50-237

Commonwealth Edison Company

ONE FIRST NATIONAL PLAZA ★ CHICAGO, ILLINOIS

Address Reply to:

POST OFFICE BOX 767 ★ CHICAGO, ILLINOIS 60690

May 14, 1971

Dr. Peter A. Morris, Director
Division of Reactor Licensing
U.S. Atomic Energy Commission
Washington, D.C. 20545

Subject: Additional Information concerning the operation of Dresden Unit 2

Regulatory File Cy.

Dear Dr. Morris:

On March 22, 1971, we submitted to you nine reports concerning several operational problems on Dresden Unit 2. On April 14, at a meeting with your Staff, we discussed these reports. At that meeting, members of your Staff requested additional information concerning the jet pump riser brace vibration problem, the venting problem as it related to the installation of a new air system for the main steam line isolation valves, core asymmetry, and radwaste. On April 24, 1971, we submitted to you four special reports which were also concerned with operational problems encountered on Dresden Unit 2.

Enclosed is the supplementary information which your Staff requested in our meeting of April 14. In addition, we are submitting additional information concerning the resolution of the limitorque problem and the core spray water hammer problem which was discussed in Report Nos. 11 and 13, respectively.

We would like to point out again that the report concerning off-gas emissions will be filed with you prior to June 1, 1971, and that the fuel report which discusses the cause of failed fuel at Dresden Unit 2 will also be submitted by June 1.

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We would also like to bring to your attention the fact that the report on hydrogen control, which was to be submitted to you on May 15, will be submitted on May 24. This report is undergoing review by Commonwealth Edison and based on this review, is being revised which accounts for the delay in the submittal.

In addition to three signed originals, 19 copies of this additional information is also submitted.

Very truly yours,

Byron Lee Jr.

Byron Lee, Jr.
Assistant to the President

SUBSCRIBED and SWORN to
before me this 14th day
of May, 1971.

Patricia A. Nelson
Notary Public

279.2

DRESDEN NUCLEAR POWER STATION
UNIT 2

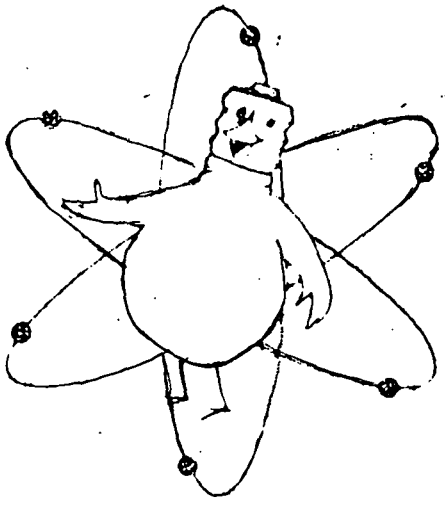
50-237

Regulatory File Cy.

Received w/Ltr Dated 5-14-71

Special Reports

May 13, 1971



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237-279

SUPPLEMENTARY INFORMATION
for
DRESDEN UNIT 2
SPECIAL REPORT NOS. 8 AND 11

CORRECTIVE ACTIONS FOR LIMITORQUE

May 13, 1971

Commonwealth Edison Company

Comment

Corrective actions taken on problem associated with Limitorque Operators.

Response

As described in Speical Reports No. 8, March 17, 1971 and No. 11 on April 21, 1971, the limitorque problems have been isolated to the following four areas:

1. Improper staking of stem drive locking nuts (jam nuts).

2. Circuit breaker trip settings.

3. Limit switch settings.

4. Gearing of limitorque for valve 1501-21 A & B (LPCI modulating valve).

The actions described below have been taken to resolve these problems:

(1) All valves had the staking of the jam nuts and lubrication completed with the exception of 1501-21 (LPCI modulating valve).

(2) The limitorque circuit breakers are of two types; one used primarily on smaller motors contains only an instantaneous trip for electrical system protection and the other, used on larger motors, contains both an instantaneous trip and magnetic thermal overload for motor protection. It was resolved that since all limitorque motors were 15 minute rated motors and since they are operated for only seconds at a time and are located on safety systems where valves should be opened or closed without regard to valve life; the breaker setting should be designed for lock rotor operation. The following actions were taken:

   (a) The locked rotor current for all motors was obtained.
   (b) Resized or reset all breakers and magnetic thermal overloads for locked rotor current.
   (c) All motors reviewed for settings on breaker and adjustment made to correct as described above.

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3. The opening circuits of the limitorque operators include torque switches (limit switches) separate from closing torque switches, which limit the torque and protect the operator during opening travel of the valve. However, the torque required to break the valve free of its seat is higher than the normal torque switch setting and the switch is bypassed during this initial travel by a position limit switch. This position limit switch, while not the same contact, has the same setting as the limit switch which indicates the closed position of the valve. In order to obtain the most accurate indication of valve closing, the switch has been set to the very end travel of the valve. Consequently, the limit switch, used to bypass the torque switch on valve opening, opens before the opening torque has been reduced by the break free of the valve from its seat. With both torque and limit switch now open, the valve operator stops or jogs open in halting steps until free of its seat.

   This problem was corrected by setting the position limit switches earlier in the closing cycle; i.e., the limit switch is set to close when the valve is partially open.

4. As described in Report No. 11, the stroke and gear change will be made to valves 1501-21 A & B (LPCI system).

   All work except valve 1501-21 A & B will be complete before start-up of Dresden 2. Equipment for valve 1501-21 A & B is on order and valve modification will be complete as soon as possible. In the interim, valve operator inspection will be made after each valve operation to verify its condition.

SUPPLEMENTARY INFORMATION
for
DRESDEN UNIT 2
SPECIAL REPORT NO. 13

CORRECTIVE ACTIONS FOR CORE SPRAY WATER HAMMER PROBLEM

May 13, 1971

Commonwealth Edison Company

COMMENTS

Corrective actions taken for the core spray water hammer problem and to prevent recurrence.

RESPONSE

CORE SPRAY LINE REPAIR

The core spray line has been restored to its original condition with all seismic restraints replaced and the circumferential welds, which were calculated to have experienced a stress in excess of yield stress, were dye-penetrant inspected.

ECCS Fill System

A. Design Basis

The performance objectives of the ECCS Fill System are (1) to keep the LPCI and Core Spray System lines full of water at all times, and (2) to recycle the torus water so that leakage through the check valves downstream of the pumps will not cause a rise in torus water level. To achieve these objectives the design of the ECCS Fill System used the following bases:

Valve Design Leak Rate	5 gpm/valve 20 gpm total
Design Pressure	less than 100 psi 230' but greater than 50 psi (115')
Piping Design Code	USAS B31.1
Seismic	Class I Piping

The design leak rate was based on data taken at the site which confirmed that the average leakage over a several day period, was less than 20 gpm.

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The design pressure was set to ensure that the pressure in the system would not affect the AC interlock logic but would be sufficient to keep the lines full.

As an extension of primary containment, the piping is of the same quality and design basis as the torus ring header and is designed for Class I seismic conditions.

The pump power supply will be from a bus which is supplied by the diesel generator.

B. DESCRIPTION

The Core Spray and LPCI are designed with a fill system which keeps the lines full of water at all times.

The ECCS Fill System (Figure 1) provides for a single continuously operating pump. The piping and valving are of the same quality as the ECCS supply header piping and valving. The ECCS Fill System utilizes the same fill points as previously utilized and the pump suction is downstream from the first motor operated valve on the torus header. The pump is rated at 50 gpm flow and 150 foot head (65 psi). Each core spray piping leg and each LPCI piping leg has an independent pressure switch which alarms in the control room if any leg loses pressure. These alarms are set at 50 psi, which is above the maximum static pressure (when the line is full) of 45 psi.

If the pump were unavailable due to repairs, the Condensate Transfer System can be valved back into operation and the temporary excess leakage through the valve again routed to radwaste. For this service, the condensate transfer water now will go through a pressure control valve so that the system pressure will not affect the AC interlock logic.

C. System Performance

The fill system will meet the following requirement:

1. Keep the ECCS lines full.

2. Maintains a flow rate in excess of maximum leakage.

3. Keep the system full without violating AC interlock logic.

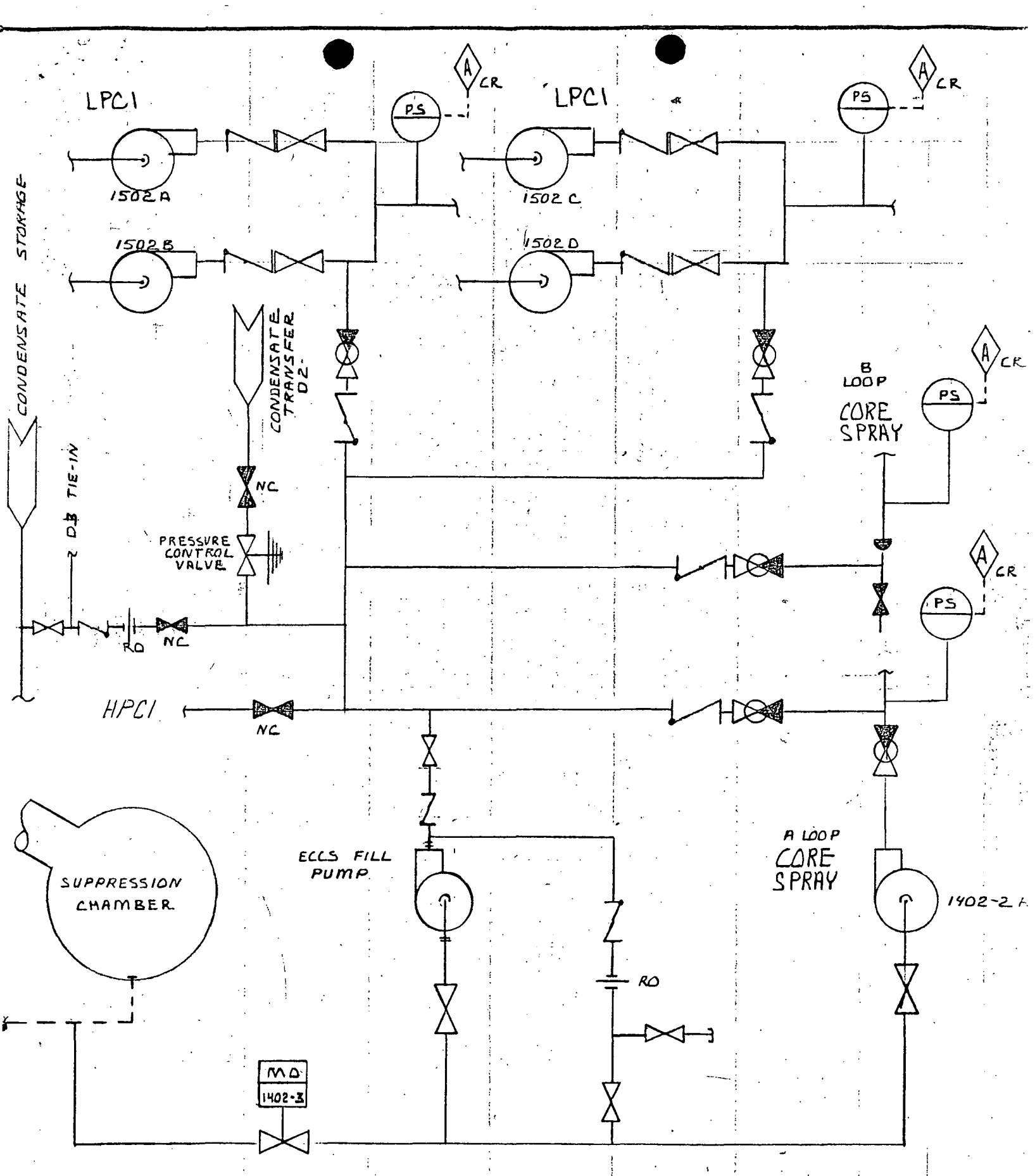
4. There are four alarms which alarm in the control room if the system pressure drops below allowable levels.

5. Maintains containment integrity through component design and quality assurance.

6. Provides a suitable backup for use during pump maintenance.

It should be emphasized that this system has alarms which will notify the operator if the jockey pump has stopped by setting the alarm above the static head. This allows the operator to valve in the original condensate system, thus giving further assurance that the lines are full.

279.7



ECCS FILL SYSTEM
TYPICAL D2/3

FIGURE 1

5/12/71 J.E.H.

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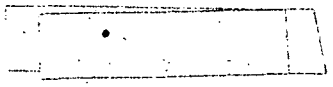
SUPPLEMENTARY INFORMATION
for
DRESDEN UNIT 2
SPECIAL REPORT NOS. 2 AND 7

DRYWELL PNEUMATIC SUPPLY SYSTEM

May 13, 1971

Commonwealth Edison Company



COMMENTS

I. Provide capacity, rating and design details of the Drywell Pneumatic Supply System.

RESPONSE

A. Design Basis

The performance objective of the Drywell Pneumatic Supply System is to provide a source of clean, dry, oil-free gas to all of the pneumatic operated equipment inside of the primary containment. In effect, it totally replaces that portion of the instrument air supply system which was originally designed for the plant but has not remained oil-free in service. A secondary benefit of this system is to reduce the need for venting of the primary containment caused by 1) internal pressure rise of the containment atmosphere due to continuous "bleeding" of air from the pneumatic operated components and 2) excessive oxygen concentration of the inerted containment atmosphere caused by the continuous "bleeding" of air from the pneumatic operated components.

To achieve these objectives, the Drywell Pneumatic Supply System is designed to supply up to 7 acfm of clean, dry, oil-free gas at a nominal pressure of 100 psig. The pneumatic supply requirement during normal operation is approximately 1 scfm.

B. Description

The Drywell Pneumatic Supply System consists of a dual compressor unit, after cooler, moisture separator, dryer, receiver, filters and associated valves, piping, and instrumentation. A schematic diagram of the system is shown on the attached Figure 1.

Suction is taken directly from the drywell, filtered and compressed. The compressed gas discharging from the compressors passes through the after cooler, separator, dryer and after-filter to the receiver which is nominally held at 100 psig pressure. The gas then passes from the receiver through another set of after-filters to supply all of the pneumatic operated components inside the drywell. System and/or component design requirements are as follows:

1. Suction Inlet Screen This screen is provided to prevent foreign objects from entering and plugging the suction line.

2. Suction Line Containment Isolation Valves Redundant valves are provided to effect automatic primary containment isolation in the event of a loss of coolant accident. These valves receive group 2 isolation signals originating from the primary containment isolation system described in Section 7 of the FSAR. In

addition, the valves will fail-close; i.e., the valves require air (gas) to open. The solenoid pilots are normally energized, hence, the valves will close automatically in the event of power or air (gas) failure.

3. Compressor Suction A suction filter is provided to protect the compressor from dirt. A suction relief valve and a vacuum switch are provided to prevent high suction and low suction pressures respectively.

4. Compressor Control Two compressors are provided, each having a capacity of 3.5 scfm at 100 psig. Normally only one compressor is running at a time. The "running" compressor starts and stops automatically as determined by the receiver pressure. Low receiver pressure will automatically start the "running" compressor and a still lower pressure will automatically start the standby compressor. Both compressors will shut off automatically when normal operating pressure is reached in the receiver. The provision of two compressors is made to give a higher degree of system operational flexibility and reliability.

5. Compressors The compressors are of a proven high-quality industrial type being of oil-free design.

6. After Cooler and Separator An air-cooled after cooler, utilizing a motor driven fan, together with a moisture separator and traps, removes the bulk of the moisture in the gas leaving the compressors.

7. Dryer A refrigerated air dryer is provided utilizing an aluminum packed "Thermal Mass" heat exchanger and an air cooled regrigeration system. It cools the air to a temperature of $35^{o}F$ at 100 psig, equivalent to an atmospheric dew point of minus $12^{o}F$. A high temperature alarm in the control room indicates a dryer malfunction.

8. Receiver A 250 gallon ($35\ ft.^{3}$) receiver is provided. This size was selected to prevent system pressure drawdown which would result in bringing in the backup supply system when all four main steam isolation valves trip closed.

9. After-Filters Filters are provided to minimize the amount of particulates entering the pneumatic supply system from the receiver piping or from the back-up supply system. Two parallel sets of filters are provided to permit continuity of service while one set is being cleaned.

10. Supply Line Containment Isolation Valves A check valve and a fail-closed air (gas) operated globe valve is provided to effect primary containment isolation in the event of an accident. The air (gas) operated valve is capable of remote manual actuation from the control room.

11. Equipment Inside the Drywell No changes were made to equipment inside of the drywell except for the supply line to the ventilation dampers and controls. For this case the former supply line has been capped off at its drywell penetration and a new line has been installed from the existing piping within the drywell to supply this equipment. Pressure regulators have been installed in this line to reduce the system pressure to the required control system supply pressure of 20 psig.

C. Design Evaluation

Loss of instrument air (gas) will cause closing of the main steam line isolation valves which results in a reactor scram. The resultant transient is identical to the single failure analysis of "Main Steam Line Isolation Valve Closure" given in Section 11 of the FSAR. There are no critical instruments (those for which a failure thereof would limit or jeopardize the safety of the plant or prevent its safe shutdown) operated from the Drywell Pneumatic Supply System.

Although the Drywell Pneumatic Supply System is not essential to the safe shutdown of the plant, it nevertheless has been designed to accommodate a high degree of operational reliability and flexibility. In addition to redundant compressors, a back-up supply system has also been provided. This back-up supply system is taken from the Nitrogen Supply to the Primary Containment Inerting and Atmospheric Control System. This system provides an additional capacity of approximately 8 scfm at a nominal 100 psig system pressure.

The lines in the system were carefully checked to ensure that they are free of all leakage. The system was given a pre-operational test to ensure that the components are functional and perform per the design requirements.

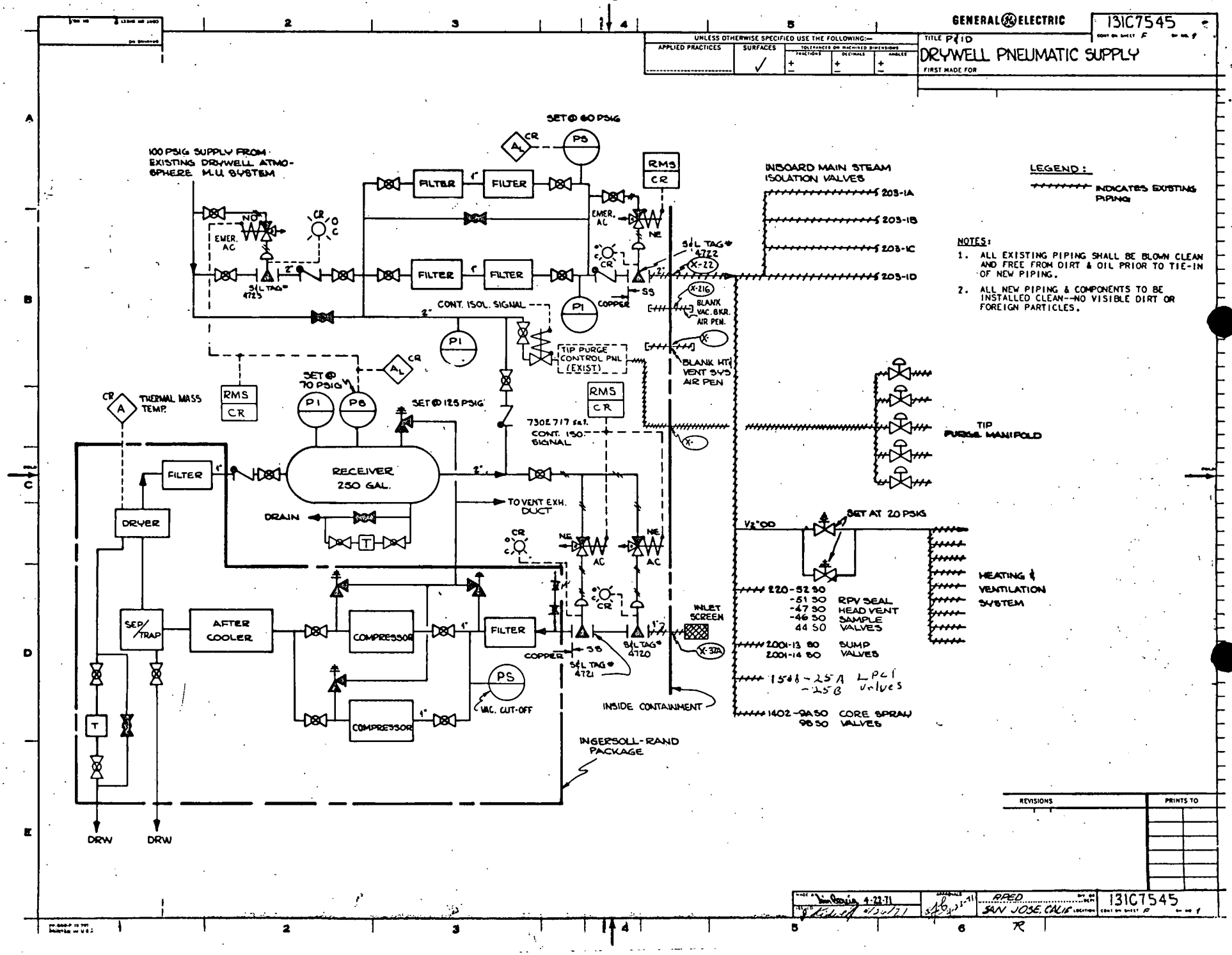


FIGURE 1

COMMENT

II. Provide description of the interim and final design for the instrument air supply for the outside main steamline isolation valves.

RESPONSE

The performance objective of the new Station Instrument Air System is to provide a source of clean, dry, oil-free air for operation of all of the plant Pneumatic Control Systems and other air operated equipment which requires instrument quality air. The original plant design provided two station air compressors which supplied the needs of both the Station Service Air and Instrument Air Systems. That portion of the system used for instrument air incorporated the use of pre-filters, dryers, after-filters and an instrument air receiver. In addition, all of the air discharged from the compressors passed through oil filters. However, system operating experience has shown that the Instrument Air System does not remain oil-free in service. The cause of this has been attributed to the station air compressors which are not of the oil-free design. This condition has caused operational problems with the Main Steam Line Isolation Valves. Reference: Dresden-2 Special Report dated March 17, 1971 (Report No. 7).

Corrective Action

Corrective Action is being taken as follows:

1. Air Supply to Equipment Inside the Primary Containment. The Station Instrument Air Supply has been removed from the pneumatic operated equipment inside the Primary Containment and replaced with a Closed Loop Pneumatic Supply System as described in Report No. 7 of the Dresden-2 Special Report dated, 17th March, 1971.

2. Interim Action for Equipment Outside of Primary Containment. The most critical equipment outside of the Primary Containment with respect to Contaminated Air Supply are the Outboard Main Steam Line Isolation Valves. During the refueling outage the Station Instrument Air Supply has been removed from actuator assemblies and replaced with a temporary supply system served by a small air compressor unit. This system consists of an oil-free compressor unit, after cooler, receiver, dryer, filters, and associated valves, piping, and instrumentation. A schematic diagram of this system is shown on Figure 2 and 3.

Suction is taken from the Turbine Building and discharged through a filter station to both the Dresden-2 and Dresden-3 X-area Main Steam Isolation Valves. In order to maintain maximum plant operability and flexibility, a temporary backup supply of nitrogen is provided from a bottled liquid source. This is the same system as described in the March 17, 1971 Special Report for Dresden-2, Report No. 7.

The compressor is a single stage, water cooled non-lubricated cylinder type which is rated at 9.4 acfm dry, oil-free air at 100 psig. The compressor is mounted on the 80 gallon receiver tank along with a water cooled after cooler.

The compressor and after cooler receive their cooling water from the Turbine Building Closed Cooling Water System. The dryer is the same type supplied for the Drywell Pneumatic Supply System i.e., thermal mass refrigerated dryer.

The filter station will remove particles down to .5 mircon. A separate filter is provided for the compressor air and the liquid nitrogen backup supply.

The compressor has local controls with a pressure switch mounted off the receiver. When the receiver drops in pressure an alarm annuciates in the control room and the backup liquid nitrogen system supplies the system requirements.

The normal expected usage for both plants is about 2 acfm. The compressor is capable of about 4 1/2 times the amount. Upon installation of the new instrument air compressors, the temporary system would be removed.

Final Action for Equipment Outside Primary Containment.

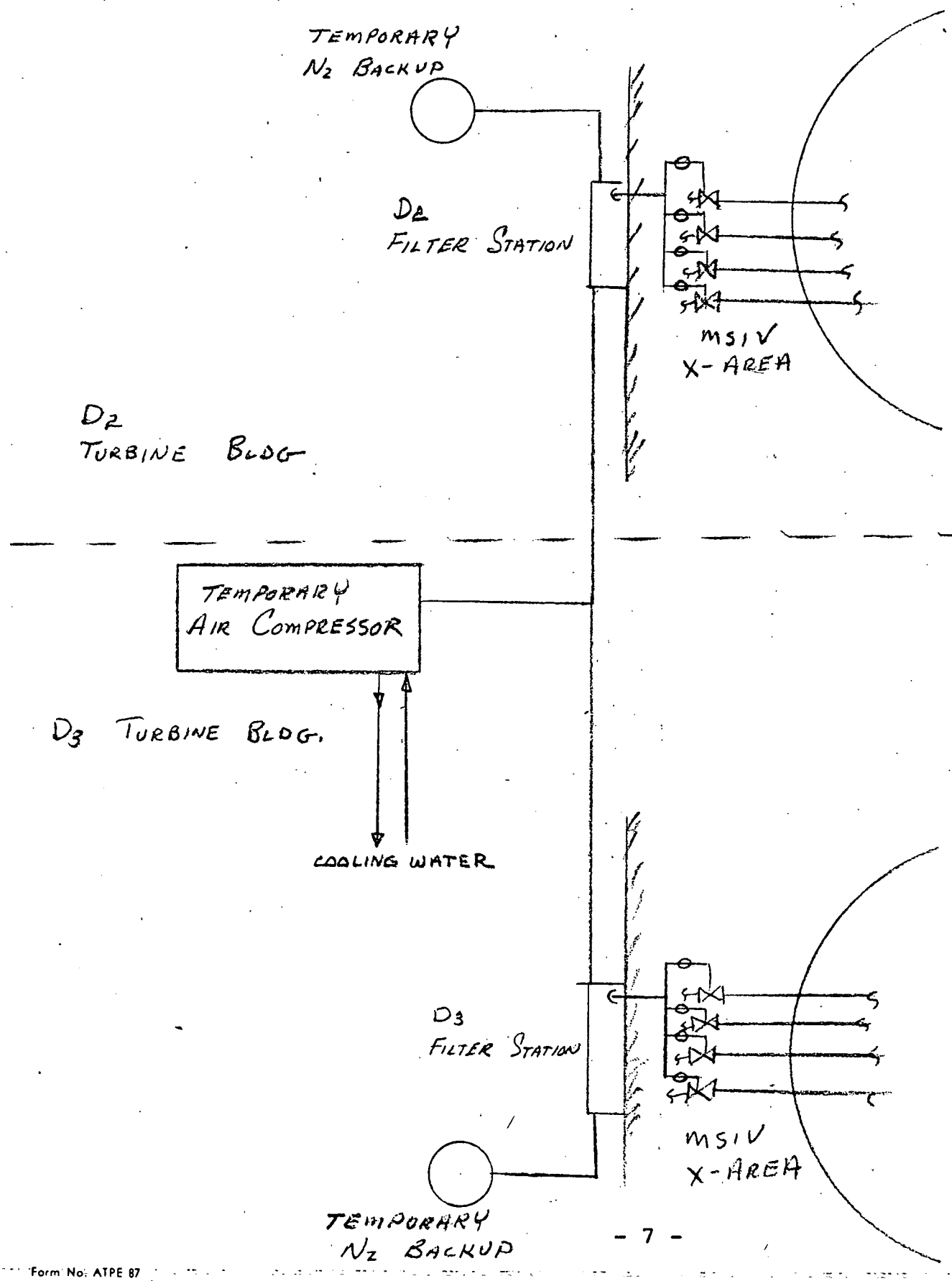
Final action will consist of complete separation of the Instrument Air System from the existing Station Air Compressor System. Thus leaving the existing station air compressors serving only the station service air requirements. All of the existing instrument air piping and tubing will be thoroughly cleaned with an appropriate cleaning agent, flushed, and blown clear. Where this is not practical, the pipe and/or tubing will be replaced. Two new air-compressors each having a capacity of 216 acfm at a nominal system pressure of 110 psig are being provided to serve the Station Instrument Air Supply needs exclusive of the Primary Containment. Existing pre-filters, dryers, and after-filters will be utilized to assure instrument quality air. A simplified schematic diagram of the system is shown on Figure 4.

Each instrument air compressor shall be installed so that it normally supplies one plant only. Plant operation will be such that if one compressor fails or is shut down for servicing, the remaining compressor will service both plants. Each instrument air system alarms in the control room on low reciever pressure or shutdown of the compressor.

The new piping and valving being installed are consistent with that already existing. The new equipment will be pre-operational tested to ensure conformance to design requirements and system operation.

FIGURE 2

TEMPORARY X-AREA COMPRESSOR



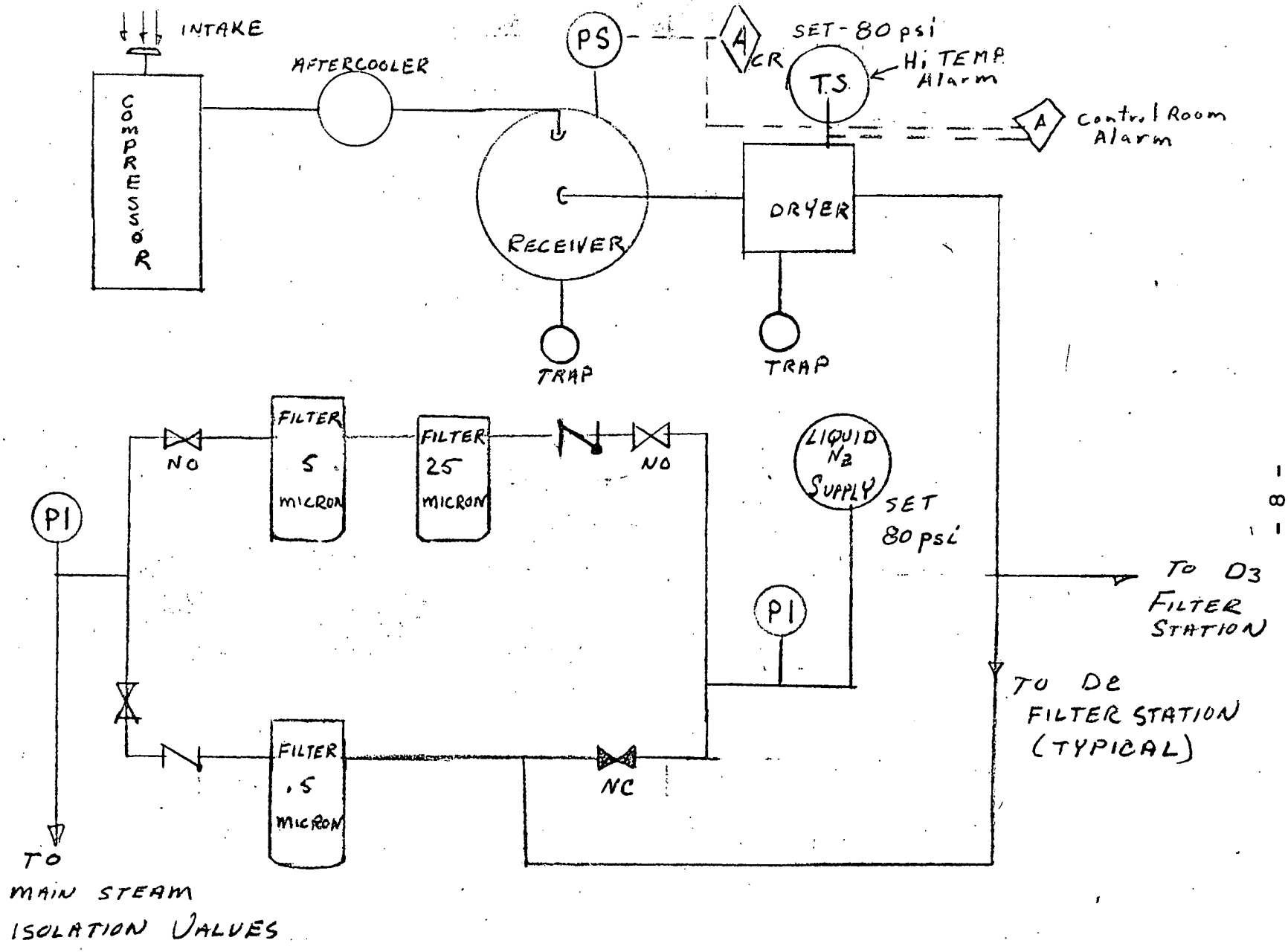
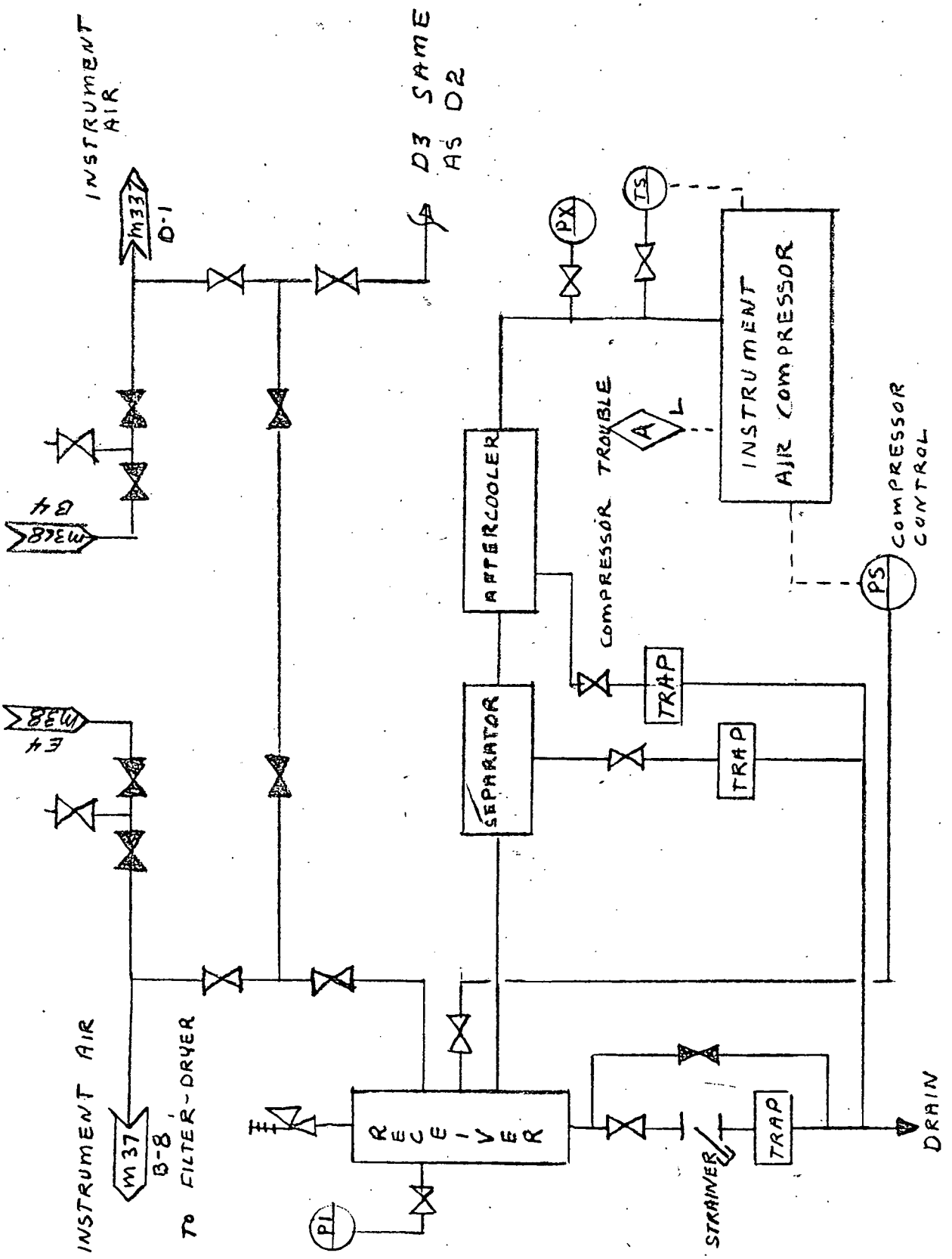


FIGURE 3

TEMPORARY X-AREA COMPRESSOR

FIGURE 4

INSTRUMENT AIR



SUPPLEMENTARY INFORMATION
for
DRESDEN UNIT 2
SPECIAL REPORT NO. 1

RECIRCULATION SYSTEM OPERATION LIMITATIONS

May 13, 1971

Commonwealth Edison Company

Comments

Provide a curve to show the relationship of recirculation pump speed and area where high vibrations occur. Also provide information concerning the procedures which have been established to prevent operation in an area which results in vibrations in relation to power level

Provide discussion of the operational limits which have been placed on the use of the equalizer valves.

Response

Special Report No. 1 of the Special Reports for Dresden Nuclear Power Station Unit 2, dated March 17, 1971, indicated that an automatic interlock system will be installed to prevent recirculation pump operation in the range in which jet pump vibration could occur. This report provides further information in response to AEC concerns in this area and on other recirculation system operational restrictions.

Discussion

Startup and operation of the recirculation pumps in the area which causes high vibration has been precedurally prohibited. An automatic interlock system will be installed to act as backup to the procedural restrictions.

A high "speed asymmetry" between the two recirculation pump causes opposition of flows in the low speed loop jet pumps and consequent vibration of the jet pumps and their riser braces. A curve showing the relationship of pump speed to the set points of the alarm and interlock is shown on Figure 1. The area of prohibited operation has been conservatively defined and is shown as region 1 on Figure 1. The interlock system is being designed to perform the following functions:

1. Automatically prevent restarting an idle recirculation pump when the operating pump exceeds 65% of design speed. An alarm in the control room will be activated if the speed of the active pump is greater than 65% and a restart of the idle pump is attempted.

2. Prevent recirculation pump operation from shifting into region 1 of Figure 1 by providing limiters set to function along lines AB of Figure 1. This interlock will not prevent any normal pump trips from occurring.

3. Provide an alarm in the control room which will be actuated when recirculation pump operation falls within 5% of region 1 of Figure 1 as shown by lines CD of Figure 1.

Jet pump vibration does not occur for single recirculation pump operation with the equalizer valve open or shut because under either condition the opposition of flow situation does not occur in the jet pumps. Prohibition of operation of the system with the equalizer valve open will continue until tests at Dresden or other plants have been completed and the data has been reviewed to provide verification of acceptable recirculation pump operation for single loop operation with the equalizer valve open.

In addition to the previously discussed restriction, for steady state two pump operation, the pump speeds shall be maintained within 10% of their average speed whenever reactor power level is above 80% and within 15% at other times except during transient periods required by testing, pump starting, or recirculation system adjustments. This restriction was applied to match the recirculation loop selection logic settings to the permitted recirculation flow variations between the recirculation loops. The LPCI logic selection system has been previously described in Dresden Nuclear Power Station Units 2 and 3 Amendment 7/8. The logic selects the loop with the highest jet pump external riser pressures for injection based on a differential pressure determination. For some limited low probability accidents with the recirculation pumps operating with large speed differences, it is possible for the logic to select the wrong loop for injection. For those limited conditions, the core spray system itself is adequate to prevent fuel temperatures from exceeding allowable limits. However, to limit the probability even further, a procedural limitation has been placed on the allowable variation in the speed between the recirculation pumps.

Summary

The present procedural restrictions placed on the recirculation system provide assurance against operation in prohibited modes. The interlock system will provide backup protection against operation of the recirculation pumps in modes which cause jet pump vibration.

DRESDEN II *

INTERLOCK SYSTEM FOR JET PUMP RISER BRACE PROTECTION

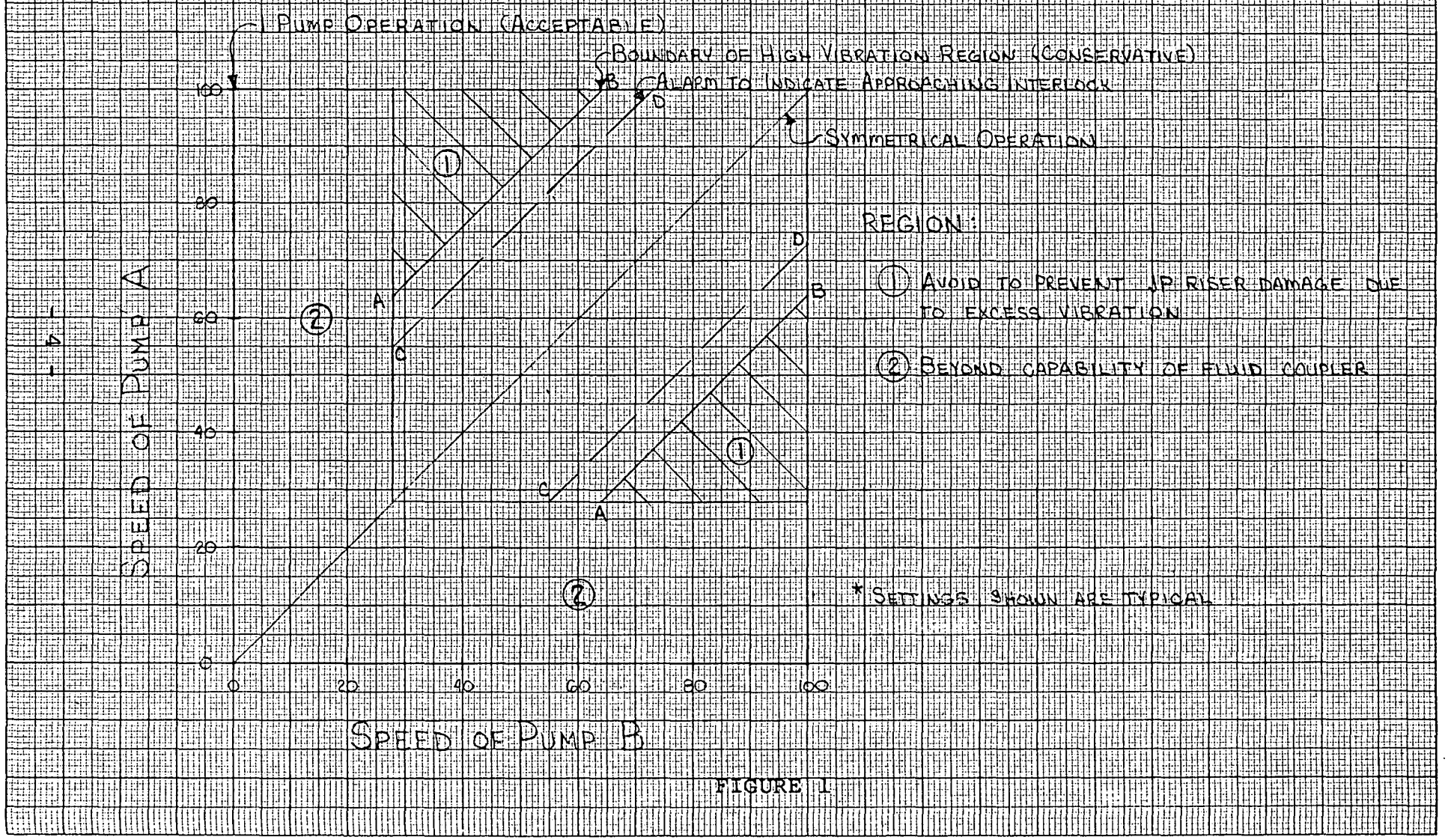


FIGURE 1

12-6642

SUPPLEMENTARY INFORMATION
for
DRESDEN UNIT 2
SPECIAL REPORT NO. 6

CORE ASYMMETRY

May 13, 1971

Commonwealth Edison Company

D-2

COMMENT

Provide information on the history and results of various experiements that have been done on the core asymmetry problem.

RESPONSE

A General Electric Generic Topical Report will be filed in the last quarter of 1971 on the BWR core asymmetry.

SUPPLEMENTARY INFORMATION
for
DRESDEN UNIT 2
SPECIAL REPORT NO. 3

DRESDEN RADWASTE FLOW DIAGRAM

May 13, 1971

Commonwealth Edison Company

D-2

COMMENT

Provide an up-dated Flow Diagram of the Dresden radwaste including the evaporator.

RESPONSE

The Flow Diagrams of the Dresden Radwaste System are in the process of being up-dated to reflect all modifications to the system at Dresden. These Flow Diagrams will be submitted by June 15, 1971.