations that has caused Cygna to make this comment. Without at least a statement such as: "connections OK by judgment", Cygna had no way of knowing whether certain joints had been checked or not. Conversely, if stiffeners were added to a joint without calculations, Cygna had no means of determining that the stiffeners were properly designed, without performing our own calculations. Thus, while the lack of calculations in this area made the review more difficult, Cygna did not find any instances of overstress due to inadequate engineering judgment.

4. 3-Sided Welds

In certain connections, Cygna noted the use of 3-sided (see sketch) welds used to transfer the loads from one member to another. In most instances, the designer did not transfer the loads from the center of gravity of the beam (Point A) to the center of gravity of the weld (Point B). It is TUGCO's position that the designers use engineering judgment in determining if the effect will significantly impact design. That is, if the stress levels are low, the designer does not transfer the loads. For Cygna's assessment, **see Observation PS-05.**



Weld Detail

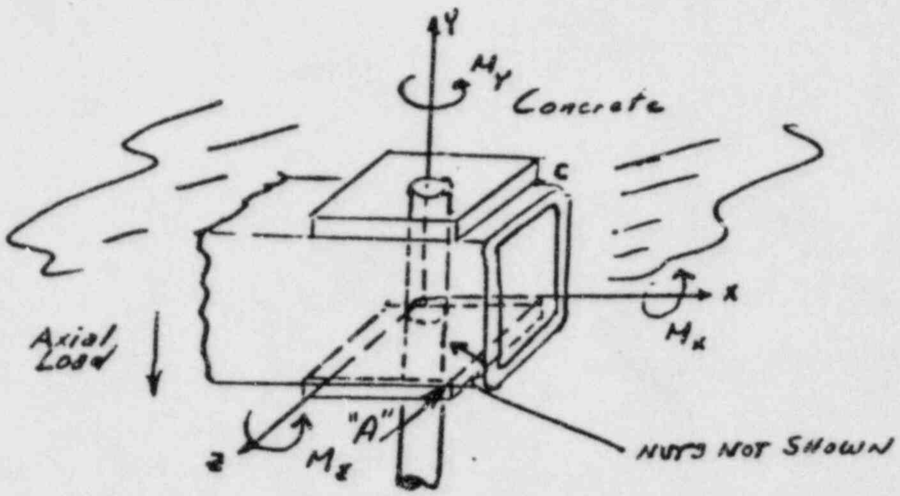


5. Use of .6Fy for U-Bolts

In designing the larger, non-standard U-bolts (i.e., 2-3/4" diameter rods, 2-1/4" diameter rods), the pipe support organizations have used an allowable tensile stress of .6Fy; actual bolt stresses were based on the tensile area of the threaded region. This conforms with the ASME Code Section III, Appendix XVII, Paragraph XVII-2211. In order to provide further justification for this procedure, ITT Grinnell performed a test program for 1/2" diameter and 1" diameter U-bolts (Reference Attachment to TUGCO letter dated May 2, 1984). Based on the results of those tests, ITT has shown quite clearly that .6Fy is an acceptable tensile stress allowable for U-bolts.

6. **Tubesteel Prying on Richmond Inserts**

In the designs which employ tubesteel/Richmond insert combinations, Cygna noted that the engineer released the rotation about the Y and Z axes (see sketch) in the STRUDL model for the frame. While release of the Y rotation is appropriate since the bolt is free within the tube, release of the Z rotation assumes that the tube will not bear against the washer at point "A" and create a load due to prying on the bolt. TUGCO has provided justification for this and other analytical assumptions (i.e., the bolt does not carry any load in bending; the effect of bolt hole offset on bolt load) by performing both testing and analysis. Details of the justification may be found in the TUGCO letter dated 5/8/84 and in the "Affidavit of John C. Finneran, Jr., Robert C. Iotti and R. Peter Deubler Regarding Design of Richmond Inserts and their Application to Support Designs." In the letter to Cygna, TUGCO shows that prying due to rotation about the Z axis is not present when only vertical loads exist. When torsional moments (M_x) exist, the study done by TUGCO shows that even with small amounts of torsion (1000 in-lb vs 40000 lb tension load), the effect of prying is due to torsion, with no contribution from moments about the Z axis. For large torsional loads (4000 in-lb vs. 2000 lb tension), the same effect holds true. Cygna then reviewed all tubesteel/Richmond insert joints within their scope and determined that the configuration analyzed by TUGCO (4 x 4 x 3/8 TS with 20" bolt spacing) is representative of the most flexible configurations and, therefore, most conservative. As a result, Cygna finds the method used by TUGCO to model these connections is acceptable.



7. Support Self-Weight Excitation

As Cygna found in the Phase 2 review, the design organizations at CPSES do not usually consider additional support load due to the seismic excitation of the support mass in the unrestrained direction. In the case of simple support combinations, such as clamps, struts, and base plates, the effect is minimal since the mass is very small. In the case of frames, Cygna has found some examples where self-weight excitation was considered, usually by applying 1.0g in all 3 directions. However, this practice was not commonly employed in the supports which Cygna reviewed. Since the issue of self-weight excitation has been raised and reviewed by the NRC (reference the NRC SIT Report, Item 3h), Cygna did not perform any additional technical evaluations. Cygna did note that the mainsteam supports inside containment involve fairly massive frames, although the applied loads are already sufficiently large such that the added effect may be minimal.

8. Effect of Support Stiffness

As noted in the Phase 2 Cygna Report, the design organizations do not calculate actual support stiffnesses for Class 2 and 3 piping systems. Rather, they limit deflections of frames to 1/16" and do not consider the deformation of standard components, such as struts, clamps and snubbers, or the base plates. Since the effects of support stiffness on the piping analysis has been raised by the NRC (the NRC SIT Report, Item 3j), Cygna did not perform a technical evaluation of this concern other than to note it is necessary to consider the effects.

9. Cross-Sectional Properties for Tubesteel

In the review of pipe supports, Cygna noted that two of the pipe support design organizations, NPSI and ITT Grinnell, use cross-sectional properties for tubesteel from the AISC Manual, 7th Edition. Another design organization, PSE, uses the properties from the AISC Manual, 8th Edition. When Cygna questioned the apparent inconsistency, TUGCO referenced the "Affidavit of J.C. Finneran and R.C. Iotti Regarding CASE's Allegation Involving Section Property Values." As explained in that filing, the tubesteel at CPSES is A500 GRB, cold-formed, for which the section properties from the 8th Edition of the AISC Manual are more appropriate. The differences in section properties between the two editions are minor and have negligible impact on design. As further noted in the TUGCO response to Cygna (TUGCO letter 6/8/84), TUGCO will issue a DCA to specification 2323-MS-46A to note this exception to the AISC 7th Edition. Cygna considers this question adequately addressed and the matter closed.

10. "Cinched" U-Bolts on the Component Cooling Water System

In reviewing the pipe supports for the Component Cooling Water System, Cygna noted a number of instances where a U-bolt is tightened around a pipe to provide stability for the support. Cygna asked TUGCO to provide justification that the U-bolt would not be overstressed. In response to Cygna's request for one example, TUGCO provided calculations in their 6/8/84 letter and subsequently revised them on June 18, 1984. Cygna has reviewed the TUGCO calculations and agrees that there will be no adverse stress effects in the U-bolt for the component cooling water systems. For the pipe, see Note 12, which discusses the Westinghouse test and analysis program for U-bolts.

11. Rear Bracket Dimensions

In reviewing the designs at CPSES, Cygna used the certified vendor catalog and load data available at the site. In Revision 17 of the Design Report Summary (DRS) for rear brackets (ITT Grinnell), Cygna noted dimensions which did not agree with those used by the support designers. The use of larger dimensions would affect weld lengths and, therefore, design. As explained by TUGCO in their 6/8/84 letter, Revision 16 of the DRS is the appropriate revision for the dimensions since the majority of the brackets were purchased prior to the issuance of Revision 17 in April, 1983. TUGCO provided Cygna with a copy of Revision 16 and Cygna verified that the dimensions used correctly correspond to Revision 16. To further confirm the appropriate dimensions, Cygna measured rear brackets in those supports chosen for a latter walkdown and confirmed that the installed bracket dimensions are the same as those in the DRS revision used by the designer. Based on the outcome of that walkdown, Cygna considers this matter adequately addressed.

12. "Cinched" U-Bolts: Effects on Piping, Stability, and the U-Bolt

In reviewing supports on the Main Steam and other systems, Cygna noted instances where a U-bolt was tightened around the pipe. This was typically done by TUGCO to provide stability for the support by having the U-bolt act as a clamp. Cygna asked TUGCO if the local stresses in the pipe and the additional stresses in the U-bolt had been considered during the design process. In response to this same question by the ASLB, TUGCO had contracted Westinghouse to perform a test/analysis program. The details of this program are described in Westinghouse letter EQ&T-EQT-737, dated 3/5/84.

The objectives of this test/analysis program were to ensure that:

1) Stress levels in the U-bolt remained within acceptable limits;
2) Stress levels in the piping remained within acceptable limits;
3) Stress levels in the crosspieces remained within acceptable limits;
4) The U-bolt would maintain the support in a stable configuration (i.e., would not slip) under maximum allowable strut/snubber angularity (5°);
5) The U-bolt would maintain its stability characteristics over time (i.e., would not relax).
6) The U-bolt would maintain its stability characteristics under normal vibration loading.

As part of the program, TUGCO selected the following piping:

a) 4" sch 160 (stainless) with temperature = 559°F
b) 10" sch 40 (stainless) with temperature = 210°F
c) 10" sch 80 (carbon steel) with temperature = 210°F
d) 32" with T = 1.25" (carbon steel) with temperature = 557°F

These represent a broad range of piping and material combinations at CPSES and would provide assurance that the worst combination of wall thickness, pipe size, and temperature effects have been considered.

At the time of Cygna's review, only preliminary results from this study are available (reference, EBASCO letter dated 6/15/84 from R.C. Iotti to N.H. Williams). Cygna is continuing with an evaluation of this design and will make the results available at a later date. Cygna considers this an open item in this Phase 3 report and finds all supports utilizing "cinched" U-bolts acceptable contingent solely upon the acceptability of that test/analysis program. A list of those supports utilizing "cinched" U-bolts for stability is provided below:

Support Number	Checklist No.
CC-1-020-001-A33K	PS-009
CC-1-028-007-S33R	PS-017*
CC-1-028-701-A33R	PS-036
MS-1-001-003-S72R	PS-069
MS-1-001-004-S72R	PS-070
MS-1-001-005-S72R	PS-071
MS-1-002-003-S72R	PS-082

Support Number	Checklist No.
MS-1-002-005-S72R	PS-084
MS-1-003-003-S72R	PS-099
MS-1-003-004-S72R	PS-100
MS-1-003-005-S72R	PS-101
MS-1-004-003-S72R	PS-119
MS-1-004-005-S72R	PS-121

* Support design revised per TUGCO letter 6-8-84.

13. Embedded Plate Design

During the review of supports attached to embedded plates, Cygna noted that in most cases the designers assume a fixed joint at the embedded plate. The governing criteria in Appendix 4 of G&H Specification 2323-MS-46A states that the connections to embedded plates shall be assumed "pin" joints (i.e., forces only, no moments) unless stiffeners are provided, but no guidelines are given for these stiffeners. The standard procedure at CPSES is to assume that the attachment to the plate, usually a beam or base plate, provides the stiffener for the embedded plate. The moments are then distributed to the bolts using a conservative estimate for the dimension of the attachment. Also, in these cases, the lower allowables for the embedded plates are used. Cygna did find a case in which TUGCO performed a finite element analysis of the connection to the embedded plate, when their initial approach was too conservative. Based on Cygna's review of the design of connections to embedded plates, we find the approach acceptable.

14. A563A Nuts with High Strength Bolts

In certain supports at CPSES, Cygna noted the use of A563 grade A nuts with high strength A193 B7 thru bolts. The ASTM specification states that A563 grade A nuts are suitable only for low strength A307 bolts, based on a comparison of yield and ultimate strength data. TUGCO has stated that their standard practice is to use A194 2H nuts with A193 B7, but they do allow the use of double A563 grade A nuts, since they will have sufficient strength to ensure the acceptability of the joint. Also, all nuts are tightened "snug tight", thus ensuring both nuts will share the load. In all supports within the Cygna scope, CPSES designers did use double nuts wherever A563 grade A nuts were specified for A193 B7 bolts. Thus, the bolted joint design is acceptable.

15. **1-1/8" Bolt Holes Used in Base Plates with Hilti Kwik-Bolts and in Tubesteel with Richmond Inserts**

Paragraph NF-4721(a) of the ASME B&PV Code, Section III, provides guidelines for the fabrication and installation of bolting. In it, the Code allows 1/8" oversize bolt holes to be used with 1" bolts made from low strength (yield $\leq$ 80 ksi) material. Since the tubesteel/Richmond insert combinations seen by Cygna use A36 threaded rod (yield = 36 ksi), this provision is met. Hilti Kwik bolts, however, have a yield greater than 80 ksi, so, in the absence of manufacturer's guidelines, paragraph NF-4721(b)-1 should apply. This paragraph does not prohibit the use of oversize holes with high strength bolting. As noted by TUGCO in their 6/8/84 letter, this interpretation was agreed to by both the CPSES constructor and the authorized nuclear inspector. In addition, the Hilti Product Management Brochure for Hilti installation states that the wedge clearance hole in a base plate should be 1.17" for 1" bolt, to facilitate installation. Therefore, the use of 1-1/8" holes for Hilti bolts does meet the manufacturer's guidlines. Based on the above, Cygna concurs with the bolt hole diameters used at CPSES.

16. **Box Frames with 0" Gap**

In the Phase 3 support review, Cygna noted rare instances where a box frame was used with a strut in place of a pipe clamp. In these cases, the drawing specified a 0" gap between the pipe and frame. Cygna asked TUGCO to evaluate the stresses in the pipe and frame, due to thermal expansion of the piping. In response to this and a similar question from the ASLB, TUGCO performed calculations on these Component Cooling Water frames; these calculations show that additional stresses in the pipe are less than 10 ksi and that additional support loads are less than 500 lbs. Since the loads are thermally induced and, therefore, self-limiting, both of these additional effects are well within Code allowables for self-limiting loads. Cygna has reviewed the TUGCO calculation (Attachment B to the TUGCO 6/8/84 letter to Cygna) and concurs with the conclusions in that calculation.

17. **U-Bolts Used on Trapeze Supports**

In a number of trapeze supports reviewed in Phase 3, Cygna noted the use of a U-Bolt to keep the pipe positioned on the frame. In these cases (typically spring supports), there is no upward load on the U-bolt. In effect, the U-bolt is not needed as a load carrying member, but only to keep the pipe in place on the trapeze beam. In these cases, Cygna has referenced this note on the checklist to help explain the U-bolt's function.

PIPE SUPPORT CHECKLIST INDEX

Support No.	Checklist No.	Support No.	Checklist No.
CC-1-009-001-A33R	PS-001	CC-1-028-044-S33R	PS-034
CC-1-009-003-A33R	PS-002	CC-1-028-700-A33R	PS-035
CC-1-009-004-A33R	PS-003	CC-1-028-701-A33R	PS-036
CC-1-009-007-A33R	PS-004	CC-1-028-713-S33K	PS-037
CC-1-009-008-A33K	PS-005	CC-1-028-714-S33K	PS-038
CC-1-009-014-A33R	PS-006	CC-1-028-720-S33R	PS-039
CC-1-009-015-A33R	PS-007	CC-1-028-721-S33R	PS-040
CC-1-009-016-A43A	PS-008	CC-1-028-723-S33R	PS-041
CC-1-020-001-A33K	PS-009	CC-1-028-725-S33R	PS-042
CC-1-020-002-A33R	PS-010	CC-1-028-726-S33K	PS-043
CC-1-021-001-A33R	PS-011	CC-1-031-001-S43K	PS-044
CC-1-028-001-A33R	PS-012	CC-1-031-002-S43S	PS-045
CC-1-028-003-A33R	PS-013	CC-1-031-003-S43K	PS-046
CC-1-028-004-A33K	PS-014	CC-1-031-005-S33R	PS-047
CC-1-028-005-A33R	PS-015	CC-1-031-007-S33R	PS-048
CC-1-028-006-A33R	PS-016	CC-1-031-008-S33R	PS-049
CC-1-028-007-S33R	PS-017	CC-1-031-009-S33R	PS-050
CC-1-028-017-S33R	PS-018	CC-1-031-010-S43S	PS-051
CC-1-028-019-S33R	PS-019	CC-1-031-011-S43R	PS-052
CC-1-028-020-S33R	PS-020	CC-1-031-012-S43R	PS-053
CC-1-028-022-S33K	PS-021	CC-1-031-013-S43S	PS-054
CC-1-028-023-S33R	PS-022	CC-1-031-014-S33K	PS-055
CC-1-028-024-S33R	PS-023	CC-1-077-001-S43K	PS-056
CC-1-028-026-S33R	PS-024	CC-1-077-002-S43S	PS-057
CC-1-028-027-S33R	PS-025	CC-1-077-003-S43K	PS-058
CC-1-028-033-S33K	PS-026	CC-1-077-005-S33R	PS-059
CC-1-028-034-S33R	PS-027	CC-1-077-007-S33R	PS-060
CC-1-028-035-S33R	PS-028	CC-1-077-008-S33R	PS-061
CC-1-028-036-S33R	PS-029	CC-1-077-011-S43R	PS-062
CC-1-028-038-S33R	PS-030	CC-1-077-012-S43R	PS-063
CC-1-028-039-S33R	PS-031	CC-1-077-013-S43S	PS-064
CC-1-028-042-A33R	PS-032	CC-1-077-014-S33K	PS-065
CC-1-028-043-S33R	PS-033	CC-1-087-004-A33A	PS-066

PIPE SUPPORT CHECKLIST INDEX

Support No.	Checklist No.	Support No.	Checklist No.
MS-1-001-001-S72R	PS-067	MS-1-003-004-S72R	PS-100
MS-1-001-002-S72R	PS-068	MS-1-003-005-S72R	PS-101
MS-1-001-003-S72R	PS-069	MS-1-003-006-S72R	PS-102
MS-1-001-004-S72R	PS-070	MS-1-003-001-Q72S	PS-103
MS-1-001-005-S72R	PS-071	MS-1-003-002-C72S	PS-104
MS-1-001-006-S72R	PS-072	MS-1-003-003-C72S	PS-105
MS-1-001-001-C72S	PS-073	MS-1-003-004-C72S	PS-106
MS-1-001-002-C72S	PS-074	MS-1-003-005-C72K	PS-107
MS-1-001-003-C72K	PS-075	MS-1-003-006-C72K	PS-108
MS-1-001-004-C72K	PS-076	MS-1-003-007-C72K	PS-109
MS-1-001-005-C72K	PS-077	MS-1-003-008-C72K	PS-110
MS-1-001-006-C72K	PS-078	MS-1-003-009-C72K	PS-111
MS-1-001-007-C72K	PS-079	MS-1-003-010-C72K	PS-112
MS-1-002-001-S72R	PS-080	MS-1-003-011-C72K	PS-113
MS-1-002-002-S72R	PS-081	MS-1-003-012-C72K	PS-114
MS-1-002-003-S72R	PS-082	MS-1-003-013-C72K	PS-115
MS-1-002-004-S72R	PS-083	MS-1-003-014-C72K	PS-116
MS-1-002-005-S72R	PS-084	MS-1-004-001-S72R	PS-117
MS-1-002-006-S72R	PS-085	MS-1-004-002-S72R	PS-118
MS-1-002-001-C72S	PS-086	MS-1-004-003-S72R	PS-119
MS-1-002-003-C72S	PS-087	MS-1-004-004-S72R	PS-120
MS-1-002-004-C72K	PS-088	MS-1-004-005-S72R	PS-121
MS-1-002-005-C72K	PS-089	MS-1-004-006-S72R	PS-122
MS-1-002-006-C72K	PS-090	MS-1-004-001-C72S	PS-123
MS-1-002-007-C72K	PS-091	MS-1-004-002-C72S	PS-124
MS-1-002-008-C72K	PS-092	MS-1-004-003-C72S	PS-125
MS-1-002-009-C72K	PS-093	MS-1-004-004-C72K	PS-126
MS-1-002-010-C62K	PS-094	MS-1-004-005-C72K	PS-127
MS-1-002-012-C72S	PS-095	MS-1-004-006-C72K	PS-128
MS-1-002-013-C72K	PS-096	MS-1-004-009-C62K	PS-129
MS-1-003-001-S72R	PS-097	MS-1-004-007-C72K	PS-130
MS-1-003-002-S72R	PS-098	MS-1-004-008-C72K	PS-131
MS-1-003-003-S72R	PS-099		

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Independent Design Review Checklist

PIPE SUPPORT CC-009-003-A33R

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-002

Calculation No. CC-1-009-003-A33R, Rev. 1; B&R Drawing No. CC-1-009-003-A33R, Rev. 7 **Date** 3/6/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
2. Pin-to-pin dimension	X			There is a small discrepancy in the C-C dimension (34-1/4" vs. 33"). The effect is negligible.
3. Swing angle	X			
10. U-Bolt: a. Is load within U-Bolt allowable load? b. Is the U-Bolt used as a two-way restraint? c. Is lateral stiffness considered in the calculations? d. If U-Bolt is used as a clamp, 1. Is thermal expansion load (pipe on bolt) considered? 2. Is effect of bolt preload considered?			X	
11. Base Plates and Anchor Bolts: a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			Base plate analysis is not provided in the calculation. Interaction equation for the anchor bolts is not checked. Stresses in base plate were not checked. However, per Cygna Calculation Set No. F10, Binder 4/F, it is acceptable.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-009-007-A33R

Reviewer E. Kuo/C. Wong (CKW)		**Approver** J. Minichiello JM		**Checklist No.** PS-004	

Calculation No. CC-1-009-007-A33R, Rev. 3; B&R Drawing No. CC-1-009-007-A33R, Rev. 7 **Date** 3/3/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			Weld lengths between Items 6 and 7; 11 and 16 are not indicated on the drawing. Cygna checked during a latter walkdown and found it to be acceptable. (Drawing up-date is required.)
b. Dimensions		X		
c. Member sizes	X			
d. Drawings/Configuration				
2. Check the acceptability of the design of Calculation No. CC-1-009-007-A33R, Rev. 3.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 3, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap (if applicable):				
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.	X			
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?	X			

Independent Design Review Checklist

PIPE SUPPORT CC-1-009-007-A33R

Reviewer	E. Kuo/C. Wong	Approver	J. Minichiello	Checklist No.	PS-004
Calculation No. CC-1-009-007-A33R, Rev. 3; B&R Drawing No. CC-1-009-007-A33R, Rev. 7				Date	3/3/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			Not checked by TUGCO, but
2. Edge distance from concrete edge	X			acceptable per Cygna calculation,
3. Anchor allowable load	X			F7, Binder 4/F.
4. Embedment length	X			
5. Reduced allowable load			X	
6. Combined tension and shear	X			
12. Richmond Structural Connection Inserts (if applicable):			X	
Check for consistency with:				
a. Cygna Criteria 84042-Dc-2, Section 4.6.				
b. G&H Specification No. 2323-SS-30 (3/19/81), Appendix 3.				
c. As a minimum, check the following items:				
1. Allowable loads				
2. Center-to-center spacing				
3. Edge distance from concrete edge				
4. Combined tension and shear				
5. Allowable loads of bolt				
d. Is the base plate within allowable stress?				

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Independent Design Review Checklist

PIPE SUPPORT CC-1-009-008-A33K

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-005

Calculation No. CC-1-009-008-A33K, Rev. 1; B&R Drawing No. CC-1-009-008-A33K, Rev. 6 **Date** 3/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			No stiffeners were provided at rear bracket to W6 x 15.5 connection. No calculations were provided to check the adequacy of the connection without stiffeners. Refer to Note 3.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			See comment under Item 23.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-009-008-A33K

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-005

Calculation No. CC-1-009-008-A33K, Rev. 1; B&R Drawing No. CC-1-009-008-A33K, Rev. 6 **Date** 3/15/84

Item	Satisfactory: Yes	No	N/A	Comments
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-009-014-A33R

Reviewer F. Khanachet/C. K. Wong | Approver J. Minichiello | Checklist No. PS-006

Calculation No. CC-1-009-014-A33R, Rev. 1; B&R Drawing No. CC-1-009-014-A33R, Rev. 3 | Date 3/5/84

Item	Satisfactory Yes	No	N/A	Comments
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			No calculation provided; however, the load is not large and the design is acceptable for this load. Refer to Note 3 for additional information.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full <u>unstiffened</u> span?			X	

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Independent Design Review Checklist

PIPE SUPPORT CC-1-009-015-A33R

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-007

Calculation No. CC-1-009-015-A33R, Rev. 1; B&R Drawing No. CC-1-009-015-A33R, Rev. 4 **Date** 3/15/84

Item	Satisfactory: Yes	No	N/A	Comments
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			
5. Reduced allowable load	X			The allowable loads were reduced based on the separation ratio.
6. Combined tension and shear	X			
12. Richmond Structural Connection Inserts: Check for consistency with:			X	
a. Cygna Criteria 84042-DC-2, Section 4.6.				
b. G&H Specification No. 2323-SS-30, Appendix 3.				
c. As a minimum, check the following items:				
1. Allowable loads				
2. Center-to-center spacing				
3. Edge distance from concrete edge				
4. Combined tension and shear				
5. Allowable loads of bolt				
d. Is the base plate within allowable stress?				

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Independent Design Review Checklist

PIPE SUPPORT CC-1-009-015-A33R

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-007

Calculation No. CC-1-009-015-A33R, Rev. 1; B&R Drawing No. CC-1-009-015-A33R, Rev. 4 **Date** 3/15/84

Item	Satisfactory Yes	No	N/A	Comments
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		Stiffness calculation was not provided but the deflections are less than 1/16".
b. Is actual stiffness computed?		X		Refer to Note 8.
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Stiffener plates were not provided at moment joints (between M 4x13's). Stress levels are low, joint is OK.

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
f. Steamhammer (SHL) g. Relief Valve Discharge (RV) h. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)				
17. Has the weight of the support been included in the design?	X			Acceptable as it is small and negligible.
18. Has the inertial load of the support been included in the design?		X		Acceptable as it is negligible considering the stress levels in the design calculation. Refer to Note 7.
19. Friction Loads:				
a. Has friction load been included in the support design?			X	
b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements:				
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		No stiffness calculation was provided but deflection is less than 1/16". Refer to Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		

Independent Design Review Checklist

PIPE SUPPORT CC-1-021-001-A33R

Reviewer M. Meyer/C. Wong **Approver** J. Minichiello **Checklist No.** PS-011

Calculation No. CC-1-021-001-A33R, Rev. 0; B&R Drawing No. CC-1-021-001-A33R, Rev. 1 **Date** 3/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
20. Design Interface Requirements:				
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?	X			Stiffness calculation was not provided. But deflections were all less than 1/16". Refer to Note 8.
b. Is actual stiffness computed?	X			
c. Does the stiffness include all support elements, including baseplates and anchor bolts?	X			
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Stresses were low, less than 10 ksi.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-021-001-A33R

Reviewer M. Meyer/C. Wong **Approver** J. Minichiello **Checklist No.** PS-011

Calculation No. CC-1-021-001-A33R, Rev. 0; B&R Drawing No. CC-1-021-001-A33R, Rev. 1 **Date** 3/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Cover plates were not provided at moment joints near tube ends. However, due to low stresses and stiffening by cross members this will not impact design. Refer to Note 3.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			See comments under Items 21 and 23.
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 3, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-003-A33R

Reviewer E. Kuo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-013

Calculation No. CC-1-028-003-A33R, Rev. 4; B&R Drawing No. CC-1-028-003-A33R, Rev. 7 **Date** 3/6/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
9. Strut: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.7.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable load	X			Strut design calculation was not provided. However, it is acceptable per Cygna calculation Set No. A4 File 4/F.
2. Pin-to-pin dimension	X			
3. Swing angle	X			
10. U-Bolt:			X	
a. Is load within U-Bolt allowable load?				
b. Is the U-Bolt used as a two-way restraint?				
c. Is lateral stiffness considered in the calculations?				
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-006-A33R

Reviewer E. Kuo/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-016

Calculation No. CC-1-028-006-A33R, Rev. 5; B&R Drawing No. CC-1-028-006-A33R, Rev. 8 **Date** 3/10/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			Load summary sheet is not enclosed in the package for Rev. 5 calculation. However, Cygna has verified the loads.
d. Drawings/Configuration		X		Support drawing should be updated for revised pipe movements. However, the differences are very small.
2. Check the acceptability of the design of Calculation No. CC-1-028-006-A33R, Rev. 5.				
a. Assumptions		X		In the STRUDL model only the Z moment was released at joints 16 and 18 of members 17 and 18, respectively. Since these points represent a pin connection between the strut and bracket, all moments should be released. This modeling omission is acceptable since the moments at these points are small (Mx = 30 in-lb, My = 240 in-lb @ 16; Mx = 8 in-lb, My = 240 in-lb @ 18).
b. Design Methodology	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-019-S33R

Reviewer M. Meyer/C. Wong **Approver** J. Minichiello **Checklist No.** PS-019

Calculation No. CC-1-028-019-S33R, Rev. 1; B&R Drawing No. CC-1-028-019-S33R, Rev. 4 **Date** 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
17. Has the weight of the support been included in the design?	X			
18. Has the inertial load of the support been included in the design?		X		This support has sufficient margin to accommodate the effect due to the inertial load. For additional information refer to Note 7.
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?	 X X			
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		 X X X		Stiffness calculation was not provided, but the defections are less than 1/16". Refer to Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-020-S33R

Reviewer M. Meyer/C. Wong **Approver** J. Minichiello **Checklist No.** PS-020

Calculation No. CC-1-028-020-S33R, Rev. 3; B&R Drawing No. CC-1-028-020-S33R, Rev. 6 **Date** 3/8/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
20. Design Interface Requirements:				
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		Stiffness calculation was not provided, but the deflections were less than 1/16". Refer to Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements: a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?.	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-023-S33R

Reviewer S. Luo/C. Wong CKW **Approver** J. Minichiello JZM **Checklist No.** PS-022

Calculation No. CC-1-028-023-S33R, Rev. 2; B&R Drawing No. CC-1-028-023-S33R, Rev. 6 **Date** 5/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items: a. Loads b. Dimensions c. Member sizes d. Drawings/Configuration	 X X	 X X		Forces input due to the swing angle were less than the actual values, but the loads are small and by itself the impact is negligible. Y coordinates of nodes 5, 6, & 7 specified in STRUDL input should be 10.25" instead of 8.5". X coordinate of node 8 should be 0" instead of 2", node 9 should be 2" instead of 0". However, it is acceptable based on the TUGCO response dated June 8, 84 (Item 53) and Cygna Calculation Set No. F6. AISC 8th Edition section properties are used instead of 7th Edition, but the differences are small. Refer to Note 9.
2. Check the acceptability of the design of Calculation No. CC-1-028-023-S33R, Rev. 2. a. Assumptions b. Design Methodology	 X	 X		Locations of bolts 1 and 2 used for the base plate analysis shown on Section F-F were not at the center of gravity the weld pattern as stated by the designer. But the dimension used provides a closer bolt location and would give

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-023-S33R

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-022

Calculation No. CC-1-028-023-S33R, Rev. 2; B&R Drawing No. CC-1-028-023-S33R, Rev. 6 **Date** 5/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. Is lateral stiffness considered in the calculations?			X	
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?		X		See Note 10.
2. Is effect of bolt preload considered?		X		
11. Base Plates and Anchor Bolts:				Evaluation of base plates shown on Sections E-E and F-F was recommended since the STRUDL frame was not input correctly in nodal coordinate and Y applied force. The interactions for the plates are already 0.82 and 0.81 respectively. They are acceptable based on the TUGCO response dated June 8, 84 and Cygna Calculation Set No. F6 (Item 53). (Note: The presence of stiffener plates may reduce the values of the interaction equation). Base plate in Section F-F has Hiltis and welds. Weld is designed for entire shear load and stresses are acceptable per design calculation.
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.				
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			
5. Reduced allowable load			X	
6. Combined tension and shear	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-023-S33R

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-022

Calculation No. CC-1-028-023-S33R, Rev. 2; B&R Drawing No. CC-1-028-023-S33R, Rev. 6 **Date** 5/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
17. Has the weight of the support been included in the design?	X			
18. Has the inertial load of the support been included in the design?		X		1 g was assumed in both X and Z directions only, but the signs of those inertial loads were not input in the way which would create the worse case for the support. However, the inertial loads are small compared to the applied loads. Refer to Note 7.
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		No stiffness calculation provided. See Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-024-S33R

Reviewer E. Kuo/C. Wong CKW **Approver** J. Minichiello **Checklist No.** PS-023

Calculation No. CC-1-028-024-S33R, Rev. 5; B&R Drawing No. CC-1-028-024-S33R, Rev. 11 **Date** 3/9/84

Item	Satisfactory: Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Fy-loads from latest pipe stress analysis output are slightly (max. 3.8%) higher than design loads. This has no design impact.
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. CC-1-028-024-S33R, Rev. 0-5.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-026-S33R

Reviewer	C. Wong CKW	Approver	J. Minichiello JCM	Checklist No.	PS-024
Calculation No. CC-1-028-026-S33R, Rev. 0; B&R Drawing No. CC-1-028-026-S33R, Rev. 4				Date	3/21/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				Based on the original design, the input for the model shown on sheet 1 of 3 dated 8/12/82 has an input error at node point 24 in the sign of X coordinate (should be -X instead of +X). This created some fictitious moments. Note: A revised model is shown on sheet 1 of 4 calculation dated 3/4/83, but output is not provided in the package and results are not used in the design calculation. This revised model was used by TUGCO in their calculation attached to the 6/8/84 letter (question #52) and showed acceptable results. The analysis corresponds to the 3/4/84 revised model and is acceptable. (Cygna 5/24/84 communications report, question #52).
a. Loads		X		Loads have been reduced from original design loads by a minimum of 15%, so design loads are conservative. Member weights for struts are incorrect, but they contribute little to total effect.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-026-S33R

Reviewer C. Wong **Approver** J. Minichiello **Checklist No.** PS-024

Calculation No. CC-1-028-026-S33R, Rev. 0; B&R Drawing No. CC-1-028-026-S33R, Rev. 4 **Date** 3/21/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Dimensions		X		Sma l discrepancy in STRUDL model for diagonal brace & vertical member (Items 24 & 25), but insignificant.
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. CC-1-028-026-S33R, Rev. 0.				0" gap specified for the box frame. As shown in the calculations attached to TUGCO letter 6/8/84, question #8, this does not impact the pipe or frame design. See Note 16.
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:				
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.		X		0" gap in box frame. See Note 16.
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?	X			

Independent Design Review Checklist

PIPE SUPPORT CC-1-028-026-S33R

Reviewer C. Wong Approver J. Minichiello Checklist No. PS-024

Calculation No. CC-1-028-026-S33R, Rev. 0; B&R Drawing No. CC-1-028-026-S33R, Rev. 4 Date 3/21/84

Item	Satisfactory Yes	No	N/A	Comments
				bolt pattern. This results in higher bolt loads, which are conservative and acceptable. Plate stress is quite low.
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length		X		Embedment length calculated is not correct, but allowables are based on minimum embedment, so OK.
5. Reduced allowable load			X	
6. Combined tension and shear	X			
12. Richmond Structural Connection Inserts: Check for consistency with:				See comments under Item 11.
a. Cygna Criteria 84042-Dc-2, Section 4.6.	X			
b. G&H Specification No. 2323-SS-30, Appendix 3.	X			
c. As a minimum, check the following items:				
1. Allowable loads	X			
2. Center-to-center spacing	X			
3. Edge distance from concrete edge	X			
4. Combined tension and shear	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-026-S33R

Reviewer	C. Wong	**Approver**	J. Minichiello	**Checklist No.**	PS-024
Calculation No. CC-1-028-026-S33R, Rev. 0; B&R Drawing No. CC-1-028-026-S33R, Rev. 4				**Date**	3/21/84

Item	Satisfactory Yes	No	N/A	Comments
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		 X X X		See Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		See comment in Item 2.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2 Section 4.1.10?		X		Incorrect weld lengths are used in the calculation (sheet 4 Of 11). As-Built support has 4-side weld between Material Items 27 and 28; 27 and 36. Weld stress is acceptable per Cygna's review calculation.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-033-S33K

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-026

Calculation No. CC-1-028-033-S33K, Rev. 0; B&R Drawing No. CC-1-028-033-S33K, Rev. 15 **Date** 3/16/84

Item	Satisfactory: Yes	No	N/A	Comments
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods			X	
8. Snubbers: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.6.	X			
c. As a minimum, the following items shall be checked: 1. Allowable loads	X			
2. Pin-to-pin dimension		X		There was no information on the drawing to verify snubber Pin-to-Pin distance used in the design calculation. Cygna verified the pin-pin dimension in a later walk-down and found it acceptable.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-035-S33R

Reviewer	F. Khanachet/C. Wong	**Approver**	J. Minichiello	**Checklist No.**	PS-028
Calculation No. CC-1-028-035-S33R, Rev. 2; B&R Drawing No. CC-1-028-035-S33R, Rev. 7				**Date**	3/7/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. As a minimum, the following items shall be checked:				
1. Allowable load	X			
2. Pin-to-pin dimension	X			
3. Swing angle	X			
10. U-Bolt:			X	
a. Is load within U-Bolt allowable load				
b. Is the U-Bolt used as a two-way restraint?				
c. Is lateral stiffness considered in the calculations?				
d. If U-Bolt [illegible] used as a clamp,				
1. Is th[illegible] expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				
11. Base Plates and Anchor Bolts:				
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			Since the swing angle was cal culated to be less than 1°, component forces due to swing angle were not considered in base plate analysis.
b. Does anchor bolt design meet the requirement of Cygna Criteria 84042-DC-2, Section 4.5?	X			

CYGNA

Independent Design Review Checklist

PIPE SUPPORT CC-1-028-701-A33R

Reviewer M. Meyer/C. Wong CK(l) **Approver** J. Minichiello JCM **Checklist No.** PS-036

Calculation No. CC-1-028-701-A33R, Rev. 1; B&R Drawing No. CC-1-028-701-A33R, Rev. 3 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		CC-2-002-003-A33R (gang hanger) loads used in the design are less than the current loads, Ref. CPPA-#35139. Loads from pipe stress analysis output are higher than those used in design. The calculation needs to be updated for latest loads (i.e. Rev, 2 of Analysis AB-1-61A). As-built piping loads have increased approximately 10%. These loads appear to have not been transmitted to the pipe support group. The updated loads do not appear in the calculation package. By review of the support calculation there is sufficient margin for an increase in the load of approximately 10%.
b. Dimensions	X			Used 8th Edition AISC properties, (See Note 9).
c. Member sizes	X			
d. Drawings/Configuration	X			

Independent Design Review Checklist

PIPE SUPPORT CC-1-028-701-A33R

Reviewer	M. Meyer/C. Wong	Approver	J. Minichiello	Checklist No.	PS-036
Calculation No. CC-1-028-701-A33R, Rev. 1; B&R Drawing No. CC-1-028-701-A33R, Rev. 3				Date	3/9/84

Item	Satisfactory Yes	No	N/A	Comments
2. Check the acceptability of the design of Calculation No. CC-1-028-701-A33R, Rev. 1.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap (if applicable):			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				
5. Restraints:				
a. Check whether the design conforms to the piping analysis restraint requirements.	X			
b. Check consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2, (Box Restraints).			X	

Independent Design Review Checklist

PIPE SUPPORT CC-1-028-701-A33R

Reviewer	M. Meyer/C. Wong	Approver	J. Minichiello	Checklist No.	PS-036
Calculation No. CC-1-028-701-A33R, Rev. 1; B&R Drawing No. CC-1-028-701-A33R, Rev. 3				Date	3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
6. Spring Supports: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Sections 3.6.2.2.3 and 3.6.2.2.4. b. Cygna Criteria 84042-DC-2, Section 4.1.4. c. As a minimum, the following items shall be checked: 1. Variability of spring force 2. Cold load 3. Allowable loads 4. Available travels 5. Swing angle/off-set			X	
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods			X	

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-701-A33R

Reviewer M. Meyer/C. Wong **Approver** J. Minichiello **Checklist No.** PS-036

Calculation No. CC-1-028-701-A33R, Rev. 1; B&R Drawing No. CC-1-028-701-A33R, Rev. 3 **Date** 3/9/84

Item	Satisfactory: Yes	No	N/A	Comments
8. Snubbers: Check for consistency with:			X	
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6.				
b. Cygna Criteria 84042-DC-2, Section 4.1.6.				
c. As a minimum, the following items shall be checked:				
1. Allowable loads				
2. Pin-to-pin dimension				
3. Cold setting				
4. 1/4" stroke in excess of thermal movement				
5. Swing angle				
9. Strut: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.7.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable load	X			
2. Pin-to-pin dimension	X			
3. Swing angle	X			Swing angle was not checked but is within the allowable.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-701-A33R

Reviewer	M. Meyer/C. Wong	Approver	J. Minichiello	Checklist No.	PS-036

Calculation No. CC-1-028-701-A33R, Rev. 1; B&R Drawing No. CC-1-028-701-A33R, Rev. 3 Date 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
12. Richmond Structural Connection Inserts (if applicable): Cneck for consistency with: a. Cygna Criteria 84042-Dc-2, Section 4.6. b. G&H Specification No. 2323-SS-30, Appendix 3. c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing 3. Edge distance from concrete edge 4. Combined tension and shear 5. Allowable loads of bolt d. Is the base plate within allowable stress?			X	
13. Civil Anchor and Thru-Bolts: a. Embeded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8. b. Thru-Bolts: Does it meet the bolt allowable load requirements of the ASME Code? c. Is the base plate bolts within allowable stress?			X	

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-713-S33K

Reviewer E.Kuo/C. Wong CKCW **Approver** J. Minichiello JRM **Checklist No.** PS-037

Calculation No. CC-1-028-713-S33K, Rev. 1; B&R Drawing No. CC-1-028-713-S33K, Rev. 4 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		
b. Dimensions		X		
c. Member sizes	X			
d. Drawings/Configuration		X		Load of SMF-10-PC shown on Material list should be 16346 lbs. instead of 22558 lbs. per latest revision of calculation. Drawing update required. Note: This support is attached to support AF-1-099-712-S33R which is a gang hanger frame. The computer model of this main frame has some input errors, dimensional discrepancies and incomplete load combination. A reanalysis was necessary. It is acceptable per TUGCO response dated June 3, 1984. The model was corrected and reanalyzed.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT CC-1-028-720-S33R

Reviewer E. Kuo/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-039

Calculation No. CC-1-028-720-S33R, Rev. 4; B&R Drawing No. CC-1-028-720-S33R, Rev. 5 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration		X		Revisions of BRHL drawings as shown on "Support Load Table" are not latest revisions. Latest revisions are as follows: BRHL # CC-1-AB-007, Rev. 4 →, Rev. 6 BRHL # CC-1-AB-013, Rev. 7 →, Rev. 10 BRHL # CC-1-AB-049, Rev. 5 →, Rev. 6 BRHL # CC-1-SB-001, Rev. 3 →, Rev. 5 BRHL # CC-1-SB-003, Rev. 4 →, Rev. 5 This has no impact on design.
2. Check the acceptability of the design of Calculation No. CC-1-028-720-S33R, Rev. 4.				
a. Assumptions		X		In STRUDL math model, the end moment was released for Members 1 and 2 in the Y and Z direction only. It should be released for all directions. After review of TUGCO response dated 6-8-84 to question 34, Cygna agrees that the change has no design impact.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT CC-1-028-721-S33R

Reviewer M. Meyer/C. Wong **Approver** J. Minichiello **Checklist No.** PS-040

Calculation No. CC-1-028-721-S33R, Rev. 0; B&R Drawing No. CC-1-028-721-S33R, Rev. 2 **Date** 3/09/84

Item	Satisfactory Yes	No	N/A	Comments
19. Friction Loads:				
a. Has friction load been included in the support design?	X			Not included in STRUDL. The deflection is less than 1/16". See Observation PS-08.
b. Is friction considered in the appropriate direction(s)?	X			
20. Design Interface Requirements:				
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		Stiffness calculations were not provided, but all deflections were less than 1/16" based on the STRUDL output. Refer to Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See comments under Items 1, 2, and 18.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-723-S33R

Reviewer F. Khanachet/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-041

Calculation No. CC-1-028-723-S33R, Rev. 0; B&R Drawing No. CC-1-028-723-S33R, Rev. 2 **Date** 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			For Rev. 2 Load Summary, see CPPA-26,449. Load summary sheet showing loads from stress problem AB-1-61A, Rev. 2, are not given in the package. Loads used in the design are slightly larger than or very close to actual loads. Acceptable.
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration		X		There is an apparent discrepancy in the line identification between 24"ϕ CC-1-028-151-3 (drawing) and 24"ϕ CC-1-028-152-3 (calculation). Support drawing appears to be in error. No design impact.
2. Check the acceptability of the design of Calculation No. CC-1-028-723-S33R, Rev. 0.				
a. Assumptions	X			
b. Design Methodology	X			

Reviewer J.P. Russ/C. Wong **Approver** J. Minichiello **Checklist No.** PS-042

Calculation No. CC-1-028-725-S33R, Rev. 2; B&R Drawing No. CC-1-028-725-S33R, Rev. 3 **Date** 3/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				
11. Base Plates and Anchor Bolts:				
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			The bolt hole size indicated in Section "C-C" indicates a diameter that may be interpreted as 1-1/16". This size would not allow the nuts of the 5/8" ϕ Hilti Kwik bolts to bear against Item 5. Per TUGCO's response dated May 2, 1984, the bolt hole is verified to be 11/16" which is appropriate.
b. Does anchor bolt design meet the requirement of Cygna Criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			Embedment length was not checked. However, the bolt loads are within allowables.
5. Reduced allowable load	X			
6. Combined tension and shear	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-725-S33R

Reviewer	J.P. Russ/C. Wong	Approver	J. Minichiello	Checklist No.	PS-042
Calculation No. CC-1-028-725-S33R, Rev. 2; B&R Drawing No. CC-1-028-725-S33R, Rev. 3				Date	3/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
18. Has the inertial load of the support been included in the design?		X		A 1g load for member weight was included in the X, Y, Z directions. This does not accurately account for inertial load effect. See Note 7.
19. Friction Loads:				
a. Has friction load been included in the support design?	X			Friction was not considered for 4"-VD-1-013-152-5 in Z-direction. Friction force is 300 lb which is negligible.
b. Is fr' tion considered in the appropriate direction(s)?	X			
20. Design Interface Requirements:				
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		
b. Is actual stiffness computed?	X			Stiffness calculation was not clearly performed. Frequency was not checked. But deflection was less than 1/16".
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		Base plate and anchor bolt flexibility was not considered. See Note 8.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-028-725-S33R

Reviewer J.P. Russ/C. Wong **Approver** J. Minichiello **Checklist No.** PS-042

Calculation No. CC-1-028-725-S33R, Rev. 2; B&R Drawing No. CC-1-028-725-S33R, Rev. 3 **Date** 3/[illegible]5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Weld of Item 1 to Item 4 is shown and checked as a 1/4" fillet. 5/16" fillets are minimum required. Weld is acceptable per TUGCO response dated June 8, 84 to Cygna Question 31 (see Observation PS-04). The weld of Item 3 to Item 1 is checked using enveloped emergency loads. The actual and allowable loads were incorrect, and wrong weld pattern was used in calculations. However, the welds are acceptable per Cygna calculation F-13 (84042, 4-F).
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See comments under Item 22.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-001-S43K

Reviewer E. Kuo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-044

Calculation No. CC-1-031-001-S43K, Rev. 1; B&R Drawing No. CC-1-031-001-S43K, Rev. 5 **Date** 3/8/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods				
8. Snubbers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6. b. Cygna Criteria 84042-DC-2, Section 4.1.6. c. As a minimum, the following items shall be checked:				
1. Allowable loads	X			
2. Pin-to-pin dimension		X		Pin-to-pin dimension used in design calculation (20") did not match the calculated value based on the dimensions shown on the drawing (22"), but did not change the snubber allowable (Refer to Cygna calculation).
3. Cold setting	X			
4. 1/4" stroke in excess of thermal movement	X			
5. Swing angle	X			Sheet 2 of drawing seems to show dimension between pipe and rear bracket as 9 5/8". TUGCO response in letter dated June 8, 1984 (Item 34) references CMC 86833, which

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-001-S43K

Reviewer E. Kuo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-044

Calculation No. CC-1-031-001-S43K, Rev. 1; B&R Drawing No. CC-1-031-001-S43K, Rev. 5 **Date** 3/8/84

Item	Satisfactory Yes	No	N/A	Comments
				shows 9-5/8" as the dimension to the base plate centerline and 15" as the dimension to the rear bracket. Cygna verified this by reviewing the CMC.
9. Strut: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.1.7. c. As a minimum, the following items shall be checked: 1. Allowable load 2. Pin-to-pin dimension 3. Swing angle			X	
10. U-Bolt:				
a. Is load within U-Bolt allowable load?	X			
b. Is the U-Bolt used as a two-way restraint?			X	
c. Is lateral stiffness considered in the calculations?			X	
d. If U-Bolt is used as a clamp, 1. Is thermal expansion load (pipe on bolt) considered? 2. Is effect of bolt preload considered?			X	

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-003-S43K

Reviewer E. Kuo/C. Wong CKW	Approver J. Minichiello JCM	Checklist No. PS-046
Calculation No. CC-1-031-003-S43K, Rev. 4; B&R Drawing No. CC-1-031-003-S43K, Rev. 7		Date 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			Vendor certified drawing is not in calculation. Not a design requirement.
2. Check the acceptability of the design of Calculation No. CC-1-031-003-S43K, Rev. 4.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				

Independent Design Review Checklist

PIPE SUPPORT CC-1-031-007-S33R

Reviewer E. Kuo/C. Wong CKW **Approver** J. Minichiello JRM **Checklist No.** PS-048

Calculation No. CC-1-031-007-S33R, Rev. 2; B&R Drawing No. CC-1-031-007-S33R, Rev. 6 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				Thermal movements are not shown on support drawing; Item 3 in the Bill of Materials, the strut load is not up-to-date. OK since movements are small and correct loads are used in design calculation.
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration		X		
2. Check the acceptability of the design of Calculation No. CC-1-031-007-S33R, Rev. 2				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap (if applicable):			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-007-S33R

Reviewer	E. Kuo/C. Wong	Approver	J. Minichiello	Checklist No.	PS-048

Calculation No. CC-1-031-007-S33R, Rev. 2; B&R Drawing No. CC-1-031-00? -S33R, Rev. 6 — Date 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
3. Swing angle	X			Swing angle was not checked, but OK by inspection. Movement is very small.
10. U-Bolt:				
a. Is load within U-Bolt allowable load?	X			
b. Is the U-Bolt used as a two-way restraint?			X	
c. Is lateral stiffness considered in the calculations (if applicable)?			X	
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?		X		See Note 10.
2. Is effect of bolt preload considered?		X		See Note 10.
11. Base Plates and Anchor Bolts:				
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing		X		Stud and bolt center to center spacing = 6-1/8"; close to 10 times bolt diameter = 6-1/4". No design impact.
2. Edge distance from concrete edge			X	
3. Anchor allowable load	X			
4. Embedment length	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-011-S43R

Reviewer F. Khanachet/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-052

Calculation No. CC-1-031-011-S43R, Rev. 1; B&R Drawing No. CC-1-031-011-S43R, Rev. 5 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. CC-1-011-013-S43R, Rev. 2.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-011-S43R

Reviewer F. Khanachet/C. Wong	Approver J. Minichiello	Checklist No. PS-052
Calculation No. CC-1-031-011-S43R, Rev. 1; B&R Drawing No. CC-1-031-011-S43R, Rev. 5		Date 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
15. Support attachment/connection to supporting structural element: a. Has the design calculation included the design of support attachment/connection points? b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI) f. Steamhammer (SHL) g. Relief Valve Discharge (RV) h. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)			X	Covered in Cygna's pipe stress review.
17. Has the weight of the support been included in the design?	X			Acceptable as it is small and negligible.
18. Has the inertial load of the support been included in the design?		X		Acceptable as it is small and negligible. See Note 7.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-031-013-S43S

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-054

Calculation No. CC-1-031-013-S43S, Rev. 2; B&R Drawing No. CC-1-031-013-S43S, Rev. 5 **Date** 3/10/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
18. Has the inertial load of the support been included in the design?		X		Acceptable as it is small and negligible. Refer to Note 7.
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		a. X b. X c. X		Stiffness calculation was not provided, but the deflection was less than 1/16". Refer to Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 4042-DC-2, Section 4.1.10?	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-077-005-S33R

Reviewer J.P. Russ/C. Wong **Approver** J. Minichiello **Checklist No.** PS-059

Calculation No. CC-1-077-005-S33R, Rev. 2; B&R Drawing No. CC-1-077-005-S33R, Rev. 5 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
9. Strut: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.7.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable load	X			
2. Pin-to-pin dimension	X			
3. Swing angle	X			No swing angle calculated but is acceptable by inspection.
10. U-Bolt:			X	
a. Is load within U-Bolt allowable load?				
b. Is the U-Bolt used as a two-way restraint?				
c. Is lateral stiffness considered in the calculations?				
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				

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Independent Design Review Checklist

PIPE SUPPORT CC-1-077-005-S33R

Reviewer J.P. Russ/C. Wong **Approver** J. Minichiello **Checklist No.** PS-059

Calculation No. CC-1-077-005-S33R, Rev. 2; B&R Drawing No. CC-1-077-005-S33R, Rev. 5 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
				rear bracket and connection of Item 5, but is acceptable by inspection.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		For the welded connection of the rear bracket of Item 4 to Item 3, the weld length used in analysis was too large. Actual length = 5-1/4"; length used = 5-1/2". No significant impact since difference is small. For welded connection between Items 3 and 5: Loads used to check welds were incorrectly, but conservatively, rotated into weld axis. Weld length used in analysis was calculated incorrectly, but weld pattern used was conservative.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See the second comment under Item 21.

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Independent Design Review Checklist

PIPE SUPPORT CC-1-077-007 S33R

Reviewer J. Russ/C. Wong	Approver J. Minichiello	Checklist No. PS-060
Calculation No. CC-1-077-007-S33R, Rev. 4; B&R Drawing No. CC-1-077-007-S33R, Rev. 8		Date 3/7/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
4. Embedment length 5. Reduced allowable load 6. Combined tension and shear	X X X			
12. Richmond Structural Connection Inserts: Check for consistency with: a. Cygna Criteria 84042-DC-2, Section 4.6. b. G&H Specification No. 2323-SS-30, Appendix 3. c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing 3. Edge distance from concrete edge 4. Combined tension and shear 5. Allowable loads of bolt d. Is the baseplate within allowable stress?			X	
13. Civil Anchors and Thru-Bolts: a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8. b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code? c. Is the base plate within allowable stress?			X	

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Independent Design Review Checklist

PIPE SUPPORT CC-1-077-008-S33R

Reviewer J. Russ/C. Wong **Approver** J. Minichiello **Checklist No.** PS-061

Calculation No. CC-1-077-008-S33R, Rev. 2; B&R Drawing No. CC-1-077-008-S33R, Rev. 4 **Date** 3/21/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
10. U-Bolt:			X	
a. Is load within U-Bolt allowable load?				
b. Is the U-Bolt used as a two-way restraint?				
c. Is lateral stiffness considered in the calculations?				
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				
11. Base Plates and Anchor Bolts:				
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.		X		For the analysis of Item 8, the loads input to the program are incorrect. The effect is negligible since the later revisions of the piping analysis show a reduction in support loads, there is significant margin and the difference in loads are small.
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				Designers used allowables for a 7" embedment rather than 4-3/4" embedment for Item 6. Using correct values the interaction ratio = 0.80 using a safety factor of 5. Note that 1 nut height may be added to the embedment length, and 5" allowables were used.
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load		X		
4. Embedment length	X			
5. Reduced allowable load	X			
6. Combined tension and shear	X			

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Independent Design Review Checklist

PIPE SUPPORT CC-1-077-011-S43R

Reviewer F. Khanachet/C. Wong Approver J. Minichiello Checklist No. PS-062

Calculation No. CC-1-077-011-S43R, Rev. 1; B&R Drawing No. CC-1-077-011-S43R, Rev. 3 Date 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Allowable load	X			
2. Pin-to-pin dimension	X			
3. Swing angle	X			
10. U-Bolt:			X	
a. Is load within U-Bolt allowable load?				
b. Is the U-Bolt used as a two-way restraint?				
c. Is lateral stiffness considered in the calculations?				
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				
11. Base Plates and Anchor Bolts:				
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			Bolt allowable used is less than given in NPSI catalog for BSA-W-SIL anchor bolts; thus, it is acceptable.

Independent Design Review Checklist

PIPE SUPPORT CC-1-077-011-S43R

Reviewer F. Khanachet/C. Wong **Approver** J. Minichiello **Checklist No.** PS-062

Calculation No. CC-1-077-011-S43R, Rev. 1; B&R Drawing No. CC-1-077-011-S43R, Rev. 3 **Date** 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
4. Embedment length	X			A nut height was added to embedent length.
5. Reduced allowable load			X	
6. Combined tension and shear	X			
12. Richmond Structural Connection Inserts: Check for consistency with: a. Cygna Criteria 84042-DC-2, Section 4.6. b. G&H Specification No. 2323-SS-30, Appendix 3. c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing 3. Edge distance from concrete edge 4. Combined tension and shear 5. Allowable loads of bolt d. Is the base plate within allowable stress?			X	
13. Civil Anchor and Thru-Bolts: a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8. b. Thru-Bolts:			X	

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Independent Design Review Checklist

PIPE SUPPORT CC-1-077-014-S33K

Reviewer F. Khanachet/C. Wong CKW **Approver** J. Minichiello JRM **Checklist No.** PS-065

Calculation No. CC-1-077-014-S33K, Rev. 4; B&R Drawing No. CC-1-077-014-S33K, Rev. 7 **Date** 3/14/84

Item	Satisfactory Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Incorrect emergency load is shown on load summary sheet 4 of 16 in the calculation package. Design load on summary sheet = ± 1835 lbs from the pipe stress analysis (AB-1-61A Rev. 2) computer output, load = 1735 lbs. The load used is acceptable.
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design No. CC-1-028-038-S33R, Rev. 0.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-002-S72R

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-068

Calculation No. MS-1-001-002-S72R, Rev. 1; B&R Drawing No. MS-1-001-002-S72R, Rev. 2 **Date** 3/10/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Bolt connection in 2 locations on frame called Hilti-Kwik bolts for bolted connection. This appears to be a drawing error. Cygna has verified this in a later walkdown. 1" diameter standard bolting is used. Anchor bolt locations do note quite match with the design (Section C-C). However, interaction value is small, so no design impact.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			Acceptable, since stress level is low, but see comments under items 23 and 25.
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-003-S72R

Reviewer R. Baliga/C. Wong CKW **Approver** J. Minichiello JM **Checklist No.** PS-069

Calculation No. MS-1-001-003-S72R, Rev. 2 ; B&R Drawing No. MS-1-001-003-S72R, Rev. 2 **Date** 3/3/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data:				Design was based on a set of conservative loads.
Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			Rear bracket dimensions used in design have been modified.
b. Dimensions	X			
c. Member sizes	X			Drawing does not show item number for U-Bolt. No impact.
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-001-003-S72R, Rev. 2.				
a. Assumptions	X			Additional steel provided with no design for loading. OK since it serves no function.
b. Design Methodology		X		The methodology used to check the weld between items 8 and 9 is incorrect. However, the weld is acceptable (composite section). See Cygna calculation 84042, 4-F, Set B3, Rev. 0. **See Observation PS-07.**

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-003-S72R

Reviewer R. Baliga/C. Wong	**Approver** J. Minichiello	**Checklist No.** PS-069			
Calculation No. MS-1-001-003-S72R, Rev. 2	; B&R Drawing No. MS-1-001-003-S72R, Rev. 2	**Date** 3/3/84			

Item	Satisfactory Yes	No	N/A	Comments
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:				
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.			X	
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			X	
5. Restraints:				
a. Check whether the design conforms to the piping analysis restraint requirements.	X			
b. Check for consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. (Box frame)			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-003-S72R

Reviewer R. Baliga/C. Wong Approver J. Minichiello Checklist No. PS-069

Calculation No. MS-1-001-003-S72R, Rev. 2 ; B&R Drawing No. MS-1-001-003-S72R, Rev. 2 Date 3/3/84

Item	Satisfactory Yes	No	N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Weld design of the rear bracket to the T.S. member (Item 4) has not considered the effect of eccentric moment due to the weld pattern but the stress is still acceptable per Cygna's review calculation. (84042, 4-F, Cygna Calculation Set B3, Rev. 0. See Observation PS-05.)
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Based on the comment on Item 2.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			Based on the comment on Item 2.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-004-S72R

Reviewer	Craig L. McClung/C. Wong CKW	Approver	J. Minichiello JM	Checklist No.	PS-070
Calculation No. MS-1-001-004-S72R, Rev. 1; B&R Drawing No. MS-1-001-004-S72R, Rev. 1				Date	6/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			Rear bracket dimensions from LCD, Rev. 16.
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-001-004-S72R, Rev. 1.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:				
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.	X			
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-004-S72R

Reviewer Craig L. McClung/C. Wong **Approver** J. Minichiello **Checklist No.** PS-070

Calculation No. MS-1-001-004-S72R, Rev. 1; B&R Drawing No. MS-1-001-004-S72R, Rev. 1 **Date** 6/5/84

Item	Satisfactory: Yes	No	N/A	Comments
c. Is the base plate within allowable stress?	X			Note: Baseplate stresses are within allowable stress without considering stiffeners in the model. This is conservative.
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H specification No. 2323-SS-30 Appendix 4 or Appendix 5, as applicable?			X	
15. Support attachment/connection to supporting structural element: a. Has the design calculation included the design of support attachment/connection points? b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI)			X	Covered in Cygna's pipe stress review.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-004-S72R

Reviewer	Craig L. McClung/C. Wong	Approver	J. Minichiello	Checklist No.	PS-070

Calculation No. MS-1-001-004-S72R, Rev. 1; B&R Drawing No. MS-1-001-004-S72R, Rev. 1 **Date** 6/5/84

Item	Satisfactory Yes	No	N/A	Comments
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?			X	
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Weld of T.S. to Item 5 is not considered in calculations, weld stresses acceptable per Cygna Calculation (File 4-F, 84042, Calculation Set B2, Rev. 0). Also see **Observation PS-07.**
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-005-S72R

Reviewer R. Baliga/C. Wong	Approver J. Minichiello	Checklist No. PS-071
Calculation No. MS-1-001-005-S72R, Rev. 3; B&R Drawing No. MS-1-001-005-S72R, Rev. 4		Date 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code?		X		Analysis SA-4298: Signs for loads were changed twice while taking the loads from STRUDL to input into base plate analysis. As a result, compression became tension on the baseplate. The approach is conservative.
c. Is the base plate within allowable stress?	X			Base plate model does not show any node points or grid points, bolt locations, etc. (Ref. SA-4299.)
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H specification No. 2323-SS-30, Appendix 4 or Appendix 5, as applicable?			X	
15. Support attachment/connection to supporting structural element: a. Has the design calculation included the design of support attachment/connection points? b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-005-S72R

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-071

Calculation No. MS-1-001-005-S72R, Rev. 3; B&R Drawing No. MS-1-001-005-S72R, Rev. 4 **Date** 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
20. Design Interface Requirements:				No stiffness calculation provided. See Note 8.
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			On vendor certification cover sheet 1, Rev. 1 a note stating that "warping of Items 3 and 7 as indicated in CMC 59142 not considered or approved". There is no indication in the calculation that the warping problem has been resolved. Also on sheet 1 of drawing, Rev. 4, note 3 states that Items 3 and 7 may not warp. Per TUGCO's response, this matter was addressed by the site task force (see response in 6/8/84 letter, Question #42) and engineers were directed to decrease the section properties 5% (see Attachment K to that letter). Support member is acceptable per

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-005-S72R

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-071

Calculation No. MS-1-001-005-S72R, Rev. 3; B&R Drawing No. MS-1-001-005-S72R, Rev. 4 **Date** 3/13/84

Item	Satisfactory Yes	No	N/A	Comments
				Cygna Calculation Set A9 (Binder 4F, 84042) with 5% modification. Per TUGCO response dated 6/22/84, all 12 affected supports have been or will be reviewed to ensure that the 5% is accounted for.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			No local stress was check and no cover plate was provided at the tube end. But it is acceptable. See Note 3.
24. Code Allowable Stress Requirements:				See comment under Item 21.
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 3, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full <u>unstiffened</u> span?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-006-S72R

Reviewer	R. Baliga/C.K. Wong	Approver	J. Minichiello	Checklist No.	PS-072
Calculation No. MS-1-001-006-S72R, Rev. 4; B&R Drawing No. MS-1-001-006-S76R, Rev. 5				Date	3/12/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
13. Civil Anchors and Thru-Bolts:				
a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.			X	
b. Thru-Bolts: Does it meet the bolt allowable load requirements of the ASME Code?	X			
c. Is the base plate within allowable stress?		X		The distribution of load input to the base plate analysis of sections B-B & D-D is based on the assumption of a rigid region between plates, Item 15. This is incorrect since the two plates are separate and are not a rigid attachment. However, the bolts and base plates are acceptable per Cygna calculation set B7 (84042, 4-f). Note: On Sheet 1 of drawing the 8" dimension for material Item 15 is not clearly defined. However, the TSDR 4408 in the calculation package gives the as-built dimensions.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-006-S72R

Reviewer R. Baliga/C.K. Wong **Approver** J. Minichiello **Checklist No.** PS-072

Calculation No. MS-1-001-006-S72R, Rev. 4; B&R Drawing No. MS-1-001-006-S76R, Rev. 5 **Date** 3/12/84

Item	Satisfactory Yes	No	N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			The weld between Items 22 and 23 was not checked. However, the weld is adequate based on Cygna Calculation Set B7 (84042, 4-F). Also see **Observation PS-07.**
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-001-C72S

Reviewer R. Baliga/D. Stevens/C. Wong **Approver** J. Minichiello **Checklist No.** PS-073

Calculation No. MS-1-001-001-C72S, Rev. 4; B&R Drawing No. MS-1-001-001-C72S, Rev. 5 **Date** 3/7/84

Item	Satisfactory: Yes	No	N/A	Comments
13. Civil Anchors and Thru-Bolts: a. Embeded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8. b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code? c. Is the base plate within allowable stress?			X	
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H specification No. 2323-SS-30, Appendix 4 or Appendix 5, as applicable?			X	
15. Support attachment/connection to supporting structural element: a. Has the design calculation included the design of support attachment/connection points? b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?	a. X b. X		c. X	Frame is attached to existing whip restraint structural member. Design has not addressed connection of support members to 1" Plate or 1" Plate connection to pipe whip restraint members. Cygna agrees that the connections to the pipe whip restraint members are acceptable per TUGCO's June 8, 1984

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-002-C72S

Reviewer R. Baliga/C. K. Wong CKW	**Approver** J. Minichiello JCM	**Checklist No.** PS-074			

Calculation No. MS-1-001-002-C72S, Rev. 2; B&R Drawing No. MS-1-001-002-C72S, Rev. 5 **Date** 3/10/84

Item	Satisfactory: Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Loads used in design are slightly different from latest pipe stress analysis, but there is no design impact. **See Observation PI-00-06.**
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-001-002-C72S, Rev. 5.				Punching shear was not checked; however, it meets the requirements per Cygna review.
a. Assumptions	X			
b. Design Methodology		X		Weld between material Items 13 and 18 was checked without considering the additional eccentric moment due to the location of weld center of gravity for assymmetric weld pattern (Sheet 17 of 19). However, the stress is still acceptable per Cygna's calculation, set A6 (84042, 4-F). **See Observation PS-05.**

Independent Design Review Checklist

PIPE SUPPORT MS-1-001-003-C72K

Reviewer S. Lou/C.K. Wong CKW **Approver** J. Minichiello JZM **Checklist No.** PS-075

Calculation No. MS-1-001-003-C72K, Rev. 6; B&R Drawing No. MS-1-001-003-C72K, Rev. 8 **Date** 3/6/84

Item	Satisfactory: Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-001-003-C72K Rev. 6.				
a. Assumptions	X			
b. Design Methodology	X			Stresses in pad are not computed and are the responsibility of NPSI (Secaucus). See Note 2 for more information. The component forces due to swing angle were not considered in the design, but are acceptable since effect is small.
3. Loading Combinations: Check for consistency with:				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-003-C72K

Reviewer S. Lou/C.K. Wong **Approver** J. Minichiello **Checklist No.** PS-075

Calculation No. MS-1-001-003-C72K, Rev. 6; B&R Drawing No. MS-1-001-003-C72K, Rev. 8 **Date** 3/6/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		 X X X		Stiffness was not calculated, but the deflection was less than 1/16". See Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Web crippling and buckling of members where concentrated load is applied are not checked. However, all the members are within allowable per Cygna Calculation File 4-F, Set B1.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			The welds of the composite beam section are not checked between Material Items 21, 25 and 26. However, they are acceptable per Cygna Calculation Set No. B1. Also see **Observation PS-07.**
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See comments under Item 21.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-004-C72K

Reviewer S. Luo/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-076

Calculation No. MS-1-001-004-C72K, Rev. 2; B&R Drawing No. MS-1-001-004-C72K, Rev. 3 **Date** 3/2/84

Item	Satisfactory: Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration		X		The orientation of the rear bracket shown on DWG MS-1-001-004-C72K Rev. 3 Section A-A & plan view is not consistent. No design impact.
2. Check the acceptability of the design of Calculation No. MS-1-001-004-C72K, Rev. 2.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-004-C72K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-076

Calculation No. MS-1-001-004-C72K, Rev. 2; B&R Drawing No. MS-1-001-004-C72K, Rev. 3 **Date** 3/2/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
13. Civil Anchor and Thru-Bolts: a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.		X		Minimum spacing violations exist (i.e. less than 10") but since interaction value is very low (0.26), the anchor bolts are still acceptable by inspection.
b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code?			X	
c. Is the base plate within allowable stress?			X	Section CC - one of the holes is 5/16" larger than the 2" bolt size (i.e. 2 5/16"); however, the interaction is low and this bolt is not needed for shear capacity.
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H Specification No. 2323-SS-30, Appendix 4 or Appendix 5, as applicable?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-001-005-C72K

Reviewer D. K. Leong/J. Russ/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-077

Calculation No. MS-1-001-005-C72K, Rev. 7; B&R Drawing No. MS-1-001-005-C72K, Rev. 8 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			Inconsistency in dimensions - 18-1/2" on Item 9, pg. 1, is 8-1/2" on pg. 2; 18-1/2" used in STRUDL model. This has been clarified by TUGCO (see 6/8/84 letter) as a drafting error.
b. Dimensions		X		Centerline of Items 12 and 21 are not coincident but are modeled as such; eccentricity = 3-5/16". Effect on the member is small.
c. Member sizes	X			
d. Drawings/Configuration		X		
2. Check the acceptability of the design of Calculation No. MS-1-001-005-C72K, Rev. 4.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-002-001-S72R

Reviewer R. Baliga/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-080

Calculation No. MS-1-002-001-S72R, Rev. 2; B&R Drawing No. MS-1-002-001-S72R, Rev. 3 **Date** 3/6/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			Dimension line for 4'-7 1/2" between the baseplate and pipe is not well defined. Drawing should be updated.
2. Check the acceptability of the design of Calculation No. MS-1-002-001-S72R, Rev. 2.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-001-S72R

Reviewer	R. Baliga/C. Wong	Approver	J. Minichiello	Checklist No.	PS-080
Calculation No. MS-1-002-001-S72R, Rev. 2; B&R Drawing No. MS-1-002-001-S72R, Rev. 3				Date	3/6/84

Item	Satisfactory Yes	No	N/A	Comments
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				
5. Restraints: a. Check whether the design conforms to the piping analysis restraint requirements. b. Check for consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2, (Box Restraints).	X 		 X	
6. Spring Supports: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Sections 3.6.2.2.3 and 3.6.2.2.4. b. Cygna Criteria 84042-DC-2, Section 4.1.4. c. As a minimum, the following items shall be checked: 1. Variability of spring force 2. Cold load 3. Allowable loads 4. Available travels 5. Swing angle/off-set			X	
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5,			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-002-S72R

Reviewer R. Baliga/C. Wong	Approver J. Minichiello	Checklist No. PS-081
Calculation No. MS-1-002-002-S72R, Rev. 3; B&R Drawing No. MS-1-002-002-S72R, Rev. 3		Date 3/2/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing 3. Edge distance from concrete edge 4. Combined tension and shear 5. Allowable loads of bolt d. Is the baseplate within allowable stress?				
13. Civil Anchors and Thru-Bolts: a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.			X	
b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code?	X			Applied loads used to qualify Thru-Bolt did not match the STRUDL frame output. Also, analysis SA-3662, Rev. 1 does not show the same values as used in sheet 4 of 8 the analysis SA-4282 calculation. Note: These comments are clarified per TUGCO's June 8, 1984 letter (item 44) and Cygna's review of the original calculation at Grinnell's office in Providence, RI, which confirms the acceptability of these components.
c. Is the base plate within allowable stress?	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-002-002-S72R

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-081

Calculation No. MS-1-002-002-S72R, Rev. 3; B&R Drawing No. MS-1-002-002-S72R, Rev. 3 **Date** 3/2/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Covered in MS-1-004-002-S72R design calculation.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			No cover plate provided at tube end moment joint (Material Item 18). It is acceptable per Cygna Calculation set C2, Binder 4-F. See also Note 3.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support:	Y			
Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-003-S72R

Reviewer	R. Baliga/C. Wong	Approver	J. Minichiello	Checklist No.	PS-082
Calculation No. MS-1-002-003-S72R, Rev. 4; B&R Drawing No. MS-1-002-003-S72R, Rev. 4				Date	3/4/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
10. U-Bolt:				
a. Is load within U-Bolt allowable load?	X			0.6 Fy used to design U-bolt; see Note 5.
b. Is the U-Bolt used as a two-way restraint?			X	
c. Is lateral stiffness considered in the calculations?			X	
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?			X	
2. Is effect of bolt preload considered?			X	
11. Base Plates and Anchor Bolts:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.				
b. Does anchor bolt design meet the requirement of Cygna Criteria 84042-DC-2, Section 4.5?				
c. As a minimum, check the following items:				
1. Center-to-center spacing				
2. Edge distance from concrete edge				
3. Anchor allowable load				
4. Embedment length				
5. Reduced allowable load				
6. Combined tension and shear				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-004-S72R

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-083

Calculation No. MS-1-002-004-S72R, Rev. 1; B&R Drawing No. MS-1-002-004-S72R, Rev. 2 **Date** 3/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Special analysis SA-4123 shows that the pad used between U-Bolt and pipe fails due to bearing stress. However, the pad is qualified based on a rapid letter from R.B. Reslau to Nick Patsalides which does not show back-up calculation. It is acceptable per TUGCO calculation in their June 8, 1984 letter, Item 43.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			See comments under Items 2 and 23.
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 3, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?		X		See comments under Item 1.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-001-C72S

Reviewer S. Luo/C. Wong CKW **Approver** J. Minichiello JZM **Checklist No.** PS-086

Calculation No. MS-1-002-001-C72S; Rev. 2; B&R Drawing No. MS-1-002-001-C72S; Rev. 4 **Date** 3/7/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		The load used in the calculation was 20194 lbs. The load reported i. the analysis AB-1-02, Rev. 1 was 20305 lbs., a difference of 111 lbs. This difference is negligible because the support allows a 10% deviation in loads. **See Observation PI-00-06.**
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-002-001-C72S, Rev. 2.				The travel check for the spring did not include the additional travel length due to the pipe rotation. However, the rotational movement is very small.
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-003-C72S

Reviewer D.K. Leong/C. Wong **Approver** J. Minichiello **Checklist No.** PS-087

Calculation No. MS-1-002-003-C72S, Rev. 0; B&R Drawing No. MS-1-002-003-C72S, Rev. 2 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI) f. Friction g. Steamhammer (SHL) h. Relief Valve Discharge (RV) i. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)			X	Covered in Cygna's pipe stress review.
17. Has the weight of the support been included in the design?	X			Weight of the spring is not considered in STRUDL analysis (approximately 5%). See Note 1.
18. Has the inertial load of the support been included in the design?		X		Additional dead load has been added; however, no frequency analysis was performed - an approximate inertial load was applied, though no explanation or justification is provided. See Note 7.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-003-C72S

Reviewer D.K. Leong/C. Wong **Approver** J. Minichiello **Checklist No.** PS-087

Calculation No. MS-1-002-003-C72S, Rev. 0; B&R Drawing No. MS-1-002-003-C72S, Rev. 2 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?		X X		Friction load is not considered on a related gang support CH-1-030-004-C76R. **See Observation PS-08.**
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?			X	Stiffness not used for spring.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Additional moments due to the eccentricity in 3 sided welded connection between Items 31 and 45 are not considered, but acceptable since the stresses in the weld are low. **See Observation PS-05.**

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-004-C72K

Reviewer	S. Luo/C. Wong	Approver	J. Minichiello	Checklist No.	PS-088
Calculation No. MS-1-002-004-C72K, Rev. 5; B&R Drawing No. MS-1-002-004-C72K, Rev. 9				Date	3/8/84

Item	Satisfactory Yes	No	N/A	Comments
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full <u>unstiffened</u> span?	X			Members are short and since the maximum stress was 13.668 ksi (EL. 9), the buckling & lateral bracing are not critical.
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			See item 1.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-005-C72K

Reviewer M. de Guzman/C. Wong	Approver J. Minichiello	Checklist No. PS-089
Calculation No. MS-1-002-005-C72K, Rev. 5; B&R Drawing No. MS-1-002-005-C72K, Rev. 7		Date 3/5/84

Item	Satisfactory Yes	No	N/A	Comments
1. Allowable load 2. Pin-to-pin dimension 3. Swing angle				
10. U-Bolt:				
a. Is load within U-Bolt allowable load?	X			ITT-DRS-137S, 2" ϕ Rod, U-Bolt capacity was used in the design calculation to qualify the U-Bolts.
b. Is the U-Bolt used as a two-way restraint?			X	
c. Is lateral stiffness considered in the calculations?			X	
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?		X		See Note 12.
2. Is effect of bolt preload considered?		X		See Note 12.
11. Base Plates and Anchor Bolts:				
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-005-C72K

Reviewer	M. de Guzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-089
Calculation No. MS-1-002-005-C72K, Rev. 5; B&R Drawing No. MS-1-002-005-C72K, Rev. 7				Date	3/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
5. Reduced allowable load			X	
6. Combined tension and shear	X			Base plate computer models did not match all dimensions shown for as-builts. Stiffener plates were not actually incorporated into the computer models. It could affect the plate and anchor bolt design in the upper base plate (Section A-A). Since bolt interaction values reached 1.0 for section A-A, Cygna requested TUGCO reanalyze this connection. As shown in the calculation attached to the TUGCO response (6/8/84 letter), the effect of the model revision lowers the interaction to .95, which is acceptable.
12. Richmond Structural Connection Inserts: Check for consistency with: a. Cygna Criteria 84042-DC-2, Section 4.6. b. G&H Specification No. 2323-SS-30, Appendix 3. c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-005-C72K

Reviewer M. d Guzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-089

Calculation No. MS-1-002-005-C72K, Rev. 5; B&R Drawing No. MS-1-002-005-C72K, Rev. 7 **Date** 3/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?				
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI) f. Steamhammer (SHL) g. Relief Valve Discharge (RV) h. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)			X	Covered in Cygna's pipe stress review.
17. Has the weight of the support been included in the design?	X			The weight of half the snubbers, and the trunnion, saddle, beam and its attachments are lumped as an added mass into the pipe model for stress analysis. This in effect accounts for the weight in support design.
18. Has the inertial load of the support been included in the design?		X		See Note 7.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-005-C72K

Reviewer M. de Guzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-089

Calculation No. MS-1-002-005-C72K, Rev. 5; B&R Drawing No. MS-1-002-005-C72K, Rev. 7 **Date** 3/5/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
19. Friction Loads:				
a. Has friction load been included in the support design?			X	
b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements:				
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		See Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Calculation for stiffener stress was not provided, but it is acceptable by inspection.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			On Sheet No. 9, weld size used is 3/8", not 5/16". This is conservative.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See comments under Item 21. Connections are satisfactory.

Independent Design Review Checklist

PIPE SUPPORT MS-1-002-006-C72K

Reviewer M.T. deGuzman/C. Wong CKW **Approver** J. Minichiello JRM **Checklist No.** PS-090

Calculation No. MS-1-002-006-C72K, Rev. 6; B&R Drawing No. MS-1-002-006-C72K, Rev. 7 **Date** 3/7/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Loads used in design are slightly different from those in latest pipe stress analysis, but there is no design impact. **See Observation PI-00-06.**
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-002-006-C72K, Rev. 7.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-006-C72K

Reviewer M.T. deGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-090

Calculation No. MS-1-002-006-C72K, Rev. 6; B&R Drawing No. MS-1-002-006-C72K, Rev. 7 **Date** 3/7/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				
5. Restraints: a. Check whether the design conforms to the piping analysis restraint requirements. b. Check for consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. (Box Restraint)	X 		 X	
6. Spring Supports: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Sections 3.6.2.2.3 and 3.6.2.2.4. b. Cygna Criteria 84042-DC-2, Section 4.1.4. c. As a minimum, the following items shall be checked: 1. Variability of spring force 2. Cold load 3. Allowable loads 4. Available travels 5. Swing angle/off-set			X	
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2.			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-006-C72K

Reviewer M.T. deGuzman/C. Wong	**Approver** J. Minichiello		**Checklist No.** PS-090		
Calculation No. MS-1-002-006-C72K, Rev. 6; B&R Drawing No. MS-1-002-006-C72K, Rev. 7			**Date** 3/7/84		

Item	Satisfactory Yes	No	N/A	Comments
b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods				
8. Snubbers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.6.	X			
c. As a minimum, the following items shall be checked: 1. Allowable loads	X			There are no calculations for sizing the snubbers. Snubber is acceptable for Cygna calculation A4.
2. Pin-to-pin dimension	X			
3. Cold setting	X			
4. 25% stroke in excess of thermal movement	X			
5. Swing angle	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-006-C72K

Reviewer M.T. deGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-090

Calculation No. MS-1-002-006-C72K, Rev. 6; B&R Drawing No. MS-1-002-006-C72K, Rev. 7 **Date** 3/7/84

Item	Satisfactory Yes	No	N/A	Comments
9. Strut: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.1.7. c. As a minimum, the following items shall be checked: 1. Allowable load 2. Pin-to-pin dimension 3. Swing angle			X	
10. U-Bolt: a. Is load within U-Bolt allowable load? b. Is the U-Bolt used as a two-way restraint? c. Is lateral stiffness considered in the calculations: (if applicable)? d. If U-Bolt is used as a clamp, 1. Is thermal expansion load (pipe on bolt) considered? 2. Is the effect of bolt preload considered?			X	A flat bar, Item 22, is shaped like a U-bolt and provides a radial clearance of 1/4" to the upper half portion of the pipe. Since the bottom of the pipe is welded to the trunnion and W10 beam, the 1/4" clearance is adequate for thermal growth of the pipe.
11. Base Plates and Anchor Bolts: a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 84042-DC-2, Section 4.5?	X X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-006-C72K

Reviewer M.T. deGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-090

Calculation No. MS-1-002-006-C72K, Rev. 6; B&R Drawing No. MS-1-002-006-C72K, Rev. 7 **Date** 3/7/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			
5. Reduced allowable load			X	
6. Combined tension and shear	X			The interaction value was 0.99, conservatively using the maximum tension and maximum shear from all computer runs. This interaction value could exceed unity if the self-weight of support is added. The 0.99 value was calculated using a factor of safety of 5 for the Hilti Bolts, while the NRC allows a factor of safety of 4. Using a factor of safety of 4 would result in a ratio of 0.79. Thus, the omission is acceptable.
12. Richmond Structural Connection Inserts: Check for consistency with:				
a. Cygna Criteria 84042-DC-2, Section 4.6.	X			
b. G&H Specification No. 2323-SS-30, Appendix 3.	X			
c. As a minimum, check the following items:				
1. Allowable loads	X			
2. Center-to-center spacing	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-007-C72K

Reviewer J. Russ/C. Wong **Approver** J. Minichiello **Checklist No.** PS-091

Calculation No. MS-1-002-007-C72K, Rev. 2; B&R Drawing No. MS-1-002-007-C72K, Rev. 2 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X X X		Stiffness calculation was not provided, but maximum deflection was less than 1/16". Refer to Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		See comment under Item 2. Incorrect weld dimensions were used in the design of rear bracket to material Item 6 connection (5/8" plate). Correct weld dimensions are 12-1/2" x 10" rather than 12-1/2" x 12-1/2", since Item 6 is only 10" wide (sheet 16 of calculation). However, the stress is still acceptable.

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MS-1-002-008-C72K

Reviewer M. T. DeGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-092

Calculation No. MS-1-002-008-C72K, Rev.5; B&R Drawing No. MS-1-002-008-C72K, Rev. 7 **Date** 3/11/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
7. Rod Hangers:			X	
Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2.				
b. Cygna Criteria 84042-DC-2, Section 4.1.5.				
c. As a minimum, the following items shall be checked:				
1. Rod size				
2. Allowable load				
3. Swing angle/off-set				
4. Bending or torsion on rods				
8. Snubbers:				
Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.6.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable loads	X			
2. Pin-to-pin dimension	X			
3. Cold setting	X			
4. 1/4" stroke in excess of thermal movement	X			
5. Swing angle		X		Swing angle as shown in calculation on Sheet 14 of 62 is 5.54°. The actual angle based on the dimensions given is less than 5°, therefore acceptable.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-009-C72K

Reviewer M. T. DeGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-093

Calculation No. MS-1-002-009-C72K, Rev. 3; B&R Drawing No. MS-1-002-009-C72K, Rev. 3 **Date** 3/9/84

Item	Satisfactory Yes	No	N/A	Comments
12. Richmond Structural Connection Inserts: Check for consistency with: a. Cygna Criteria 84042-DC-2, Section 4.6. b. G&H Specification No. 2323-SS-30, Appendix 3. c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing 3. Edge distance from concrete edge 4. Combined tension and shear 5. Allowable loads of bolt d. Is the baseplate within allowable stress?			X	
13. Civil Anchors and Thru-Bolts: a. Embeded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8. b. Thru-Bolts: Does it meet the bolt allowable load requirements of the ASME code? c. Is the base plate within allowable limits?			X	
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H specification No. 2323-SS-30, Appendix 4 or Appendix 5, as applicable?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-009-C72K

Reviewer M. T. DeGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-093

Calculation No. MS-1-002-009-C72K, Rev. 3; B&R Drawing No. MS-1-002-009-C72K, Rev. 3 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
15. Support attachment/connection to supporting structural element: a. Has the design calculation included the design of support attachment/connection points? b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI) f. Steamhammer (SHL) g. Relief Valve Discharge (RV) h. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)			X	Covered in Cygna's pipe stress review.
17. Has the weight of the support been included in the design?	X			Weight of frame included in Load cases 3, 4 & 5.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-009-C72K

Reviewer M. T. DeGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-093

Calculation No. MS-1-002-009-C72K, Rev. 3; B&R Drawing No. MS-1-002-009-C72K, Rev. 3 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Snubber bracket attachment welds not checked. However, it is acceptable per Cygna Calculation Set A4.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			No calculations were provided for checking of the stiffener plates on the W 12 x 58 at location of concentrated loads and reactions. They are adequate, however. See Note 3.
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			Stresses are small.
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			Very short column members.
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-010-C62K

Reviewer M.T. de Guzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-094

Calculation No. MS-1-002-010-C62K, Rev. 3; B&R Drawing No. MS-1-002-010-C62K, Rev. 3 **Date** 3/9/84

Item	Satisfactory Yes	No	N/A	Comments
17. Has the weight of the support been included in the design?	X			
18. Has the inertial load of the support been included in the design?		X		See Note 7.
19. Friction Loads:				
a. Has friction load been included in the support design?			X	
b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements:				Stiffness calculations were not provided, but total deflection is less than 1/16". See Note 8.
a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		

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Independent Design Review Checklist

PIPE SUPPORT MS-1-002-012-C72S

Reviewer M. T. DeGuzman/C. Wong CKW **Approver** J. Minichiello JRM **Checklist No.** PS-095

Calculation No. MS-1-002-012-C72S, Rev. 2; B&R Drawing No. MS-1-002-012-C72S, Rev. 2 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				This support is part of the gang hanger, MS-1-002-013-C72K. Actual load from pipe stress analysis output is lower than the design load and is acceptable; however, see **Observation PI-00-06.**
a. Loads		X		
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-002-012-C72S, Rev. 2.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:				
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.			X	

Independent Design Review Checklist

PIPE SUPPORT MS-1-002-012-C72S

Reviewer M. T. DeGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-095

Calculation No. MS-1-002-012-C72S, Rev. 2; B&R Drawing No. MS-1-002-012-C72S, Rev. 2 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
Section 3.6.2.2.2. b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods				
8. Snubbers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6. b. Cygna Criteria 84042-DC-2, Section 4.1.6. c. As a minimum, the following items shall be checked: 1. Allowable loads 2. Pin-to-pin dimension 3. Cold setting 4. 1/4" stroke in excess of thermal movement 5. Swing angle			X	
9. Strut: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.1.7. c. As a minimum, the following items shall be checked:			X	

Independent Design Review Checklist

PIPE SUPPORT MS-1-002-012-C72S

Reviewer M. T. DeGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-095

Calculation No. MS-1-002-012-C72S, Rev. 2; B&R Drawing No. MS-1-002-012-C72S, Rev. 2 **Date** 3/9/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
4. Embedment length 5. Reduced allowable load 6. Combined tension and shear				
12. Richmond Structural Connection Inserts Check consistency with:				
a. Cygna Criteria 84042-Dc-2, Section 4.6.	X			By comparing loads of this support with the other support on this gang hanger assembly, this component is acceptable. (Refer to Calculation No. MS-1-002-013-C72K.)
b. G&H Specification No. 2323-SS-30 (3/19/81), Appendix 3.	X			
c. As a minimum, check the following items:				
1. Allowable loads	X			
2. Center-to-center spacing	X			
3. Edge distance from concrete edge	X			
4. Combined tension and shear	X			
5. Allowable loads of bolt	X			
d. Is the base plate within allowable stress?	X			
13. Civil Anchors and Thru-Bolts:			X	
a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.				
b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code?				
c. Is the base plate within allowable stress?				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-003-S72R

Reviewer S. Luo/C. K. Wong CKW		**Approver** J. Minichiello JCM		**Checklist No.** PS-099	
Calculation No. MS-1-003-003-S72R, Rev. 5; B&R Drawing No. MS-1-003-003-S72R, Rev. 5				**Date** 3/21/84	

Item	Satisfactory Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			Higher applied load was used for design (conservative).
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-003-003-S72R, Rev. 5.				Additional steel provided with no design for loading. OK since it serves no function.
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:				
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.	X			
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-003-S72R

Reviewer S. Luo/C. K. Wong	Approver J. Minichiello	Checklist No. PS-099
Calculation No. MS-1-003-003-S72R, Rev. 5; B&R Drawing No. MS-1-003-003-S72R, Rev. 5		Date 3/21/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
a. Cygna Criteria 84042-DC-2, Section 4.6. b. G&H Specification No. 2323-SS-30, Appendix 3. c. As a minimum, check the following items: 1. Allowable loads 2. Center-to-center spacing 3. Edge distance from concrete edge 4. Combined tension and shear 5. Allowable loads of bolt d. Is the base plate within allowable stress?				
13. Civil Anchors and Thru-Bolts:				
a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.			X	
b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code?	X			
c. Is the base plate within allowable stress?	X			
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H Specification No. 2323-SS-30, Appendix 4 or Appendix 5, as applicable?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-003-S72R

Reviewer S. Luo/C. K. Wong **Approver** J. Minichiello **Checklist No.** PS-099

Calculation No. MS-1-003-003-S72R, Rev. 5; B&R Drawing No. MS-1-003-003-S72R, Rev. 5 **Date** 3/21/84

Item	Satisfactory Yes	No	N/A	Comments
15. Support attachment/connection to supporting structural element:				
a. Has the design calculation included the design of support attachment/connection points?	X			
b. Is it acceptable?			X	
c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI) f. Steamhammer (SHL) g. Relief Valve Discharge (RV) h. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)			X	Covered in Cygna's pipe stress review.
17. Has the weight of the support been included in the design?	X			Acceptable since it is small.
18. Has the inertial load of the support been included in the design?		X		Refer to Note 7.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-004-S72R

Reviewer S. Luo/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-100

Calculation No. MS-1-003-004-S72R, Rev. 2; B&R Drawing No. MS-1-003-004-S72R, Rev. 3 **Date** 6/6/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			The 5" weld length specified in Attachment 1 (an NCR) is conservative when compared to actual length of 2 x 2 3/4" (top right corner of "Plate weld detail" shown on Drawing, Sheet 3 of 4).
2. Check the acceptability of the design of Calculation No. MS-1-003-004-S72R, Rev. 2.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.			X	

CYGNA

Independent Design Review Checklist

PIPE SUPPORT MS-1-003-004-S72R

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-100

Calculation No. MS-1-003-004-S72R, Rev. 2; B&R Drawing No. MS-1-003-004-S72R, Rev. 3 **Date** 6/6/84

Item	Satisfactory Yes	No	N/A	Comments
9. Strut: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			No calculation provided. However, it is acceptable per Cygna calculation Set No. D5 (84042, 4-F)
b. Cygna Criteria 84042-DC-2, Section 4.1.7.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable load	X			
2. Pin-to-pin dimension	X			
3. Swing angle	X			
10. U-Bolt:				
a. Is load within U-Bolt allowable load?	X			U-bolt failed at emergency condition according to the LCD allowable: allowable load = 89120 lbs; applied load = 99560 lbs. However, per TUSI's criteria to use 0.6 Fy as allowable stress, the U-bolt is acceptable as shown in Calculation SA-4184, Rev. 1. Also see Note 5.
b. Is the U-Bolt used as a two-way restraint?			X	
c. Is lateral stiffness considered in the calculations?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-S72R

Reviewer R. Baliga/C. Wong Approver J. Minichiello Checklist No. PS-101

Calculation No. MS-1-003-005-S72R, Rev. 1; B&R Drawing No. MS-1-003-005-S72R, Rev. 2 Date 3/9/84

Item	Satisfactory: Yes	No	N/A	Comments
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Frame analysis output is not available. However, frame members are within allowables (moments are calculated by rigid frame formulae in Cygna's review).
22. Is the design of the welded connection of the members in accordance with Cygna Creteria Criteria 84042-DC-2, Section 4.1.10?		X		Incorrect shear load (Vmax) was used for weld checks between material Items 4 & 6 and 2 & 3, shown as sheets 6 & 7 in design calculation. However, the weld stress is still acceptable. **See Observation PS-07.**
23. Is the design of the member connection, including local stiffening, adequate for load transfer? a. Does it meet Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements: a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4? b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X X			See comment under Item 22.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-S72R

Reviewer R. Baliga/C. Wong Approver J. Minichiello Checklist No. PS-101

Calculation No. MS-1-003-005-S72R, Rev. 1; B&R Drawing No. MS-1-003-005-S72R, Rev. 2 Date 3/9/84

Item	Satisfactory: Yes	No	N/A	Comments
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-003-006-S72R

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-102

Calculation No. MS-1-003-006-S72R, Rev. 3; B&R Drawing No. MS-1-003-006-S72R, Rev. 3 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Design of composite section did not check shear flow through weld. Acceptable per Cygna calculation. **See Observation PS-07.**
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-001-C72S

Reviewer S. Luo/C.K. Wong CKW Approver J. Minichiello JZM Checklist No. PS-103

Calculation No. MS-1-003-001-C72S, Rev. 1; B&R Drawing No. MS-1-003-001-C72S, Rev. 3 Date 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		The design load should be 22,445 lbs based on the pipe stress output, but 23,691 lbs was shown on the cover sheet of calculation. This is conservative. **See Observation PI-00-06.**
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-003-001-C72S, Rev. 1.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-001-C72S

Reviewer S. Luo/C.K. Wong **Approver** J. Minichiello **Checklist No.** PS-103

Calculation No. MS-1-003-001-C72S, Rev. 1; B&R Drawing No. MS-1-003-001-C72S, Rev. 3 **Date** 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
12. Richmond Structural Connection Inserts:				
Check for consistency with:				
a. Cygna Criteria 84042-DC-2, Section 4.6.	X			
b. G&H Specification No. 2323-SS-30, Appendix 3.	X			
c. As a minimum, check the following items:				
1. Allowable loads	X			
2. Center-to-center spacing	X			
3. Edge distance from concrete edge	X			
4. Combined tension and shear	X			
5. Allowable loads of bolt	X			
d. Is the base plate within allowable stress?				
13. Civil Anchor and Thru-Bolts:			X	
a. Embeded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.				
b. Through Bolts: Does it meet the bolt allowable load requirements of the ASME Code?				
c. Is the base plate within allowable stress?				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-002-C72S

Reviewer S. Luo/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-104

Calculation No. MS-1-003-002-C72S, Rev. 2; B&R Drawing No. MS-1-003-002-C72S, Rev. 4 **Date** 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		
b. Dimensions	X			Input load should be 26,428 lbs based on the pipe stress computer output rather than 27,240 lbs. This is acceptable and conservative. **See Observation PI-00-06.**
c. Member sizes	X			Displacements from pipe stress com puter output are slightly different than those shown on the cover sheet of design calculation. This is acceptable since design values are larger.
d. Drawings/Configuration		X		Vertical weld lengths between Items 1 and 4 are not clearly specified on the drawing.
2. Check the acceptability of the uesign of Calculation No. MS-1-003-002-C72S, Rev. 2.				
a. Assumptions	X			
b. Design Methodology	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-004-C72S

Reviewer S. Luo/C. K. Wong CKW **Approver** J. Minichiello JZM **Checklist No.** PS-106

Calculation No. MS-1-003-004-C72S, Rev. 1; B&R Drawing No. MS-1-003-004-C72S, Rev. 3 **Date** 3/12/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items: a. Loads b. Dimensions c. Member sizes d. Drawings/Configuration	 X X X	 X		Load provided to Support Group 22317 lbs. Load from latest stress run is 24522 lbs. Cygna has checked the support to ensure acceptability to the latest load. **See Observation PS-00-06.**
2. Check the acceptability of the design of Calculation No. MS-1-003-004-C72S, Rev. 1. a. Assumptions b. Design Methodology	 X X			
3. Loading Combinations: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.3.	 X X			See comment under Item 1.
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-004-C72S

Reviewer S. Luo/C. K. Wong **Approver** J. Minichiello **Checklist No.** PS-106

Calculation No. MS-1-003-004-C72S, Rev. 1; B&R Drawing No. MS-1-003-004-C72S, Rev. 3 **Date** 3/12/84

Item	Satisfactory Yes	No	N/A	Comments
17. Has the weight of the support been included in the design?	X			Negligible compared to applied load.
18. Has the inertial load of the support been included in the design?		X		See Note 7.
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?			X	Not required for a spring.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Since the stress level was low, the member stresses are still acceptable even though the design load was not updated. Washer plate (Item #17) provided is 1" x 7" x 12". Actual size required is 1-

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer M.T. deGuzman/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-107

Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2 **Date** 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-003-005-C72K, Rev. 1.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			
4. Gap:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.				
b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-107
Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2				Date	3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
5. Restraints: a. Check whether the design conforms to the piping analysis restraint requirements. b. Check for consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. (Box Restraints)			X	
6. Spring Supports: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Sections 3.6.2.2.3 and 3.6.2.2.4. b. Cygna Criteria 84042-DC-2, Section 4.1.4. c. As a minimum, the following items shall be checked: 1. Variability of spring force 2. Cold load 3. Allowable loads 4. Available travels 5. Swing angle/off-set			X	
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size			X	

Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-107
Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2				Date	3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods				
8. Snubbers: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.6.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable loads	X			
2. Pin-to-pin dimension	X			
3. Cold setting	X			
4. 1/4" stroke in excess of thermal movement	X			
5. Swing angle	X			Actual swing angle = arctan 2.8213/44.375 = 3.64° < 5°
9. Strut: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.1.7. c. As a minimum, the following items shall be checked: 1. Allowable load 2. Pin-to-pin dimension 3. Swing angle			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-107

Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2 — Date 3/13/84

Item	Satisfactory: Yes	Satisfactory: No	Satisfactory: N/A	Comments
10. U-Bolt: a. Is load within U-Bolt allowable load? b. Is the U-Bolt used as a two-way restraint? c. Is lateral stiffness considered in the calculations? d. If U-Bolt is used as a clamp, 1. Is thermal expansion load (pipe on bolt) considered? 2. Is effect of bolt preload considered?			X	
11. Base Plates and Anchor Bolts: a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8. b. Does anchor bolt design meet the requirement of Cygna Criteria 84042-DC-2, Section 4.5? c. As a minimum, check the following items: 1. Center-to-center spacing 2. Edge distance from concrete edge 3. Anchor allowable load 4. Embedment length 5. Reduced allowable load 6. Combined tension and shear			X	
12. Richmond Structural Connection Inserts? Check for consistency with: a. Cygna Criteria 84042-DC-2, Section 4.6.	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-107
Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2				Date	3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. G&H Specification No. 2323-SS-30, Appendix 3.				
c. As a minimum, check the following items:				
1. Allowable loads	X			
2. Center-to-center spacing	X			
3. Edge distance from concrete edge	X			
4. Combined tension and shear	X			
5. Allowable loads of bolt	X			
d. Is the base plate within allowable stresses?	X			
13. Civil Anchors and Thru-Bolts:				
a. Embedded Civil or Grouted Structural Anchor: Does it meet G&H spacing and allowable load requirements? Refer to Cygna Criteria 84042-DC-2, Section 4.8.			X	
b. Thru-Bolts: Does it meet the bolt allowable stress requirements of the ASME Code?			X	
c. Is the base plate within allowable stress?			X	
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H Specification No. 2323-SS-30, Appendix 4 or Appendix 5, as applicable?			X	

Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-107
Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2				Date	3/13/84

Item	Satisfactory: Yes	No	N/A	Comments
15. Support attachment/connection to supporting structural element: a. Has the design calculation included the design of support attachment/connection points? b. Is it acceptable? c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI) f. Steamhammer (SHL) g. Relief Valve Discharge (RV) h. LOCA (See Cygna Criteria 84042-DC-2 for definitions.)			X	Covered in Cygna's pipe stress review.
17. Has the weight of the support been included in the design?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	**Approver**	J. Minichiello	**Checklist No.**	PS-107

Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2 **Date** 3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
18. Has the inertial load of the support been included in the design?		X		Since the member and connection stresses are low, it does not appear that the allowable stresses will be exceeded if inertial loads of the support were included in the design. Refer to Note 7.
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		Stiffness calculated was not provided but the maximum deflection is less than 1/16". Refer to Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-003-005-C72K

Reviewer	M.T. deGuzman/C. Wong	Approver	J. Minichiello	Checklist No.	PS-107
Calculation No. MS-1-003-005-C72K, Rev. 1; B&R Drawing No. MS-1-003-005-C72K, Rev. 2				Date	3/13/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements:				Stanchion stress, pad plate stress and weld stress connecting the above are not checked, but will be checked by NPSI (Secaucus) as explained in Note 2.
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 3, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full <u>unstiffened</u> span?			X	
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-009-C72K

Reviewer M.T. deGuzman/C. K. Wong **Approver** J. Minichiello **Checklist No.** PS-111

Calculation No. MS-1-003-009-C72K, Rev. 4; B&R Drawing No. MS-1-003-009-C72K, Rev. 6 **Date** 3/17/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.3.	X X			Final as-built loads and movements are lower than design loads by approximately 4%; design is acceptable.
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			X	
5. Restraints: a. Check whether the design conforms to the piping analysis restraint requirements. b. Check for consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2, (Box Restraint).	X		 X	
6. Spring Supports: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Sections 3.6.2.2.3 and 3.6.2.2.4. b. Cygna Criteria 84042-DC-2, Section 4.1.4.			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-009-C72K

Reviewer M.T. deGuzman/C. K. Wong Approver J. Minichiello Checklist No. PS-111

Calculation No. MS-1-003-009-C72K, Rev. 4; B&R Drawing No. MS-1-003-009-C72K, Rev. 6 Date 3/17/84

Item	Satisfactory Yes	No	N/A	Comments
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?	 X	 X X		 See Note 8. Computed displacement is less than 1/16"
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See comments under Item 24.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Stiffener stress near load application is not checked, but is acceptable.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-009-C72K

Reviewer M.T. deGuzman/C. K. Wong **Approver** J. Minichiello **Checklist No.** PS-111

Calculation No. MS-1-003-009-C72K, Rev. 4; B&R Drawing No. MS-1-003-009-C72K, Rev. 6 **Date** 3/17/84

Item	Satisfactory: Yes	No	N/A	Comments
24. Code Allowable Stress Requirements: a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4? b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6? c. For buckling, is the appropriate length used, considering the full <u>unstiffened</u> span?	 X X X			Material Item 9, 20"ϕ trunion, is qualified by engineering judgement (Sheet 23 of calculation.) Since the calculation shows the attaching weld stress is low, the trunnion is acceptable.
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?		X		NPS Calculation Sheet 22 shows that for Item 11, plate thickness re quired = 2" without stiffeners. It also provides 4 1"-thick stif- feners as an alternative design with a 1" plate for item 11. Al- though no calculations are done, Cygna's review shows the 1" plate with stiffeners acceptable. Design calculation for weld between 1" plate and Built-up section shows 3/4" fillet weld all around whereas Drawing shows on 1/2" fillet weld on all 4 sides. (Sheet 26 of cal- culation). However, the weld stress is still acceptable based on 21 ksi allowable stress.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-011-C72K

Reviewer S. Luo/C. Wong CKW **Approver** J. Minichiello JZM **Checklist No.** PS-113

Calculation No. MS-1-003-011-C72K, Rev. 1; B&R Drawing No. MS-1-003-011-C72K, Rev. 2 **Date** 3/10/84

Item	Satisfactory: Yes	Satisfactory: No	Satisfactory: N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads	X			
b. Dimensions		X		8 3/8" distance between the centerline of E-W tube (item 1) and south insert bolt was shown on the drawing. But 18-3/8" was used in the STRUDL model. 18-3/8" is the correct dimension per TUGCO field verification (Item 39, June 8, 1984 response).
c. Member sizes	X			Incorrect modeling of member end points (point of fixity) - reaction point for member (1) TS 6"x6"x3/8" is taken at centerline of base plate. But centerline of weld between the TS & base plate does not coincide with centerline of base plate. This is acceptable since off-set is small and interaction value is low.
d. Drawings/Configuration	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-011-C72K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-113

Calculation No. MS-1-003-011-C72K, Rev. 1; B&R Drawing No. MS-1-003-011-C72K, Rev. 2 **Date** 3/10/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X X X		Stiffness calculation was not provided. See Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		The applied forces were not transferred to the centroid of the weld pattern (e.g. T.S. to base plate connection). However, weld stress still acceptable as per Cygna calculation Set No. A6. **See observation PS-05.**

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-013-S72K

Reviewer S. Luo/C.K. Wong | Approver J. Minichiello | Checklist No. PS-115

Calculation No. MS-1-003-013-C72K, Rev. 2; B&R Drawing No. MS-1-003-013-C72K, Rev. 3 | Date 4/24/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods			X	
8. Snubbers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6.	X			Swing angle was not checked in design calculation. However, it meets the allowable (see Cygna Calculation D1, File 84042/4F).
b. Cygna Criteria 84042-DC-2, Section 4.1.6.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable loads	X			
2. Pin-to-pin dimension	X			
3. Cold setting	X			
4. 1/4" stroke in excess of thermal movement	X			
5. Swing angle	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-003-013-S72K

Reviewer S. Luo/C.K. Wong   Approver J. Minichiello   Checklist No. PS-115

Calculation No. MS-1-003-013-C72K, Rev. 2; B&R Drawing No. MS-1-003-013-C72K, Rev. 3   Date 4/24/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
c. As a minimum, check the following items:				analysis performed, the moments, Mx, due to snubber load 26777 lbs. and component force (due to vertical thermal movement) are not considered. Hence it is not acceptable. Per TUGCO's response dated 6/8/84, the bolts and baseplates are acceptable (Question #45). Interaction ratio for super Hilti Bolts = 0.83 based on safety factor of 4.
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			
5. Reduced allowable load			X	
6. Combined tension and shear	X			
12. Richmond Structural Connection Inserts: Check for consistency with:			X	
a. Cygna Criteria 84042-Dc-2, Section 4.6.				
b. G&H Specification No. 2323-SS-30 Appendix 3.				
c. As a minimum, check the following items:				
1. Allowable loads				
2. Center-to-center spacing				
3. Edge distance from concrete edge				
4. Combined tension and shear				
5. Allowable loads of bolt				
d. Is the base plate within allowable stresses?				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-003-014-C72K

Reviewer M. T. DeGuzman/C. Wong CKW		**Approver** J. Minichiello JM		**Checklist No.** PS-116	
Calculation No. MS-1-003-014-C72K, Rev. 11; B&R Drawing No. MS-1-003-014-C72K, Rev. 11				**Date** 3/21/84	

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Loads used in design calculations are 3.4% to 6.2% higher than loads taken from pipe stress output. This conservative and acceptable. Also see **Observation PI-00-06.**
b. Dimensions		X		Dimensions used in computer model for members 2 & 11 is 5.25." Correct value is 8". The effect is negligible.
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-003-014-C72K, Rev. 11.				
a. Assumptions	X			
b. Design Methodology	X			
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.3.	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-002-S72R

Reviewer R. Baliga/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-118

Calculation No. MS-1-004-002-S72R, Rev. 2; B&R Drawing No. MS-1-004-002-S72R, Rev. 2 **Date** 3/6/84

Item	Satisfactory: Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items: a. Loads b. Dimensions c. Member sizes d. Drawings/Configuration	 X X X X			Since this support and MS-1-002-002-S72R are similar, the design is based on the higher set of loads, i.e., those from MS-1-002-002-S72R.
2. Check the acceptability of the design of Calculation No. MS-1-004-002-S72R, Rev. 2. a. Assumptions b. Design Methodology	X			Strut, rear bracket and Item 7 were not designed. However, they are OK per Cygna Calculation Set No. A4.
3. Loading Combinations: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.3.	 X X			
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-003-S72R

Reviewer S. Luo/C. Wong CKW	**Approver** J. Minichiello JCM	**Checklist No.** PS-119			
Calculation No. MS-1-004-003-S72R, Rev. 2; B&R Drawing No. MS-1-004-003-S72R, Rev. 4		**Date** 3/19/84			

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Normal & upset load of 59548 lbs. governs but was not used in design. Emergency load 47777 lbs. was used in design. Ratio = $\frac{59548}{47777}$ = 1.23
b. Dimensions	X			However, it is acceptable since the stresses are low.
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-004-003-S72R, Rev. 2.				The auxiliary steel provided for stability of the support is not designed (Reference **Observation PS-02**). The review of this support is limited to the members considered in the design calculation.
a. Assumptions	X			
b. Design Methodology		X		
3. Loading Combinations: Check for consistency with:				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-003-S72R

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-119

Calculation No. MS-1-004-003-S72R, Rev. 2; B&R Drawing No. MS-1-004-003-S72R, Rev. 4 **Date** 3/19/84

Item	Satisfactory: Yes	No	N/A	Comments
9. Strut:				
Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1.	X			
b. Cygna Criteria 84042-DC-2, Section 4.1.7.	X			
c. As a minimum, the following items shall be checked:				
1. Allowable load	X			
2. Pin-to-pin dimension	X			
3. Swing angle	X			
10. U-Bolt:				U-Bolt qualified using .6Fy (see Note 5).
a. Is load within U-Bolt allowable load?	X			
b. Is the U-Bolt used as a two-way restraint?			X	
c. Is lateral stiffness considered in the calculations?			X	
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?			X	
2. Is effect of bolt preload considered?			X	
11. Base Plates and Anchor Bolts:			X	
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.				
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?				

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-003-S72R

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-119

Calculation No. MS-1-004-003-S72R, Rev. 2; B&R Drawing No. MS-1-004-003-S72R, Rev. 4 **Date** 3/19/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members acceptable in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?		X		Incorrect method used to check composite section weld. Stress is acceptable per Cygna calculation. **See Observation PS-07.**
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Plate Material Item 8 failed in local stress calculation as indicated on Sheet 4 of 8 and was referred to analysis SA-4198 for resolution, but no local stress calculation for Item 8 is provided in the analysis. Further Cygna calculations (Set E4) show the plate acceptable (the designer used a very conservative method).
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			See comments under Items 2 and 23.
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-004-S72R

Reviewer C. Wong **Approver** J. Minichiello **Checklist No.** PS-120

Calculation No. MS-1-004-004-S72R, Rev. 1; B&R Drawing No. MS-1-004-004-S72R, Rev. 2 **Date** 3/20/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
18. Has the inertial load of the support been included in the design?		X		See Note 7.
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X X X		No stiffness calculation provided. See Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X	X		Incorrect section properties for weld between Items 17 and rear bracket and base plates. The weld was designed based on larger

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-001-C72S

Reviewer M.T. deGuzman/C.K. Wong CKW **Approver** J. Minichiello JRM **Checklist No.** PS-123

Calculation No. MS-1-004-001-C72S; Rev. 3; B&R Drawing No. MS-1-004-001-C72S; Rev. 5 **Date** 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Load used in design is slightly different from latest pipe stress analysis, but there is no design impact. **See Observation PI-00-06.** This gang hanger carries pipe support MS-1-004-002-C72S. Total load from this carried pipe support = 18906 + 600 ≅ 19506 lbs.
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-004-001-C72S, Rev. 3.				
a. Assumptions		X		Welded joints to embedment plate should take all the shear load and anchor bolt-base plate should be considered as ineffective in taking shear loads. **See Observation PS-06.** Fixed joint at embedment plate was modeled in the STRUDL analysis rather than as pinned joint, as required by 2323-SS-30. See Note 13.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-001-C72S

Reviewer M.T. deGuzman/C.K. Wong Approver J. Minichiello Checklist No. PS-123

Calculation No. MS-1-004-001-C72S; Rev. 3; B&R Drawing No. MS-1-004-001-C72S; Rev. 5 Date 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
b. Design Methodology	X			Based on Cygna's calculation (84042, 4-F, Set A7), the weld joints at embedment plate can take the additional shear load from the Hilti bolts. The moments at the connections to the embedment plates are quite small, the embedment plates will be adequate. However, the final acceptability of the embedment plates should be verified by the Civil/Structural group of Gibbs & Hill.
3. Loading Combinations: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.3.	 X X			Two loading cases were considered: a) Normal Condition b) Hydro-test Condition Hydro-test condition loads are twice as much as loads from Normal condition (see NPS calculations).
4. Gap (if applicable): a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-002-C72S

Reviewer M.T. deGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-124

Calculation No. MS-1-004-002-C72S, Rev. 3; B&R Drawing No. MS-1-004-002-C72S, Rev. 5 **Date** 3/15/84

Item	Satisfactory: Yes	Satisfactory: No	Satisfactory: N/A	Comments
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			X	
5. Restraints: a. Check whether the design conforms to the piping analysis restraint requirements. b. Check for consistency with G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. (Box Restraint)			X	
6. Spring Supports: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Sections 3.6.2.2.3 and 3.6.2.2.4.	X			Load capacity @ 350° = 9,800 lbs. for N/U condition.
b. Cygna Criteria 84042-DC-2, Section 4.1.4.	X			Actual load (N/U)
c. As a minimum, the following items shall be checked: 1. Variability of spring force			X	$\frac{19794}{2}$ + wt. = 9,897 + 700 = 10,597 lbs. <1.1 x 9,800 = 10,780 lbs. Note that 10% adjustment is allowed by the manufacturer.
2. Cold load	X			
3. Allowable loads	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-002-C72S

Reviewer M.T. deGuzman/C. Wong **Approver** J. Minichiello **Checklist No.** PS-124

Calculation No. MS-1-004-002-C72S, Rev. 3; B&R Drawing No. MS-1-004-002-C72S, Rev. 5 **Date** 3/15/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
4. Available travels	X			
5. Swing angle/off-set	X			Negligible.
7. Rod Hangers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.2. b. Cygna Criteria 84042-DC-2, Section 4.1.5. c. As a minimum, the following items shall be checked: 1. Rod size 2. Allowable load 3. Swing angle/off-set 4. Bending or torsion on rods			X	
8. Snubbers: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.6. b. Cygna Criteria 84042-DC-2, Section 4.1.6. c. As a minimum, the following items shall be checked: 1. Allowable loads 2. Pin-to-pin dimension 3. Cold setting 4. 1/4" stroke in excess of thermal movement 5. Swing angle			X	

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-003-C72S

Reviewer E. Kuo/C. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-125

Calculation No. MS-1-004-003-C72S, Rev. 3; B&R Drawing No. MS-1-004-003-C72S, Rev. 7 **Date** 3/19/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Spring load from stress analysis is about 3% higher than the design load. However, it is acceptable since it is within the working range of the spring. See Observation PI-00-06.
b. Dimensions	X			
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-004-003-C72S, Rev. 3.				
a. Assumptions	X			
b. Design Methodology	X			Note that the weld between 3/4" x 7" x 20" plate and the spring load flange was not checked to ensure composite section action. (Sheet 8 of calculation). However, the final design uses a 1 1/2" plate which does not require composite action, therefore it is acceptable.
3. Loading Combinations: Check for consistency with:				
a. G&H Specification No. 2323-MS-46A, Rev. 5,				

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-004-C72K

Reviewer	S. Luo/C. Wong CKW	**Approver**	J. Minichiello JM	**Checklist No.**	PS-126
Calculation No. MS-1-004-004-C72K, Rev. 2; B&R Drawing No. MS-1-004-004-C72K, Rev. 3				**Date**	4/24/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items: a. Loads b. Dimensions c. Member sizes d. Drawings/Configuration	 X X X	 X		Part of design calculation was based on the result of previous analysis which had higher applied loads. **See Observation PI-00-06.**
2. Check the acceptability of the design of Calculation No. MS-1-004-004-C72K, Rev. 2. a. Assumptions b. Design Methodology	 X	 X		In the computer model at joints 3 and 11 (members 17 and 18) all the member end moments should be released according to the joint detail provided. Only local Mz was released in the analysis. However it is acceptable since the movements at these joints are small. See Cygna Calculation set E6 (84042, 4-F). Per G&H Specification 2323-SS-30, connection at embedment plate should be modelled as pinned-joint, for nodes 7 and 9 in the model only M_z is released. See Note 13. The effect of the loads from the whip plate (Section "D-D") was not

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-004-C72K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-126

Calculation No. MS-1-004-004-C72K, Rev. 2; B&R Drawing No. MS-1-004-004-C72K, Rev. 3 **Date** 4/24/84

Item	Satisfactory Yes	No	N/A	Comments
c. As a minimum, the following items shall be checked:				
1. Allowable load				
2. Pin-to-pin dimension				
3. Swing angle				
10. U-Bolt:			X	
a. Is load within U-Bolt allowable load?				
b. Is the U-Bolt used as a two-way restraint?				
c. Is lateral stiffness considered in the calculations?				
d. If U-Bolt is used as a clamp,				
1. Is thermal expansion load (pipe on bolt) considered?				
2. Is effect of bolt preload considered?				
11. Base Plates and Anchor Bolts:				Component forces due to the swing angle were not considered in base plate analysis. However, the bolt and plate will still be adequate since the component forces were small and a sufficient safety margin is shown in the calculation (interacton was 0.52).
a. Check for consistency with Cygna Criteria 84042-DC-2, Section 4.1.8.	X			
b. Does anchor bolt design meet the requirement of Cygna criteria 84042-DC-2, Section 4.5?	X			
c. As a minimum, check the following items:				
1. Center-to-center spacing	X			
2. Edge distance from concrete edge	X			
3. Anchor allowable load	X			
4. Embedment length	X			
5. Reduced allowable load			X	
6. Combined tension and shear	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-004-C72K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-126

Calculation No. MS-1-004-004-C72K, Rev. 2; B&R Drawing No. MS-1-004-004-C72K, Rev. 3 **Date** 4/24/84

Item	Satisfactory: Yes	No	N/A	Comments
14. Structural Embedment Plates: Does it meet the allowable load and spacing requirements of G&H specification No. 2323-SS-30 Appendix 4 or Appendix 5, as applicable?	X			Bolt locations are not shown on the drawing. There is a whip plate 1" away from the Item 10 which was not considered in design calculation. Gibbs & Hill shall verify the acceptability of the embedded plate (see Note on Sheet 1 of drawing).
15. Support attachment/connection to supporting structural element:				
a. Has the design calculation included the design of support attachment/connection points?	X			No calculation provided for the connections between Item 1 and existing whip restraint. However, it is acceptable per Cygna's calculation set E6.
b. Is it acceptable?	X			
c. Have potential effects of reduced areas (due to bolt holes) been considered?			X	
16. Inspect Loadings for reasonableness: a. Dead Load (DL) b. Thermal (TH) c. Safe Shutdown Earthquake (SSE) d. Pipe Impact (PI) e. Jet Impingement (JI)			X	Covered in Cygna's pipe stress review.

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-004-C72K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-126

Calculation No. MS-1-004-004-C72K, Rev. 2; B&R Drawing No. MS-1-004-004-C72K, Rev. 3 **Date** 4/24/84

Item	Satisfactory Yes	No	N/A	Comments
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See comments under Items 2 and 14.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Joint 1 (joint 13 similar) where W10 x 48 are connected to the whip restraint, the weld was not checked, but it is acceptable per Cygna's calculation. Weld between Items 5 and 6 was not checked. However, it is adequate per Cygna calculation set E6.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			See Items 2, 14 and 22.
24. Code Allowable Stress Requirements:				See comment under Items 2, 11, 14, 15, and 22.
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?	X			

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-004-C72K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-126

Calculation No. MS-1-004-004-C72K, Rev. 2; B&R Drawing No. MS-1-004-004-C72K, Rev. 3 **Date** 4/24/84

Item	Satisfactory: Yes	No	N/A	Comments
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-005-C72K

Reviewer E. Kuo/C. Wong CKW Approver J. Minichiello JCM Checklist No. PS-127

Calculation No. MS-1-004-005-C72K, Rev. 4; B&R Drawing No. MS-1-004-005-C72K; Rev. 3 Date 4/2/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items: a. Loads b. Dimensions c. Member sizes d. Drawings/Configuration	 X X X	 X		Loads from pipe stress analysis are higher than (7.3%) those used in the design. Cygna calculations indicate the increase is acceptable. See **Observation PI-00-06.**
2. Check the acceptability of the design of Calculation No. MS-1-004-005-C72K, Rev. 4. a. Assumptions b. Design Methodology	 X X			
3. Loading Combinations: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.3.	 X X			
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2.			 X	

Independent Design Review Checklist

PIPE SUPPORT MS-1-004-005-C72K

Reviewer E. Kuo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-127

Calculation No. MS-1-004-005-C72K, Rev. 4; B&R Drawing No. MS-1-004-005-C72K; Rev. 3 **Date** 4/2/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
19. Friction Loads: a. Has friction load been included in the support design? b. Is friction considered in the appropriate direction(s)?			X	
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1? b. Is actual stiffness computed? c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X X		Stiffness was not provided. See Note 8.
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Stress check of some members was not provided, but acceptable per CYGNA Calculation Set No. E5. Pad stress (material items 13) will be checked by NPSI (Secaucus). See Note 2.
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			Design of welds between items (35) and (9) is based on engineering judgement. However, it is acceptable per Cygna's Review Calculation Set. No. E4.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-009-C62K

Reviewer S. Luo/C. Wong CKW Approver J. Minichiello JCM Checklist No. PS-129

Calculation No. MS-1-004-009-C62K, Rev. 2; B&R Drawing No. MS-1-004-009-C62K, Rev. 6 Date 3/16/84

Item	Satisfactory Yes	No	N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items: a. Loads b. Dimensions c. Member sizes d. Drawings/Configuration	 X X X	 X		Loads used in the design calculation do not match the loads from the latest pipe stress computer output (higher loads were used in design, therefore they are acceptable). **See Observation PI-00-06.**
2. Check the acceptability of the design of Calculation No. MS-1-004-009-C62K, Rev. 2. a. Assumptions b. Design Methodology	 X X			Item 2 (pad) was not checked, and is the responsibility of NPSI (Secaucus). See Note 2.
3. Loading Combinations: Check for consistency with: a. G&H Specification No. 2323-MS-46A, Rev. 5, Section 3.6.2.2.1. b. Cygna Criteria 84042-DC-2, Section 4.3.	 X X			
4. Gap: a. Check for consistency with Cygna Criteria 84042-DC-2 Section 4.1.2. b. Does the gap accommodate thermal and seismic movements in the unrestrained directions?			 X X	

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-009-C62K

Reviewer S. Luo/C. Wong **Approver** J. Minichiello **Checklist No.** PS-129

Calculation No. MS-1-004-009-C62K, Rev. 2; B&R Drawing No. MS-1-004-009-C62K, Rev. 6 **Date** 3/16/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
20. Design Interface Requirements: a. Stiffness: Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.1?		X		Stiffness was not calculated in design calculation but deflection was less than 1/16". See Note 8.
b. Is actual stiffness computed?		X		
c. Does the stiffness include all support elements, including baseplates and anchor bolts?		X		
21. Is the design of the support frame member in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?			X	
24. Code Allowable Stress Requirements: a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-007-C72K

Reviewer R. Baliga/C. K. Wong CKW **Approver** J. Minichiello JCM **Checklist No.** PS-130

Calculation No. MS-1-004-007-C72K, Rev. 4; B&R Drawing No. MS-1-004-007-C72K, Rev. 6 **Date** 3/22/84

Item	Satisfactory Yes	Satisfactory No	Satisfactory N/A	Comments
1. Design Input Data: Check that all data are used correctly. As a minimum, check the following items:				
a. Loads		X		Loads in design calculation are slightly different from those in latest pipe stress analysis, but there is no design impact. **See Observation PI-00-06.**
b. Dimensions	X			Member properties were not calculated for members 11 to 16 for STRUDL input. However, they are correct based on Cygna calculation. (Refer to Cygna Binder 84042/4-F, Calculation Set No. E2.)
c. Member sizes	X			
d. Drawings/Configuration	X			
2. Check the acceptability of the design of Calculation No. MS-1-004-007-C72K, Rev. 6.				
a. Assumptions	X			
b. Design Methodology	X			Weld capacities for all the composite sections were not qualified in the design calculation. However, they are OK based on Cygna calculation. (Refer to Cygna Binder 84042/4-F, Calculation Set No. E2. Pad stress was not checked. (Item 55.) See Note 2.

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Independent Design Review Checklist

PIPE SUPPORT MS-1-004-008-C72K

Reviewer R. Baliga/C. Wong **Approver** J. Minichiello **Checklist No.** PS-131

Calculation No. MS-1-004-008-C72K, Rev. 4; B&R Drawing No. MS-1-004-008-C72K, Rev. 6 **Date** 3/15/84

Item	Satisfactory: Yes	No	N/A	Comments
22. Is the design of the welded connection of the members in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			No weld calculation provided but acceptable per Cygna calcuation set A4.
23. Is the design of the member connection, including local stiffening, adequate for load transfer in accordance with Cygna Criteria 84042-DC-2, Section 4.1.10?	X			
24. Code Allowable Stress Requirements:				
a. Does the design meet the requirements of Cygna Criteria 84042-DC-2, Section 4.4?	X			Member and weld stresses were not calculated but they are acceptable per Cygna calculation Set A4.
b. Does the design meet the requirements of G&H Specification 2323-MS-46A, Rev. 5, Section 3.6?	X			
c. For buckling, is the appropriate length used, considering the full unstiffened span?			X	
25. As-Built Support: Do the dimensions, section properties and configuration of the as-built support conform to the final design calculation?		X		Support elevation in Section B-B is incorrectly shown.

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