NORTHEAST NUCLEAR ENERGY COMPANY

MILLSTONE POINT UNIT NO. 1

SEP TOPIC III-5.A

HIGH ENERGY LINE BREAKS INSIDE CONTAINMENT

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A. F. Magid

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Table of Contents

1.0 Introduction

As part of the Systematic Evaluation Program Topic III-5.A, a detailed study of the effects of postulated breaks in high energy piping systems on other systems, structures, cables and components necessary to place the plant in a safe shutdown condition is underway. This study includes:

a. Definition of the criteria and assumptions used in the study.

b. Identification of the high energy piping systems inside the drywell.

c. A discussion of the independent methods of placing the plant in safe shutdown condition including the systems and components required to do so. Not all of these methods are necessarily available in the case of pipe break event.

d. A discussion of the effects of postulated ruptures in each of the high energy systems.

e. An evaluation of the ability to place the reactor in a safe shutdown condition following each postulated pipe break event.

f. A discussion of the approaches, under consideration, that will help mitigate the consequences of pipe breaks and place the plant in safe shutdown condition.

2.0 Criteria

This study is based on the following criteria:

a. A high energy piping system is one which meets any of the following two conditions:

   1. Design temperature is 200°F. or greater, or

   2. Design pressure is 275 PSIG or greater.

b. A whipping pipe should be considered sufficient to rupture an impacted pipe of smaller nominal size and lighter wall thickness.

c. Pipe whip protection need not be provided when the energy associated with the whipping pipe is insufficent to impair the safety function of any structure, system, or component to an unacceptable level (e.g., a system damaged by pipe whip may be capable of performing its safety function but not capable of completely fulfilling its design function).

d. Pipe whip protection need not be provided where piping is physically separated (or isolated) from other piping or components by protective barriers or restrained from whipping by plant design features such as concrete encasement.

e. Following a single break, the unrestrained pipe movement of either end of the ruptured pipe about a plastic hinge formed at the nearest pipe whip restraint cannot impair the safety function of any structure, system, or component important to safety.

f. Pipe break orientation:

   1. Circumferential breaks are perpendicular to the pipe axis and the break area is equivalent to the internal cross-sectional area of the ruptured pipe.

   2. Longitudinal breaks are parallel to the pipe axis at any point around the pipe circumference. The break area is equal to the sum of the effective cross-sectional flow areas upstream and downstream of the break location or equal to break area determined by test data which defines the break geometry.

g. Pipe sizes subject to breaks:

   1. Circumferential breaks will be postulated for all piping runs and branch runs above one (1) inch nominal size.

   2. Longitudinal breaks will be postulated for all piping runs and branch runs four (4) inches nominal pipe size and larger.

h. Postulated pipe break locations:

Either one of the following two approaches will be used to determine the postulated pipe break locations in each pipe run:

1. All terminal ends and all weld joints.

2. All locations that meet the requirements of Regulatory Guide 1.46, including the stress criteria stipulated therein for ASME Section III, Classes 1, 2 and 3 piping.

3.0 High Energy Piping Systems

All piping systems inside the drywell that have a design temperature of 200°F. or greater and/or design pressure of 275 PSIG or greater are considered high energy systems.

System	Nominal Size, in	Min. Wall Thickness, in	Design Temp., °F.	Design Pressure, Psig
Isolation Condenser	14	0.750	575	1250
	10	0.594	575	1250
Core Spray	10	0.594	575	1250
Main Stream	20	1.031	575	1250
Cleanup Water	8	0.500	575	1250
Shutdown Cooling	14	0.750	350	1250
Feedwater	18	1.562	375	2300
	12	0.844	375	1250
Recirculation	12	0.566	575	1250
Cont. Cooling (LPCI)	18	0.938	575	1250
Main Steam S/R Lines	10	0.594	-	-
Control Rod Drive	1		150	1900

4.0 Plant Shutdown Methods

Four (4) independent methods of plant shutdown are available to bring the plant to a safe shutdown condition. None require that the control room be available for functional activities. These methods are:

- Isolation condenser only.
- Normal shutdown (steam dump to main condenser).
- Auto pressure relief (APR) and control rod drive (CRD).
- Emergency core cooling (APR and core spray/LPCI).

It should be noted, however, that these plant shutdown methods may not be all available in the event of a high energy pipe break, or may not be capable of handling such an event.

In each postulated break event, as will be discussed later, the specific available safe shutdown method will be outlined.

4.1 Isolation Condenser Only

If the inventory of water in the vessel is maintained, assurance of fuel integrity is maintained. Therefore, with the reactor scram used and the vessel isolated, use of the isolation condenser retains the inventory of water by condensing the steam and returning the condensate to the vessel with no losses. Temperatures can be reduced to and maintained at approximately 200°F. for the duration of decay heat production.

4.1.1 Prerequisites for Cooldown

a. Reactor scrammed. Verified by visually checking that all scram inlet and outlet valves are open inside the reactor building.

b. Group II and III isolation. Verified by visually checking that cleanup recirc. pumps tripped.

c. Group I isolation. Verified by visually checking recirc. loop sample flow stopped by isolation signal.

d. Isolation condenser intact.

e. 1-IC-1, 2 and 4 open (normally open and fail as is on loss of DC and/or AC power).

f. 1-IC-3 manually operable (inside reactor building, outside of primary containment).

g. Yarway leval and pressure non-electrical gauges (2206 or 2205 operable adjacent to 1-IC-3).

h. Makeup to isolation condenser available (required within 30 minutes).

1) Firemain system and diesel driven fire pump operable.

i. Flashlights available.

4.1.2 Procedure

a. Immediate Action

1) Prior to leaving control room, manually scram the reactor, if possible, and verify safe shutdown.

2) Close all main steam isolation valves.

3) Pass the word over the P/A System "Evacuate the control room and turbine building; all shift personnal proceed to reactor building".

b. Subsequent Action

1) In the event control room personnel were unable to perform steps in immediate action:

a) Close instrument air stop valve to scram pilot headers in reactor building. Verify all scram valves are open.

b) Close instrument air stop valves to drywell and MSIV's. This will close MSIV's if not already closed.

2) Manually open 1-IC-3 and control pressure and cooldown by observing pressure instruments 2206 (or 2205) on instrument racks.

4.2 Normal Shutdown (Steam Dump to Main Condenser)

With the reactor scrammed out and not isolated, a safe shutdown may proceed by using the main condenser as a heat sink for pressure reduction and control, with the condensate/feedwater systems supplying makeup water to the vessel for level control.

4.2.1 Prerequisites for Cooldown

a. Reactor scrammed.

b. Air removal system available.

c. Condensate system available.

1) One (1) condensate pump.

2) One (1) condensate booster pump.

d. Feedwater system available.

1) One (1) reactor feedwater pump.

2) One (1) reactor feedwater pump seal water pump.

e. Circulating water system available.

f. Main steam system available.

g. Reactor building closed cooling water system available.

h. Shutdown cooling and service water systems available.

i. Turbine building secondary closed cooling water system available.

j. Instrument air system available.

k. Electrical equipment.

1) 125 DC available.

2) Vital AC and instrument AC available.

3) Reactor protection 120V AC available.

4) Neutron monitoring 24V DC available.

5) 4160V AC available.

6) 480V AC available.

4.2.2 Procedure

a. Immediate Action.

1) Verify reactor scrammed.

2) Reduce reactor pressure by opening the by-pass valve with the by-pass opening jack.

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3) Change to manual control of feedwater regulating valves to maintain vessel level.

b. Subsequent Action.

1) When steam jet air ejectors are no longer effective, isolate reactor vessel.

2) At approximately 350°F., put shutdown cooling system in service.

4.3 Auto Pressure Relief (APR) and Control Rod Drive (CRD) System

With the reactor scrammed and the vessel isolated, a safe shutdown may be made by using one (1) auto pressure relief valve for pressure reduction and control, with the control rod drive system supplying water to the vessel for level control. The control rod drive pumps (2) can supply more than 200 gpm at 1200 psig for this shutdown method.

4.3.1 Prerequisites for Cooldown

a. Reactor scrammed.

b. Reactor isolated.

c. Reactor pressure and level instrumentation available in control room.

d. Condensate storage tank at 225,000 gallons (normal level).

e. Control rod drive hydraulic system available.

f. APR's available.

g. Instrument air available.

h. 4160V and 125V DC available.

4.3.2 Procedure

a. Immediate Action.

1) Verify reactor scrammed.

2) Verify reactor isolated.

3) Control the pressure build-up, due to reactor decay heat, by intermittently opening one (1) main steam relief valve (APR).

4) Compensate for the reactor vessel level, reduction caused by water inventory loss to the torus, with the control rod drive hydraulic system. Note: Each control rod drive pump is rated at 84 gpm at operating pressure. Use second control rod drive pump via head spray system if needed.

b. Subsequent Action.

1) Continue Steps 3 and 4 under Immediate Action until in cold shutdown condition.

4.4 Emergency Core Cooling System (APR and Core Spray/LPCI)

With the reactor scrammed and the vessel isolated, a safe shutdown may proceed, with one (1) core spray or LPCI (low pressure coolant injection) pump for makeup water to the vessel for level control.

4.4.1 Prerequisites for Cooldown

a. Reactor scrammed.

b. Reactor isolated.

c. Reactor pressure and level instrumentation readouts available in control room.

d. Torus water level normal.

e. Auto pressure relief valves available.

f. One (1) core spray or one (1) LPCI pump available.

g. One emergency service water pump available.

h. Instrument air available.

i. 4160V AC and 125V DC available.

4.4.2 Procedure

a. Immediate Action.

1) Verify reactor scrammed.

2) Verify reactor isolated.

3) Control the pressure buildup, due to reactor decay heat, by intermittently opening one (1) main steam relief valve, and decrease pressure to 300 psig.

4) Compensate for the reactor vessel level reduction caused by water inventory loss to the torus with one (1) core spray or LPCI pump.

b. Subsequent Action.

1) Continue Steps 3 and 4 in Immediate Action, until in cold shutdown condition.

5.0 Pipe Break Effects On Drywell Liner and Biological Shield Wall

5.1 Drywell Liner

For the purposes of this evaluation it is assumed that a whipping pipe impacting against the drywell liner is not going to penetrate the liner. Millstone Unit No. 1 Technical Specifications Basis, Sections 3.6F and 4.6F directly address the special inspections performed on the main feed and steam lines to provide added protection against pipe whip. These welds are selected on the basis of an analysis that shows these welds are the highest stress welds and that due to their physical location, a break would result in the least interference and maximum energy upon impact with the liner.

These welds are identified in Figure 4.6.3 and 4.6.4 of the Technical Specifications Basis as Group I welds and are the only ones which offer any significant risk and are therefore inspected four times as often as the other welds within the drywell.

All other welds, designated as Group II on Figures 4.6.3 and 4.6.4 in the Basis are selected without regard for the operating stress levels and interfering equipment because they have sufficient energy to propel the pipe toward the liner; they are therefore included in the first inspection. Upon consideration of impact angle, interfering equipment and the distance the pipe would have to travel, no substantial risk is involved and no additional inspection is needed.

It is felt that the above In-Service-Inspection Program is adequate to protect the drywell liner from damage due to pipe whipping. No further considerations of pipe impact on the liner is included in this evaluation.

5.2 Biological Shield Wall

Jersey Central Power & Light Co. has prepared an analysis entitled "Evaluation of Structural Integrity of the Biological Shield Wall Under Pipe Whip Loadings". The results of the analyses which are applicable to Millstone Unit No. 1, indicate that no gross structural damage will occur under "worst case" impact loadings, and that the shield wall is capable of withstanding the full spectrum of postulated breaks without incurring significant loss of load carrying capability. Damage to the shield wall will be restricted to the local region of impact and will not significantly affect overall structural capability.

6.0 Breaks at Penetration Assemblies

The penetration assemblies were assumed to withstand and transmit pipe rupture forces to support structures without plastic deformation. Additionally, the effects of jet impingement were not analyzed for breaks postulated to occur between the penetration assembly and the first isolation valve outside containment, since they were previously evaluated as part of another assessment.

7.0 Interaction Analysis

The purpose of this section of the report is to describe the effects of pipe whip and jet impingement resulting from postulated pipe breaks. Circumferential and longitudinal breaks were considered to be non-simultaneous occurences and the effects of these breaks were, therefore, analyzed independently.

7.1 Assumptions

The criteria of Section 2.0 along with the following assumptions form the basis for the interaction analysis:

7.1.1 Pipe whip was assumed to occur as a result of a circumferential rupture in a high energy system provided there was a significant reservoir of energy. Table 7-1 of this report lists these systems and their attendent energy reservoirs.

7.1.2 For circumferential breaks, the free end of a moving pipe will be assumed to move in only one direction parallel to its reaction force. This type of pipe break event will not cause dynamic instability (large amplitude oscillations) since the critical length required for this phenomena is substantially greater than any major pipes in the drywell of BWR plants.

7.1.3 Impacted active equipments (e.g., valves and instruments) will be considered unable to perform its intended function unless it has been specifically designed to operate following such impact.

7.1.4 Impacted passive equipment (e.g., pipes, restraints, or structures) will be considered capable of continuing to perform their intended functions provided that the resulting strain levels due to the impact do not exceed defined allowables. These allowables are defined in Appendix D of this report.

7.1.5 Valves which are normally closed and are not signaled to open, shall not be assumed to fail open.

7.1.6 Plastic hinge formation due to pipe rupture was assumed to occur at system anchors or at other intermediate locations as dictated by the complexity of the particular system configuration. The hinges can form in either bending or torsion mode depending on the configuration.

7.1.7 Longitudinal breaks were assumed to cause a jet in the form of a cone with a 20° angle of divergence.

7.2 Interaction Consequences

The basis for evaluating the consequences of interactions between the high energy source system and the selected targets were as follows:

A whipping pipe was considered to have sufficient energy to cause damage to:

a) Pipes of smaller nominal size and lighter wall thickness.

b) Electric motor operators.

c) Electric conduit and cable trays.

A steam jet was considered to have sufficient energy to cause damage to:

a) Electric cable trays.

b) Electric motor operators.

Reports deemed applicable to Millstone Unit No. 1, prepared by MPR Associates, Inc., (Report No. MPR-285, May 7, 1971) and Burns and Roe, Inc., (Penetration Analysis for Jet Impingement Due to Pipe Rupture, April 24, 1968) demonstrate the ability of the steel containment vessel to withstand the effects of jet impingement.

7.3 Interaction Matrices

The results of the analysis are shown on matrices in Appendix B. The isometric drawings used to develop these interaction matrices are included in Appendix A. All postulated break points on the high energy piping are shown and numbered on these drawings.

The matrices are prepared on a system basis showing the potential interactions between the source, for each postulated break point, and the selected target. Interactions are defined as follows:

a. (A) Acceptable - Interaction causes no damage.

b. (N) No Interaction - Interaction physically not possible.

c. (D) Damage Possible - Further evaluation required.

It should be noted that interactions falling within the last category (D) does not mean that the occurring damage will impair the safety function of the target. Each interaction falling within this category will be evaluated individually, in Appendix C, to assure that such possible damage does not prevent the safe shutdown of the

reactor or that the damage does not impair the safety function of the target (if any).

Table 7-2 gives a summary of the interactions between piping, structures, and components within the drywell for each high energy piping system.

The single failure criteria will be considered in preparing the interaction scenarios and evaluation presented in Appendix C.

Table 7-1

Piping Systems and Energy Reservoirs

System	Energy Reservoir
Isolation Condenser	Reactor Vessel
Core Spray	Reactor Vessel
Reactor Clean Up	Reactor Vessel
Shutdown Cooling	Reactor Vessel
Reactor Recirculation Loop	Reactor Vessel
LPCI	Reactor Vessel
Main Steam	Reactor Vessel and Main Steam System Outside Drywell
Feedwater	Reactor Vessel and Feedwater System Outside Containment

Table 7-2

Summary Interaction Evaluation Matrix

Source		Target: Shield	Target: Piping	Target: Electrical
Isolation Condenser	A	A	A	N
	B	A	N	D
Core Spray	A	N	A	N
	B	N	A	N
Main Steam	A	A	D	D
	B	A	D	D
	C	A	D	D
	D	A	D	D
Cleanup Water	A	A	A	D
	B	N	N	N
Shutdown Cooling	A	N	D	D
Feedwater	A	A	D	D
	B	A	D	D
Recirculation	A	N	A	N
	B	N	A	N
	C	N	N	N
	D	N	N	N
	E	N	N	N
	F	N	N	N
	G	N	N	N
	H	N	N	N
	J	N	A	N
	K	N	A	N
LPCI	A	N	D	D
	B	N	N	D
Control Rod Drive		A	N	N

(A) Acceptable Interaction - Causes no damage.

(N) No Interaction - Interaction physically not possible.

(D) Damage Possible - Further evaluation required.

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8.0 Conclusions

Our analysis and evaluation of all possible interactions, due to postulated high energy pipe breaks between piping, structures, equipment--etc., inside the drywell of Millstone Unit No. 1, leads to the following conclusions:

1. For 346 out of 349 total postulated break locations, acceptable Safe Shutdown Scenarios could be developed. These scenarios are included in Appendix C of this report.

2. For the other three (3) postulated break locations, additional review is required. The proposed line of action is defined in section 4 of Appendix C. A first step will be to acquire a complete stress analysis for the involved system, Main Steam Line C, a step that is being pursued at the moment. The results of any further analysis for these three (3) locations will be incorporated into this report later.

Appendix A

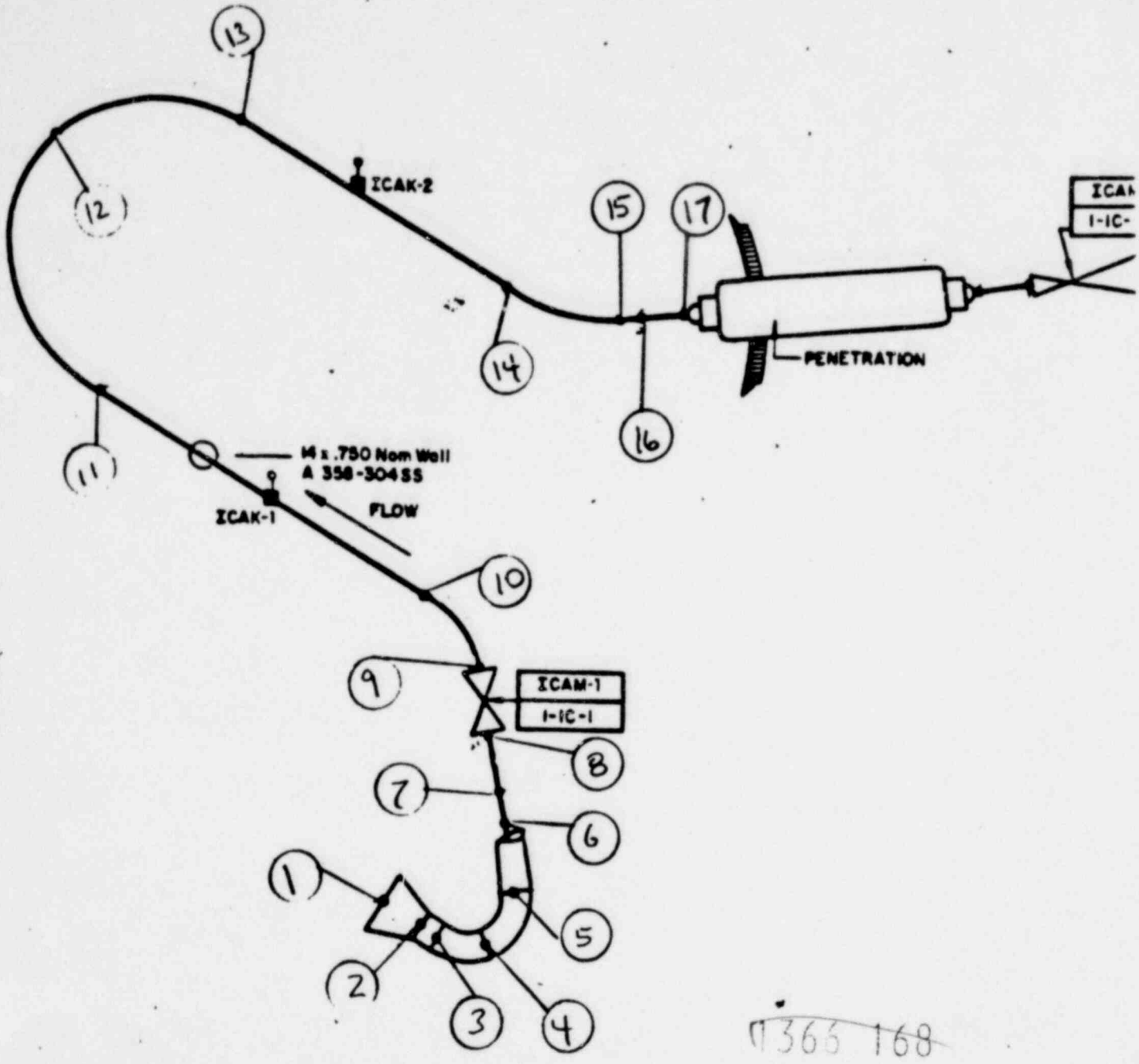
Isometric Drawings

Postulated break point locations are numbered on the isometric drawings listed below.

List of Drawings

System	Drawing Number
Isolation Condenser A	BMR072-IC15
Isolation Condenser B	BMR072-IC16
Core Spray A	BMR072-IC11
Core Spray B	BMR072-IC12
Main Steam A	BMR072-IC10
Main Steam B	BMR072-IC9
Main Steam C	BMR072-IC8
Main Steam D	BMR072-IC7
Cleanup Water A	BMR072-IC17, 18
Cleanup Water B	BMR072-IC19
Shutdown Piping A	BMR072-IC13
Feedwater A	BMR072-IC6
Feedwater B	BMR072-IC5
Recirculation	BMR072-IC20, 23
LPCI A	BMR072-IC1
LPCI B	BMR072-IC3

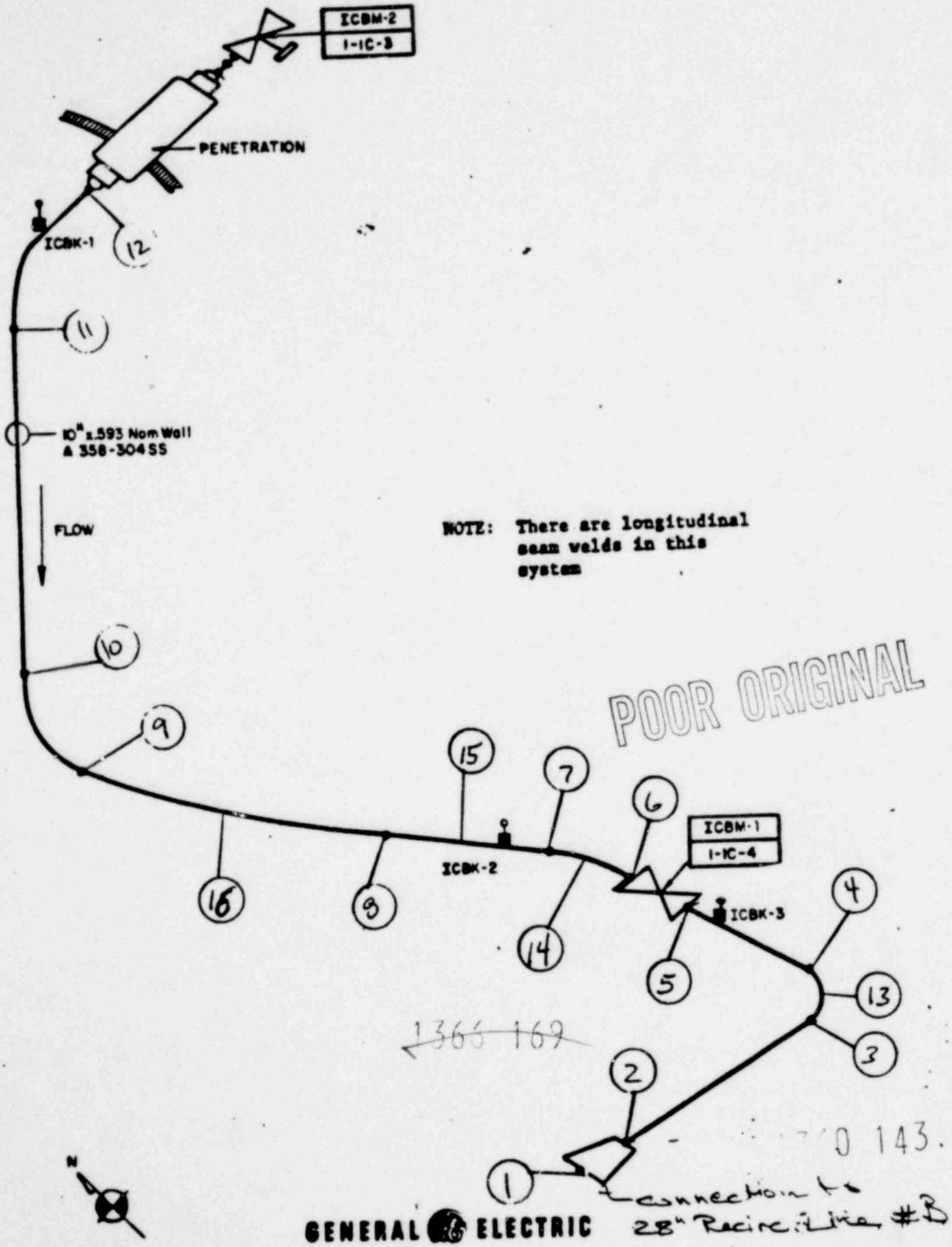
ISOLATION CONDENSER A
BWR072-IC1B



NOTE: There are longitudinal seam welds in this system

ISOLATION CONDENSER B
BMR072-IC16

REV. 1-6/1/77



NOTE: There are longitudinal seam welds in this system

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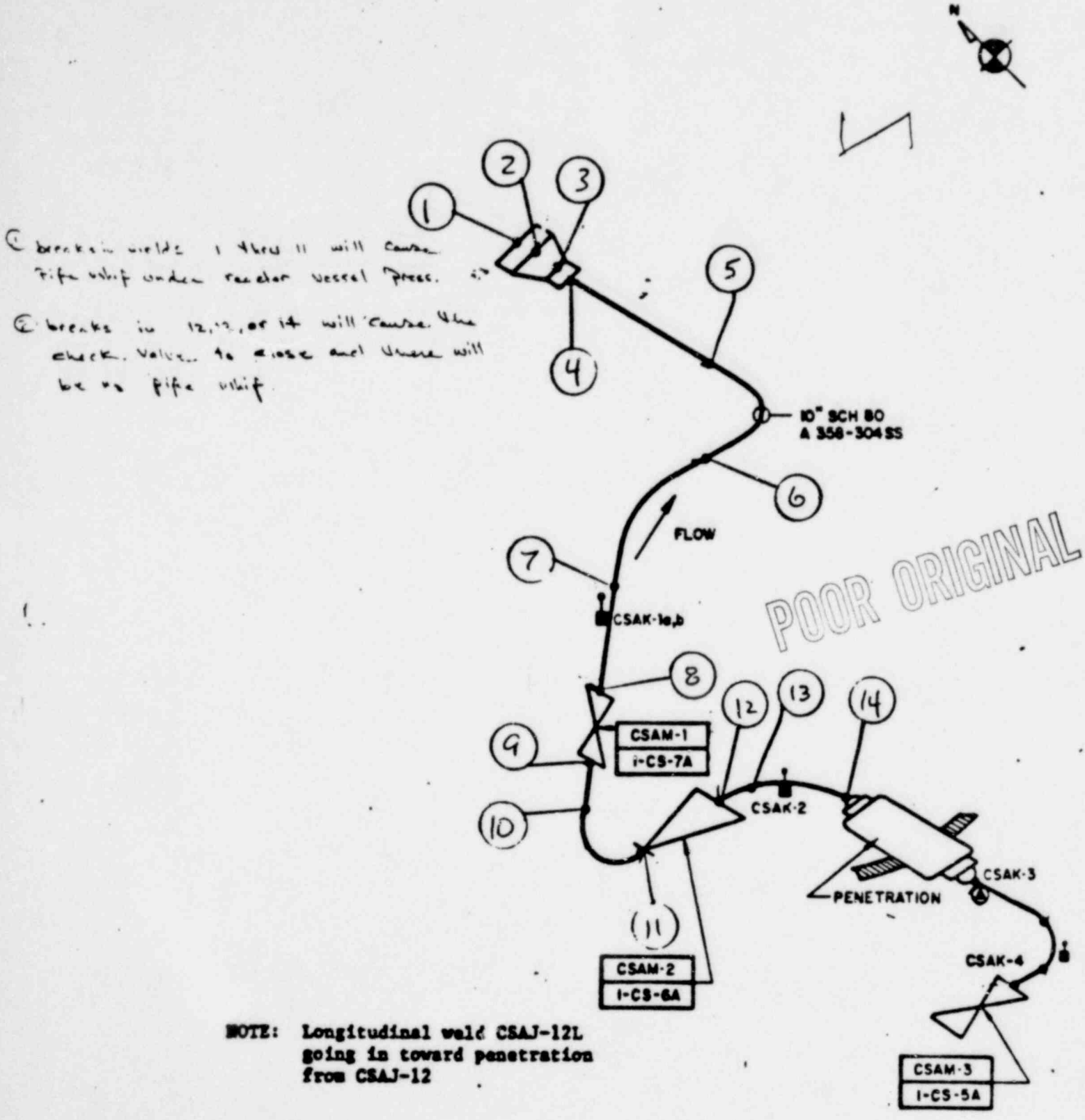
Connection to 28" Recirc Line #B

GENERAL ELECTRIC

CORE SPRAY A

BWR072-IC11

REV. 1 - 6/1/77



① breaks in welds 1 thru 11 will cause pipe whip under reactor vessel press.

② breaks in 12, 13, or 14 will cause the check valves to close and there will be no pipe whip

NOTE: Longitudinal weld CSAJ-12L going in toward penetration from CSAJ-12

1365 170

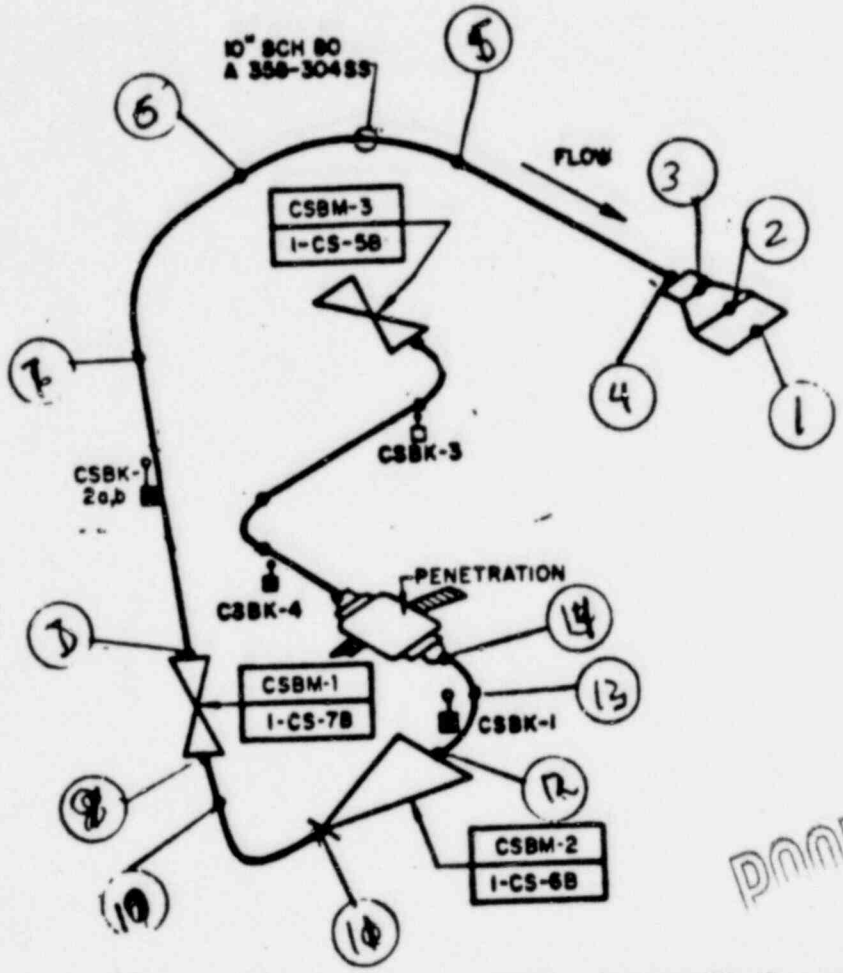
GENERAL ELECTRIC

CORE SPRAY B

BMR072-IC12

① Breaks at 1 thru 11 could cause pipe whip under vessel's pressure

② Breaks at 12, 13, or 14, i.e. beyond the check valves will not generate any pipe whip.

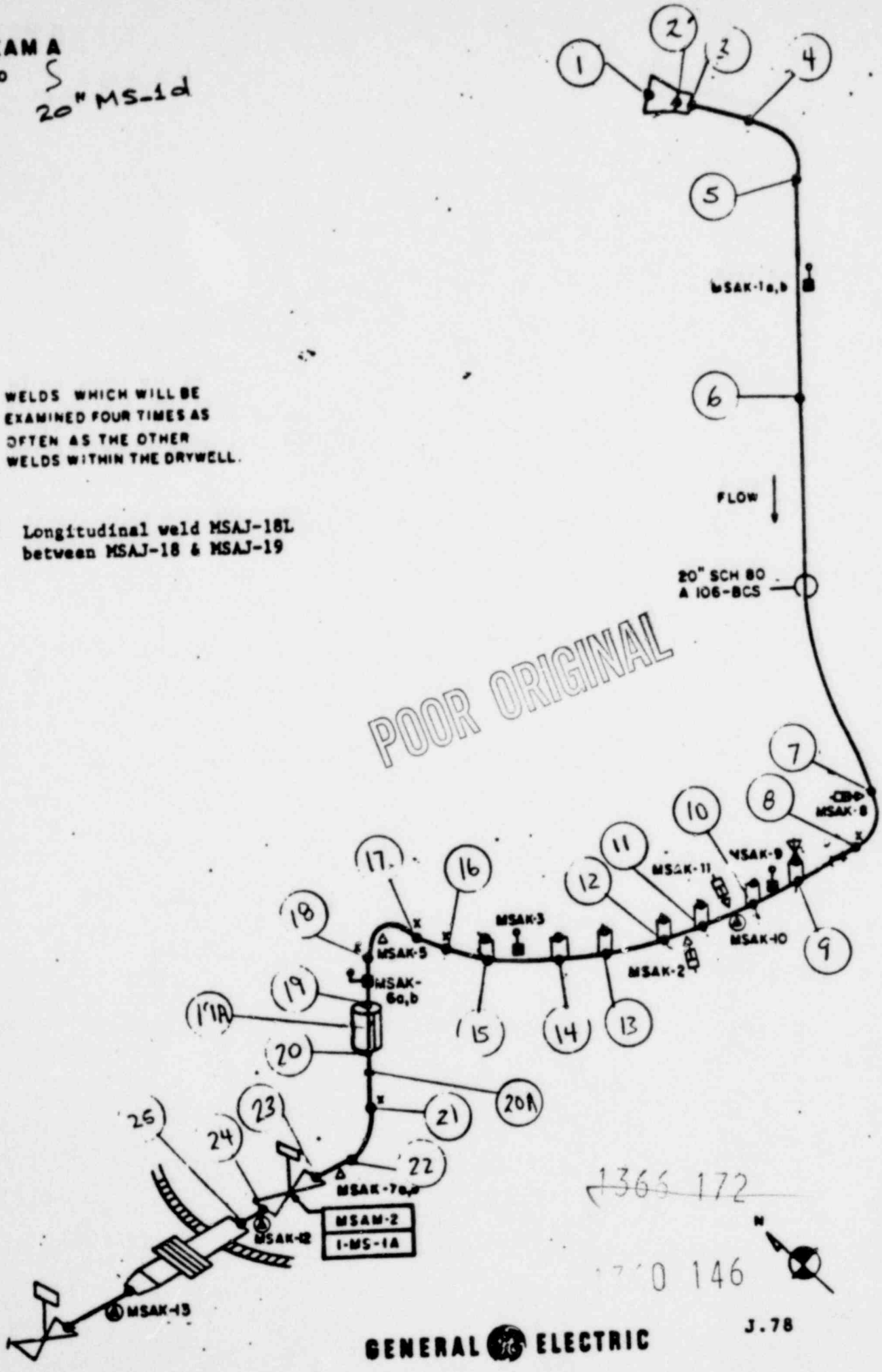


NOTE: Longitudinal seam exists from CSBJ-11 into penetration

MAIN STEAM A

BMR072-IC10

20" MS-1d



x- WELDS WHICH WILL BE EXAMINED FOUR TIMES AS OFTEN AS THE OTHER WELDS WITHIN THE DRYWELL.

NOTE: Longitudinal weld MSAJ-18L between MSAJ-18 & MSAJ-19

GENERAL ELECTRIC

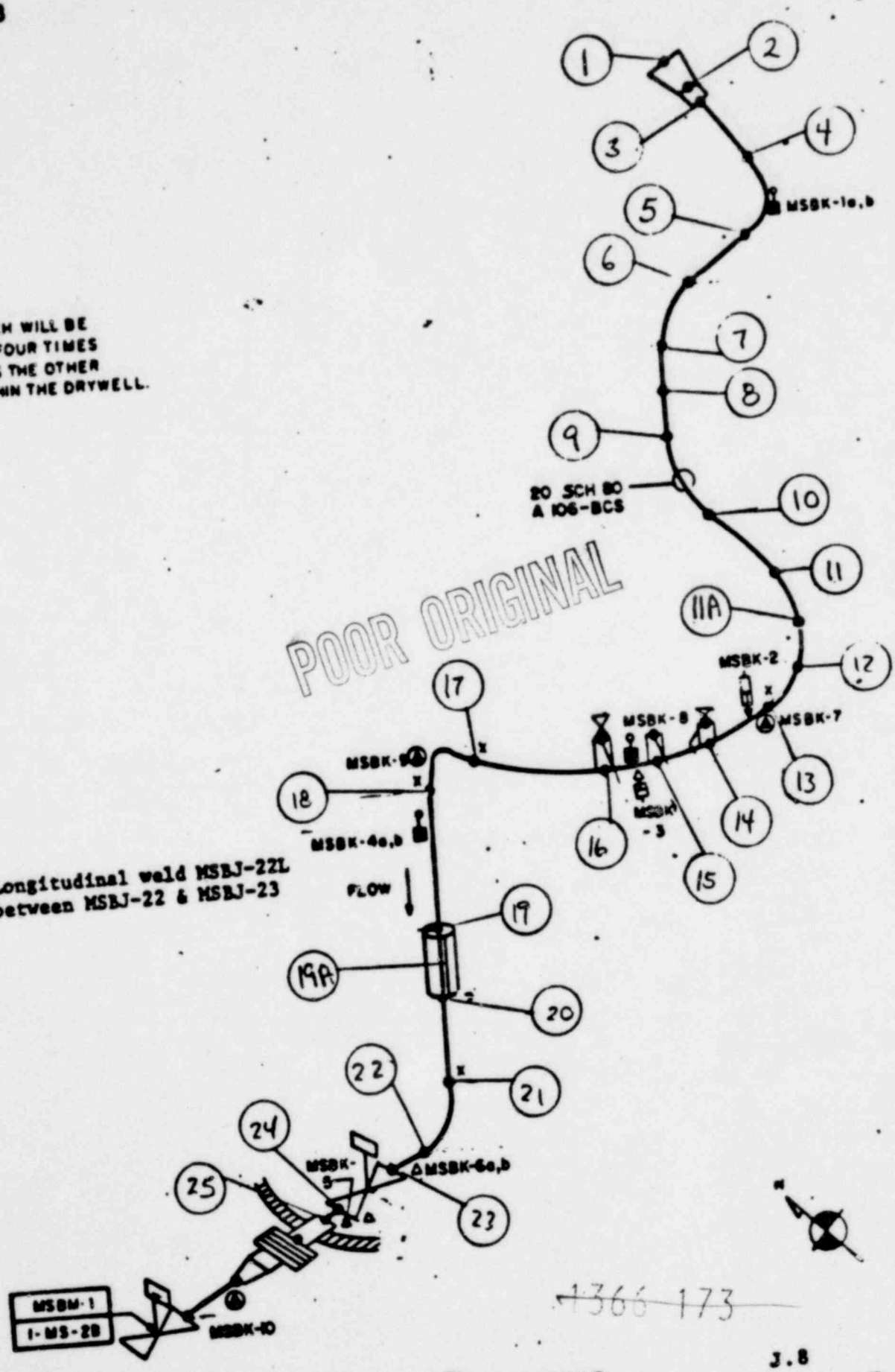
J.78

REV. 1 - 6/1/77

MAIN STEAM B

BMR072-IC9

x- WELDS WHICH WILL BE EXAMINED FOUR TIMES AS OFTEN AS THE OTHER WELDS WITHIN THE DRYWELL.



NOTE: Longitudinal weld MSBJ-22L between MSBJ-22 & MSBJ-23

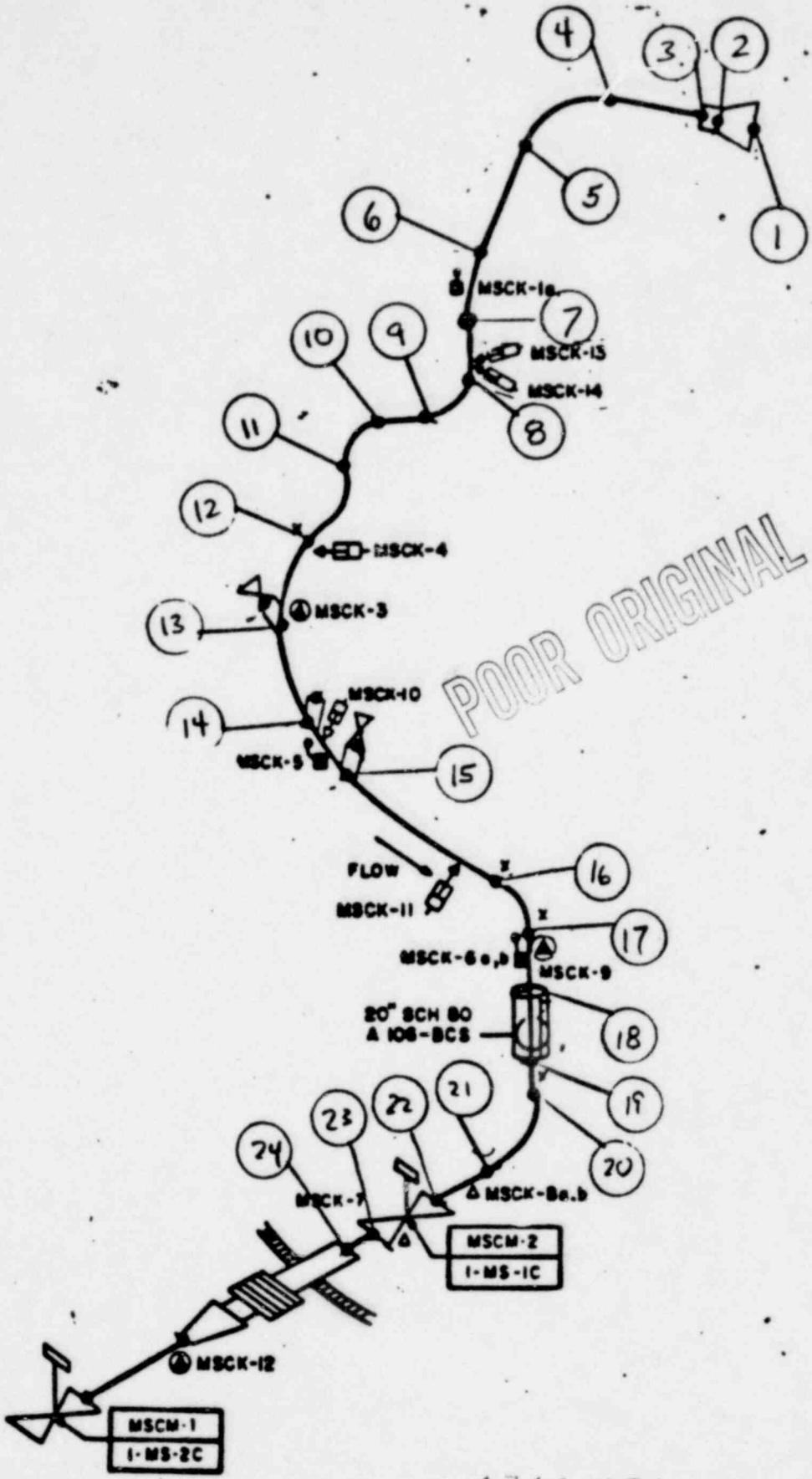
J.8

GENERAL ELECTRIC

MAIN STEAM C

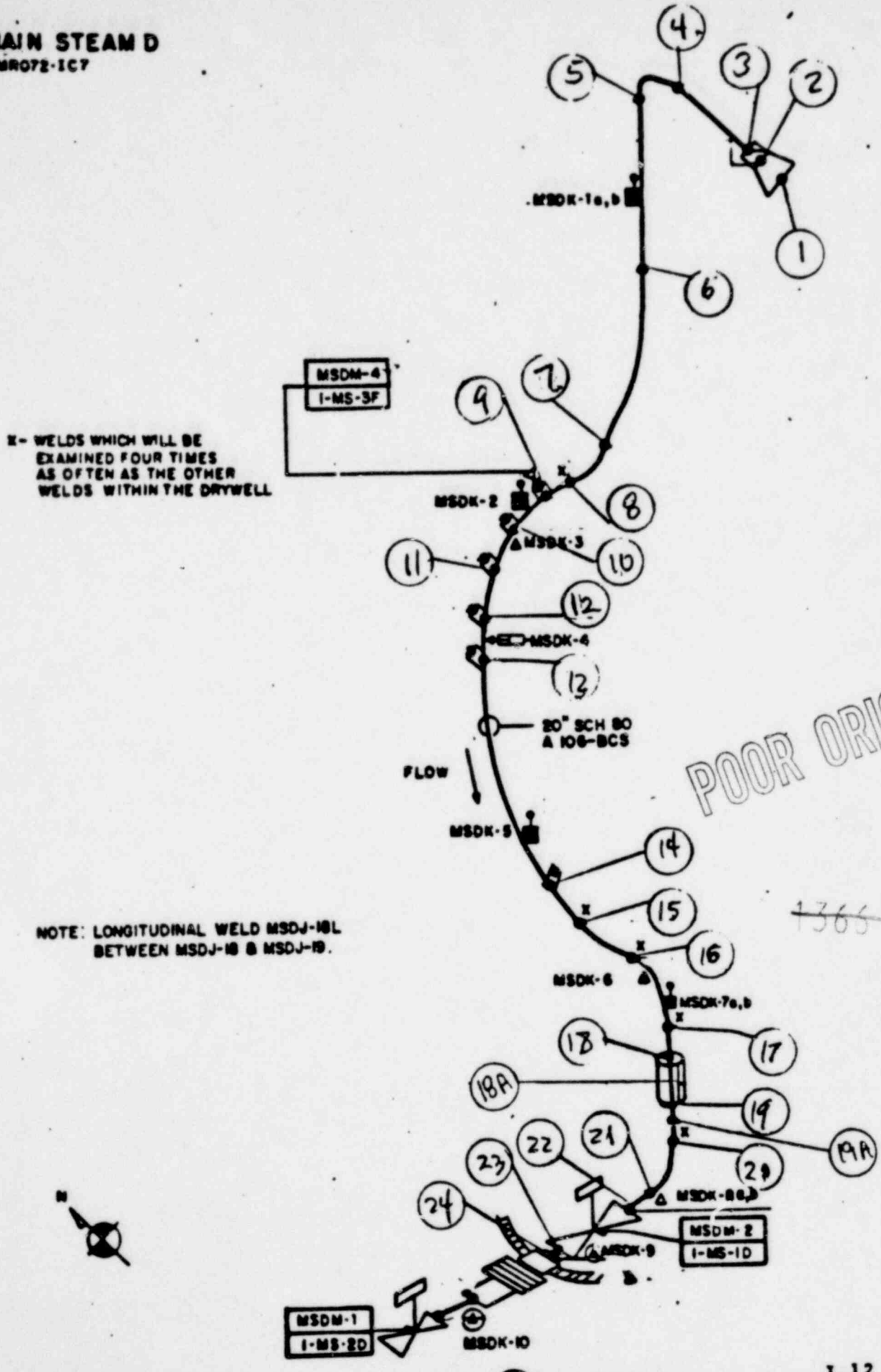
BMR072-1C8

X- WELDS WHICH WILL BE EXAMINED FOUR TIMES AS OFTEN AS THE OTHER WELDS WITHIN THE DRYWELL



MAIN STEAM D

BWR072-IC7



NOTE: LONGITUDINAL WELD MSDJ-16L BETWEEN MSDJ-18 & MSDJ-19.

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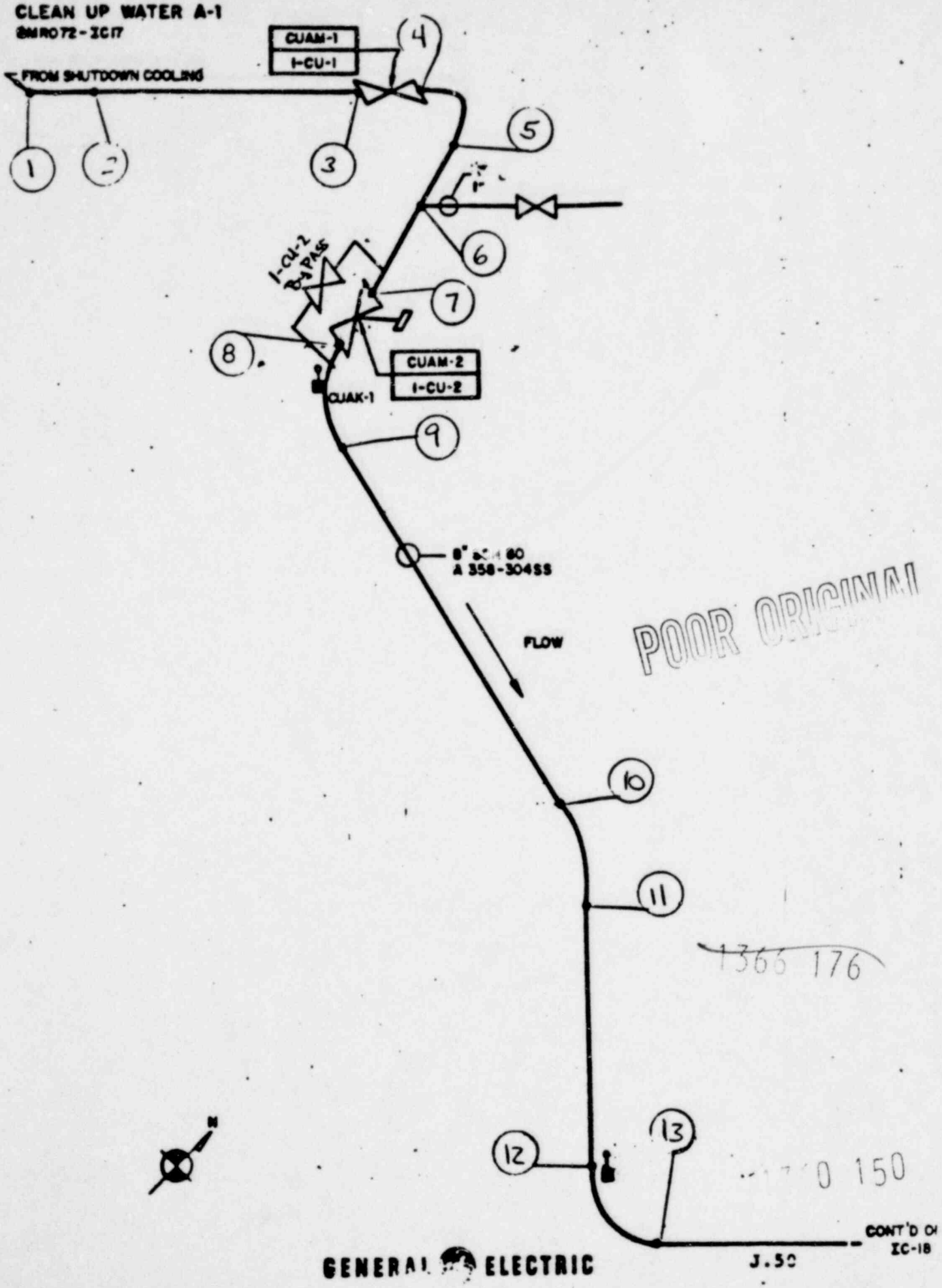
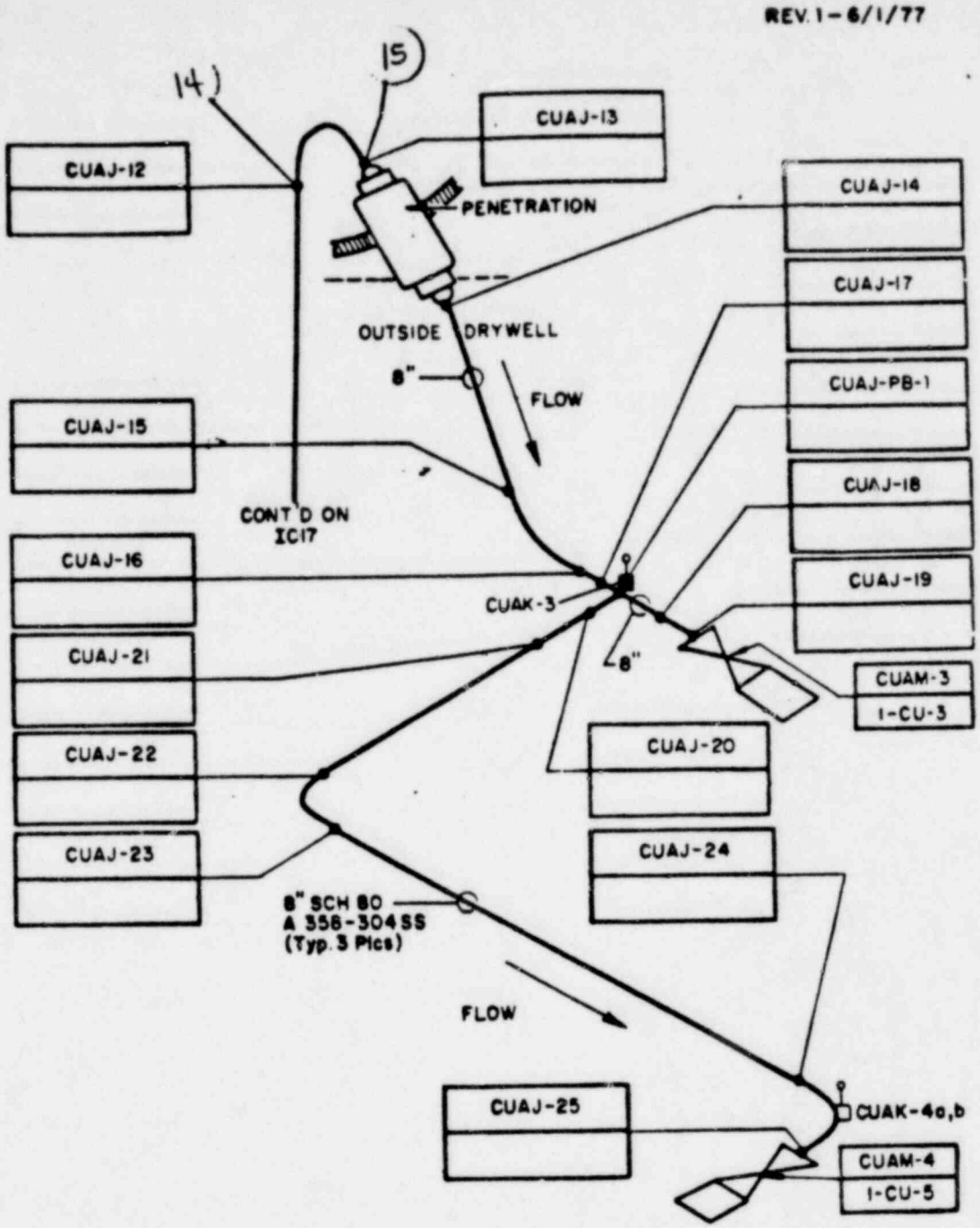
GENERAL ELECTRIC

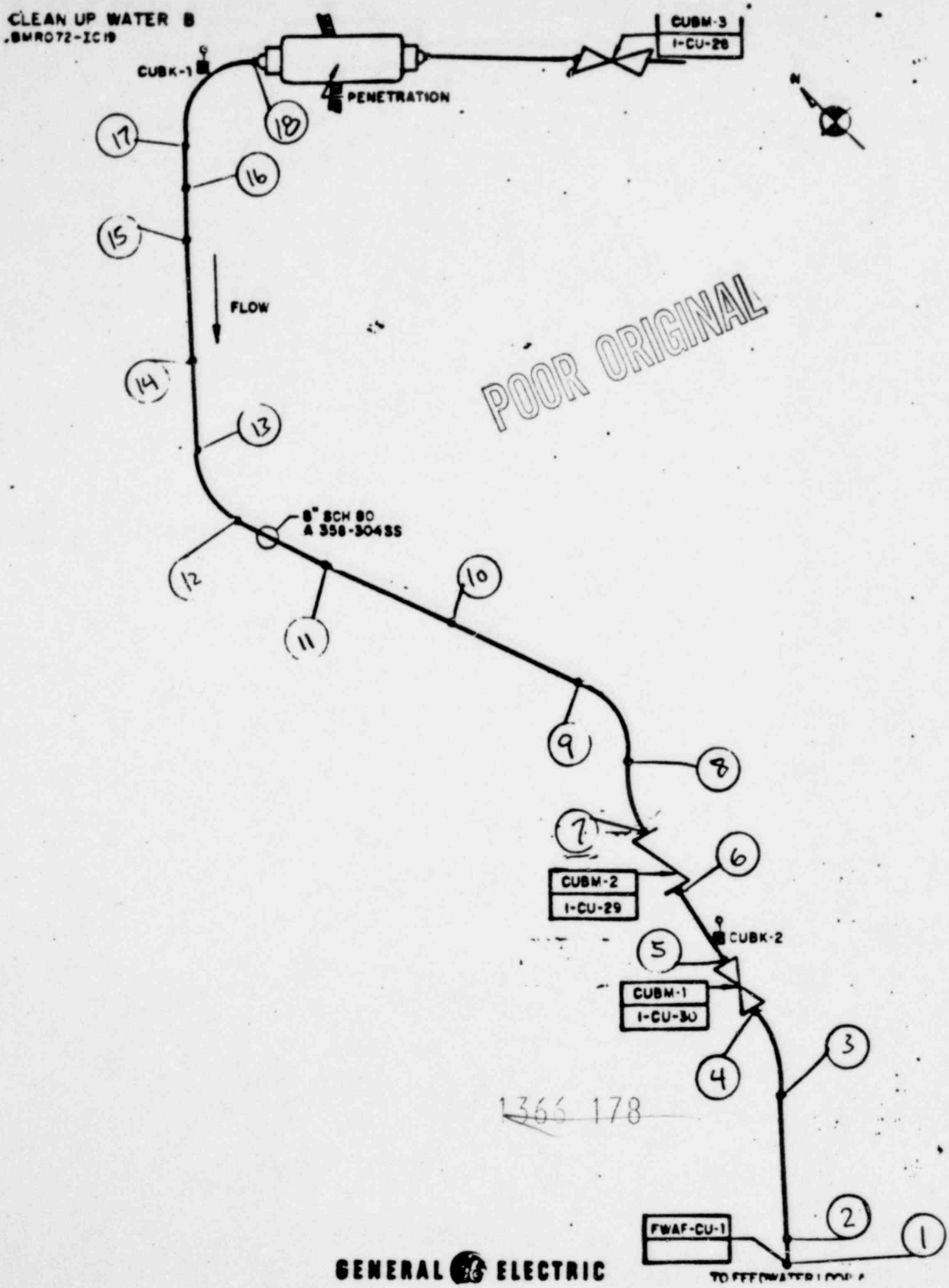
J.12



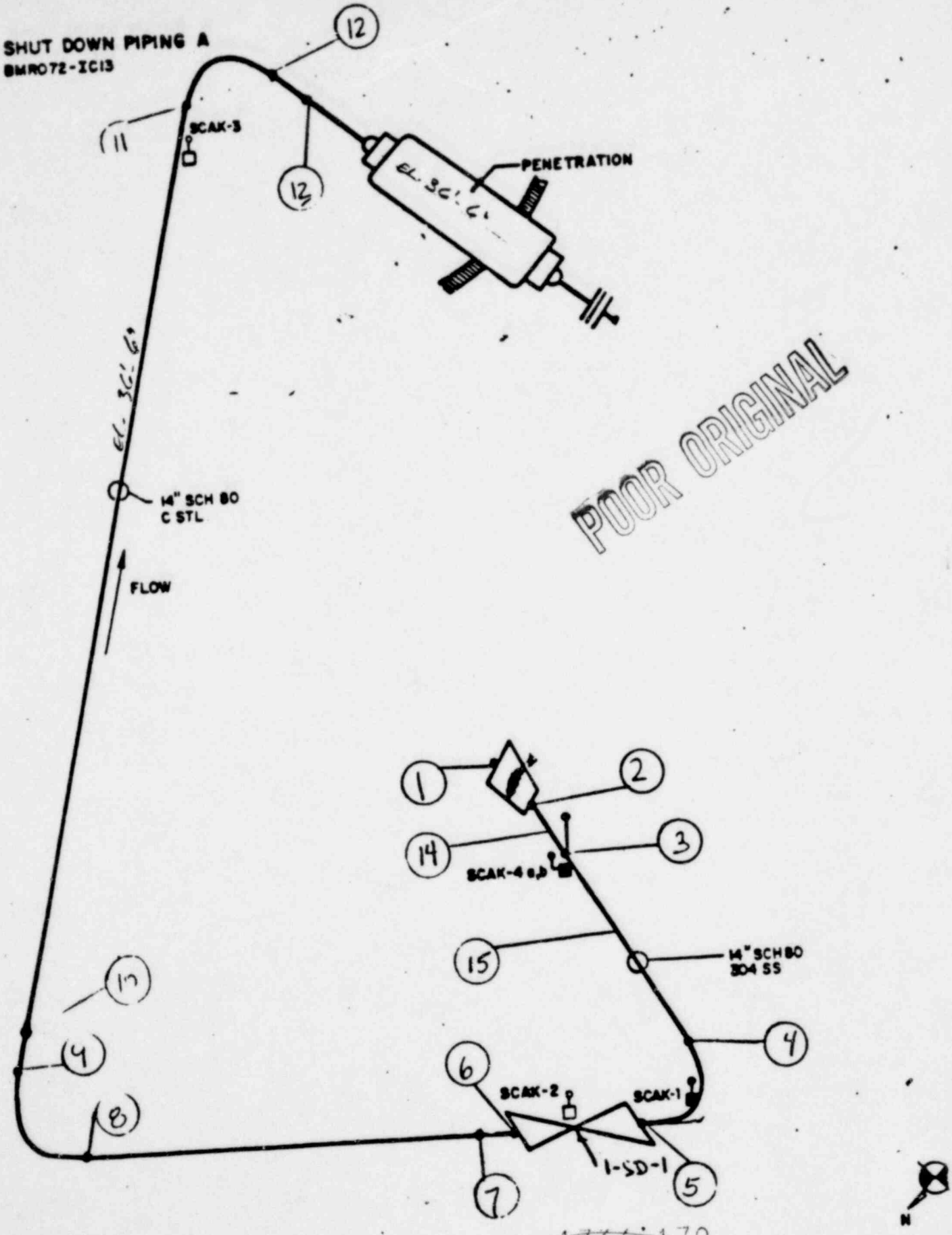
CLEAN UP WATER A-2
BM #072 - IC18

REV. 1 - 6/1/77





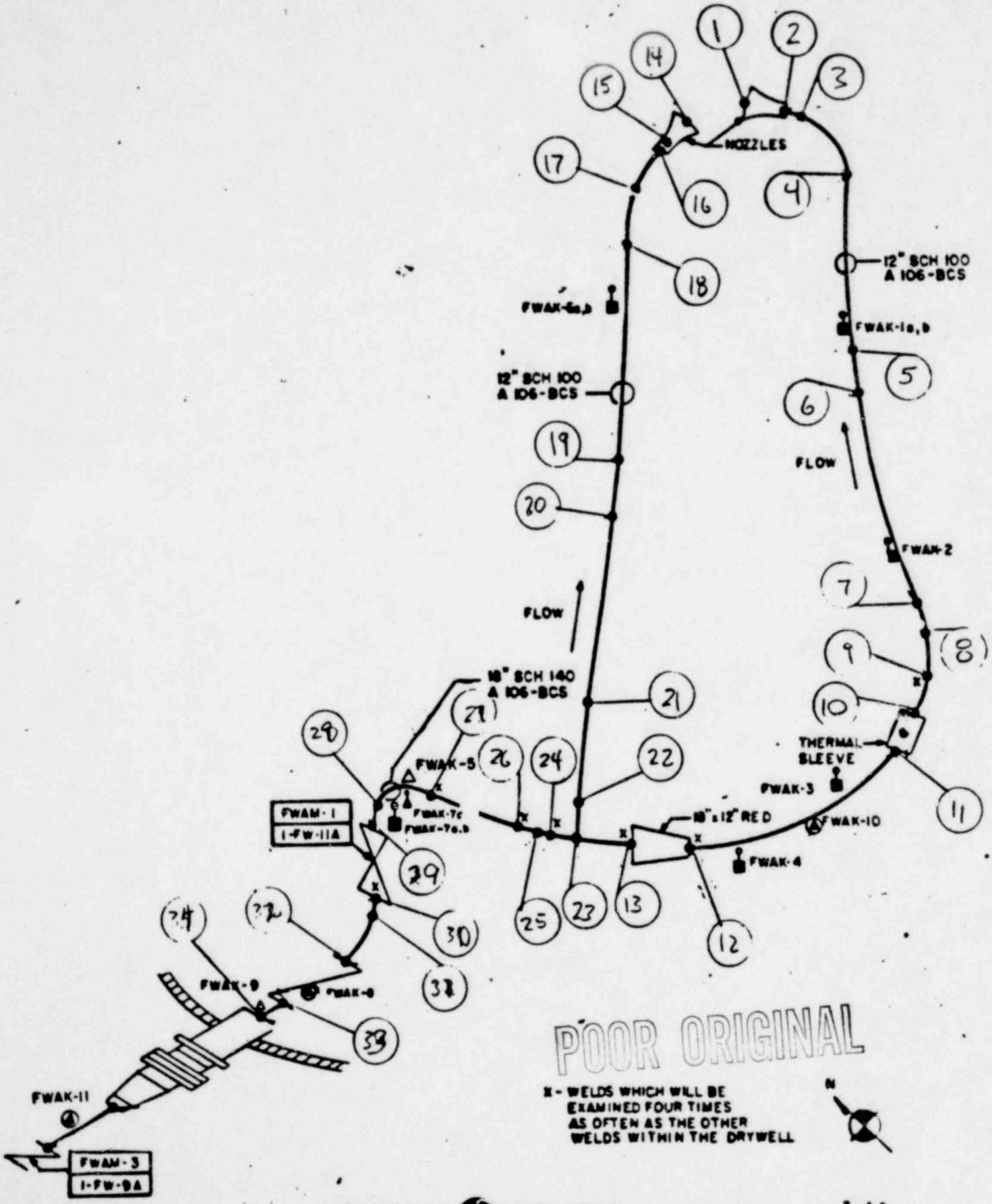
GENERAL ELECTRIC



FEEDWATER A

BWR072-1C6

REV. 1 - 6/1/77



GENERAL ELECTRIC

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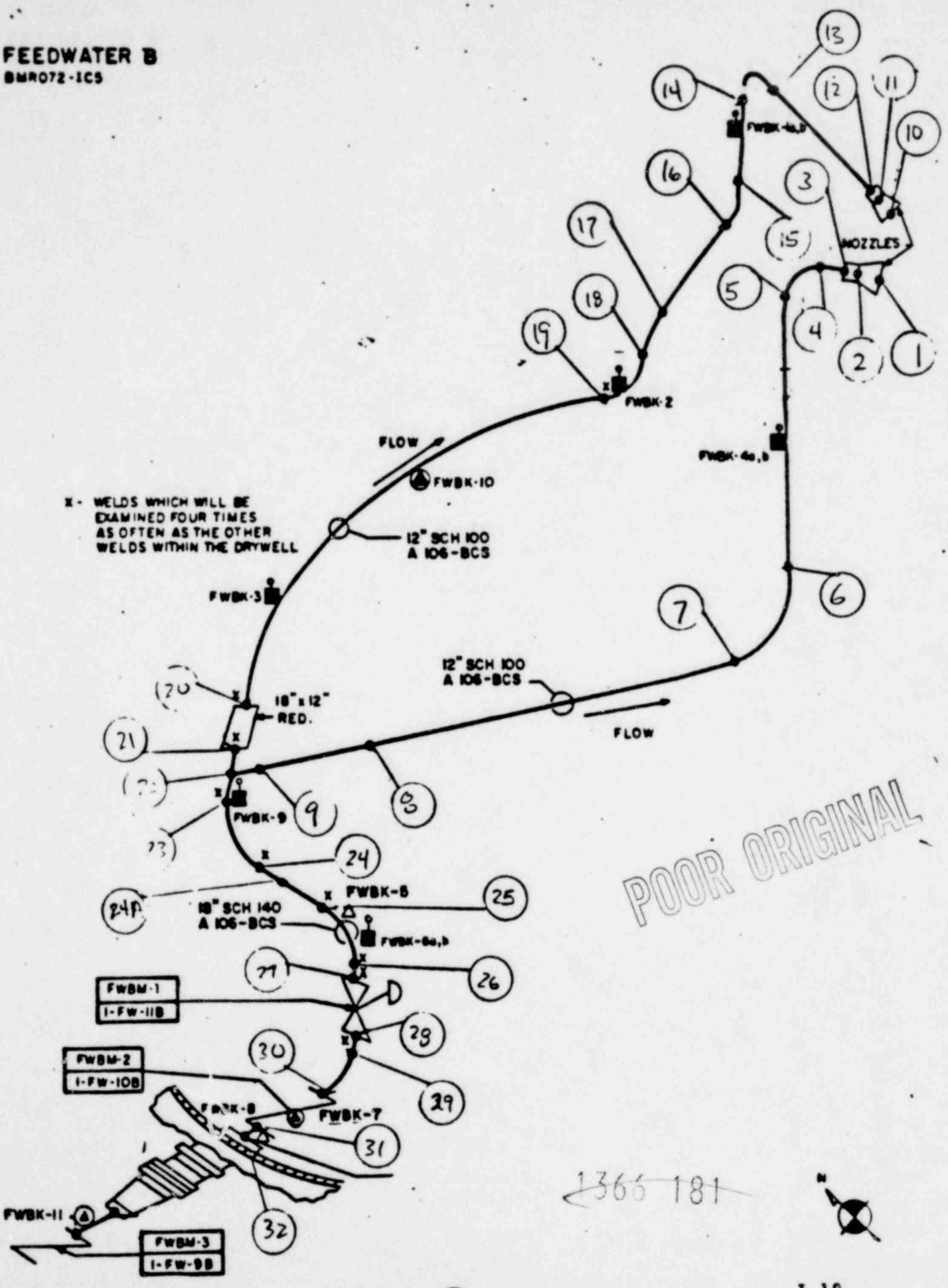
J.16

FEEDWATER B

BMR072-IC5

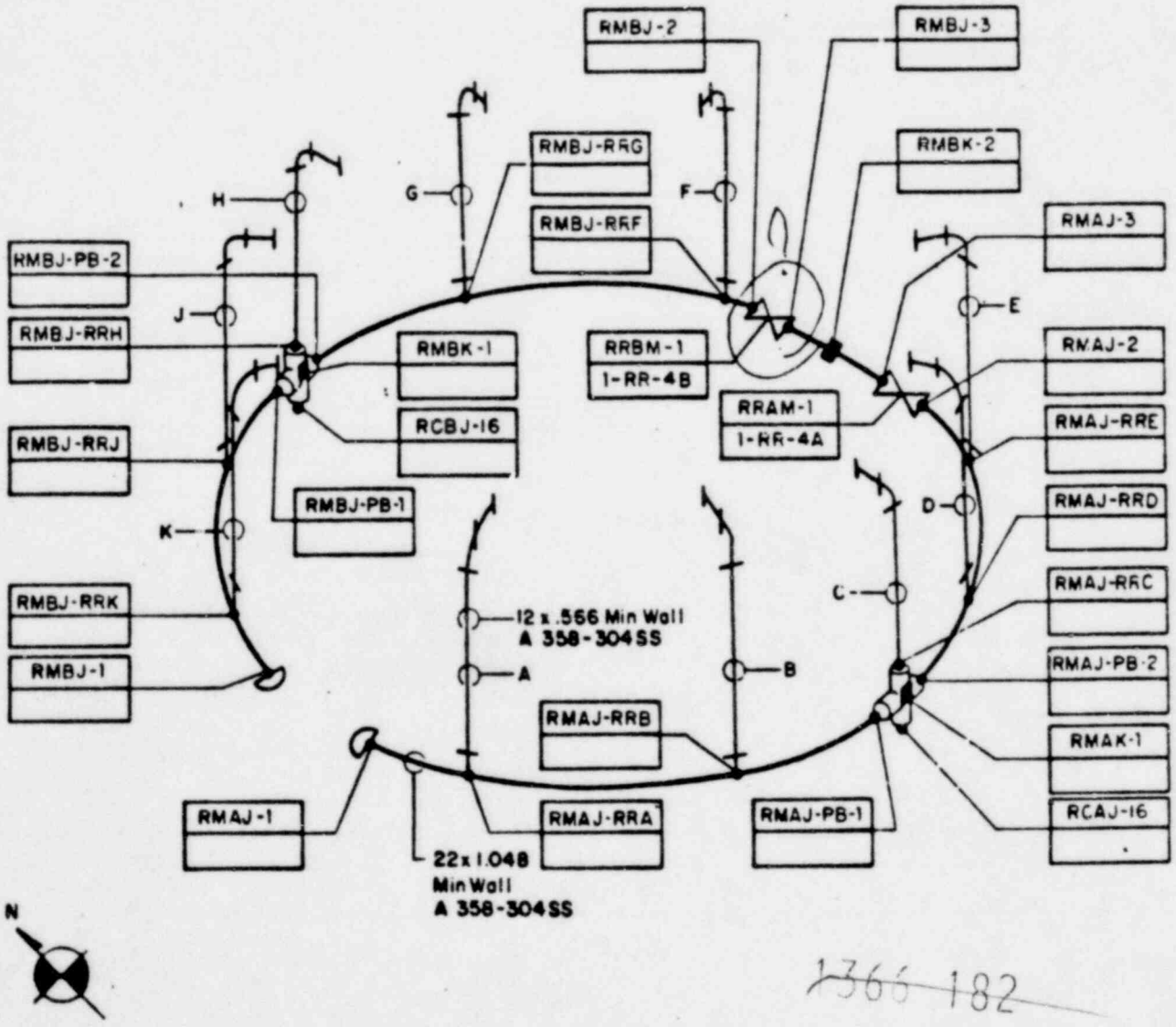


GENERAL ELECTRIC

NOTE: SEE IC-23 FOR RISER DETAILS AND EXAMINATION SCHEDULE

SEE IC-20A FOR HANGER AND RESTRAINT LOCATIONS.

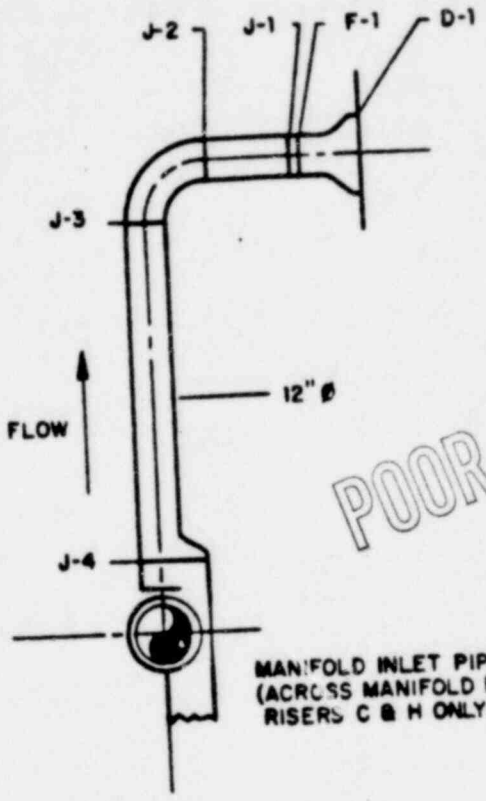
THERE ARE LONGITUDINAL SEAM WELDS IN THIS SYSTEM.



RECIRCULATION RISER (TYPICAL)
BMR072-IC23

TO IDENTIFY WELD, ADD NUMBER FROM SKETCH TO FOLLOWING RISER CODE:

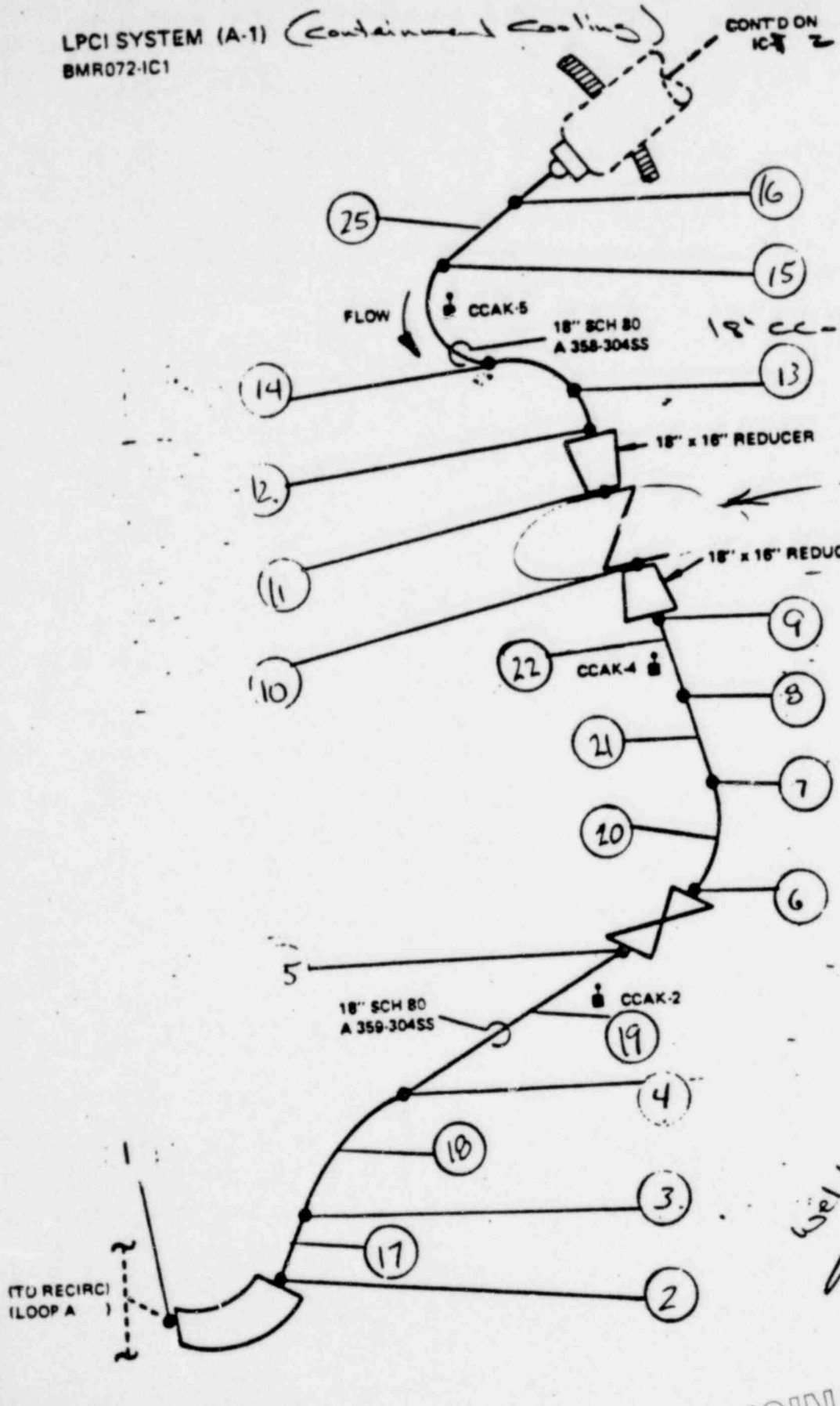
RISER NO.	CODE
A	RRA
B	RRB
C	RRC
D	RRD
E	RRE
F	RRF
G	RRG
H	RRH
J	RRJ
K	RRK



NOTE:
THERE ARE LONGITUDINAL SEAM WELDS IN THIS SYSTEM

~~1366 183~~

LPCI SYSTEM (A-1) (Containment Cooling)
BMR072-IC1



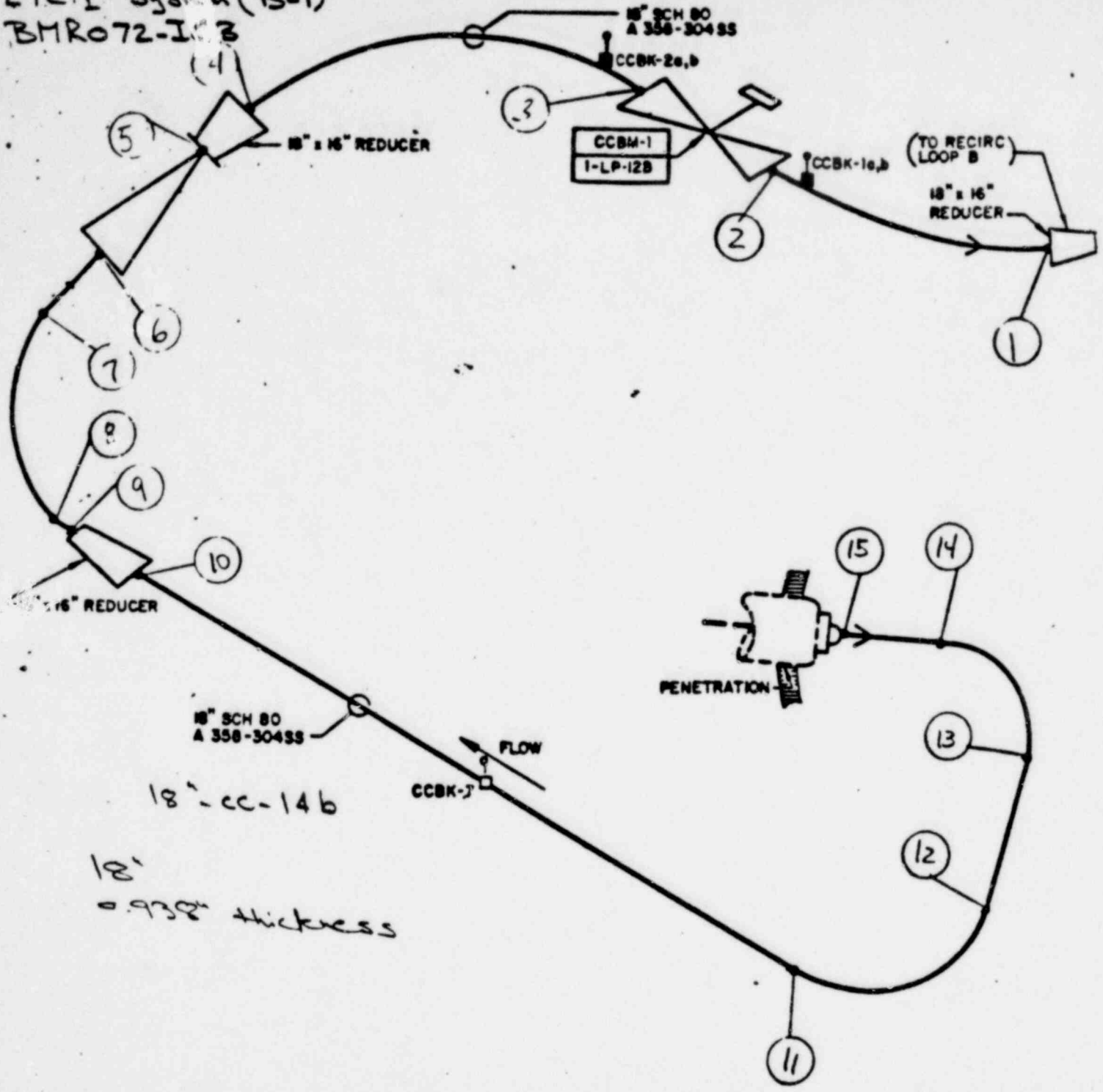
Can we take a credit for a check valve in the line and disregard breaks at 11, 12, 13, 14, 15?

Welds (17) thru (25) are not circumferential pipe welds. (are they integral attachments welds?)

POOR ORIGINAL

J.55

LPCIL System (B-1)
BMR072-I...3



18"-CC-14b

18"
0.938" thickness

Breaks from 6 to 15 are not going to cause a pipe whip. However, long breaks will cause impingement forces on other piping and electrical cable and trays.

N

GENERAL ELECTRIC J.59

Appendix B

Interaction Evaluation Matrices

List of Matrices

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

SOURCE

SYSTEM: Main Steam

LINE: A

DRAWING: BMR 072. IC 10

TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A	N	N	N	N	N	N	N
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A					D N	D N	D N
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							D N
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL							A	A	A
REACTOR VESSEL			N	N	N	N	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: Isolation Condenser, LINE: A, DRAWING: BMR072. IC15 — 8	9	10	11	12	13	14
ISOLATION CONDENSER		A, B	N	N	N	N	N	N	N
CORE SPRAY		A, B							
MAIN STEAM		A, B, C, D			A N	A N			
REACTOR CLEANUP		A, B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A					A N		
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A, B, C, D, E, F, G, H, J, K							
PRIMARY CONTAINMENT COOLING (LPCI)		A, B							
MAIN STEAM RELIEF VALVES		A, B, C, D, E, F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

SYSTEM			Isolation Condenser	
LINE			A	
DRAWING			BMR072-IC15	
BK. PT.			15	16	17
TARGET					
ISOLATION CONDENSER		A B	N	N	N
CORE SPRAY		A B			
MAIN STEAM		A B C D			
REACTOR CLEANUP		A B			
SHUTDOWN COOLING		A			
FEEDWATER	(18") (12") (18") (12")	A A B B			
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK				
REACTOR RECIRCULATION	(12")	A B C D E F G H J K			
PRIMARY CONTAINMENT COOLING (LPCI)		A B			
MAIN STEAM RELIEF VALVES		A B C D E F			
ELECTRICAL	(Whip) (Impingement)				
BIOLOGICAL SHIELD WALL			A	A	A
REACTOR VESSEL			N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Isolation Condenser						
LINE			B						
DRAWING			BMR072-IC16						
			1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B	—	—	—	—	—	—	—
CORE SPRAY		A	N	N	N	N	N	N	N
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)				D				
	(Impingement)				N				
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Isolation Condenser						
LINE			B						
DRAWING			BMR 072 - IC 16						
			8	9	10	11	12	13	14
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B	—	—	—	—	—	—	—
CORE SPRAY		A	N	N	N	N	N	N	N
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F			↓	↓			
ELECTRICAL	(Whip)				D	D			
	(Impingement)				N	N			
BIOLOGICAL SHIELD WALL						A	A		
REACTOR VESSEL			↓	↓	↓	N	N	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE	
		SYSTEM	Isolation Condenser	
		LINE	B	
		DRAWING	BMR072-IC16	
TARGET		BK. PT.	15	16
ISOLATION CONDENSER		A	N	N
		B	—	—
CORE SPRAY		A	N	N
		B		
MAIN STEAM		A		
		D		
		C		
		D		
REACTOR CLEANUP		A		
		B		
SHUTDOWN COOLING		A		
FEEDWATER	(18")	A		
	(12")	A		
	(18")	B		
	(12")	B		
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK			
	SOUTH BANK			
REACTOR RECIRCULATION	(12")	A		
		B		
		C		
		D		
		E		
		F		
		G		
		H		
		J		
		K		
PRIMARY CONTAINMENT COOLING (LPCI)		A		
		B		
MAIN STEAM RELIEF VALVES		A		
		B		
		C		
		D		
		E		
		F		
ELECTRICAL	(Whip)			
	(Impingement)			
BIOLOGICAL SHIELD WALL				
REACTOR VESSEL				

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Core Spray						
		LINE	A						
		DRAWING	BMR072. IC11						
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	Z	Z	Z	Z	Z	Z	Z
		B							
CORE SPRAY		A	IZ	IZ	IZ	IZ	IZ	IZ	IZ
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL		(Whip)							
		(Impingement)							
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Core Spray						
LINE			A						
DRAWING			BMR072. IC11						
			8	9	10	11	12	13	14
ISOLATION CONDENSER		A	Z	Z	Z	Z	Z	Z	Z
		B							
CORE SPRAY		A	I Z	I Z	I Z	I Z	I Z	I Z	I Z
		B							
MAIN STEAM		A				Z			
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL			↓	↓	↓	↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE					
		SYSTEM	Core Spray					
		LINE	B					
		DRAWING	BMR 072 - IC 12					
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A	N	N	N	N	N	N	N
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL		(Whip)							
		(Impingement)							
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL			↓	↓	↓	↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	9	10	11	12	13	14
			Core Spray	B	BMR072-IC 12						
ISOLATION CONDENSER		A				N	N	N	N	N	N
		B									
CORE SPRAY		A									
		B									
MAIN STEAM		A									
		B									
		C						A N			
		D									
REACTOR CLEANUP		A									
		B									
SHUTDOWN COOLING		A									
FEEDWATER	(18")	A									
	(12")	A									
	(18")	B									
	(12")	B									
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK										
	SOUTH BANK										
REACTOR RECIRCULATION	(12")	A									
		B									
		C									
		D									
		E									
		F									
		G									
		H									
		J									
		K									
PRIMARY CONTAINMENT COOLING (LPCI)		A									
		B									
MAIN STEAM RELIEF VALVES		A									
		B									
		C									
		D									
		E									
		F									
ELECTRICAL	(Whip)										
	(Impingement)										
BIOLOGICAL SHIELD WALL											
REACTOR VESSEL						↓	↓	↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	1	2	3	4	5	6	7
			Main Steam	A	BMR 072. IC 10							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B										
CORE SPRAY		A										
		B										
MAIN STEAM		A				I	I	I	I	I	I	I
		B										
		C										
		D										
REACTOR CLEANUP		A										
		B										
SHUTDOWN COOLING		A										
FEEDWATER	(18")	A								D	D	D
	(12")	A								N	N	N
	(18")	B										
	(12")	B										
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK											
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A										
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										D
		B										N
MAIN STEAM RELIEF VALVES		A										
		B										
		C										
		D										
		E										
		F										
ELECTRICAL	(Whip)											
	(Impingement)											
BIOLOGICAL SHIELD WALL										A	A	A
REACTOR VESSEL										N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

		SOURCE						
	SYSTEM	Main Steam						
	LINE	A						
	DRAWING	BMR072. IC10						
TARGET	BK. PT.	8	9	10	11	12	13	14
ISOLATION CONDENSER	A, B	N	N	N	N	N	N	N
CORE SPRAY	A, B							
MAIN STEAM	A, B, C, D	N	N	N	N	N	N	N
REACTOR CLEANUP	A, B							
SHUTDOWN COOLING	A							
FEEDWATER (18")	A	D						
FEEDWATER (12")	A							
FEEDWATER (18")	B							
FEEDWATER (12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK							
	SOUTH BANK							
REACTOR RECIRCULATION (12")	A	D						
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	J							
	K							
PRIMARY CONTAINMENT COOLING (LPCI)	A	D	D	D	D	D	D	D
	B							
MAIN STEAM RELIEF VALVES	A		D					
	B							
	C							
	D							
	E							
	F							
ELECTRICAL (Whip)			N	N	N	N	N	N
(Impingement)								
BIOLOGICAL SHIELD WALL			A	A	A	A	A	A
REACTOR VESSEL		N	N	N	N	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Main Steam						
LINE			A						
DRAWING			BMR072-2C10						
			15	16	17	18	19	19A	20
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A	N	N	N	N	N	N	N
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A				D	D	D	D
FEEDWATER	(18")	A				N	N	N	N
	(12")	A		D	D				
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C		D	D				
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A	D	D	D				
		B							
MAIN STEAM RELIEF VALVES		A				D	D	D	D
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL			A						
REACTOR VESSEL			N						

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	20A	21	22	23	24	25
			Main Steam	A	BMR072. IC10						
ISOLATION CONDENSER		A				N	N	N	N	N	N
		B									
CORE SPRAY		A									
		B									
MAIN STEAM		A				I	I	I	I	I	I
		B						N	N	N	N
		C									
		D									
REACTOR CLEANUP		A									
		B									
SHUTDOWN COOLING		A				D	D				
FEEDWATER	(18")	A				N	N				
	(12")	A									
	(18")	B									
	(12")	B									
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK										
	SOUTH BANK										
REACTOR RECIRCULATION	(12")	A									
		B									
		C									
		D									
		E									
		F									
		G									
		H									
		J									
		K									
PRIMARY CONTAINMENT COOLING (LPCI)		A									
		B									
MAIN STEAN RELIEF VALVES		A				I	I				
		B				D	D				
		C				N	N				
		D									
		E									
		F									
ELECTRICAL	(Whip)										
	(Impingement)										
BIOLOGICAL SHIELD WALL											
REACTOR VESSEL						↑	↑	↑	↑	↑	↑

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

SOURCE

SYSTEM: Main Steam

LINE: B

DRAWING: BMR 072- IC9

TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A	I N	I N	I N	I N	I N N	I N N	I N
		B							
		C							
		D							
REACTOR CLEANUP		A					D N	D N	
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A					D N	D N	
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								A
	(Impingement)								
BIOLOGICAL SHIELD WALL									N
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	8	9	10	11	11A	12	13
			Main Steam	B	BMR072. IC9							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B										
CORE SPRAY		A										
		B										
MAIN STEAM		A				N	N	A	A	N	D	D
		B				N	N	N	N	N	N	N
		C										
		D										
REACTOR CLEANUP		A										
		B										
SHUTDOWN COOLING		A										
FEEDWATER	(18")	A										
	(12")	A										
	(18")	B										
	(12")	B										
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK											
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A						D	D	D		
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										
		B										
MAIN STEAM RELIEF VALVES		A										
		B										
		C										
		D										
		E										
		F										
ELECTRICAL	(Whip)											
	(Impingement)											
BIOLOGICAL SHIELD WALL						A	A	A	A			
REACTOR VESSEL						N	N	N	N			

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	14	15	16	17	18	19	19A
			Main Steam	B	BMR072-IC9							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B							N			
CORE SPRAY		A							D			
		B							N			
MAIN STEAM		A				I	I	I	I	I	I	I
		B				N	N	N	N	N	N	N
		C								N	N	N
		D										
REACTOR CLEANUP		A								D	D	D
		B								N	N	N
SHUTDOWN COOLING		A										
FEEDWATER	(18")	A										
	(12")	A										
	(18")	B										
	(12")	B										
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK											
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A										
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										
		B										
MAIN STEAM RELIEF VALVES		A										
		B										
		C										
		D										
		E										
		F										
ELECTRICAL	(Whip)											
	(Impingement)											
BIOLOGICAL SHIELD WALL												
REACTOR VESSEL						N	N	N	N	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

		SOURCE					
	SYSTEM	Main Steam					
	LINE	B					
	DRAWING	BMR072-IC9					
TARGET	BK. PT.	20	21	22	23	24	25
ISOLATION CONDENSER	A	N	N	N	N	N	N
	B						
CORE SPRAY	A						
	B						
MAIN STEAM	A	I	I	I	I	I	I
	B	I	I	I	I	I	I
	C	I	I	I	I	I	I
	D	N	N	N	N	N	N
REACTOR CLEANUP	A	D	D				
	B	N	N				
SHUTDOWN COOLING	A						
FEEDWATER (18")	A						
FEEDWATER (12")	A						
FEEDWATER (18")	B						
FEEDWATER (12")	B						
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK						
	SOUTH BANK						
REACTOR RECIRCULATION (12")	A						
	B						
	C						
	D						
	E						
	F						
	G						
	H						
	J						
	K						
PRIMARY CONTAINMENT COOLING (LPCI)	A						
	B						
MAIN STEAM RELIEF VALVES	A						
	B						
	C						
	D						
	E						
	F						
ELECTRICAL (Whip)						I	I
ELECTRICAL (Impingement)		N	N	N	N	D	D
BIOLOGICAL SHIELD WALL		A	A	A	A	A	A
REACTOR VESSEL		N	N	N	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Main Steam						
		LINE	C						
		DRAWING	BMR072. IC8						
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A	I	I	I	I	I	I	I
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								D
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A	D	D	D	D	D	D	D
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A	N	N	N	N			
		B							
MAIN STEAM RELIEF VALVES		A	N	N	N	N			
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	8	9	10	11	12	13	14
		SOURCE							
		SYSTEM	Main Steam						
		LINE	C						
		DRAWING	BMR072-1C8						
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A					D		
		B							
MAIN STEAM		A	I	I	I	I	N	I	I
		B	N	N	N	N	N	N	N
		C					A		
		D					N		
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		D			D			
	SOUTH BANK		N			N			
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H	D	D	D	D			
		J	N	N	N	N			
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A		N	N				
		B		D	D				
MAIN STEAM RELIEF VALVES		A		N	N				
		B							
		C							
		D						A	
		E						N	
		F							
ELECTRICAL	(Whip)								
	(Impingement)			N	N				
BIOLOGICAL SHIELD WALL				A	A				
REACTOR VESSEL				N	N				

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Main Steam						
LINE			C						
DRAWING			BMR072. IC8						
			15	16	17	18	19	20	21
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A		D					
		B							
MAIN STEAM		A	I	N	I	I	I	I	I
		B		N					
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C	A	N					
		D							
		E							
		F							
ELECTRICAL	(Whip)			D	D				
	(Impingement)								
BIOLOGICAL SHIELD WALL				N	N				A
REACTOR VESSEL				N	N				

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: Main Steam, C, BMR072-IC8 — 22	23	24
ISOLATION CONDENSER		A	N	N	N
		B			
CORE SPRAY		A			
		B			
MAIN STEAM		A			
		B			
		C	N	N	N
		D			
REACTOR CLEANUP		A			
		B			
SHUTDOWN COOLING		A			
FEEDWATER	(18")	A			
	(12")	A			
	(18")	B			
	(12")	B			
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK				
	SOUTH BANK				
REACTOR RECIRCULATION	(12")	A			
		B			
		C			
		D			
		E			
		F			
		G			
		H			
		J			
		K			
PRIMARY CONTAINMENT COOLING (LPCI)		A			
		B			
MAIN STEAM RELIEF VALVES		A			
		B			
		C			
		D			
		E			
		F			
ELECTRICAL	(Whip)				
	(Impingement)				
BIOLOGICAL SHIELD WALL			A	A	A
REACTOR VESSEL			N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Main Steam						
		LINE	D						
		DRAWING	BMR072-IC7						
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A	N	N	N	N	N	N	N
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B	D	D	D	D	D	D	D
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		N	N	N	N	N	N	N
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL							A	A	A
REACTOR VESSEL							N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	8	9	10	11	12	13	14
			Main Steam	D	BMR 072 - IC7							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B										
CORE SPRAY		A										
		B										
MAIN STEAM		A										
		B										
		C										
		D										
REACTOR CLEANUP		A				N	N	N	N	N	N	N
		B										
SHUTDOWN COOLING		A										
FEEDWATER	(18")	A										
	(12")	A										
	(8")	B										
	(12")	B				D						
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK					N						
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A										
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										
		B										
MAIN STEAM RELIEF VALVES		A										
		B										
		C										
		D										
		E										
		F										
ELECTRICAL	(Whip)											
	(Impingement)											
BIOLOGICAL SHIELD WALL						A						
REACTOR VESSEL						N						

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	15	16	17	18	18A	19	19A
			Main Steam	D	BMR a72. IC7							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B										
CORE SPRAY		A										
		B										
MAIN STEAM		A										
		B										
		C										
		D										
REACTOR CLEANUP		A				N	N	N	N	N	N	N
		B										
SHUTDOWN COOLING		A										
FEEDWATER	(18")	A										
	(12")	A				A	A	D	D	D	D	D
	(18")	B				N	N					
	(12")	B										
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK							N	N	N	N	N
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A										
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										
		B										
MAIN STEAM RELIEF VALVES		A										
		B										
		C						D	D	D	D	D
		D						N	N	N	N	N
		E										
		F										
ELECTRICAL	(Whip)					D	A					
	(Impingement)					D	D					
BIOLOGICAL SHIELD WALL						N	N					
REACTOR VESSEL						N	N					

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

		SOURCE				
	SYSTEM	Main Steam				
	LINE	D				
	DRAWING	BMR072-IC7				
TARGET	BK. PT.	20	21	22	23	24
ISOLATION CONDENSER	A B	N	N	N	N	N
CORE SPRAY	A B					
MAIN STEAM	A B C D	I	A	A	A	A
REACTOR CLEANUP	A B	N	N	N	N	N
SHUTDOWN COOLING	A					
FEEDWATER (18") A (12") A (18") B (12") B		D				
CONTROL ROD DRIVE (Supply & Return) NORTH BANK SOUTH BANK		N				
REACTOR RECIRCULATION (12")	A B C D E F G H J K					
PRIMARY CONTAINMENT COOLING (LPCI)	A B		D	D	D	D
MAIN STEAM RELIEF VALVES	A B C D E F	DN	NNDN	NNDN	NNDN	NNDN
ELECTRICAL	(Whip) (Impingement)				D	D
BIOLOGICAL SHIELD WALL					N	N
REACTOR VESSEL					N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Cleanup Water						
		LINE	A						
		DRAWING	BMR 072. IC 17, 18						
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A	N	N	N	N	N	N	N
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)					D	D		
	(Impingement)					N	N		
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL									

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LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Cleanup Water						
		LINE	A						
		DRAWING	BMR 072 - IC 17, 18						
TARGET		BK. PT.	8	9	10	11	12	13	14
ISOLATION CONDENSER		A	Z	Z	Z	Z	Z	Z	Z
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A	Z	Z	Z	Z	Z	Z	Z
		B							
SHUTDOWN COOLING		A		A	A				
FEEDWATER	(18")	A		Z	Z			A Z	A Z
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)		D						
	(Impingement)								
BIOLOGICAL SHIELD WALL			Z			A	A		
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Cleanup Water
		LINE	A
		DRAWING	BMR 072 - IC 17,18
ISOLATION CONDENSER		A B	15
CORE SPRAY		A B	N
MAIN STEAM		A B C D	
REACTOR CLEANUP		A B	21
SHUTDOWN COOLING		A	
FEEDWATER	(18") (12") (18") (12")	A A B B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK		
REACTOR RECIRCULATION	(12")	A B C D E F G H J K	
PRIMARY CONTAINMENT COOLING (LPCI)		A B	
MAIN STEAM RELIEF VALVES		A B C D E F	
ELECTRICAL	(Whip) (Impingement)		
BIOLOGICAL SHIELD WALL			A
REACTOR VESSEL			N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	1	2	3	4	5	6	7
			Cleanup Water	B	BMR 012 - IC 19							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B										
CORE SPRAY		A										
		B										
MAIN STEAM		A										
		B										
		C										
		D										
REACTOR CLEANUP		A				D	D	D	D	D	D	D
		B										
SHUTDOWN COOLING		A				N	N	N	N	N	N	N
FEEDWATER	(18")	A										
	(12")	A										
	(18")	B										
	(12")	B										
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK											
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A										
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										
		B										
MAIN STEAM RELIEF VALVES		A										
		B										
		C										
		D										
		E										
		F										
ELECTRICAL	(Whip)											
	(Impingement)											
BIOLOGICAL SHIELD WALL												
REACTOR VESSEL												

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	8	9	10	11	12	13	14
			Cleanup Water	B	BMR-072. IC19							
ISOLATION CONDENSER		A				N	N	N	N	N	N	N
		B										
CORE SPRAY		A										
		B										
MAIN STEAM		A										
		B										
		C										
		D										
REACTOR CLEANUP		A				↓	↓	↓	↓	↓	↓	↓
		B										
SHUTDOWN COOLING		A				N	N	N	N	N	N	N
FEEDWATER	(18")	A										
	(12")	A										
	(18")	B										
	(12")	B										
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK											
	SOUTH BANK											
REACTOR RECIRCULATION	(12")	A										
		B										
		C										
		D										
		E										
		F										
		G										
		H										
		J										
		K										
PRIMARY CONTAINMENT COOLING (LPCI)		A										
		B										
MAIN STEAM RELIEF VALVES		A										
		B										
		C										
		D										
		E										
		F										
ELECTRICAL	(Whip)											
	(Impingement)											
BIOLOGICAL SHIELD WALL												
REACTOR VESSEL						↓	↓	↓	↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET			SOURCE			
SYSTEM			Cleanup Water			
LINE			B			
DRAWING			BMR072- IC19			
BK. PT.			15	16	17	18
ISOLATION CONDENSER		A, B	N	N	N	N
CORE SPRAY		A, B				
MAIN STEAM		A, B, C, D				
REACTOR CLEANUP		A, B	↓	↓	↓	↓
SHUTDOWN COOLING		A	N	N	N	N
FEEDWATER	(18")	A				
	(12")	A				
	(18")	B				
	(12")	B				
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK					
	SOUTH BANK					
REACTOR RECIRCULATION	(12")	A, B, C, D, E, F, G, H, J, K				
PRIMARY CONTAINMENT COOLING (LPCI)		A, B				
MAIN STEAM RELIEF VALVES		A, B, C, D, E, F				
ELECTRICAL	(Whip)					
	(Impingement)					
BIOLOGICAL SHIELD WALL						
REACTOR VESSEL			↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Shutdown Cooling						
		LINE	A						
		DRAWING	BMR072-IC13						
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A	—	—	—	—	—	—	—
FEEDWATER	(18")	A	N	N	N	N	N	N	N
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)						D	D	D
	(Impingement)								
BIOLOGICAL SHIELD WALL							N	N	N
REACTOR VESSEL									

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM						
			LINE						
			DRAWING						
			8	9	10	11	12	13
ISOLATION CONDENSER		A	N	N	N	N	N	N
		B						
CORE SPRAY		A						
		B						
MAIN STEAM		A						
		B						
		C		A	A	A		
		D		N	N	N		
REACTOR CLEANUP		A					D	D
		B					N	N
SHUTDOWN COOLING		A	—	—	—	—	—	—
FEEDWATER	(18")	A	N	N	N	N	N	N
	(12")	A						
	(18")	B						
	(12")	B						
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK							
	SOUTH BANK							
REACTOR RECIRCULATION	(12")	A						
		B						
		C						
		D						
		E						
		F						
		G						
		H						
		J						
		K						
PRIMARY CONTAINMENT COOLING (LPCI)		A						
		B						
MAIN STEAM RELIEF VALVES		A						
		B						
		C						
		D						
		E						
		F						
ELECTRICAL	(Whip)		D	D	D	D	D	D
	(Impingement)		D	N	N	N	N	N
BIOLOGICAL SHIELD WALL			N				N	N
REACTOR VESSEL			N				N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

		SOURCE						
	SYSTEM	Feedwater						
	LINE	A						
	DRAWING	BMR072 - IC6						
TARGET	BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER	A B	N	N	N	N	N	N	N
CORE SPRAY	A B							
MAIN STEAM	A B C D							
REACTOR CLEANUP	A B							
SHUTDOWN COOLING	A							
FEEDWATER (18")	A	N	N	N	N	N	N	N
FEEDWATER (12")	A	N	N	N	N	N	N	N
FEEDWATER (18")	B	N	N	N	N	N	N	N
FEEDWATER (12")	B	N	N	N	N	N	N	N
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK							
REACTOR RECIRCULATION (12")	A B C D E F G H J K						N	
PRIMARY CONTAINMENT COOLING (LPCI)	A B						D	
MAIN STEAM RELIEF VALVES	A B C D E F						D	D
ELECTRICAL	(Whip) (Impingement)						D	D
BIOLOGICAL SHIELD WALL					A	A	A	A
REACTOR VESSEL		N	N	N	N	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Feedwater						
		LINE	A						
		DRAWING	BMR072-IC6						
TARGET		BK. PT.	8	9	10	11	12	13	14
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A					↓	↓	
		B							
MAIN STEAM		A					AN	AN	
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A	↓	↓	↓	↓	↓	↓	↓
FEEDWATER	(18")	A	IN	IN	IN	IN	IN	IN	IN
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A		↓	↓	↓	↓	↓	
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A		DN	DN	DN	DN	DN	
		B							
MAIN STEAM RELIEF VALVES		A		DDNNN	DDNNN	DDNNN	DDNNN	DDNNN	
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)		↓	DN	DN	DN	DN	DN	
	(Impingement)			↓	↓	↓	↓	↓	
BIOLOGICAL SHIELD WALL			AN				N	N	
REACTOR VESSEL			N	↓	↓	↓	N	N	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Feedwater						
LINE			A						
DRAWING			BMR 072. ICG						
			15	16	17	18	19	20	21
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A	N	N	N	N	N	N	N
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A			D N	D N	D N	D N	D N
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)						D N	D N	D N
	(Impingement)								
BIOLOGICAL SHIELD WALL					A	A	A	A	A
REACTOR VESSEL			N	N	N	N	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

		SOURCE						
	SYSTEM	Feedwater						
	LINE	A						
	DRAWING	BMR072. IC6						
TARGET	BK. PT.	22	23	24	25	26	27	28
ISOLATION CONDENSER	A	N	N	N	N	N	N	N
	B							
CORE SPRAY	A			N	N			
	B							
MAIN STEAM	A			A	A	A	A	
	B			N	N	N	N	
	C							
	D							
REACTOR CLEANUP	A	N	N	N	N	N	N	
	B							
SHUTDOWN COOLING	A	N	N	N	N	N	N	D
FEEDWATER (18")	A	I	I	I	I	I	I	I
(12")	A	N	N	N	N	N	N	N
(18")	B							
(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK							
	SOUTH BANK							
REACTOR RECIRCULATION (12")	A							
	B							
	C							
	D							
	E							
	F							
	G							
	H							
	J							
	K							
PRIMARY CONTAINMENT COOLING (LPCI)	A							
	B							
MAIN STEAM RELIEF VALVES	A	N		N	N	N	N	
	B	D		D	D	D	D	
	C	N		N	N	N	N	
	D	D		D	D	D	D	
	E	N		N	N	N	N	
	F	D		D	D	D	D	D
ELECTRICAL (Whip)		N	A	N	N	N	N	N
(Impingement)		A	A					
BIOLOGICAL SHIELD WALL		N	N					
REACTOR VESSEL		N	N					

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE					
SYSTEM			Feedwater					
LINE			A					
DRAWING			BMR 072. IC 6					
			29	30	31	32	33	34
ISOLATION CONDENSER		A	N	N	N	N	N	N
		B						
CORE SPRAY		A						
		B						
MAIN STEAM		A				A N		
		B						
		C						
		D						
REACTOR CLEANUP		A						
		B						
SHUTDOWN COOLING		A	D	D	D			
FEEDWATER	(18")	A	—	—	—	—	—	—
	(12")	A	N	N	N	N	N	N
	(18")	B						
	(12")	B						
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK							
	SOUTH BANK							
REACTOR RECIRCULATION	(12")	A						
		B						
		C						
		D						
		E						
		F						
		G						
		H						
		J						
		K						
PRIMARY CONTAINMENT COOLING (LPCI)		A						
		B						
MAIN STEAM RELIEF VALVES		A						
		B						
		C						
		D						
		E						
		F						
ELECTRICAL	(Whip)						D	D
	(Impingement)							
BIOLOGICAL SHIELD WALL							N	N
REACTOR VESSEL							N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			Feedwater						
LINE			B						
DRAWING			BMR 072- ICE						
			1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A	↓	↓	↓	↓	↓	↓	↓
	(12")	A	—	—	—	—	—	—	—
	(18")	B	—	—	—	—	—	—	—
	(12")	B	—	—	—	—	—	—	—
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		N	N	N	N	N	N	N
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C					D N	D N	D N
		D							
		E							
		F							
ELECTRICAL	(Whip)						D N	D N	D N
	(Impingement)								
BIOLOGICAL SHIELD WALL							A	N	A
REACTOR VESSEL			↓	↓	↓	↓	N	N	N

0 200

1366 126

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LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Feedwater						
		LINE	B						
		DRAWING	BMR-72-IC5						
TARGET		BK. PT.	8	9	10	11	12	13	14
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A	↓	↓	↓	↓	↓	↓	↓
	(12")	A	—	—	—	—	—	—	—
	(18")	B	—	—	—	—	—	—	—
	(12")	B	—	—	—	—	—	—	—
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		N	N	N	N	N	N	N
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D	DN	DN	DN	DN			
		E							
		F							
ELECTRICAL	(Whip)		↓	↓					↓
	(Impingement)								
BIOLOGICAL SHIELD WALL			A	A					A
REACTOR VESSEL			N	N	↓	↓	↓	↓	N

0 201

1365 227

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Feedwater						
		LINE	B						
		DRAWING	BMR 072. 1C 5						
TARGET		BK. PT.	15	16	17	18	19	20	21
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		N	N	N	N	N	N	N
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F					D N		
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A							
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D	D N	D N	D N		D N	D N	D N
		E							
		F							
ELECTRICAL	(Whip)		D N	D N	D N		D N	D N	D N
	(Impingement)								
BIOLOGICAL SHIELD WALL				A	A	A			
REACTOR VESSEL				N	N	N			

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	Feedwater						
		LINE	B						
		DRAWING	BMR072. IC5						
TARGET		BK. PT.	22	23	24	24A	25	26	27
ISOLATION CONDENSER		A B	N	N	N	N	N	N	N
CORE SPRAY		A B							
MAIN STEAM		A B C D			AN	AN	AN		
REACTOR CLEANUP		A B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A	—	—	—	—	—	—	—
	(12")	A	—	—	—	—	—	—	—
	(18")	B	—	—	—	—	—	—	—
	(12")	B	—	—	—	—	—	—	—
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK		N	N	N	N	N	N	N
REACTOR RECIRCULATION	(12")	A B C D E F G H J K							
PRIMARY CONTAINMENT COOLING (LPCI)		A B							
MAIN STEAM RELIEF VALVES		A B C D E F		DD	DD	DD	DD	DN	DD
ELECTRICAL	(Whip) (Impingement)			DA AA	DA AA	DA AA	DA AA	DA DN	DA DN
BIOLOGICAL SHIELD WALL				N	N	N	N		
REACTOR VESSEL				N	N	N	N		

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LINE	DRAWING	28	29	30	31	32
			Feedwater	B	BMR072-IC5					
ISOLATION CONDENSER		A				N	N	N	N	N
		B								
CORE SPRAY		A								
		B								
MAIN STEAM		A								
		B						↓		
		C								
		D						A		
REACTOR CLEANUP		A						N		
		B								
SHUTDOWN COOLING		A								
FEEDWATER	(18")	A				↓	↓	↓	↓	↓
	(12")	A				—	—	—	—	—
	(18")	B				—	—	—	—	—
	(12")	B				—	—	—	—	—
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK					N	N	N	N	N
	SOUTH BANK									
REACTOR RECIRCULATION	(12")	A								
		B								
		C								
		D								
		E								
		F								
		G								
		H								
		J								
		K								
PRIMARY CONTAINMENT COOLING (LPCI)		A								
		B								
MAIN STEAM RELIEF VALVES		A								
		B								
		C								
		D								
		E				D	D			
		F				N	N			
ELECTRICAL	(Whip)					D	D	↓	↓	↓
	(Impingement)					N	N			
BIOLOGICAL SHIELD WALL								A	N	N
REACTOR VESSEL						↓	↓	N	N	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE			
		SYSTEM	Recirculation			
		LINE	A			
		DRAWING	BMR 072. IC 20.23			
TARGET		BK. PT.	1	2	3	4
ISOLATION CONDENSER		A	Z	Z	Z	Z
		B				
CORE SPRAY		A				
		B				
MAIN STEAM		A				
		B				
		C				
		D				
REACTOR CLEANUP		A				
		B				
SHUTDOWN COOLING		A				
FEEDWATER	(18")	A				
	(12")	A				
	(18")	B				
	(12")	B				
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		↓	↓	↓	↓
	SOUTH BANK					
REACTOR RECIRCULATION	(12")	A	Z1	Z1	Z1	Z1
		B				
		C				
		D				
		E				
		F				
		G				
		H				
		J				
		K				
PRIMARY CONTAINMENT COOLING (LPCI)		A				
		B				
MAIN STEAM RELIEF VALVES		A				↓ Z
		B				
		C				
		D				
		E				
		F				
ELECTRICAL		(Whip)				
		(Impingement)				
BIOLOGICAL SHIELD WALL						
REACTOR VESSEL			↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Recirculation
		LINE	B
		DRAWING	BMR 072. IC 20, 23
			1 2 3 4
ISOLATION CONDENSER		A	N N N N
		B	
CORE SPRAY		A	
		B	
MAIN STEAM		A	
		B	
		C	
		D	
REACTOR CLEANUP		A	
		B	
SHUTDOWN COOLING		A	
FEEDWATER	(18")	A	
	(12")	A	
	(18")	B	
	(12")	B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		
	SOUTH BANK		
REACTOR RECIRCULATION	(12")	A	I I I I
		B	
		C	
		D	
		E	
		F	
		G	
		H	
		J	
		K	
PRIMARY CONTAINMENT COOLING (LPCI)		A	
		B	
MAIN STEAM RELIEF VALVES		A	
		B	
		C	
		D	A
		E	
		F	
ELECTRICAL	(Whip)		
	(Impingement)		
BIOLOGICAL SHIELD WALL			
REACTOR VESSEL			

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LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Recirculation
		LINE	C
		DRAWING	BMR 072. IC 20,23
			1 2 3 4
ISOLATION CONDENSER		A B	N N N N
CORE SPRAY		A B	
MAIN STEAM		A B C D	
REACTOR CLEANUP		A B	
SHUTDOWN COOLING		A	
FEEDWATER	(18") (12") (18") (12")	A A B B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK		
REACTOR RECIRCULATION	(12")	A B C D E F G H J K	I N I N I N I N
PRIMARY CONTAINMENT COOLING (LPCI)		A B	
MAIN STEAM RELIEF VALVES		A B C D E F	
ELECTRICAL	(Whip) (Impingement)		
BIOLOGICAL SHIELD WALL			
REACTOR VESSEL			↓ ↓ ↓ ↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Recirculation
		LINE	D
		DRAWING	BMR072. IC20.23
			1 2 3 4
ISOLATION CONDENSER		A B	Z Z Z Z
CORE SPRAY		A B	
MAIN STEAM		A B C D	
REACTOR CLEANUP		A B	
SHUTDOWN COOLING		A	
FEEDWATER	(18") (12") (18") (12")	A A B B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK		
REACTOR RECIRCULATION	(12")	A B C D E F G H J K	Z Z Z Z
PRIMARY CONTAINMENT COOLING (LPCI)		A B	
MAIN STEAM RELIEF VALVES		A B C D E F	
ELECTRICAL	(Whip) (Impingement)		
BIOLOGICAL SHIELD WALL			
REACTOR VESSEL			

0 208

1366 234

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Recirculation
		LINE	E
		DRAWING	BMR 072. IC 20.23
			1 2 3 4
ISOLATION CONDENSER		A B	N N N N
CORE SPRAY		A B	
MAIN STEAM		A B C D	
REACTOR CLEANUP		A B	
SHUTDOWN COOLING		A	
FEEDWATER	(18") (12") (18") (12")	A A B B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK		
REACTOR RECIRCULATION	(12")	A B C D E F G H J K	N N N N
PRIMARY CONTAINMENT COOLING (LPCI)		A B	
MAIN STEAM RELIEF VALVES		A B C D E F	
ELECTRICAL	(Whip) (Impingement)		
BIOLOGICAL SHIELD WALL			
REACTOR VESSEL			↓ ↓ ↓ ↓

0 209

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE			
		SYSTEM	Recirculation			
		LINE	F			
		DRAWING	BMR 072 - IC 20.23			
TARGET		BK. PT.	1	2	3	4
ISOLATION CONDENSER		A B	N	N	N	N
CORE SPRAY		A B				
MAIN STEAM		A B C D				
REACTOR CLEANUP		A B				
SHUTDOWN COOLING		A				
FEEDWATER	(18") (12") (18") (12")	A A B B				
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK					
REACTOR RECIRCULATION	(12")	A B C D E F G H J K	N	N	N	N
PRIMARY CONTAINMENT COOLING (LPCI)		A B				
MAIN STEAM RELIEF VALVES		A B C D E F				
ELECTRICAL	(Whip) (Impingement)					
BIOLOGICAL SHIELD WALL						
REACTOR VESSEL						

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LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Recirculation
		LINE	G
		DRAWING	BMR 072. IC 20.23
			1 2 3 4
ISOLATION CONDENSER		A	N N N N
		B	
CORE SPRAY		A	
		B	
MAIN STEAM		A	
		B	
		C	
		D	
REACTOR CLEANUP		A	
		B	
SHUTDOWN COOLING		A	
FEEDWATER	(18")	A	
	(12")	A	
	(18")	B	
	(12")	B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		
	SOUTH BANK		
REACTOR RECIRCULATION	(12")	A	I I I I
		B	
		C	
		D	
		E	
		F	
		G	
		H	
		J	
		K	
PRIMARY CONTAINMENT COOLING (LPCI)		A	
		B	
MAIN STEAM RELIEF VALVES		A	
		B	
		C	
		D	
		E	
		F	
ELECTRICAL	(Whip)		
	(Impingement)		
BIOLOGICAL SHIELD WALL			
REACTOR VESSEL			

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LEGEND
D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE
		SYSTEM	Recirculation
		LINE	H
		DRAWING	BMR072 - IC20.23
			1 2 3 4
ISOLATION CONDENSER		A	N N N N
		B	
CORE SPRAY		A	
		B	
MAIN STEAM		A	
		B	
		C	
		D	
REACTOR CLEANUP		A	
		B	
SHUTDOWN COOLING		A	
FEEDWATER	(18")	A	
	(12")	A	
	(18")	B	
	(12")	B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK		
	SOUTH BANK		
REACTOR RECIRCULATION	(12")	A	
		B	
		C	
		D	
		E	
		F	
		G	A A A A
		H	
		J	
		K	
PRIMARY CONTAINMENT COOLING (LPCI)		A	
		B	
MAIN STEAM RELIEF VALVES		A	
		B	
		C	
		D	
		E	
		F	
ELECTRICAL	(Whip)		
	(Impingement)		
BIOLOGICAL SHIELD WALL			
REACTOR VESSEL			

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE			
		SYSTEM	Recirculation			
		LINE	J			
		DRAWING	BMR 072 - Ic 20,23			
			1	2	3	4
ISOLATION CONDENSER		A	N	N	N	N
		B				
CORE SPRAY		A				
		B				
MAIN STEAM		A	N	N	N	N
		B				
		C				
		D				
REACTOR CLEANUP		A				
		B				
SHUTDOWN COOLING		A				
FEEDWATER	(18")	A				
	(12")	A				
	(18")	B				
	(12")	B				
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK					
	SOUTH BANK					
REACTOR RECIRCULATION	(12")	A				
		B				
		C				
		D				
		E				
		F				
		G				
		H				
		J	N	N	N	N
		K				
PRIMARY CONTAINMENT COOLING (LPCI)		A				
		B				
MAIN STEAM RELIEF VALVES		A				
		B				
		C				
		D				
		E				N
		F				
ELECTRICAL	(Whip)					
	(Impingement)					
BIOLOGICAL SHIELD WALL						
REACTOR VESSEL						

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE			
SYSTEM			Recirculation			
LINE			K			
DRAWING			BMR 072. IC 20.23			
			1	2	3	4
ISOLATION CONDENSER		A	N	N	N	N
		B				
CORE SPRAY		A				
		B				
MAIN STEAM		A				
		B				
		C				
		D				
REACTOR CLEANUP		A				
		B				
SHUTDOWN COOLING		A				
FEEDWATER	(18")	A				
	(12")	A				
	(18")	B				
	(12")	B				
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK					
	SOUTH BANK					
REACTOR RECIRCULATION	(12")	A				
		B				
		C				
		D				
		E				
		F				
		G				
		H				
		J				
		K	—	—	—	—
PRIMARY CONTAINMENT COOLING (LPCI)		A	N	N	N	N
		B				
MAIN STEAM RELIEF VALVES		A				
		B				
		C				
		D				N
		E				
		F				
ELECTRICAL	(Whip)					
	(Impingement)					
BIOLOGICAL SHIELD WALL						
REACTOR VESSEL						

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	1	2	3	4	5	6	7
			LINE: A							
			DRAWING: BMR 072 - IC1							
ISOLATION CONDENSER		A		N	N	N	N	N	N	N
		B								
CORE SPRAY		A						↓	↓	
		B								
MAIN STEAM		A						N	N	
		B								
		C								
		D								
REACTOR CLEANUP		A								
		B								
SHUTDOWN COOLING		A								↓
FEEDWATER	(18")	A								N
	(12")	A								
	(18")	B								
	(12")	B								
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK									
	SOUTH BANK									
REACTOR RECIRCULATION	(12")	A								
		B								
		C								
		D								
		E								
		F								
		G								
		H								
		J								
		K		↓	↓	↓	↓	↓	↓	↓
PRIMARY CONTAINMENT COOLING (LPCI)		A		N	N	N	N	N	N	N
		B								
MAIN STEAM RELIEF VALVES		A								
		B								
		C								
		D								
		E								
		F								
ELECTRICAL	(Whip)									
	(Impingement)									
BIOLOGICAL SHIELD WALL										
REACTOR VESSEL				↓	↓	↓	↓	↓	↓	↓

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	LPCI						
		LINE	A						
		DRAWING	BMR072. IC1						
TARGET		BK. PT.	8	9	10	11	12	13	14
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A	D	D	D				
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A	N	N	N	N	N	N	N
		B							
MAIN STEAM RELIEF VALVES		A							
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)								
	(Impingement)								
BIOLOGICAL SHIELD WALL									
REACTOR VESSEL									

LEGEND
D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE: SYSTEM	LPCI
			LINE	A
			DRAWING	BMR072 - IC1
			BK. PT.	15 16
ISOLATION CONDENSER		A B		N N
CORE SPRAY		A B		
MAIN STEAM		A B C D		
REACTOR CLEANUP		A B		
SHUTDOWN COOLING		A		
FEEDWATER	(18") (12") (18") (12")	A A B B		
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK			
REACTOR RECIRCULATION	(12")	A B C D E F G H J K		
PRIMARY CONTAINMENT COOLING (LPCI)		A B		I2 I2
MAIN STEAM RELIEF VALVES		A B C D E F		
ELECTRICAL	(Whip) (Impingement)			
BIOLOGICAL SHIELD WALL				
REACTOR VESSEL				

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

			SOURCE						
		SYSTEM	LPCI						
		LINE	B						
		DRAWING	BMR072 - IC3						
TARGET		BK. PT.	1	2	3	4	5	6	7
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A	I	I	I	I	I	I	I
		B							
MAIN STEAM RELIEF VALVES		A	N	N	N	N	N	N	N
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)				D				
	(Impingement)								
BIOLOGICAL SHIELD WALL					N				
REACTOR VESSEL					N				

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

TARGET		BK. PT.	SOURCE						
SYSTEM			LPCI						
LINE			B						
DRAWING			BMR072. IC3						
			8	9	10	11	12	13	14
ISOLATION CONDENSER		A	N	N	N	N	N	N	N
		B							
CORE SPRAY		A							
		B							
MAIN STEAM		A							
		B							
		C							
		D							
REACTOR CLEANUP		A							
		B							
SHUTDOWN COOLING		A							
FEEDWATER	(18")	A							
	(12")	A							
	(18")	B							
	(12")	B							
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK								
	SOUTH BANK								
REACTOR RECIRCULATION	(12")	A							
		B							
		C							
		D							
		E							
		F							
		G							
		H							
		J							
		K							
PRIMARY CONTAINMENT COOLING (LPCI)		A	↓	↓	↓	↓	↓	↓	↓
		B							
MAIN STEAM RELIEF VALVES		A	N	N	N	N	N	N	N
		B							
		C							
		D							
		E							
		F							
ELECTRICAL	(Whip)			D	D		D		D
	(Impingement)			N	N		N		N
BIOLOGICAL SHIELD WALL				N	N		N		N
REACTOR VESSEL			↓	N	N	↓	N	↓	N

LEGEND D = Damage Possible, Further Evaluation Required
A = Acceptable Interaction (Damage Not Possible)
N = No Interaction

		SOURCE
	SYSTEM	LPCI
	LINE	B
	DRAWING	BMR 072 - IC3
TARGET	BK. PT.	15
ISOLATION CONDENSER	A B	N
CORE SPRAY	A B	
MAIN STEAM	A B C D	
REACTOR CLEANUP	A B	
SHUTDOWN COOLING	A	
FEEDWATER (18") (12") (18") (12")	A A B B	
CONTROL ROD DRIVE (Supply & Return)	NORTH BANK SOUTH BANK	
REACTOR RECIRCULATION (12")	A B C D E F G H J K	
PRIMARY CONTAINMENT COOLING (LPCI)	A B	I
MAIN STEAM RELIEF VALVES	A B C D E F	N
ELECTRICAL (Whip) (Impingement)		D
BIOLOGICAL SHIELD WALL		N
REACTOR VESSEL		N

APPENDIX C

INTERACTION EVALUATION AND SAFE SHUTDOWN SCENARIOS

INTERACTION EVALUATION/SHUTDOWN SCENARIOS SUMMARY

DAMAGED PIPING IN ADDITION TO SOURCE	SOURCE	LINE A		LINE B		LINE C		LINE D		SAFE* SHUTDOWN SCENARIO
		BREAK PT.	SHEET # B	BREAK PT.	SHEET # B	BREAK PT.	SHEET # B	BREAK PT.	SHEET # B	
———	MS	1-4, 22-25	11,14	1-4,7-9, 12-17, 22-25	15-18	13-15, 17-24	20-22	9-16	24,25	1
FW		5,6	11	———	———	———	———	1-8,17-20	23-26	1
FW + LPCI		7	11	———	———	———	———	———	———	3
LPCI		9-15	12,13	———	———	———	———	21-24	26	5
LPCI + Recirc.		17	13	———	———	1-4,9,10	19,20	———	———	5
SDC		18-21	13,14	———	———	———	———	———	———	1
CUW + Recirc.		———	———	5,6	15	———	———	———	———	3
Recirc.		———	———	10-11A	16	5,6	19	———	———	5
CUW		———	———	18-21	17,18	———	———	———	———	1
Recirc. + CRD		———	———	———	———	7,8,11	19,20	———	———	4
CS(B)		———	———	———	———	12,16	19,20	———	———	2
FW + LPCI + Recirc.		8,16	12,13	———	———	———	———	———	———	3

*In all safe shutdown scenarios, the following is conservatively assumed.

1. Loss of off-site power.
2. The most limiting single active failure, concurrently with the break.
3. All electrical trays and cables in the vicinity of the breaks are wiped out.

INTERACTION EVALUATION/SHUTDOWN SCENARIOS SUMMARY

DAMAGED PIPING IN ADDITION TO SOURCE	SOURCE	LINE A		LINE B		LINE C		LINE D		SAFE* SHUTDOWN SCENARIO
		BREAK PT.	SHEET # B	BREAK PT.	SHEET # B	BREAK PT.	SHEET # B	BREAK PT.	SHEET # B	
———	IC	1-17	1-3	1-16	4-6	———	———	———	———	1
———	CS(B)	———	———	1-14	9,10	———	———	———	———	2
———	CUW	1-15	27-29	1-18	30-32	———	———	———	———	1
———	SDC	1-11	33,34	———	———	———	———	———	———	1
CUW	↓	12,13	34	———	———	———	———	———	———	1
———	FW	1-5,7,8, 14-27, 32-34	35-39	1-18,20-32	40-44	———	———	———	———	1
LPCI	↓	6,9-13	35,36	———	———	———	———	———	———	3
SDC	↓	28-31	38,39	———	———	———	———	———	———	1
Recirc.	↓	———	———	19	42	———	———	———	———	3
———	LPCI	1-6,11-16	55-57	1-15	58-60	———	———	———	———	5
FW	↓	7-10	55,56	———	———	———	———	———	———	3
———	CS(A)	1-14	7,8	———	———	———	———	———	———	6

*In all safe shutdown scenarios, the following is conservatively assumed.

1. Loss of off-site power.
2. The most limiting single active failure, concurrently with the break.
3. All electrical trays and cables in the vicinity of the breaks are wiped out.

SAFE SHUTDOWN SCENARIOS

1. (a) Vessel depressurization will be accomplished through the postulated and resulting breaks.

   (b) All emergency core cooling systems are available to obtain a safe shutdown condition including all LPCI/core spray lines, the control rod drive lines, and FWCI.

   (c) Assuming loss of off-site power and a most limiting single active failure, failure to start the gas turbine , one (1) LPCI and one (1) core spray line are yet available for safe shutdown with the additional cooling capability of the control rod drive lines.

   (d) All safety equipment inside the drywell (i.e., valves or pumps) are in the required position and the damage to the electrical trays and cables will not affect the safe shutdown scenario.

2. (a) Vessel depressurization will be accomplished through the postulated and resulting breaks.

   (b) Of the emergency core cooling systems, one (1) core spray line, Line-B, is ruptured and not available for this safe shutdown scenario.

   (c) Assuming loss of off-site power, and a most limiting single active failure, failure to start the diesel generator, causing loss of the other core spray line and one (1) LPCI line, a safe shutdown condition can be obtained using the available one (1) LPCI line in addition to the control rod drive lines and FWCI.

   (d) All safety equipment inside the drywell (i.e., valves or pumps) are in the required position and the damage to the electrical trays and cables will not affect the presented safe shutdown scenario.

SAFE SHUTDOWN SCENARIOS

3. (a) Vessel depressurization will be accomplished through the postulated and resulting breaks.

(b) Of the emergency core cooling systems, one (1) LPCI line and FWCI are not available to obtain a safe shutdown.

(c) Assuming loss of off-site power, and a most limiting single active failure, the injection valves of the other LPCI line failing to open, a safe shutdown condition can be obtained using the available core spray lines in addition to the control rod drive lines.

(d) All safety equipment inside the drywell (i.e., valves or pumps) are in the required position and the damage to the electrical trays and cables will not affect the presented safe shutdown scenario.

4. The safe shutdown scenario for the postulated ruptures at points 7, 8 and 11 of the main steam, Line C, and the consequential damage to control rod drive lines in the north bank and to a twelve inch (12") recirculation riser, depends entirely on the type and extent of damage encountered by the control rod drive lines.

The ability to scram the reactor in the event of a pipe rupture is dependent on the type and extent of CRD lines damage as can be seen from the following:

(a) Protection for the CRD insert lines is not required since the reactor pressure can adequately scram the control rods.

(b) Complete severence of CRD withdraw lines will not affect scram function.

(c) The CRD withdraw lines should be protected from the pipe break event so that no more than one (1) in any nine (9) rod array is allowed to be completely crimped (totally blocked).

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SAFE SHUTDOWN SCENARIOS

Considering the above, it is obvious that a safe shutdown scenario can be offered only if we can assure complete severence of the withdraw lines. Otherwise, different approaches should be considered, such as:

(1) Review of the stress levels in the main steam, Line C, to determine if locations 7, 8 and 11 can be excluded from being possible break locations because of relatively low stress level.

(2) Modifications to the main steam Line C, supporting system such that the stresses at these three (3) locations are reduced and could be excluded from consideration as possible break locations.

(3) Installation of pipe whip restraints on main steam, Line C, such that postulated breaks at these locations may not cause any damage to the control rod drive lines.

(4) Protection of the north bank of CRD lines, using structures or barriers, against the consequences of a pipe break event.

In case of a complete severence of the impacted CRD lines, the safe shutdown scenario will be as follows:

(A) Reactor scram is assured in case of complete severence of CRD lines.

(B) Vessel depressurization through the breaks.

(C) The LPCI line connected to the damaged recirculation loop will not be available of cooling.

(D) Assuming loss of off-site power and a most limiting single active failure causing loss of the other LPCI line and a core spray line, one (1) core spray line will be available and capable of achieving a safe shutdown condition.

(E) All valves inside the drywell are lined up to perform their safety function. Damage to the electrical trays and cables inside the drywell will not affect this scenario.

SAFE SHUTDOWN SCENARIOS

5. (a) Vessel depressurization will be accomplished through the postulated and resulting breaks.

(b) Of the emergency core cooling systems, one (1) LPCI line is ruptured or the recirculation loop associated with one (1) LPCI line is ruptured.

(c) Assuming loss of off-site power and a most limiting single active failure, the injection valves of the other LPCI line failing to open, a safe shutdown can be obtained using the available core spray lines, FWCI, and the additional cooling capability of the control rod drive lines.

(d) All safety equipment inside the drywell; i.e., valves or pumps, are in the required position and the damage to the electrical trays and cables will not affect the presented safe shutdown scenario.

6. (a) Vessel depressurization will be accomplished through the postulated and resulting breaks.

(b) Of the emergency core cooling systems, one (1) core spray line, Line-A, is ruptured and not available for this safe shutdown scenario.

(c) Assuming loss of off-site power, and a most limiting single active failure, failure to start the gas turbine, a safety shutdown condition can be obtained using one (1) available LPCI line.

(d) All safety equipment inside the drywell; i.e., valves or pumps, are in the required position and the damage to the electrical trays and cables will not affect the presented safe shutdown scenario.

APPENDIX D

RECOMMENDED STRAIN LIMITS

NOTE: This is Appendix IV of General Electric Specification No. 22A2625, Revision 0, titled "System Criteria and Applications for Protection Against the Dynamic Effects of Pipe Break".

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RECOMMENDED STRAIN LIMITS

In structural design, it is recognized that fatigue is a possible mode of failure for certain types of loading. Basically, the difference between high cycle fatigue and low cycle fatigue is the fact that the former involves little or no plastic action, whereas failure in a few thousand or less cycles can be produced only by strain in excess of yield strain. In the plastic region, large changes in strain can be produced by small changes in stress. Fatigue damage in the plastic region has been found to be a function of plastic strain rather than stress. Therefore, for those types of loadings in which fatigue is th mode of failure, Paragraph III, "Fatigue Analysis", criteria of the referenced ASME Code recommends that for design purposes, the fatigue design curves should be used in which strain rather than stress is the controlled variable.

In the unlikely event that a pipe rupture occurs during the operation of a BWR plant, certain components may be subjected to a once-in-a-lifetime accident loading such as pipe impact or jet forces causing the component strain to increase from zero to a maximum value. Because the accident loads are non-reversible and unidirectional, the strain remains at the maximum value. This type of loading may be properly considered as a cyclic load with only one-fourth cycle application (see Figure D-1) and the evaluation of the maximum allowable strain in a component subject to one (1) application of accident loading may be based on Paragraph III, "Fatigue Analysis" criteria of the referenced ASME Code.

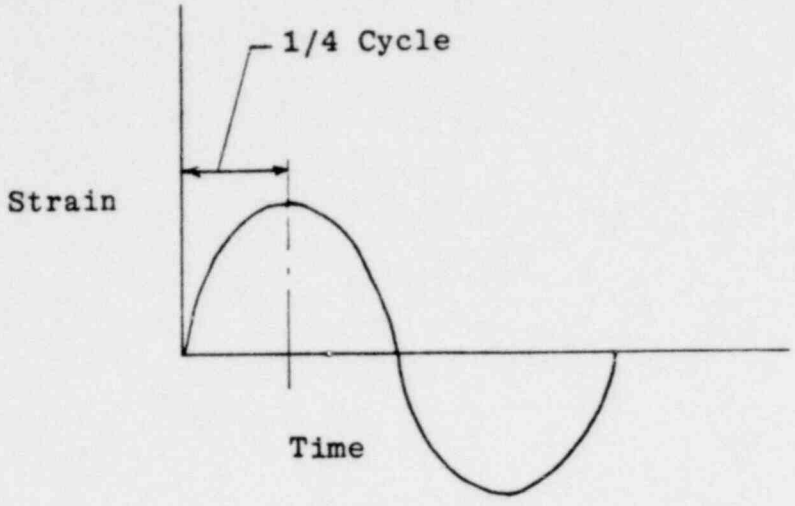

FIGURE D-1

Actual fatigue test data for carbon steel, low alloy steels, and stainless steel are given in Figures 9, 10, and 11 of the referenced ASME Code and are reproduced below for design purposes. "Fatigue Analysis" criteria of the referenced code recommends that figure design curves may be generated from the fatigue test data shown on Figures 9, 10, and 11 by applying a factor of two on the fictitious stress (equal to 1/2 $E\varepsilon$ as defined in the ordinate of the reference figures) or a factor of twenty on the number of loading cycles, whichever is more conservative, at each point. These factors were intended to cover such effects as environment, size effects, and scatter of data.

In order to determine the maximum allowable fatigue strain for one-fourth cycle application of loading, a factor of twenty on the number of loading cycles will be used for conservatism. The following calculations show the maximum strain which can be allowed in a one-fourth cycle load application for three different materials using Figures 9, 10, and 11 fatigue test data.

(a) For carbon steel:

N (number of cycles) = 1/4 cycle x 20

= 5 cycles

From Figure 9:

N = 5

S = 1/2 Eε = 3.6×10^6 psi

Maximum strain ε = $3.6 \times 10^6 \times 2/E$

= 0.24 $^{in}/_{in}$

(b) For low alloy steel:

N = 1/4 x 20 = 5 cycles

From Figure 10:

N = 5

S = 1/2 Eε = 4×10^6 psi

Maximum strain = 0.266 $^{in}/_{in}$

(c) For stainless steel:

N = 1/4 x 20 = 5 cycles

S = 1/2 Eε = 3.9×10^6

ε = 0.267 $^{in}/_{in}$

The strain values determined have what is believed to be ample margin based on comparisons of ultimate strain from a tensile test which typically runs in the 50% to 70% strain area for these materials.

REFERENCE: Criteria of ASME Boiler and Pressure Vessel Code for Design by Analysis, Sections III and VIII, Division 2, 1969.

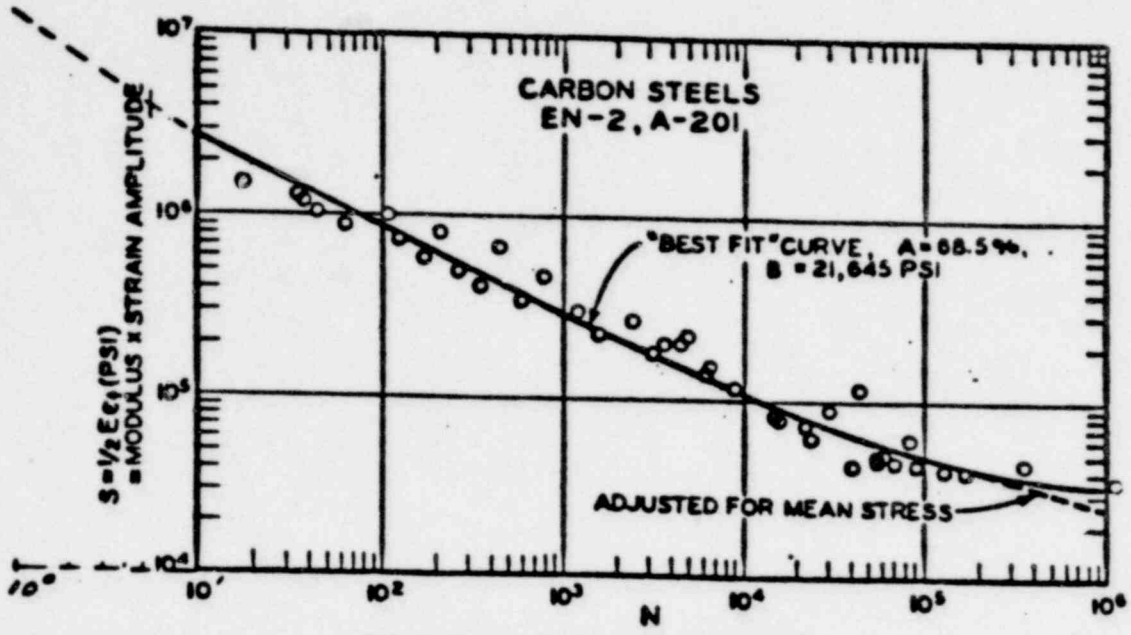

FIG. 9. FATIGUE DATA – CARBON STEELS.

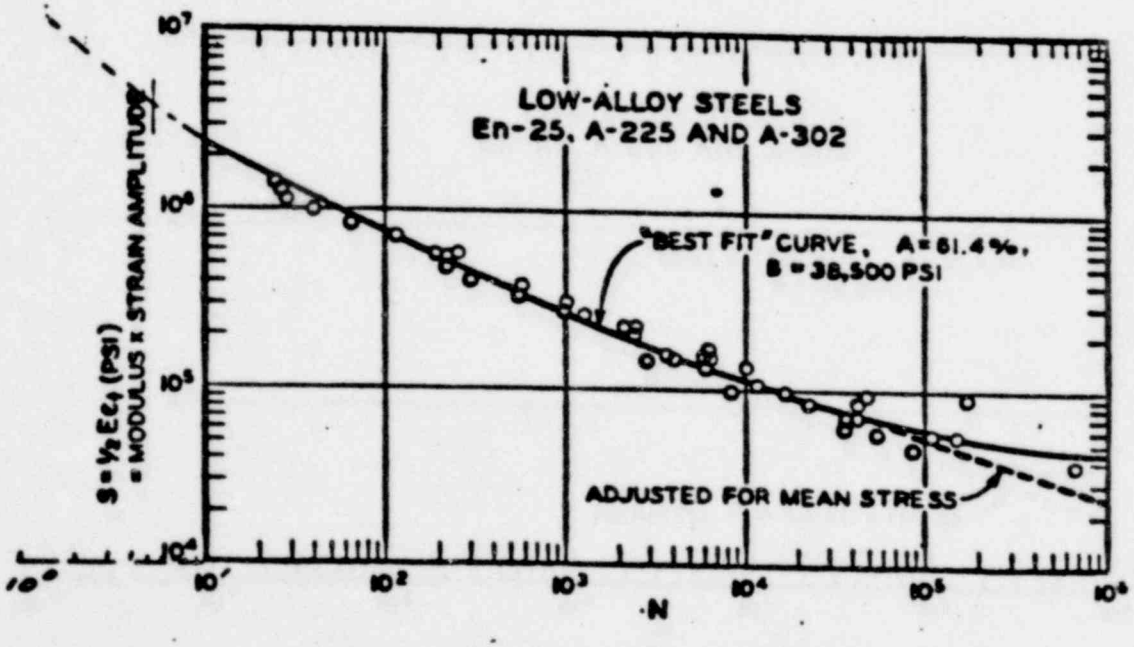

FIG. 10. FATIGUE DATA – LOW-ALLOY STEELS.

APPENDIX D

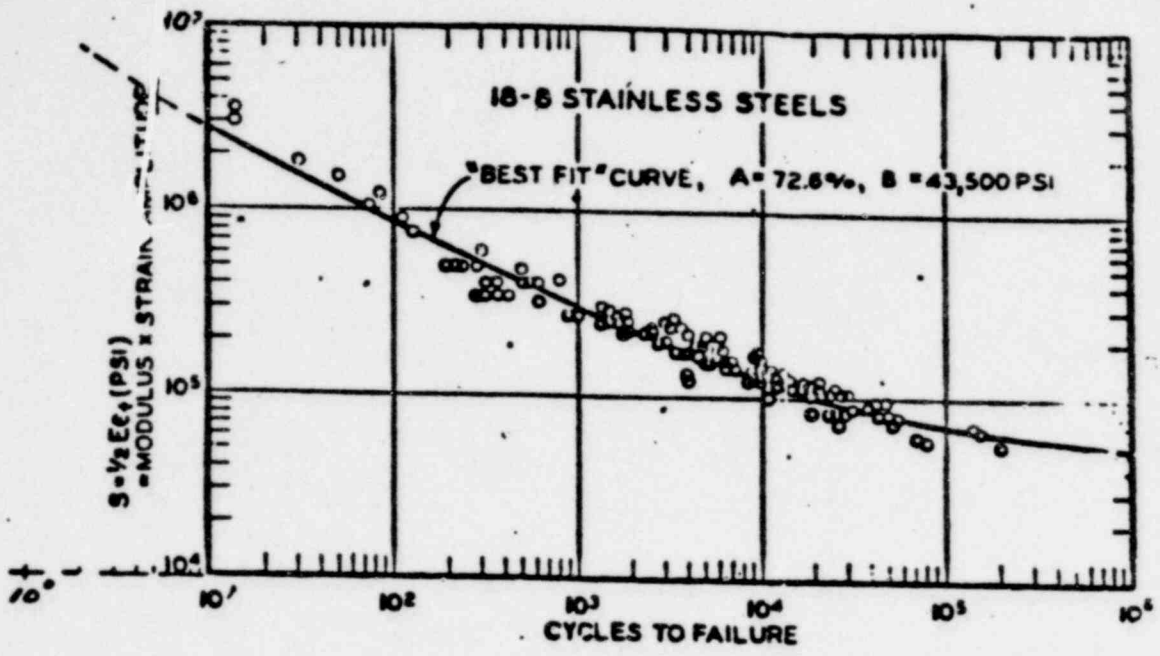

FIG. 11. FATIGUE DATA – STAINLESS STEELS.