Nebraska Public Power District

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August 1, 1979

Mr. Karl V. Seyfrit, Director
U.S. Nuclear Regulatory Commission
Office of Inspection and Enforcement
Region IV
611 Ryan Plaza
Suite 1000
Arlington, TX 76011

Subject: IE Bulletin 79-14 "Seismic Analysis for
As-Built Safety-Related Piping Systems"

Dear Mr. Seyfrit:

Enclosed please find the 30 day response requested in Item No. 1 of the subject bulletin. The enclosed discusses all safety-related piping at Cooper Nuclear Station with the exception of the piping systems analyzed by the NSSS Vendor (i.e. Recirc piping and Main Steam piping within the drywell). This information will be provided along with the response to Item No. 2 by August 31, 1979.

If you have any questions pertaining to this response, please call me.

Sincerely,

Jay M. Pilant
Director of Licensing
and Quality Assurance

JDW/cmk

Enclosure

Add: Pm- V. Rodney
R. La Grange
S. Hosford

cc: Director of the Office of Inspection and Enforcement
U.S. Nuclear Regulatory Commission
Washington, DC 20555

✓Director of the Division of Operating Reactors
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

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RESPONSE TO IE BULLETIN 79-14 (REVISION 1)

ITEM NO. 1

The major inspection elements to be used in verifying that the seismic analysis input information conforms to the actual configuration of safety-related systems are contained in the seismic and gravity load piping isometrics for each system and the Jelco-Grinnell detail deadweight and seismic support drawings. For each system, the line will be walked to review the following:

1. Line geometry agrees with isometric.
2. Line support system (deadweight and seismic) agrees with isometric for:
    a. Location
    b. Configuration (including type of attachments)
    c. Function (seismic and/or deadweight support)
    d. Pipe clearance values as shown on Jelco-Grinnell detail drawing
    e. All embedments properly identified (plates, inserts, etc.)
3. Location of valve and valve operator from nearest pipe support for valve location, and centerline of pipe for valve operator as well as its orientation.
4. Location of any miscellaneous pipe attachments.

All non-conformances will be noted and reviewed to see if the operability of the system will be affected. Modifications of non-conformances will be made to bring each system within design parameters.

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The fundamental criteria for input information for seismic analysis are contained in the Cooper Nuclear Station FSAR Sections as noted below:

<u>Seismic Loading Criteria and Analysis - Volume VI, Appendix C</u>

(Attachment 1)

For piping, this Section states in part, that piping systems were dynamically analyzed using the "response spectrum method" of analysis with mathematical model consisting of lumped masses at discrete points (including valve and valve operator masses) connected by weightless elastic elements. Input to the dynamic analyses were the 0.5% damped acceleration response spectra for the applicable floor elevation. Results for earthquakes in the X and Y (vertical) directions simultaneously, and Z and Y directions simultaneously were computed separately. The maximum responses of each mode are combined by the root mean square method to give the maximum quantities resulting from all modes.

<u>Classification of Structures and Equipment - Volume V, Section 2.0</u>

(Attachment 2)

The two classes of structures applicable to the earthquake design requirements are as follows:

Class I - This class includes those structures, equipment, and components whose failure or malfunction might cause or increase the severity of an accident which would endanger the public health and safety. This category includes those structures, equipment, and components required for safe shutdown and isolation of the reactor.

Class II - This class includes those structures, equipment, and components which are important to reactor operation, but are not essential for preventing an accident which would endanger the public health and safety, and are not essential for the mitigation of the consequences of these accidents. A Class II designated item shall not degrade the integrity of any item designated Class I.

This Section 2.0 presents a listing of Class I Structures and Equipment and Class II Structures and Equipment. A description of principal structures is presented for the Reactor Building, Turbine Building, and Control Building, of which the Reactor Building and Control Building are Seismic Class I.

Classification of Piping and Equipment Pressure Parts, Volume VI, Appendix A

(Attachment 3)

For the purpose of identification and association of requirements, piping and equipment pressure parts are classified in accordance with one of two basic principles:

G.E. Company Classification and Pressure Integrity Requirements, which include 11 Classes of piping and equipment pressure parts

Engineer - Constructor's Classification and Definition of Piping and In-Line Pressure Parts, which include four Functional Classes and two Seismic Classes of piping and in-line pressure parts

This Section provides definitions for all the aforementioned Classes and also provide a Tabulation of Classifiction Equivalencies between G.E. Company Classes and Engineer - Constructor Classes.

This Section also provides Engineer - Construction Classification and Definition of Equipment as Class I or Class II; with their respective definitions.

Piping orthographic drawings are the basic documents from which the stress and fabrication isometric drawings are developed. Because of the sequence in which the design is developed, and because the piping orthographic drawings do not reflect as-built conditions, they are not inspection elements and are not included in the attachments.

EDS performed the analysis of those systems which were dynamically analyzed for seismic loads. This analysis was based on complete stress isometrics which were drawn by Burns and Roe. Tabulated on these stress isometrics were information on geometric input, appropriate seismic response spectra, and valve weights. Thus, the stress isometrics included information which is normally available only in supplementary documents. The fabrication isometrics were prepared by Jelco, the mechanical installation contractor. Grinnell, the pipe support subcontractor, superimposed pipe support locations and other related information. During construction, Jelco took over the pipe support work from Grinnell. As part of this expanded effort, they performed the Grinnell function for the pipe support design. In some cases, there are two sets of fabrication isometrics, one of which shows supports for dead weight and thermal conditions, the other of which shows supports for seismic conditions.

Burns and Roe provided a formal review function of this work. During the course of the work, fabrication isometrics were revised to show as-built conditions. Attachment 4 is a tabulation of stress and fabrication isometric drawings which serve as inspection elements to verify that the seismic analysis information conforms to the actual system configuration.

All Seismic Category I piping not dynamically analyzed was designed on the basis of an equivalent static load. This static equivalent seismic design is based on span charts and load factors which appear as Attachment 5. For this piping, no stress isometrics were prepared. For the large diameter piping in this category, fabrication isometrics were prepared. These isometrics show piping support locations and identify pipe support type. In this case, verification must consist of comparing the fabrication isometrics with the field conditions and then assuring that the support locations are consistent with proper utilization of the span charts and load factor tables in Attachment 5.

The piping which was seismically designed on the basis of span charts and load factor tables was originally identified in Requests for Contract Changes to "Mechanical Pipe Equipment and Erection Contract No. E69-4". The specific piping identified in these contract changes is tabulated in Attachment 6. The fabrication isometrics for this piping, where applicable, are listed in Attachment 4.

The piping to be inspected in response to Item 2 of IE Bulletin No. 79-14 is tabulated in Attachment 7. The piping to be inspected in response to Item 3 of IE Bulletin No. 79-14 is tabulated in Attachment 8.

ATTACHMENT 1
FSAR - VOLUME VI - APPENDIX C
COOPER NUCLEAR STATION
DOCKET NO. 50-298

3.3.3 Piping

3.3.3.1 Piping Flexibility Analysis

The piping has been analyzed for the effects of dead loads, external loads, and thermal loads. Stresses calculated are combined bending and torsional stresses in accordance with ANSI B31.1.0. Power Piping and intensifications factors were applied in accordance with B31.1.0. Several pressure temperature cycles were evaluated and the cycle representing the worst for thermal expansion stresses was selected for the design case. All critical points were evaluated to the stress limits of B31.1.0 and, in addition, events with very low probability of occurrence were analyzed and stresses at all critical points compared with the limits defined in this loading criteria. At several selected points, an analysis was made for fatigue damage using methods based on ANSI B31.7. The load combination, allowable stresses, identification of points of highest stress and highest stress values are summarized in Table C-3-7, LOADING CRITERIA.

3.3.3.2 Piping Seismic Analysis

The piping systems were dynamically analyzed using the "response spectrum method" of analysis. For each of the piping systems, a mathematical model consisting of lumped masses at discrete joints connected together by weightless elastic elements was constructed. Valves were also considered as lumped masses in the pipe, and valve operators as lumped masses acting through the operator center of gravity. Where practical, a support is located on the pipe at or near each valve. Stiffness matrix and mass matrix were generated and natural periods of vibration and corresponding mode shapes were determined. Input to the dynamic analyses were the 0.5% damped acceleration response spectra for the applicable floor elevation. The increased flexibility of the curved segments of the piping systems was also considered. The results for earthquakes acting in the X and Y (vertical) directions simultaneously, and Z and Y directions simultaneously were computed separately. The maximum responses of each mode are calculated and combined by the root mean square method to give the maximum quantities resulting from all modes. The response thus obtained was combined with the results produced by other loading conditions to compute the resultant stresses.

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2.0 STRUCTURAL DESIGN

2.1 Classification of Structures and Equipment

2.1.1 General

The two classes of structures applicable to the earthquake design requirements are as follows:

Class I - This class includes those structures, equipment, and components whose failure or malfunction might cause or increase the severity of an accident which would endanger the public health and safety. This category includes those structures, equipment, and components required for safe shutdown and isolation of the reactor.

Class II - This class includes those structures, equipment, and components which are important to reactor operation, but are not essential for preventing an accident which would endanger the public health and safety, and are not essential for the mitigation of the consequences of these accidents. A Class II designated item shall not degrade the integrity of any item designated Class I.

The only exception of these two definitions is that a system whose failure or malfunction might increase the severity of an accident is not designed to withstand the effects of a tornado if the failure of the system will not cause an accident. The reason for this exception is that the probability of the occurrence of a design basis loss-of-coolant accident or a design-basis tornado during the life of the plant is small, therefore, the probability of the simultaneous occurrence of these two independent events is vanishingly small.

2.1.2 Class I Structures and Equipment

Structures
Reactor Building
Control Building
Elevated Release Point
Intake Structure
Diesel Generator Building
Radwaste Building (Below grade)
Controlled Corridor

Equipment
Nuclear Steam Supply System
- Reactor Primary Vessel
- Reactor Primary Vessel Supports
- Control Rods and Drive System including equipment necessary for scram operation
- Control Rod Drive Housing Supports
- Fuel Assemblies
- Core Shroud
- Core Supports
- Steam Separator
- Steam Dryer

501 056

Reactor Coolant Recirculation System Piping including valves and pumps

All piping connections from the Reactor Primary Vessel up to and including the first isolation valve external to the drywell isolation valves

Reactor Core Cooling and Station Standby Systems

- Reactor Core High Pressure Coolant Injection System (including auxiliary condensate storage tanks)
- Reactor Building floor drain sump pumps
- Reactor Core Isolation Cooling System
- Standby Liquid Control System
- Reactor Core Spray Cooling System
- Portion of Reactor Building Closed Cooling Water System associated with RHR system.
- Reactor Core Residual Heat Removal System and its associated Service Water System
- Radwaste storage tanks including Reactor Building cleanup phase separators
- Station Instrumentation Air System

Station Standby Gas Treatment System

Portion of Station Service Water System associated with Reactor Water System and its auxiliaries

Fuel Storage Facilities, to include spent fuel and new fuel storage equipment

Standby Electrical Power Systems

- Station Battery System
- Standby Diesel Generator System and auxiliaries
- Emergency Buses and other electrical gear and power to critical equipment

All instrumentation and controls required for operation of Class I equipment.

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2.0 CLASSIFICATION OF PIPING AND EQUIPMENT PRESSURE PARTS

For the purpose of identification and association of requirements, piping and equipment pressure parts are classified in accordance with one of two basic principles.

2.1 GE Company Classification and Pressure Integrity Requirements

Class A — Piping and equipment pressure parts which cannot be isolated from the reactor vessel.

Class B — Piping and equipment pressure parts, which can be isolated from the reactor vessel by only a single isolation valve.

Class C — Piping and equipment pressure parts other than included in Classes A and B, for a high integrity system.

Class D — Piping and equipment pressure parts which serve as an extension of containment and which operate at either pressures greater than 150 psig or temperatures greater than 212°F.

Class E — Piping and equipment pressure parts which serve as an extension of containment and which operate at pressures equal to or less than 150 psig or temperatures equal to or less than 212°F.

Class F — Piping and equipment pressure parts which transport fibrous or particulate materials such as resins or filter aids and which operate at pressures equal to or less than 150 psig and temperatures equal to or less than 212°F.

Class G — Piping and equipment pressure parts used for acids in concentrations of 60 to 100 percent at ambient temperatures or caustics in concentrations of 50 percent or less at temperatures less than 150°F.

Class H — Piping and equipment pressure parts used for acids in concentrations of 10 percent or less.

Class L — Piping and equipment pressure parts which require materials considerations to maintain deionized water purity.

Class M — Power piping and equipment pressure parts not otherwise classified and which are considered within the scope of USAS B31.1.0, Code for Power Piping.

Class N — Miscellaneous piping and equipment not otherwise classified and not considered within the scope of USAS B31.1.0, Code for Power Piping.

2.2 Engineer - Constructor's Classification and Definition of Piping and In-Line Pressure Parts

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For this project, all piping systems or subsystems and all in-line pressure parts are functionally classified as IN, IIN, IIIN, or IVP, and seismically classified as IS or IIS.

2.2.1 Functional Piping and Equipment Pressure Part Classifications

1. Class IN nuclear piping and in-line pressure parts are those, whose loss or failure could cause or increase the severity of a nuclear incident.

2. Class IIN nuclear piping and in-line pressure parts are those, whose loss or failure could cause a hazard to plant personnel, but would represent no hazard to the public.

3. Class IIIN nuclear piping and in-line pressure parts, are those that normally would be Class IIN, except that the operating pressure does not exceed 150 psig and the operating temperature is below 212°F.

4. Class IVP power piping and in-line pressure parts are those, which are conventional steam and service piping and equipment pressure parts.

2.2.2 Seismic Piping Classifications

1. Class IS seismic piping and in-line pressure parts are those, whose failure would cause significant release of radioactivity or which are vital to a safe shutdown of the plant and removal of decay and sensible heat.

2. Class IIS seismic piping and in-line pressure parts are those, which may be essential to the operation of the station, but which are not essential to a safe shutdown.

2.3 Tabulation of Classification Equivalencies

Classification in Accordance with Definitions of:	
GE Company	Engineer-Constructor
A and B	IN/IS
C and D	IIN/IS and IIN/IIS
E and F	IIIN/IS and IIIN/IIS
F,G,H,L,M and N	IVP/IS and IVP/IIS

2.4 Engineer-Constructor's Classification and Definition of Equipment

Equipment is classified by seismic requirements as follows:

1. Class I equipment is that whose failure would cause significant release of radioactivity or which is vital to a safe shutdown of the plant and removal of decay and sensible heat.

501 059

2. Class II equipment is that which may be essential to the operation of the station but which is not essential to a safe shutdown.

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W.O. 3401-26 Date 7-27-79

ATTACHMENT 4

NRC-IE BULLETIN NO. 79-14, INSPECTION ELEMENTS FOR SAFETY RELATED PIPING SYSTEMS

SYSTEM DESIGNATION	APPLICABLE USAS CODE	CALC. BOOK NO.	B&W/E.D.S. SEISMIC ISOMETRICS	B&R/E.D.S. SEISMIC CALC. NO. & DATE	ALL PIPE STOPS & SEISMIC RESTRAINTS ON FOLLOWING GRINNELL/JELCO ISOMETRICS:		
CORE SPRAY CS-1D, CS-1S CS-2, CS-3	B31.7-CL I&II	8.30.08 8.30.09	1285-5(0),5A(0),6(0)	0700001-005(0) 4/23/70 0700001-006(0) 5/14/70 0700001-016(0)	1501-1 (N-02) 2502-1 (7) 2602-1 (12) 2602-2 (14)	2603-1(13) 2603-2(12) 2603-3(13) 2603-4(11)	
MAIN STEAM MS-1,MS-2	B31.7-CL I&II	8.30.01 8.30.04 8.30.10	1285-1(0),3(0), 1285-10(0),11(0) 1285-90(0)	0700001-001(0),019(0),020(0) 2/28/70. 8/11/70 0700001-003(0) 3/11/70 0700001-025(0) 3/5/71	2506-1 (7) 2506-2 (8) 2506-3 (8) 2506-4 (7)	2601-4 (8) 2614-1 (6) 2614-2 (8) 2614-3 (N-01)	2629-1 (N-01) 2629-2 (8)
REACTOR FEEDWATER RF-1D, RF-1S, RF-1	B31.7-CL I&II	8.30.07	1285-7(0)	0700001-022(0) 8/28/70	2509-1 (N-01) 2509-2 (11)	2623-1 (10) 2623-2 (12)	2623-3 (13)
RESIDUAL HEAT REMOVAL RH-1D, RH-1S, RH-2, RH-3, RH-4	B31.7-CL I&II	8.30.11 8.30.12 8.30.13	1285-2(0),2A(0),2B(0) 1285-4(0),9(0) 1285-29(0),29A(0),45(0)	0700001-021(0) 8/3/70 0700001-002(0) 8/10/70 0700001-007(0) 5/27/70 0700001-008(0) 6/11/70 0700001-021(0) 8/3/70 0700001-009(0) 7/9/70 0700001-010(0) 7/9/70 0700001-023(0) 7/9/70	2510-1 (8) 2510-2 (7) 2510-3 (11) 2510-4 (11) 2510-5 (10) 2511-1 (7) 2624-1 (N-01) 2624-2 (N-02)	2624-3A (10) 2624-3B (8) 2624-3C (7) 2624-4 (6) 2624-5 (10) 2624-6 (7) 2624-7 (12) 2625-1 (10)	2625-2 (11) 2625-3 (8) 2624-4 (10) 2625-5 (7) 2626-1 (12) 2626-2 (11) 2626-3 (9) 2626-4 (13)
REACTOR WATER CLEAN-UP CU-1S	B31.7-CL. I	C.30.16	1285-52(0) 1285-53(0)	0700001-012(0) 6/25/70 0700001-013(0) 6/25/70 0700001-014(0) 6/30/70	2503-1 (7)		
STAND-BY LIQUID CONTROL LC-1S, LC-2S	B31.7-CL. I	—	—	—	2712-1 (7)		
HIGH PRESSURE COOLANT INJECTION HP-2, HP-4, HP-5	B31.7-CL. II	8/30/10	1285-91(0) 1285-92(0)	0700001-026(0) 3/23/71 0700001-027(0) 3/23/71 0700001-028(0) 4/6/71	2609-1 (10) 2611-1 (12) 2611-2 (8) 2611-3 (9)	2611-4 (9) 2611-5 (6) 2611-6 (11) 2612-2 (8)	2710-1 (12) 2710-2 (12)

NOTE: Parenthetical entries in the columns denote revision numbers

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ATTACHMENT 4 (Cont'd.)

NRC-IE BULLETIN NO. 79-14, INSPECTION ELEMENTS FOR SAFETY RELATED PIPING SYSTEMS

SYSTEM DESIGNATION	APPLICABLE USAS CODE	CALC. BOOK NO.	B&R/E.D.S. SEISMIC ISOMETRICS	B&R/E.D.S. SEISMIC CALC. NO. & DATE	ALL PIPE STOPS & SEISMIC RESTRAINTS ON FOLLOWING GRINNELL/JELCO ISOMETRICS:
REACTOR CORE INJECTION COOLING RC-2, RC-3, RC-4, RC-5	B31.7-CL. II	8.30.14	1285-94(0) 1285-95(0)	0700001-030(0) 5/10/71 0700001-031(0) 4/16/71	2619-1 (8) 2621-2 (7) 2620-1 (7) 2621-3 (7) 2621-1 (12)
BLEED STEAM BS-2	B31.7-CL II	8.30.04 8.30.10	1285-97(0) 1285-90(0)	0700001-033 5/31/71 0700001-025 3/5/71	2601-1 (8) 2601-4 (8)
REACTOR BUILDING CLOSED COOLING SYSTEM RCC-1	B31.1.0	8.30.15 8.30.17	1285-47 1285-96	0700001-017 7/15/70 0700001-032 5/4/71	2848-2 (12) 2848-14 (12) 2848-7 (8) 2848-15 (10) 2848-8 (15) 2848-16 (11) 2848-9 (N-01) 2848-21 (7)
SERVICE WATER SYSTEM SW-1	B31.1.0	—	—	—	2400-1 (7) 2851-1 (14) 2852-14 (9) 2852-57 (3) 2400-2 (8) 2851-7 (13) 2852-15 (9) 2852-16 (9) 2400-3 (N01) 2851-8 (11) 2852-16 (14) 2852-62 (3) 2400-4 (8) 2852-3 (15) 2852-19 (13) 2852-63 (2) 2851-1 (N01) 2852-6 (N01) 2852-20 (7) 2852-65 (2) 2851-2 (12) 2852-7 (16) 2852-21 (8) 2852-66 (2) 2851-3 (11) 2852-8 (12) 2852-22 (N01) 2852-67 (1) 2851-4 (9) 2852-9 (13) 2852-23 (8) 2851-5 (9) 2852-10 (12) 2852-50 (N02)
RADIOACTIVE FLOOR DRAINS FDR-1	B31.7 CL. III	—	—	—	2708-7 (7) 2708-11 (7) 2708-18 (6)
PROCESS VENTS PV-1	B31-7 CL. III	—	—	—	2716-1 (9) RCO-755-1 (9) 2716-5 (7) RCO-755-2 (9) RCO-755-3 (9)
CONTROL ROD DRIVE CRD	B31.7	—	—	—	REACTOR CONTROL INC. DRAWINGS: CP-009 SHT. 1 (3) SHT. 2 (3) SHT. 3 (3) SHT. 4 (2) SHT. 5 (0) SHT. 6 (0)
STARTING AIR (DIESEL GENERATOR) BUILDING STA-2	B31.1.0	—	—	—	2200-1 (N-01) 2200-2 (N-01)

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ATTACHMENT 5

CRITERIA FOR DESIGN OF PIPING SYSTEMS BY SPAN CHARTS AND LOAD FACTOR TABLES

I. GENERAL

A. Within the Reactor Building, the maximum horizontal and vertical seismic control spans shall be the lesser of the two following criteria:

1. Attached Table of Seismic Control Spacing - Reactor Building SK 0127-72J for plane bends and straight runs for pipe sizes 2-1/2" and larger.

2. Spans as determined by using the following limiting control loads:

   Piping -- up to 6" nom. size -- 500 lbs. max.
   -- 6" to 12" nom. size -- 1000 lbs. max.
   over 12" nom. size -- as calculated for item 1 spacing.

   The above limiting values shall be determined using 0.75g for horizontal and 0.5g for vertical seismic loadings.

B. Within the Control Building, the maximum horizontal and vertical seismic control spans shall be the lesser of the two following criteria:

1. Attached Table of Seismic Control Spacing - Control Building - SK-0128-72J for plane bends and straight runs for pipe sizes 2-1/2" and larger. Spans on SK 0720-71J Sh. 1-3 are to be multiplied by 0.632.

2. Spans as determined by using the following limiting control loads:

   Piping -- up to 6" nom. size -- 500 lbs. max.
   -- 6" to 12" nom. size -- 1000 lbs. max.
   over 12" nom. size -- as for item 1 spacing.

   The above limiting values shall be determined using 0.5g for the horizontal and 0.3 for vertical seismic loadings.

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Drawing No. ______ Calc. No. ______ Sheet 1 of 1

By: C.J. ______ Approved ______

Title: NPPD-CNS-MAX SEISMIC CONTROL SPACING REACTOR BUILDING | SK 0127-72J

TOTAL BENDLENGTHS = L1+L2 (SIMPLY SUPPORTED) (FEET)

L_2/L_1 = / PIPE SIZE	1: 90°	1: 45°	3/4: 90°	3/4: 45°	1/2: 90°	1/2: 45°	1/4: 90°	1/4: 45°	$L_2=0$: 180° = STR. MEMBER		REMARKS (PIPE EMPTY / PIPE FULL)
$2\frac{1}{2}$	18 / 17	18 / 17	20 / 18	19 / 18	20 / 19	20 / 19	22 / 20	22 / 20	22 / 20		Approx 1.8
3	20 / 18	20 / 18	22 / 20	21 / 19	23 / 21	22 / 20	24 / 22	24 / 22	24 / 22		→ 2.0
$3\frac{1}{2}$											For Now
4	23 / 21	22 / 20	25 / 22	24 / 21	26 / 24	26 / 28	28 / 25	27 / 24	28 / 25		React or
6	28 / 25	28 / 24	30 / 27	29 / 26	32 / 28	32 / 28	34 / 30	33 / 29	34 / 30		Contr. Corr.
8	33 / 28	31 / 27	35 / 30	33 / 29	36 / 32	36 / 31	36 / 33	38 / 33	39 / 34		USE 1.8 To 2.0
10	36 / 31	35 / 30	39 / 33	38 / 32	41 / 35	40 / 34	43 / 37	43 / 36	44 / 38		As Multiplying
12	39 / 34	38 / 33	42 / 36	41 / 34	45 / 38	44 / 37	47 / 40	46 / 40	48 / 41		Factor For
14	42 / 35	40 / 34	45 / 37	43 / 36	47 / 39	46 / 38	49 / 41	49 / 41	50 / 42		Span Length
16	45 / 36	43 / 35	48 / 39	46 / 38	50 / 41	50 / 40	53 / 43	53 / 43	54 / 44		(ATTACHMENTS)
18	48 / 39	46 / 38	51 / 42	49 / 40	54 / 44	52 / 43	56 / 46	55 / 46	57 / 47		
20	50 / 41	48 / 40	53 / 44	52 / 42	56 / 46	56 / 45	59 / 48	59 / 48	60 / 50		
24	55 / 42	53 / 40	59 / 45	56 / 43	62 / 48	61 / 46	65 / 50	64 / 49	66 / 50		

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NOTE: L_2 = Shorter Leg of Plane; $L_{above} = L_1 + L_2$ T = 0.250 Corrections: $\sqrt[4]{\frac{E_{new}}{27.9(10^6)}}(L)$; BLDG. PERIOD = 0.425

SK-0127-72J SH 1 OF 1 REACTOR BLDG

W.O. No. 2520-02 Date JAN 28 1972 Book No. ______ Page No. ______
Drawing No. ______ Calc. No. ______ Sheet 1 of 1
By ______ Check: ______ Approved ______
Title NPPD - CNS SEISMIC CONTROL SPACING - CONTROL BLD. (MAX) | SK-0128-72J

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#D 1

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TOTAL BENDLENGTHS = $L_1 + L_2$ (SIMPLY SUPPORTED)

Each cell: pipe empty / pipe full

L_2/L_1 → PIPE SIZE	L_2 ⌉ L_1 1 — 90°	45°	L_2 ⌉ L_1 3/4 — 90°	45°	⌉ L_1 1/2 — 90°	45°	⌉ 1/4 — 90°	45°	$L_2 = 0$ — 180° = STR. MEMBER		REMARKS (PIPE EMPTY / PIPE FULL)
2½	11/10	11/10	13/11	12/11	13/12	13/12	14/13	14/13	14/13		
3	13/11	13/11	14/13	13/12	15/13	14/13	15/14	15/14	15/14		
3½											
4	15/13	14/13	16/14	15/13	16/15	16/15	18/16	17/15	18/16		
6	18/16	18/15	19/17	18/16	20/18	20/18	21/19	21/18	21/19		
8	21/18	20/17	22/19	21/18	23/20	23/20	24/21	24/21	25/21		
10	23/20	22/19	25/21	24/20	26/22	25/22	27/23	27/23	28/24		
12	25/22	24/21	27/23	26/22	28/24	28/23	30/25	29/25	30/26		
14	26/22	25/22	28/23	27/23	30/25	29/24	31/26	31/26	32/27		
16	28/23	27/22	30/25	29/24	32/26	32/25	33/27	33/27	34/28		
18	30/25	29/24	32/27	31/25	34/28	33/27	35/29	35/29	36/30		
20	32/26	30/25	33/28	33/27	35/29	35/28	37/30	37/30	38/32		
24	35/27	33/25	37/28	35/27	39/30	38/29	41/32	40/31	42/32		

NOTE: L_2 = Shorter Leg of Fitting; L above = $L_1 + L_2$ T = 0.10 Corrections: $\sqrt[4]{\frac{E_{NEW}}{27.9(10^6)}}(L)$; BLDG. PERIOD = T... PEAK 0.19 ... 0.150
SK-0128-72J SH 1 OF 1

ATTACHMENT 6

PIPING SYSTEMS DESIGNED BY SPAN CHARTS AND LOAD FACTOR TABLES

Safety related portions of Service Water System.

Fuel Oil Supply System to Diesel Generators.

Portions of Standby Liquid Control

Portions of Radioactive Floor Drains.

Starting Air (Diesel Generator Building).

Portions of HVAC Systems.

Reactor Building Closed Cooling Water System.

501 066

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

RCIC SYSTEM
(FD 2043)

B&R Dwg.	R.B. Elv.	Item	Remarks
2167	903	RHR Ht Exchanger Room 1B	RHR Cond. Mode (4" RC-3, 4" RC-4)
2166	881	NE Corner Quadrant	Return to Emergency Cond. Storage Tank (4" RC-4) Supply from RHR Ht Exchanger (4" RC-4)
2165	859	NE Corner Quadrant	RCIC Pump suction & discharge piping

Note: (1) FD - Flow Diagram
(2) Orthographic Drawing Numbers Listed. However, applicable Grinnell/Jelco isometric drawings will be used in each case.

501 067

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

CORE SPRAY
(FD 2043)

B&R Dwg.	R.B. Elv.	Item	Remarks
2175	931	CS Pump 1B Discharge	12" CS-2
2174	903	CS Pump 1B Discharge	12" CS-2
2173	881	SE Corner Quadrant	CS Pump 1B Discharge 12" CS-2 CS Pump 1B Test 10" CS-3 CS Pump 1B Min. Flow 3" CS-3
2172	859	SE Corner Quadrant	Core Spray Pump 1B suction & discharge

501 068

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

RESIDUAL HEAT REMOVAL SYSTEM
(FD 2040)

B&R Dwg.	R.B. Elv.	Item	Remarks
2176	958	6" RH-2	
2175	931	RHR Ht Exchanger Rm 1B	Penetration X-17 to RHR Ht Exch Room 1B
2174	903	10" RH-2 (Drywell Spray Header)	RHR Ht Exch Room 1B to X-39B
2174	903	RHR Ht Exchange Room 1B	
2173	881	SW Corner Quadrant	RHR Pump 1B & 1D suction & discharge piping
2172	859	SW Corner Quadrant	RHR Pump 1B & 1D suction & discharge piping

501 069

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

SERVICE WATER
(FD 2036)

B&R Dwg.	R.B. Elv.	Item	Remarks
2157	931	18" SW-2	RCCW Heat Exchangers Service Water Supply and Return
2156	903	RHR Ht. Exchanger Room 1B	18" SW-1 Supply and Return from RHR Ht Exchanger 1B
2156	903	14" SW-1	Emergency Core Flooding Service Water Supply
2156	903	18" SW-2 4" SW-2	Piping exposed above Elv. 912 along North wall of Reactor Bldg.
2155	881, 859	SW Quadrant	18" SW-1 Piping to RHR Ht Exchanger 1B
		SE Quadrant	3" SW-1 and 3" SW-2 Supply to Radiation Monitor to 1st block valve

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

REACTOR BLDG. CLOSED COOLING WATER
(FD 2031, Sht. 2)

B&R Dwg.	R.B. Elv.	Item	Remarks
2177	976	6" RCC-1	RCCW Surge Tank Supply/Drain
2176	958	6" RCC-1	RCCW Surge Tank Supply/Drain
2175	931	RBCCW Pump Suction and Discharge Piping Through RBCCW Exchangers	Inspection Limits on Pump Suction Piping Between Pumps and Check Valve 12V323W-1
		For a 6" RCC-1 and 4" RCC-1 Piping of Critical Services Headers Through Valve 6" 711 MV	Inspection Limits on Pump Discharge Piping Between RBCCW Heat Exchangers and Valves 8" 702 MV and 10" 700 MV and 8" 1329 MV
2174	903	4" RCC-1	Interconnection With Service Water Piping
2173	881	SE Quadrant	3" RCC-1
		SW Quadrant	4" RCC-1

501 071

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

HPCI System
(FD 2044)

B&R Dwg.	R.B. Elv.	Item	Remarks
2165	859	SW Corner Quadrant	Supply from Emergency Cond. Storage Tanks 16" HP-5
		SW Corner Quadrant	Supply from Torus 16" HP-4
		SW Corner Quadrant	Return to Emergency Cond. Storage Tanks 10" HP-4
		SW Corner Quadrant	HPCI Pump Min. Flow 4" HP-4
2168	859	HPCI Room	HPCI Pump Suction and Discharge Piping

501 072

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

STEAM SYSTEM
(FD 2041)

B&R Dwg.	R.B. Elv.	Item	Remarks
2157	931	RHR Ht Exchanger Room 1B	18" MS-2
2156	903	RHR Ht Exchanger Room 1B	8" MS-2
2155	881, 859	SW Corner Quadrant	10" MS-1 20" BS-2
2155	881, 859	NE Corner Quadrant	3" MS-1 8" BS-2
2163	859	HPCI Room	MS Supply to HPCI Turbine and HPCI Turbine Exhaust

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

REACTOR FEEDWATER SYSTEM
(FD 2043, 2044)

B&R Dwg.	R.B. Elv.	Item	Remarks
2157	881, 859	SW Corner Quadrant	HPCI Pump Discharge (14" RF-1)
		NE Corner Quadrant	RCIC Pump Discharge (4" RF-1)
2168	859	HPCI Room	HPCI Pump Discharge (14" RF-1)

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

FLOOR DRAIN SYSTEM
(FD 2038)

B&R Dwg.	R.B. Elv.	Item	Remarks
2181	859	Reactor Bldg. Sump Pump Discharge in all four quadrants	3" FDR-1

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

STANDBY LIQUID CONTROL SYSTEM
(FD 2045)

B&R Dwg.	R.B. Elv.	Item	Remarks
2159	976	SLC Area	Tanks & Pumps

501 076

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

CONTROL ROD DRIVE
(FD 2039)

Reactor Controls Dwg.	R.B. Elv.	Item	Remarks
CP-002 Sht 1	903	Scram Headers	

501 077

ATTACHMENT 7

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2

MISCELLANEOUS

Control Building	FD 2036 FD 2044	Elv. 881 Elv. 881	Service Water Emergency Cond. Storage Tank Supply and Return
Diesel Gen. Building	FD 2006 FD 2011 Sht. 1	Elv. 903 Elv. 903	Service Water Diesel Fuel Oil Supply
Intake Structure	FD 2006	Elv. 903	Service Water Pump Discharge for Two 24" Headers con- necting Control Building

501 078

ATTACHMENT 7
PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 2
H&V SYSTEMS
(FD 2022, 2037)

B&R Drawing	R.B. Elv.	Item	Remarks
2207	958	Drywell Exhaust	Inspect Piping to Isolation Valve 24" 246 AV From Penetration X-26
2208	976	Standby Gas Treatment Room	10" PV-1 Discharge From S.G.T. Unit

501 079

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

RCIC SYSTEM
(FD 2043)

(Redundant Loop)

B&R Dwg.	R.B. Elv.	Item	Remarks
2167	903	RHR Ht Exchanger Room 1A	RHR Cond. Mode (4" RC-3, RC-4)

Note: (1) FD - Flow Diagram
(2) Orthographic Drawing Numbers Listed. However, applicable Grinnell/Jelco isometric drawings will be used in each case.

501 080

ATTACHMENT 8

PIPING TO BE INSPECTED
IN TESPONSE TO ITEM 3

RCIC SYSTEM
(FD 2043)

(INACCESSIBLE DURING NORMAL OPERATION)

B&R Dwg.	R.B. Elv.	Item	Remarks
2166	881	RCIC Pump Suction from RHR Ht Exchanger Passing Through Torus Area	4" RC-4 to NE Quadrant
2165	859	RCIC Pump Return to Emergency Cond Storage Tank in Torus Area	6" RC-4
2165	859	RCIC Pump Suction from Torus	6" RC-4 from Penetration X-224

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

CORE SPRAY SYSTEM
(FD 2045)

(Redundant Loop)

B&R Dwg.	R.B. Elv.	Item	Remarks
2175	931	Core Spray Pump 1A Discharge	12" CS-2 to Penetration X-16A
2174	903	Core Spray Pump 1A Discharge	12" CS-2
2173	881	NE Corner Quadrant	CS Pump 1A Discharge 12" CS-2 CS Pump 1A Test 10" CS-3 CS Pump 1A Min. Flow 3" CS-3
2172	859	NE Corner Quadrant	Core Spray Pump 1A suction & discharge

501 082

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

CORE SPRAY SYSTEM
(FD 2045)

(INACCESSIBLE DURING NORMAL OPERATION)

B&R Dwg.	R.B. Elv.	Item	Remarks
2172	859	Suction Piping from Torus to Corner Quadrants for CS Pumps 1A & 1B	16" CS-3 Piping from Torus Penetration X-227A, X-227B)
2173 2172	881 859	Test Return to Torus	10" CS-3 to Torus Penetration X-223A, X-223B
2175	931	RWCV Heat Exchanger Room - Core Spray Pump Discharge	12" CS-2 to Penetration X-16B

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

RESIDUAL HEAT REMOVAL SYSTEM
(FD 2040)
(Redundant Loop)

B&R Dwg.	R.B. Elev.	Item	Remarks
2175	931	RHR Ht Exchanger Rm 1A	
2174	903	RHR Ht Exchanger Rm 1A	
2174 2175	903 931	10" RH-2 (Dry-well Spray Hdr)	RHR Ht Exch Room 1A to X-39A
2173	881	NW Corner Quadrant	RHR Pump 1A & 1C suction & discharge piping
2172	859	NW Corner Quadrant	RHR Pump 1A & 1C suction & discharge

501 084

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3
(Cont'd.)

RHR SYSTEM
(FD 2040)

NOT ACCESSIBLE DURING OPERATION

B&R Dwg.	R.B. Elv.	Item	Remarks
2172	859	Suction Piping from Torus to RHR Pumps	X-225 A X B to NW quadrant X-225 C, D to SW quadrant
2173	881	Test Return Piping to Torus	X-210A, X210B for 18" RH-2
2174	903	Suction Piping from RPV to RHR Pumps	X-12 at shielded area for 20" RH-3
2174	903	Discharge Piping to RPV from RHR at Exchanger	X-13A X 13B at shielded area for 24" RH-2
2173	881	Spray Header to Torus	X-211A, X-211B for 6" RH-2
2173	881	Cross Connection Between Loops	20" RH-2

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

SERVICE WATER
(FD 2036)

(REDUNDANT LOOP)

B&R Dwg.	R.B. Elv.	Item	Remarks
2156	903	RHR Heat Exchange Room 1A	18" SW-1 Supply and Return from RHR Heat Exchanger 1A
2155	881, 859	NW Quadrant	18" SW-1 Piping To RHR Heat Exchanger 1A

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

SERVICE WATER SYSTEM
(FD 2036)

(INACCESSIBLE DURING NORMAL OPERATION)

B&R Dwg.	R.B. Elv.	Item	Remarks
2156	859, 881	Service Water Supply To RBCCW Heat Exchanger	14" SW-2
		Service Water Supply to RHR Heat Exchanger	18" SW-1
		Service Water Supply to Emergency Core Flooding	14" SW-1
		Service Water Return from RBCCW Heat Exchanger	18" SW-2
		Service Water Return from RHR Heat Exchanger	18" SW-1
		Service Water Supply to Radiation Monitor	3" SW-1, 3" SW-2

501 087

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

REACTOR BLDG. CLOSED COOLING WATER
(FD 2031, Sht. 2)

(REDUNDANT LOOP)

B&R Dwg.	R.B. Elv.	Item	Remarks
2174	903	4" RCC-1	Interconnection With Service Water Piping
2175	931	6" RCC-1 and 4" RCC-1 Piping of Critical Services Header Through Valve 6" 714 MV	Redundant Loop to 6" RCC-1 and 4" RCC-1 Piping of Critical Services Header Through Valve 6" 711 MV
2173	881	NW Quadrant NE Quadrant	3" RCC-1 2½" RCC-1

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

REACTOR BLDG. CLOSED COOLING WATER
(FD 2031, Sht. 2)

(INACCESSIBLE DURING NORMAL OPERATION)

B&R Dwg.	R.B. Elv.	Item	Remarks
2173	881	Critical Services Headers in Torus Area	2½" RCC-1 to NE Quadrant 3" RCC-1 to SE Quadrant 4" RCC-1 to SW Quadrant 3" RCC-1 to NW Quadrant

501 089

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

HPCI System
(FD 2044)

(INACCESSIBLE DURING NORMAL OPERATION)

B&R Dwg.	R.B. Elv.	Item	Remarks
2166	881	Cond. Return to Emergency Cond. Storage Tanks in Torus Area	10 HP-4
2165	859	Cond. Supply From Emergency Cond. Storage Tanks in Torus Area	16" HP-5
2165	859	HPCI Pump Suction From Torus	X-226 to SW Quadrant (16" HP-4)
2165	859	HPCI Pump Min. Flow in Torus Area	4" HP-4

501 090

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

STEAM SYSTEM
(FD 2041)

(Redundant Loop)

B&R Dwg.	R.B. Elv.	Item	Remarks
2157	931	RHR Ht Exchanger Room 1A	18" MS-2
2156	903	RHR Ht Exchanger Room 1A	8" MS-2

501 091

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

STEAM SYSTEM
(FD 2041)

(INACCESSIBLE DURING NORMAL OPERATIONS)

B&R Dwg.	R.B. Elv.	Item	Remarks
2156	903	Main Steam Lines in Steam Tunnel	Up to Anchor downstream of MSIV
2155	859, 881	Main Steam Supply in Torus Area for HPCI Turbine RCIC Turbine RHR Ht Exchanger	 10" MS-1 3" MS-1 8" MS-1
2156	903	Main Steam Supply in Penetration Area	10" MS-1 at Penetration X-11
2156	859, 881	HPCI Exhaust Turbine Steam to Torus to Penetration X-214	20" BS-2
2155	859, 881	RCIC Exhaust Turbine Steam to Torus to Penetration X-212	8" BS-2

ATTACHMENT 8

PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3

REACTOR FEEDWATER SYSTEM
(FD 2043, 2044)

(INACCESSIBLE DURING NORMAL OPERATIONS)

B&R Dwg.	R.B. Elv.	Item	Remarks
2156	903	Main RF Piping in Steam Tunnel	From Drywell Penetration to Anchor Upstream of Check Valve 18V360W
2155	859	HPCI Pump Discharge in Torus Area	14" RF-1
2156	903	HPCI Pump Discharge in Steam Tunnel	14" RF-1
2155	859	RCIC Pump Discharge in Torus Area	4" RF-1
2155	903	RCIC Pump Discharge in Steam Tunnel	4" RF-1
2156	903	RWCU Discharge in Steam Tunnel	4" RF-1D

501 093

ATTACHMENT 8
PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3
CONTAINMENT
(INACCESSIBLE DURING NORMAL OPERATION)

System	Penetration	Termination	Remarks
RHR (FD 2040)	X-13A	Recirc Piping	24" RH-1D
	X-13B	Recirc Piping	24" RH-1D
	X-12	Recirc Piping	20" RH-1D
	X-17	RPV	6" RH-1D
	X-39A	Spray Hdrs	12" RH*
	X-39B	Spray Hdrs	12" RH*
	X-225 A Thru D	Strainers	Below Torus* Water Level
	X-211A	Spray Hdr	6" RH*
	X-211B	Spray Hdr	6" RH*
	X-210A	Below Torus Water Level	18" RH*
	X-210B	Below Torus Water Level	18" RH*
Feedwater (FD 2043,2044)	X-9A	RPV	18" RF-1D 12" RF
	X-9B	RPV	18" RF-1D 12" RF
Steam (FD 2043, 2044, 2028, 2041)	X-214	Below Torus Water Level	20" BS*
	X-212	Below Torus Water Level	8" BS*
	X-10	Main Steam	3" MS-1
	X-11	Main Steam	10" MS-1
	X-7A Thru D	RPV	24" Main Steam Including ADS Valves (by GE)
HPCI (FD 2044)	X-226	Strainers	Below Torus* Water Level 16" HY

501 094

ATTACHMENT 8
PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3
CONTAINMENT
(INACCESSIBLE DURING NORMAL OPERATION)
(Continued)

System	Penetration	Termination	Remarks
RCIC (FD2043)	X-224	Strainer	Below Torus* Water Level 6" RC
Core Spray (FD 2045)	X-16 A	RPV	10" CS-1D
	X-16 B	RPV	10" CS-1D
	X-223 A	Below Torus Water Level	10" CS*
	X-223 B	Below Torus Water Level	10" CS*
	X-227 A, B	Strainer	Below Torus* Water Level 16" CS
Recirc (FD 2027)	N/A	---	By GE
RWCU (FD 2042 Sheet 1)	X-14	RHR Piping	6" CU-1S
CRD (FD 2039)	X-37	RPV	CRD Piping
	X-38	RPV	CRD Piping
	X-36	RPV	3" HY

* Indicates work by CB&I

501 095

ATTACHMENT 8
PIPING TO BE INSPECTED
IN RESPONSE TO ITEM 3
H&V SYSTEMS
(FD 2022, 2037)
(INACCESSIBLE DURING NORMAL OPERATIONS)

B&R Drawing	Elv.	Item	Remarks
2204	881, 859	Drywell Ventilation	Inspect Piping From Penetration X-25 to Isolation Valve 24" 238 AV
2204	881, 859	Torus Exhaust	Inspect Piping From Penetration X-205 to Isolation Valve 24" 237 AV Including Vacuum Breakers
2204	881, 859	Torus Ventilation	Inspect Piping From Penetration X-220 to Isolation Valve 24" 245 AV
2204	881, 859	10" PV-1	

501 096