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UTLEY,E.E. Carolina Power & Light Co.
RECIP.NAME RECIPIENT AFFILIATION
SCHWENCER,A. Operating Reactors Branch 1

SUBJECT: Responds to 790525 ltr re info on PWR feedwater lines. Summary of info re cracks discovered in feedwater reducers forwarded 790710.

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Carolina Power & Light Company

July 30, 1979

File: NG-3514(R)

Serial: GD-79-1936

Office of Nuclear Reactor Regulation
Attention: Mr. Albert Schwencer, Chief
Operating Reactor Branch No. 1
United States Nuclear Regulatory Commission
Washington, D.C. 20555

H. B. ROBINSON STEAM ELECTRIC PLANT, UNIT NO. 2
DOCKET NO. 50-261
LICENSE NO. DPR-23
RESPONSE TO PWR FEEDWATER LINE QUESTIONS

Dear Mr. Schwencer:

Your letter of May 25, 1979, requested data concerning the feedwater lines at the H. B. Robinson Plant. An inspection of our facility as a result of findings elsewhere disclosed linear indications in our feedwater line reducers. As indicated in our June 20, 1979, letter, CP&L did not feel it would be useful or appropriate to respond to your questions at that time.

All of the information which you requested in your May 25 letter is enclosed. A summary of all information concerning the cracks discovered in the feedwater reducers has been forwarded as a separate correspondence on July 10, 1979.

If you have any questions on this subject, do not hesitate to call upon my staff.

Yours very truly,

M. A. McDuffie

for E. E. Utley
Executive Vice President
Power Supply & Customer Services

JJS/jcb
Enclosure

A001
S 0/1

411 Fayetteville Street • P. O. Box 1551 • Raleigh, N. C. 27602

7908060335

1.0 Feedwater Line Design

The as-built piping and isometric drawings for the feedwater system within containment are provided as figures 1 and 2. Figures 3, 4 and 5 show the dimensions of the pipe segments which make up the feedwater system within containment. These pipe segments are identified by a detail number which corresponds to a segment of pipe on the as-built piping drawing.

All sixteen inch piping, sixteen inch elbows and eighteen by sixteen inch reducers in the feedwater system were manufactured to a schedule 100 thickness.

Figure 6 shows the location of each of the feedwater pipe hangers and restraints within containment. Each of the pipe hangers are of the variable spring type and make use of a standard, short or double spring depending on the hanger location and design. The feedwater restraints are of two types; a rigid sway strut assembly and a guide type formed by four structural plates tangent to the pipe. Tables 1 and 2 identify each hanger and restraint by type.

TABLE 1 - FEEDWATER PIPE HANGER TYPES

Hanger Number	Hanger Types	Spring Type
FWH 34	Floor Mount	Short
FWH 35	Trapeze	Double
FWH 36	Trapeze	Double
FWH 37	Trapeze	Standard
FWH 38	Trapeze	Short
FWH 39	Trapeze	Short
FWH 40	Floor Mount	Short
FWH 41	Floor Mount	Short
FWH 42	Trapeze	Standard
FWH 43	Trapeze	Standard
FWH 44	Trapeze	Short
FWH 45	Floor Mount	Short
FWH 46	Trapeze	Short
FWH 47	Floor Mount	Standard

TABLE 2 - FEEDWATER RESTRAINT TYPE

Restraint Number	Restraint Type	Restraint Direction
FWR 1	Sway Strut	Axially
FWR 2	Guide	Vertical & Horizontal
FWR 3	Sway Strut	Axially
FWR 4	Sway Strut	Horizontally
FWR 5	Sway Strut	Axially
FWR 6	Sway Strut	Axially & Vertical
FWR 7	Guide	Vertically & Horizontal

1.0 (Continued)

There are no valves in the feedwater system within containment.

During construction of Unit No. 2, a fatigue analysis of the feedwater piping was neither required nor performed. A stress analysis which included both thermal and static seismic conditions was performed and evaluated as being satisfactory. The results of these analyses are available for review at the H. B. Robinson Plant.

Following the discovery of cracks in the feedwater reducers, a structural analysis which included the effects of thermal, deadweight, and pressure stresses was performed on the feedwater lines. This analysis was performed to the standard of both the 1965 ASME Code (original analysis) and the 1977 ASME Code. The results of both analyses showed existing stresses to be well below the allowable code values. In addition a 2D finite element fatigue analysis of the most severe thermal transient showed the design transients described in the steam generator equipment specifications to have acceptable values of usage factors for the feedwater nozzle.

2.0 Feedwater Line Fabrication History

The materials used in the construction of the steam generator sparger, feedwater nozzle, and feedwater piping are listed in Table 3.

TABLE 3 - FEEDWATER SYSTEM MATERIALS

Component	Material
Sparger	SA 106 Grade B
Nozzle	SA 508 Class 2 (See Note 1)
Thermal Sleeve	SA 106 Grade B
Elbows	A 234 Grade WPB

Note 1: Nozzle material is SA 336 Code Case 2332 Paragraph 5A through 5D which then became SA 508 Class 2.

2.0 (Continued)

The details of the welding processes used during construction to make the nozzle to reducer welds and feedwater piping welds are shown in Tables 4 and 5. The pipe to sparger is a slipfit connection and therefore did not involve a weld.

TABLE 4 - FEEDWATER NOZZLE TO REDUCER WELD DETAILS

Material Group	P1-P3
Weld Process	Shielded Metal Arc
Nature of Current	Direct Current (Electrode Positive)
Weld Material	E 7081 - A1
Backing Ring	Flat Machined Type
Preheat Temperature	250°F
Post Weld Heat Treatment Temperature	1150°F

TABLE 5 - FEEDWATER PIPING WELD DETAILS

Material Group	P1-P1
Weld Process	Shielded Metal Arc
Nature of Current	Direct Current (Electrode Positive)
Weld Material	E7018
Backing Ring	Flat Machined Type
Preheat Temperature	250°F
Post Weld Treatment Temperature	1150°F

2.0 (Continued)

During the fabrication of the feedwater piping and nozzle to reducer weld joints a PT inspection of the outside area of each root pass was performed. Upon completion of the post weld heat treatment a magnetic particle inspection and radiographic inspection of the weld joints were perofrmed. The radiography films and weld data reports for plant construction are available for review at the H. B. Robinson Plant.

The feedwater piping system was fabricated to the standards of USAS B31.1 1967 edition.

There were no fracture toughness requirements for the feedwater system.

3.0 Feedwater Line Preservice/Inservice Inspection and Operating History

The feedwater system welds did not receive a preservice inspection in accordance with the ASME Boiler and Pressure Code, Section XI, since this inspection was not required by the Robinson 2 Technical Specifications or the Final Safety Analysis Report. Following the replacement of the cracked feedwater reducers, a radiographic and ultrasonic inspection of both the elbow to reducer and reducer to nozzle welds was performed. The ultrasonic inspection results will be used as a base line for the reinspection of these welds during the 1980 outage.

The inservice inspection program schedules two feedwater line circumferential butt welds to be volumetrically inspected over 100% of the weld area during the last 3 1/3 year period of the first ten year inspection interval. The welds which were selected for inspection are the eighteen inch nozzle to reducer weld of loop "A" and the sixteen inch reducer to elbow weld of loop "A". These welds were originally scheduled for inspection during the 1980 outage, but, following the discovery of cracks at the D. C. Cook Plant, they were inspected at the end of the 1979 outage. This inspection revealed cracks in all three feedwater reducers. A description of the cracks, the repair efforts, and corrective actions are described in our letter of July 12, 1979.

3.0 (Continued)

H. B. Robinson is currently in the last 3 1/3 year period of the first ten year inspection interval. To date, a formal schedule for the next ten year inspection interval has not been established. The schedule and extent of inservice inspections for the feedwater system for the remainder of the current inspection interval is shown in Table 6.

TABLE 6 - FEEDWATER LINE INSERVICE INSPECTION INTERVAL SCHEDULE

Outage	Component To Be Inspected	Type Inspection
1980	18 inch Feedwater nozzle to reducer weld on "A" S/G	100% Volumetric
1980	16 inch Feedwater reducer to elbow weld on "A" S/G	100% Volumetric
1981	Feedwater nozzle to vessel weld on "A" S/G	100% Volumetric

In addition, a volumetric inspection of all feedwater nozzle to pipe weld areas and all feedwater pipe weld areas inside containment will be performed in accordance with the requirements of IE Bulletin 79-13 during the 1980 refueling outage.

A thorough review of our operating history has revealed no evidence of water hammer on the feedwater lines inside containment. A slight vibration had been detected on "C" Feedwater line prior to shutting down for the 1979 refueling outage. An inspection of the feedline supports in this area revealed several loose connecting bolts which were tightened. This reduced the vibration in "C" Feedwater loop but did not eliminate it. As part of the investigation into the cause of the feedwater reducer cracking, both "B" and "C" Feedwater lines have been instrumented. Accelerometers and displacement transducers have been installed on "C" Feedwater loop and will be used to evaluate the vibration on "C" Feedwater loop.

3.0 (Continued)

Feedwater chemistry is maintained within the following limits during power operation:

pH	8.8 - 9.2
Conductivity	< 2 micro MHOS
Hydrazine	> 0.01 ppm
O_2	< 0.005 ppm

These limits are maintained by the addition of cyclohexylamine, a pH additive, and hydrazine, an oxygen scavenger, which are injected into the system at the discharge on the condensate pumps.

The steam generators are operated with a continuous feed and bleed of 26.5 GPM. To maintain the steam generator chemistry within specification, a continuous solution of tri-sodium phosphate and di-sodium phosphate is added to the feedwater lines outside containment, downstream of the feed regulating valves.

A review of feedwater chemistry data has shown that during power operations all feedwater chemistry is maintained within specification. Oxygen levels occasionally rise above their specification due to air leakage to the condensers but are returned to normal levels by hydrazine addition and repair of leakage.

During hot shutdown periods, when extensive use of auxiliary feedwater is required, high oxygen levels have been observed in the feed system. These levels are attributed to the high oxygen content of the water in the condensate storage tanks. Methods which would reduce the oxygen levels in the condensate storage tanks are presently being investigated.

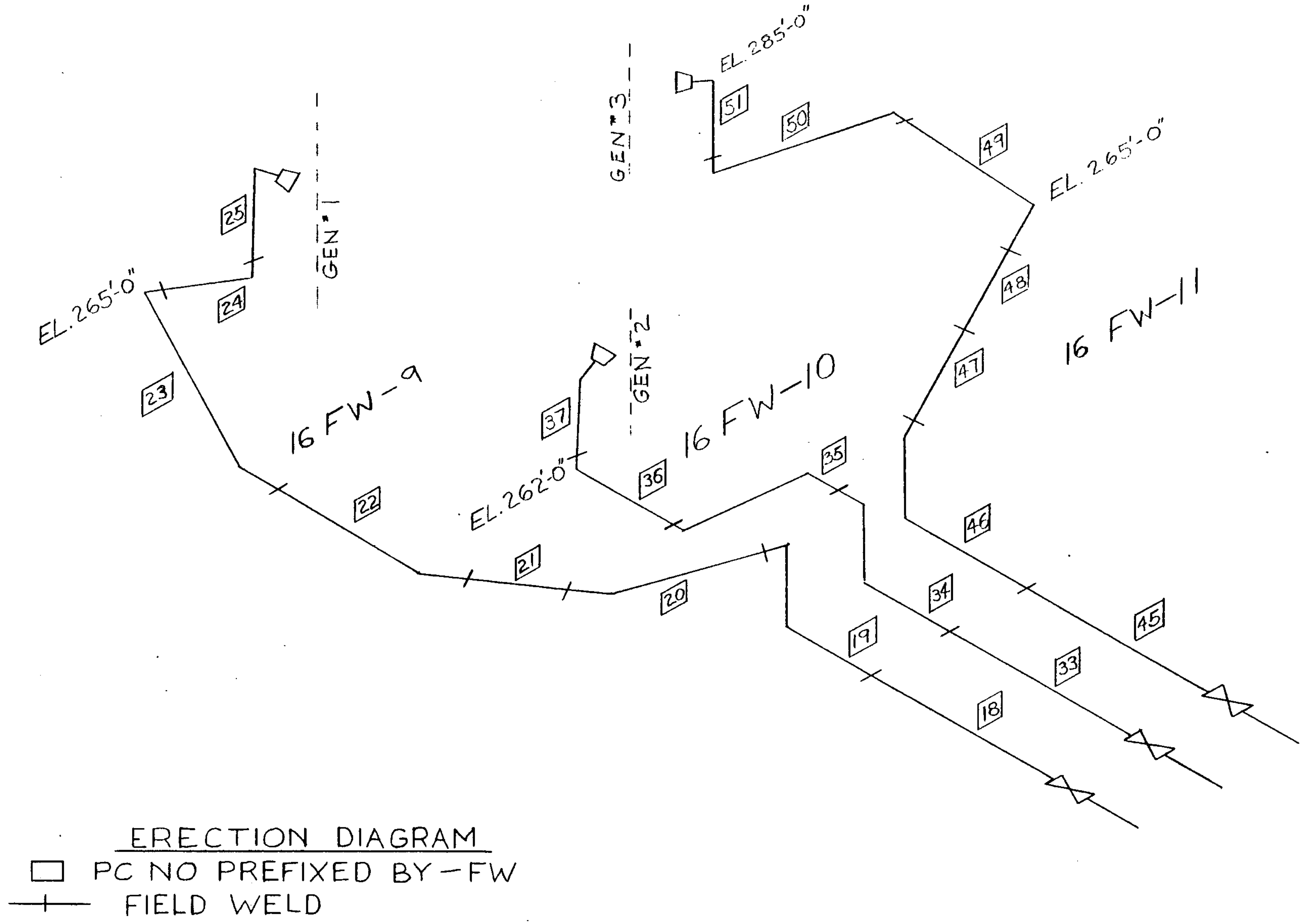
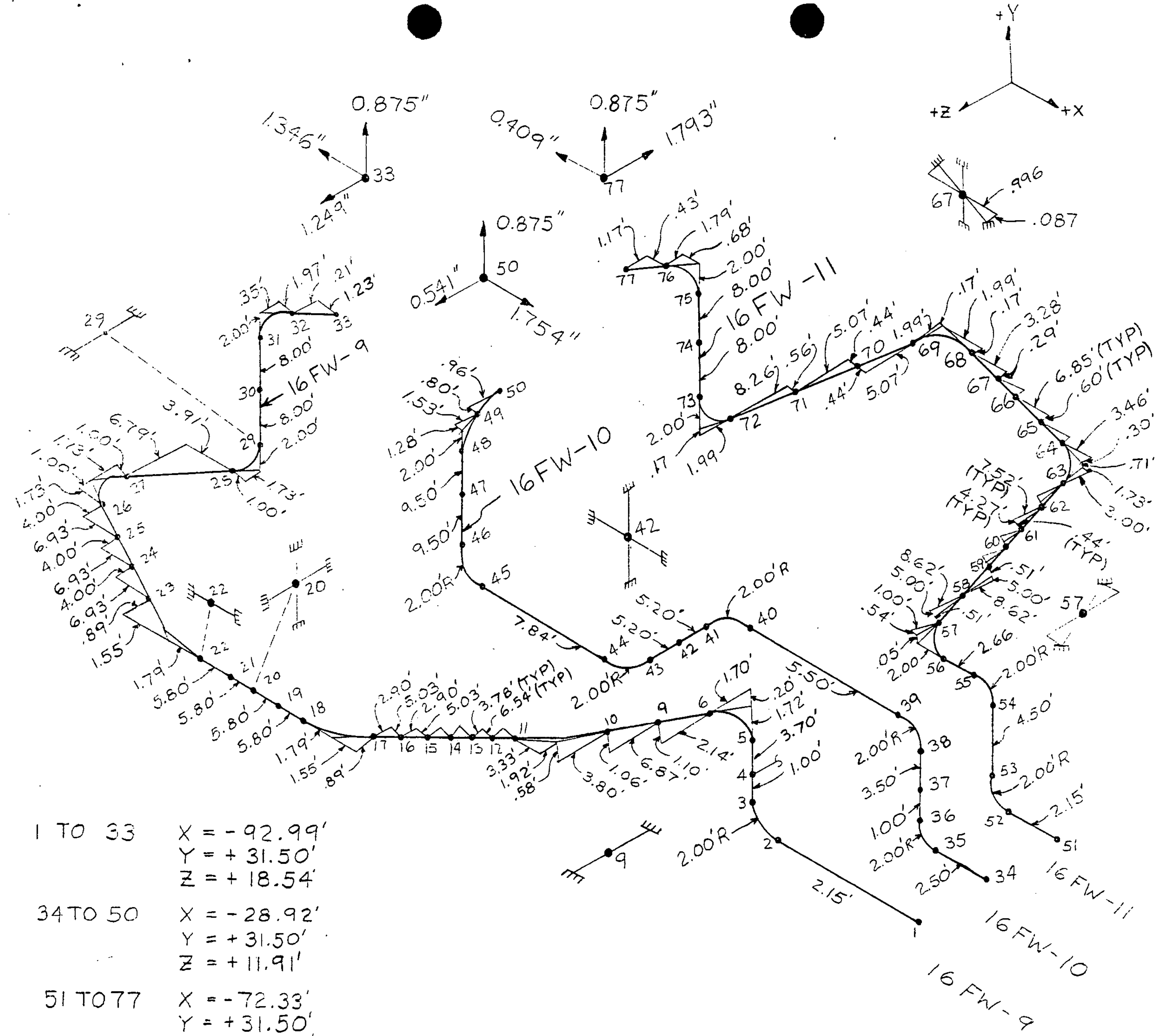


FIGURE 1 FEEDWATER PIPING DRAWING



1 TO 33 X = - 92.99' Y = + 31.50' Z = + 18.54'

34 TO 50 X = - 28.92' Y = + 31.50' Z = + 11.91'

51 TO 77 X = - 72.33' Y = + 31.50' Z = - 30.54'

51 TO 88 X = - 58.95' Y = - 7.48' Z = - 56.83'

TEMP IS 500°F, and 50°F; Δ = 3.620"/100'

HOT MODULUS OF ELASTICITY IS 26,400,000 PSI

H. B. ROBINSON

FEEDWATER PIPING
REACTOR AREA
(254)

A- 190317

REF. DWG# G-190206 REV 1 8-28-67

FIG 2 FEEDWATER LINE - ISOMETRIC

ISO FDW 5

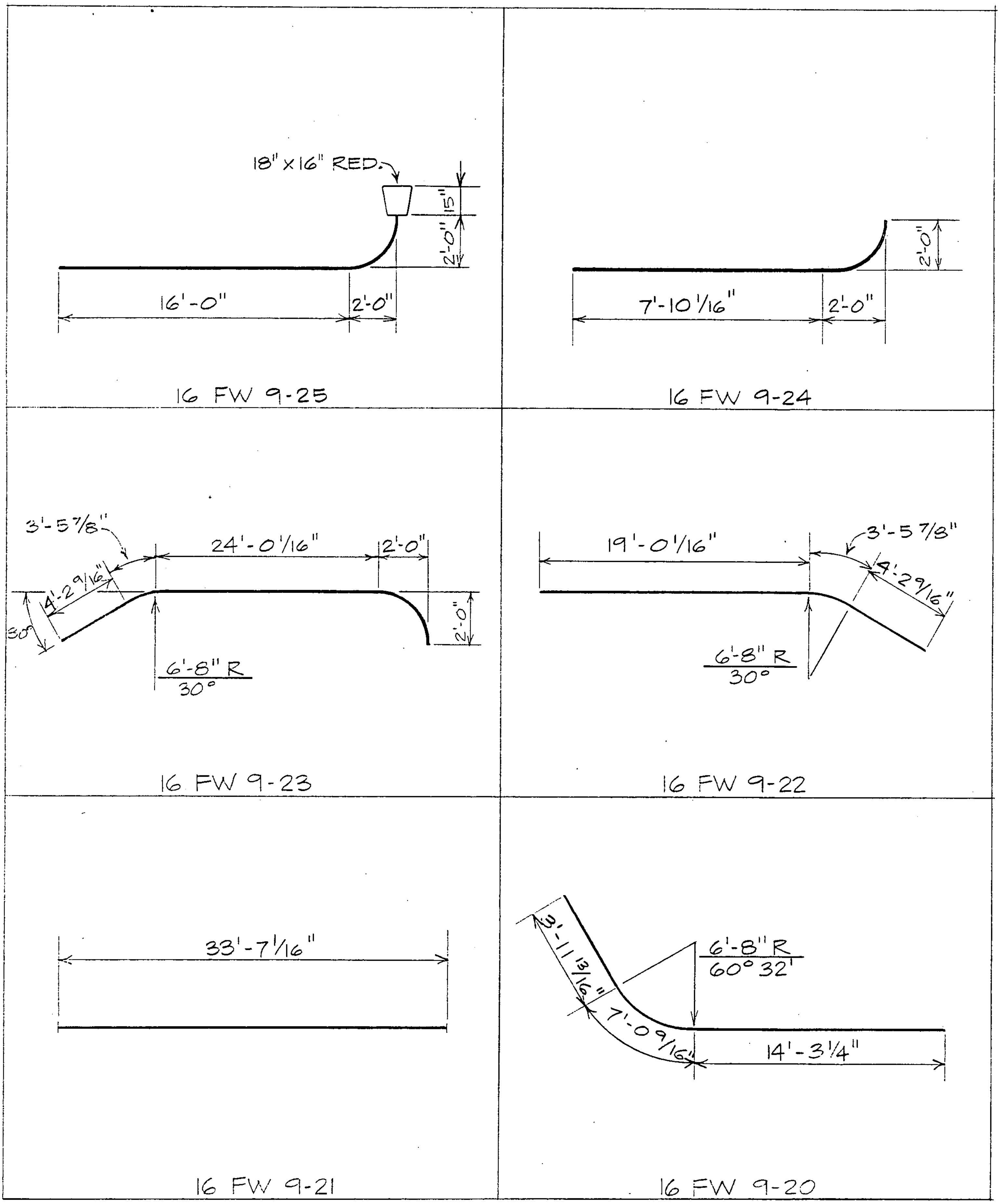


FIGURE 3 FEEDWATER PIPING DETAILS

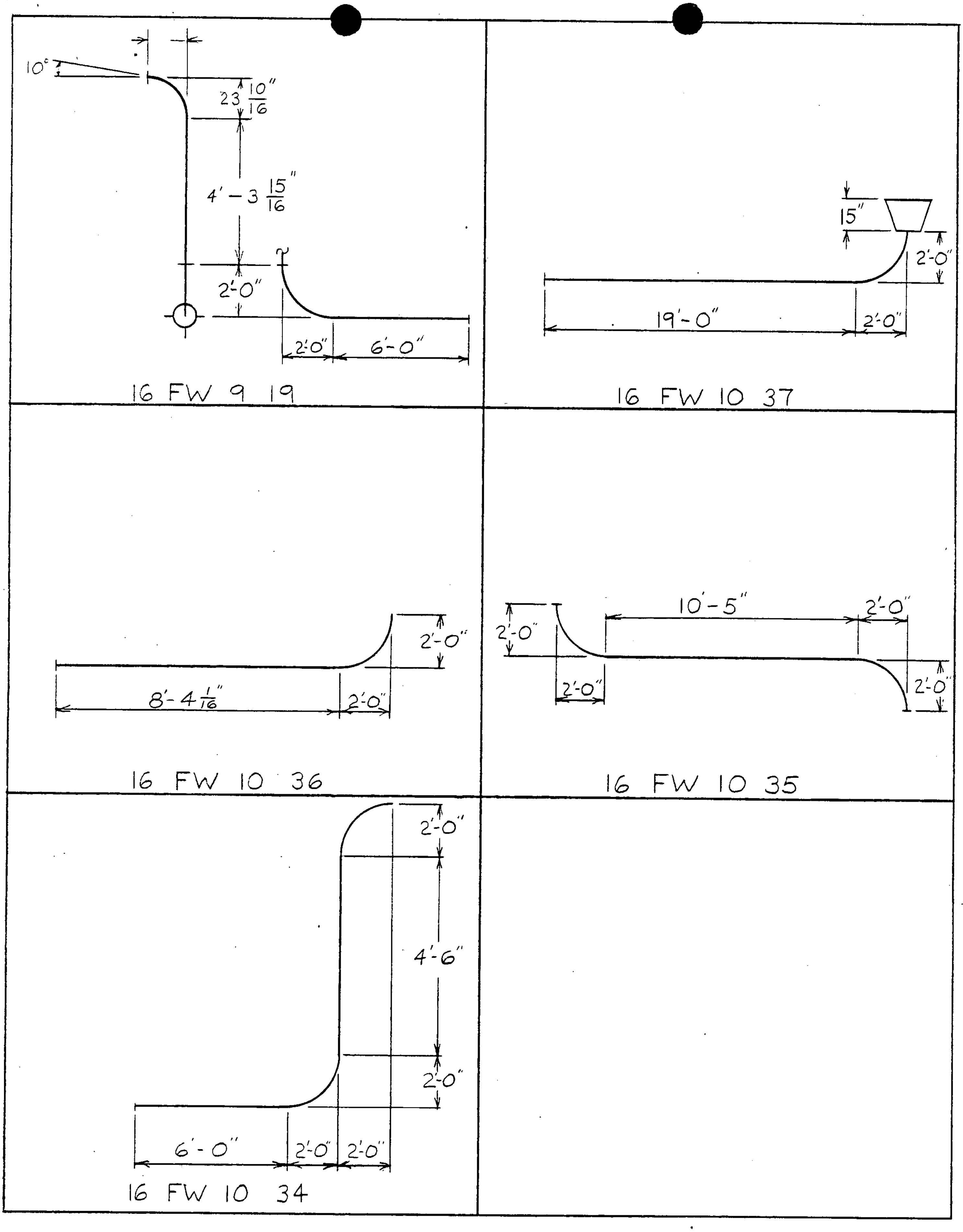


FIGURE 4 FEEDWATER PIPING DETAILS

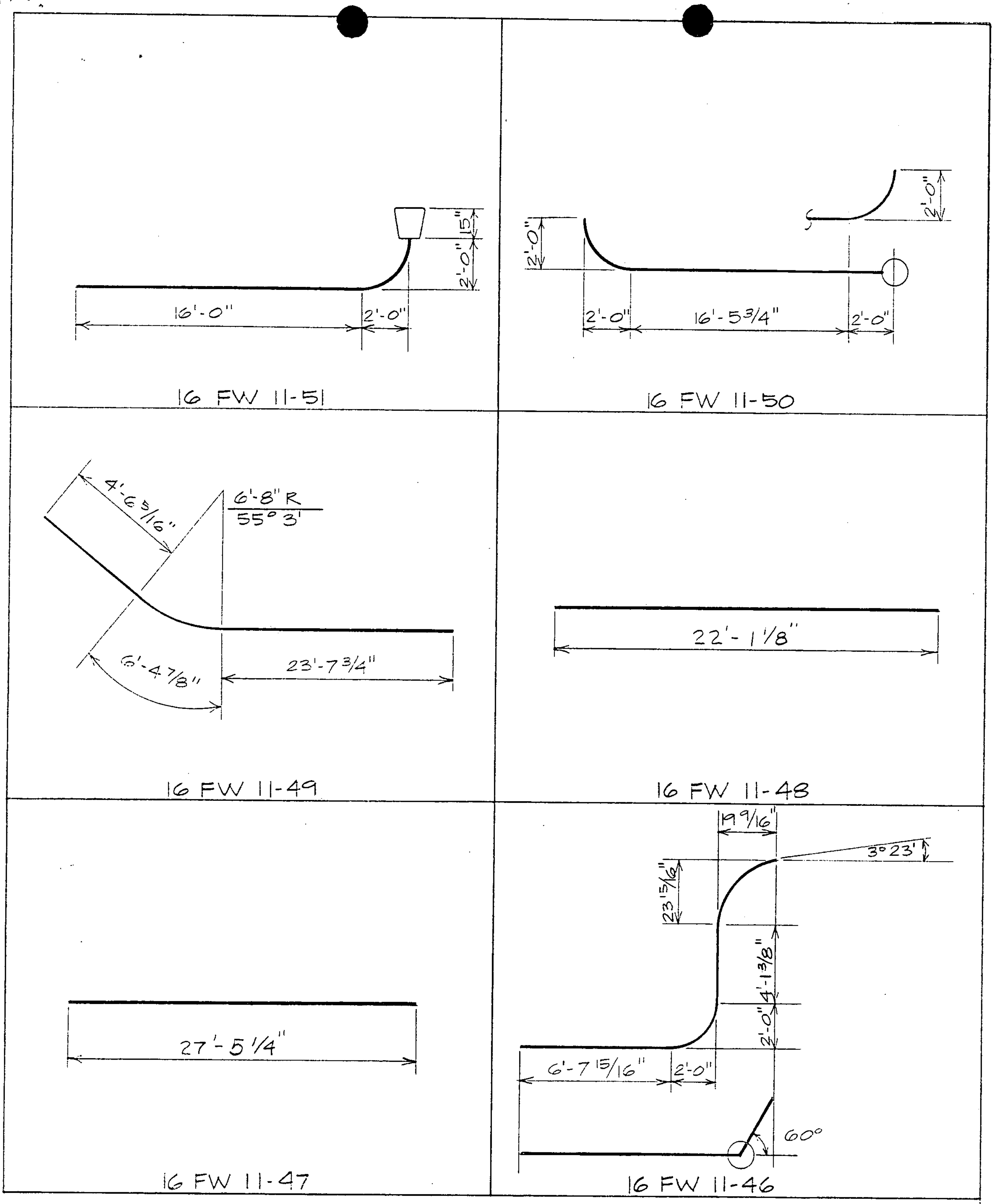
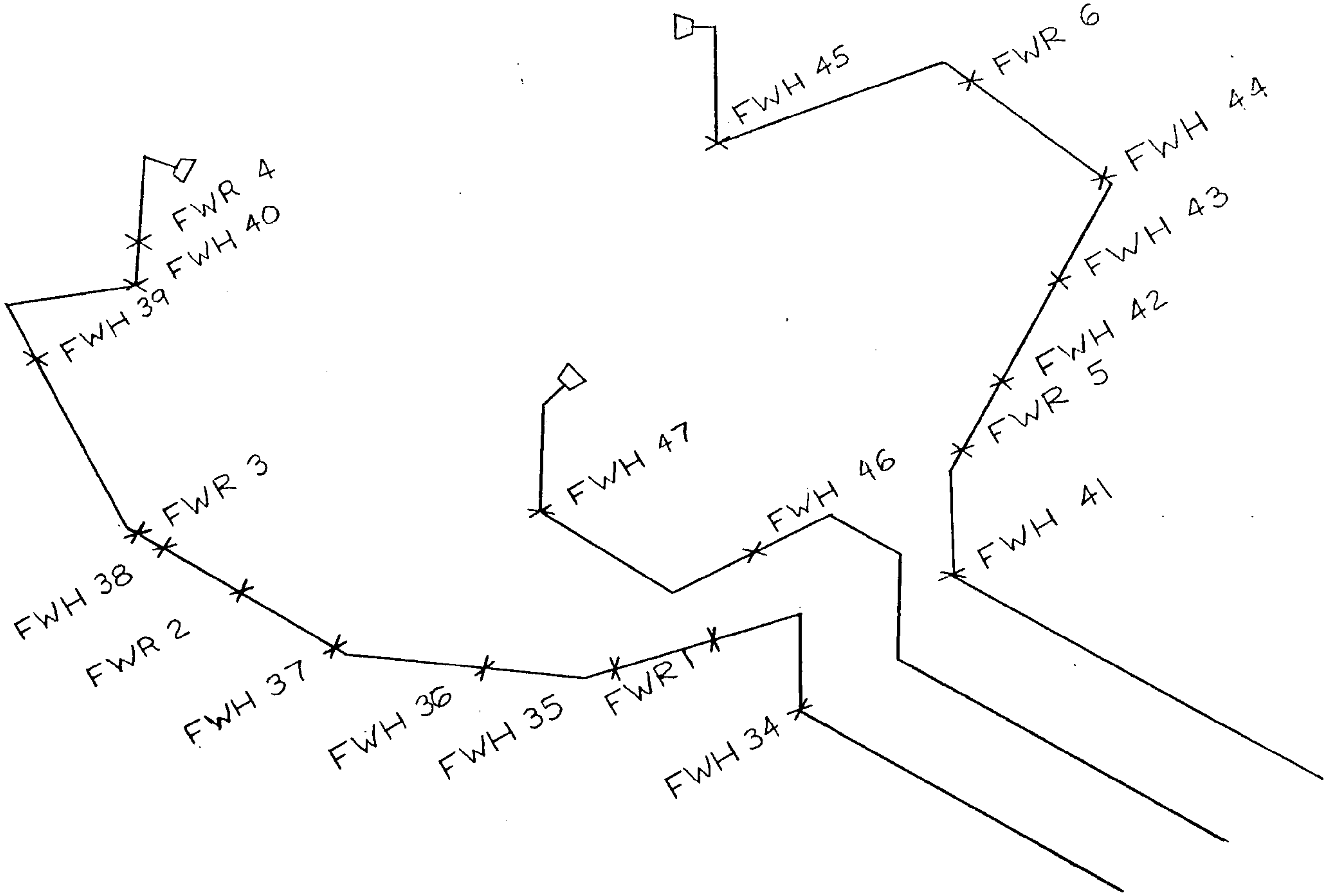


FIGURE 5 FEEDWATER PIPING DETAILS



FWH - PIPE HANGER
FWR - PIPE RESTRAINT

FIGURE 6
FEEDWATER HANGER/RESTRAINT LOCATIONS