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Dresden Nuclear Power Station
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July 8, 1992

CWS LTR #92-395

U.S. Nuclear Regulatory Commission
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Attached please find Licensee Event Report #91-031-01, Docket #050237. This revised report is being submitted to provide the result of the disassembly and inspection of Unit 2 Control Rod Drive R-10, as committed in the original report.

L. J. Gerner for 7/27/92
Charles W. Schroeder
Station Manager
Dresden Nuclear Power Station

CWS/cfq

Enclosure

cc: A. Bert Davis, Regional Administrator, Region III
NRC Resident Inspector's Office
File/NRC
File/Numerical

300042

(ZDVR/621)

IE22

LICENSEE EVENT REPORT (LER)

Form Rev 2.0

Facility Name (1)	Docket Number (2)	Page (3)
Dresden Nuclear Power Station, Unit 2	0 5 0 0 0 2 3 7	1 of 0 8

Title (4) Control Rod Drive R-10 Failure to Latch Due to Collet Piston Binding

Event Date (5)			LER Number (6)			Report Date (7)			Other Facilities Involved (8)	
Month	Day	Year	Year	Sequential Number	Revision Number	Month	Day	Year	Facility Names	Docket Number(s)
									N/A	
0 9	2 1	9 1	9 1	--- 0 3 1	--- 0 1	1 0	0 8	9 1	N/A	

OPERATING MODE (9)		THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10CFR (Check one or more of the following) (11)			
N		___ 20.402(b)	___ 20.405(c)	___ 50.73(a)(2)(iv)	___ 73.71(b)
POWER LEVEL (10)	0 8 5	___ 20.405(a)(1)(i)	___ 50.36(c)(1)	___ 50.73(a)(2)(v)	___ 73.71(c)
		___ 20.405(a)(1)(ii)	___ 50.36(c)(2)	___ 50.73(a)(2)(vii)	X Other (Specify
		___ 20.405(a)(1)(iii)	___ 50.73(a)(2)(i)	___ 50.73(a)(2)(viii)(A)	in Abstract
		___ 20.405(a)(1)(iv)	___ 50.73(a)(2)(ii)	___ 50.73(a)(2)(viii)(B)	below and in
		___ 20.405(a)(1)(v)	___ 50.73(a)(2)(iii)	___ 50.73(a)(2)(x)	Text) Voluntary

LICENSEE CONTACT FOR THIS LER (12)

Name	TELEPHONE NUMBER AREA CODE
Walter Ravelo, Technical Staff System Engineer Ext. 2997	8 1 5 9 4 2 - 2 9 2 0

COMPLETE ONE LINE FOR EACH COMPONENT FAILURE DESCRIBED IN THIS REPORT (13)

CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS	CAUSE	SYSTEM	COMPONENT	MANUFAC-TURER	REPORTABLE TO NPRDS
X	A A	D R I V	G 0 8 0	Y					

SUPPLEMENTAL REPORT EXPECTED (14)		Expected Submission Date (15)	Month	Day	Year
___ Yes (If yes, complete EXPECTED SUBMISSION DATE)	___ X NO				

ABSTRACT (Limit to 1400 spaces, i.e, approximately fifteen single-space typewritten lines) (16)

At 0327 hours on September 21, 1991 with Unit 2 at 85% power, Control Rod Drive (CRD) Exercising was being conducted on CRD R-10 per Dresden Operating Surveillance (DOS) 300-1, Daily/Weekly Control Rod Drive Exercise. While attempting to exercise CRD R-10 from position "48" (full out) to position "46", the CRD failed to latch at positions "46" and "44". With Qualified Nuclear Engineer (QNE) permission, an attempt to latch at position "42" was also made and failure to latch again occurred. The CRD was fully inserted and maintained at position "00" by continuously applying an Emergency-In signal. At 0535 hours, CRD R-10 began to drift out; the CRD was scrammed to position "00" (full in) and held in position by charging water pressure.

Tests were conducted per Special Procedure (SP) 91-9-114 to relatch CRD R-10 and flush the CRD collet piston. During testing, CRD R-10 was successfully relatched. Testing indicated that there was no leakage in the directional control valves. The CRD collet housing was determined to be intact and latching failure was determined to be a result of collet piston binding. Upon completion of flushing, latching failure again occurred and CRD R-10 was scrammed to position "00" where it successfully latched. This event had minimal safety significance because shutdown margin was not exceeded with this rod and the highest worth rod postulated to fail and all other rods postulated at position "02". Inspection during disassembly on July 11, 1992 found significant corrosion on the mating surfaces between the collet piston and collet housing (see figure 2). The corrosion is determined to be the cause of the collect piston binding. A previous rod drift due to unrelated causes was reported by LER 91-22/050237.

PLANT AND SYSTEM IDENTIFICATION:

General Electric - Boiling Water Reactor - 2527 MWt rated core thermal power

Nuclear Tracking System (NTS) tracking code numbers are identified in the text as (XXX-XXX-XX-XXXXX)

EVENT IDENTIFICATION:

Control Rod Drive R-10 [AA] Failure to Latch Due to Collet Piston Binding

A. CONDITIONS PRIOR TO EVENT:

Unit: 2 Event Date: September 21, 1991 Event Time: 0327 Hours

Reactor Mode: N Mode Name: Run Power Level: 85%

Reactor Coolant System (RCS) Pressure: 982 psig

B. DESCRIPTION OF EVENT:

At 0327 hours on September 21, 1991 with Unit 2 at 85% reactor power, Control Rod Drive (CRD) Exercising was being conducted on CRD R-10 per Dresden Operating Surveillance (DOS) 300-1, Daily/Weekly Control Rod Drive Exercise. While attempting to single notch CRD R-10 from position "48" to position "46", the Nuclear Station Operator (NSO) observed that the CRD failed to latch at position "46". Two more attempts to latch the CRD at position "46" were also unsuccessful. Attempts were then made to latch CRD R-10 at position "44" both with normal drive pressure (280 psi over reactor pressure) and with reduced drive pressure (200 psi over reactor pressure). Attempts to latch at position "44" were also unsuccessful.

Upon failing to latch at position "44", the Qualified Nuclear Engineer (QNE) was notified and permission was obtained to attempt latching at position "42". The attempt to latch CRD R-10 at position "42" was unsuccessful.

CRD R-10 was fully inserted to position "00" with a continuous insert signal per Dresden Operating Abnormal Procedure (DOA) 300-5, Inoperable or Failed Control Rod Drives, where latching failure again occurred. CRD R-10 was held at position "00" with a continuous Emergency-In insert signal and a Level 1 Operator was sent to the Hydraulic Control Unit (HCU) to locally assist in troubleshooting.

While troubleshooting CRD R-10, valve 2-305-102, Withdraw Riser Isolation Valve, was isolated to eliminate potential drive pressure to the CRD overpiston area or CRD collet piston (see Figure 1 attached). The insert signal was then removed and CRD R-10 again failed to latch at position "00". The CRD was returned to position "00" using the Emergency-In/Notch Override Switch and valve 2-305-102 was opened.

While maintaining the rod at position "00" with the Emergency-In/Notch Override Switch, the Assistant Superintendent of Operations (ASO), the Production Superintendent, the Station Manager, the QNE, and the On-Site General Electric (GE) Representative were contacted to discuss a contingency plan should rod drift occur again.

At 0535 hours, CRD R-10 began to drift out from position "00" with the Emergency-In Notch/Override Switch still engaged, and with 5 gpm of drive water flow indicated on the Control Room drive water flow meter (Panel 902-5). CRD R-10 was then individually scrammed from position "42" via the toggle switch on the CRD scram test panel per the agreed contingency plan. The Reactor Protection System [JE] (RPS) Channel A and Channel B Scram Fuses for CRD R-10 were removed to prevent valves 2-305-126 (Scram Inlet Valve) and 2-305-127 (Scram Outlet Valve) from closing. Valve 2-305-112 was closed to eliminate a continuous flow of water to the Scram Discharge Volume (SDV). CRD R-10 was maintained in the full-in position via water pressure from the CRD Charging Water Header.

By 1430 hours, the Fuel Vendor had completed calculations concerning the affect on shutdown margin relative to this event. Two scenarios were addressed:

1. Calculations were conducted with both the strongest rod in the core and CRD R-10 assumed at position "48", with all other rods at position "00";

2. Calculations were conducted with both the strongest rod in the core and CRD R-10 assumed at position "48", with all other rods at position "02".

In both cases, shutdown margin requirements were determined to be met.

At 2140 hours, testing was conducted to determine the operability of the CRD collet piston, assess any potential leakage past the Directional Control Valves, and flush the collet piston per Special Procedure (SP) 91-9-114.

Testing demonstrated CRD collet piston operability by attempting to latch CRD R-10 in position "00" or position "02". While testing for CRD collet piston operability, charging water was removed by closing valve 2-305-113, Charging Water Isolation Valve. Upon closing valve 2-305-113, CRD R-10 successfully settled and latched from the "Overtravel-in" position into position "00".

With the operability of the CRD collet piston demonstrated, leakage past the Directional Control Valves was assessed. Valves 2-305-101, Drive Water Riser Isolation Valve, 2-305-102, Withdraw Riser Isolation Valve, 2-305-126, Scram Inlet Valve, and 2-305-127, Scram Outlet Valve, were isolated. The NSO initiated a sustained Insert signal and monitored for an increase in drive water flow. No increase in flow was found, indicating no leakage past valves 2-305-120 or 2-305-122. Leakage past valves 2-305-121 and 2-305-123 was assessed by repeating the process with a sustained withdraw signal. Again, no leakage was found.

The final portion of the testing involved flushing of the collet piston. CRD R-10 was withdrawn from position "00" to position "48". The CRD was latched at positions "4", "10", "12", "24", "36", and "48" to further demonstrate collet piston operability. A drive pressure of 400 psi over reactor pressure was needed to move CRD R-10; however, failure of the collet housing would prevent any movement of the CRD. Since CRD movement was possible, it was concluded that the collet housing had not failed. At position "48", with normal valve line up, the CRD collet piston was flushed by increasing the drive water pressure to approximately 450 psi over reactor pressure and initiating a series of two minute withdrawal signals. Collet piston operability was then verified by inserting the CRD to position "46" and then withdrawing to position "48". After flushing the CRD 20 times, CRD R-10 again failed to latch.

CRD R-10 was scrammed to the "Overtravel-in" position where it settled and latched at position "00". CRD R-10 was removed from the Unit 2 core during a forced outage in December, 1991.

C. APPARENT CAUSE OF EVENT:

This report is submitted voluntarily due to Nuclear Regulatory Commission (NRC) interest and generic applicability.

The cause of this event has been determined to be due to binding of the CRD collet piston.

On July 11, 1992, the CRD was disassembled and inspected by the Technical Staff System Engineer. The Collet Piston and Collet Housing area of the Cylinder Tube were inspected for damage (see figure 2). The inspection found that the contacting surfaces between the two parts were covered with a significant film of corrosion. The corrosion resulted in the collet piston binding in the unlatched position. In this position, the collet fingers are spread by the guide cap preventing them from latching to the index tube. The result is that the CRD is unable to latch at any position during normal drive movement.

During a scram, however, CRD R-10 was able to latch at position "00". This is due to the difference in methods for returning the collet piston to the latched position during each type of drive movement. During normal drive movement, pressure from the collet spring is used to return the collet piston to the latched position. During a scram signal, as the scram outlet valve opens (see figure 3) allowing flow to the scram discharge volume, the withdraw line goes to atmospheric pressure. This results in a differential pressure of approximately 1000 psi (reactor pressure) across the collet piston. This differential pressure is able to overcome the piston binding and therefore latch the CRD at position "00". Inspections found the collet housing intact.

The cause of the rod drift with the Emergency-In/Rod Out Notch Override Switch engaged is unclear, since no leakage was found in the directional control valves. However, inadequate ball check valve seating could have been a contributing factor. CRD R-10 had been installed since February, 1975. While CRD R-10 had exceeded Station administrative guidance concerning replacement at intervals not to exceed ten years, failure to latch has not been a previous adverse trend.

D. SAFETY ANALYSIS OF EVENT:

Calculations from the fuel vendor indicate that with both the strongest control rod (C-11) and control rod R-10 at position 48 and all other control rods at position "02", shutdown margin was still within Technical Specification requirements for this case up to a cycle exposure of 5000 MWD/MTU, or approximately three further months of full power operation. The QNE conducted evaluations that indicated that should CRD R-10 unlatch from position "00" and drift out to position "48", the reactivity addition would be minor at any power level, including full power, and would not result in fuel damage since the CRD is located on the core periphery.

Since the QNE was present during all testing to assure that nuclear limits were not exceeded, and shutdown margin was found to be within parameters, the safety significance of this event was considered minimal.

On-Site Review (OSR) 91-27 was written to address further actions and considerations that resulted from allowing CRD R-10 to remain in the core.

CRD R-10 was removed from the core during a forced outage in December, 1991.

E. CORRECTIVE ACTIONS:

1. Immediate corrective actions were to demonstrate CRD collet piston operability in accordance with Technical Specification 3.3.2, assess the leakage past the directional control valves, and attempt flushing of the CRD collet piston per SP 91-9-114.

2. Since latching was achieved, the CRD was taken Out of Service at position "00" and electrically disarmed.

3. The QNE has conducted further evaluations that indicated that should CRD R-10 unlatch from position "00" and drift out to position "48", the reactivity addition at any power level, including full power, would not result in fuel damage.

4. OSR 91-27 was written to address safety concerns and special actions that resulted from allowing CRD R-10 to remain in the core.

5. CRD R-10 was removed from Unit 2 in Decmeber, 1991. The CRD was then disassembled under work request 04125 to determine the cause of the collet piston binding.

6. All originally installed CRDs have now been removed from Unit 3. Efforts are continuing to rebuild CRDs that have been installed longer than 10 years on both Unit 2 and 3 as recommended by General Electric. Only four CRDs remain in Unit 2 which have not been replaced since original startup.

F. PREVIOUS EVENTS:

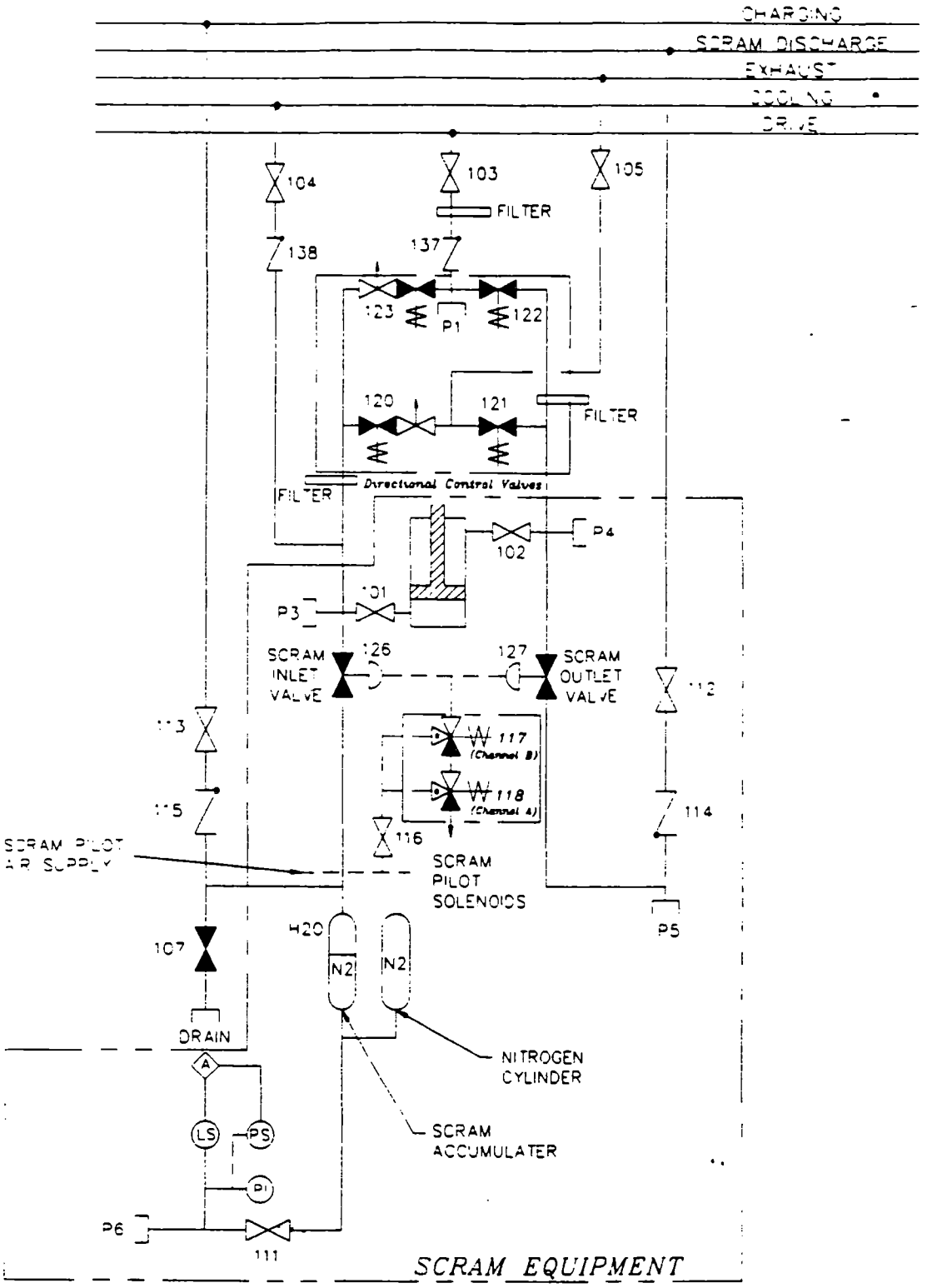
LER/Docket Numbers	Title
91-022/050237	Control Rod Drift Due to Pilot Solenoid Failure

During Electro Hydraulic Control (EHC) low pressure switch calibration per Dresden Instrument Surveillance (DIS) 500-8, EHC Low Oil Pressure Switch Calibration, CRD F-3 inserted from position "48" to position "34" on a Channel B 1/2 scram signal. Testing indicated that the rod drift was a result of leakage of pilot air past the Channel A scram pilot solenoid valves. Corrective actions were to replace the scram pilot solenoids.

G. COMPONENT FAILURE DATA:

Manufacturer	Nomenclature	Model Number	Mfg. Part Number
General Electric	Control Rod Drive	7RDB144B	N/A

An industry-wide Nuclear Plant Reliability Data System (NPRDS) data base search revealed 19 events dealing with Control Rod Drive latching mechanisms, collet pistons, or rod drifts. 18 of the events resulted from failures in the scram inlet or outlet valves or failures in the scram pilot solenoids. One of the 19 events involved excessive leakage past the collet piston due to a distorted collet piston. This failure was discovered during CRD leak testing before installation into the reactor core. Corrective actions were to replace the collet piston.



STABLE

CRD Hydraulic Control Unit (piping diagram)

Figure 1

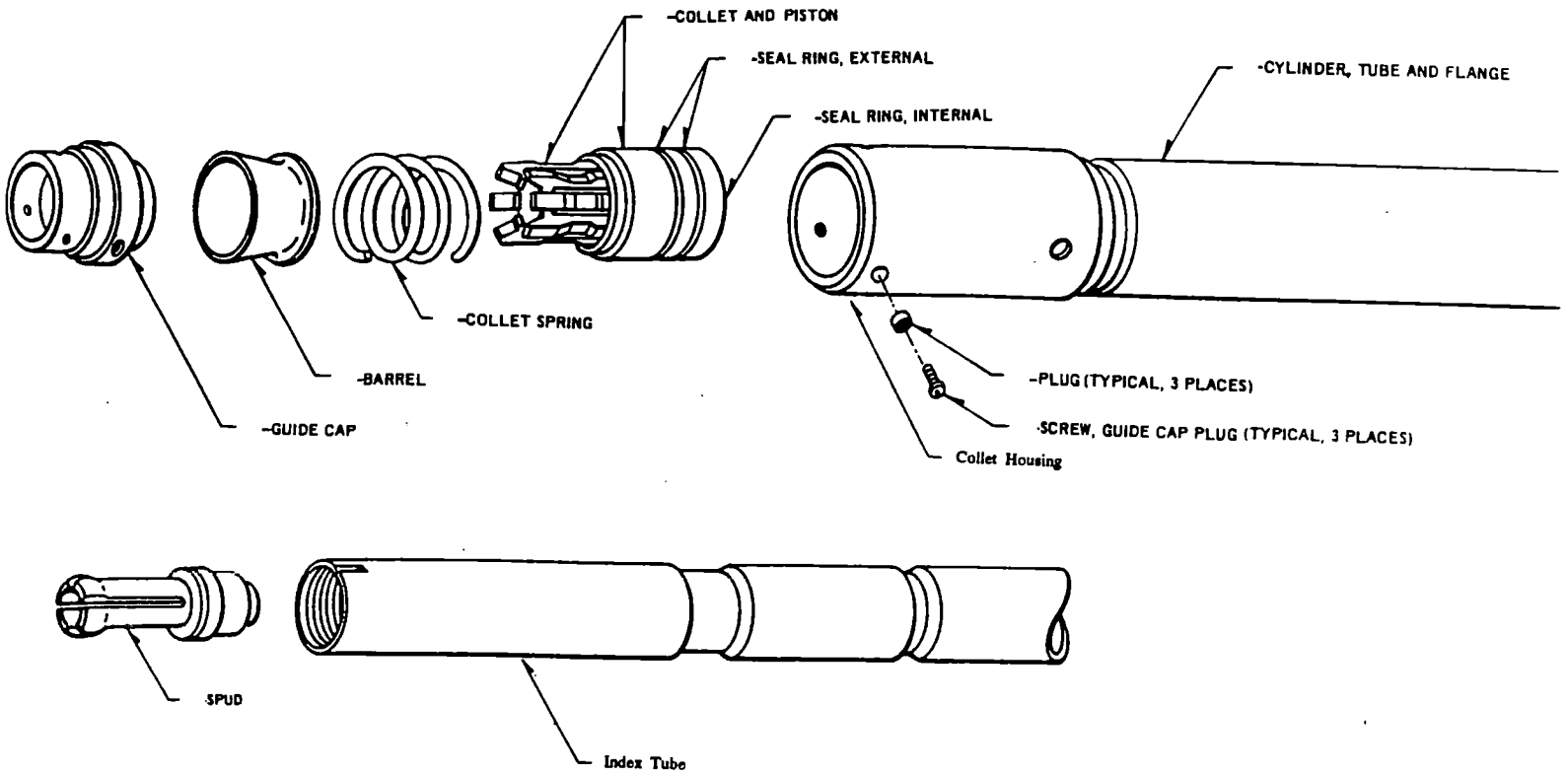
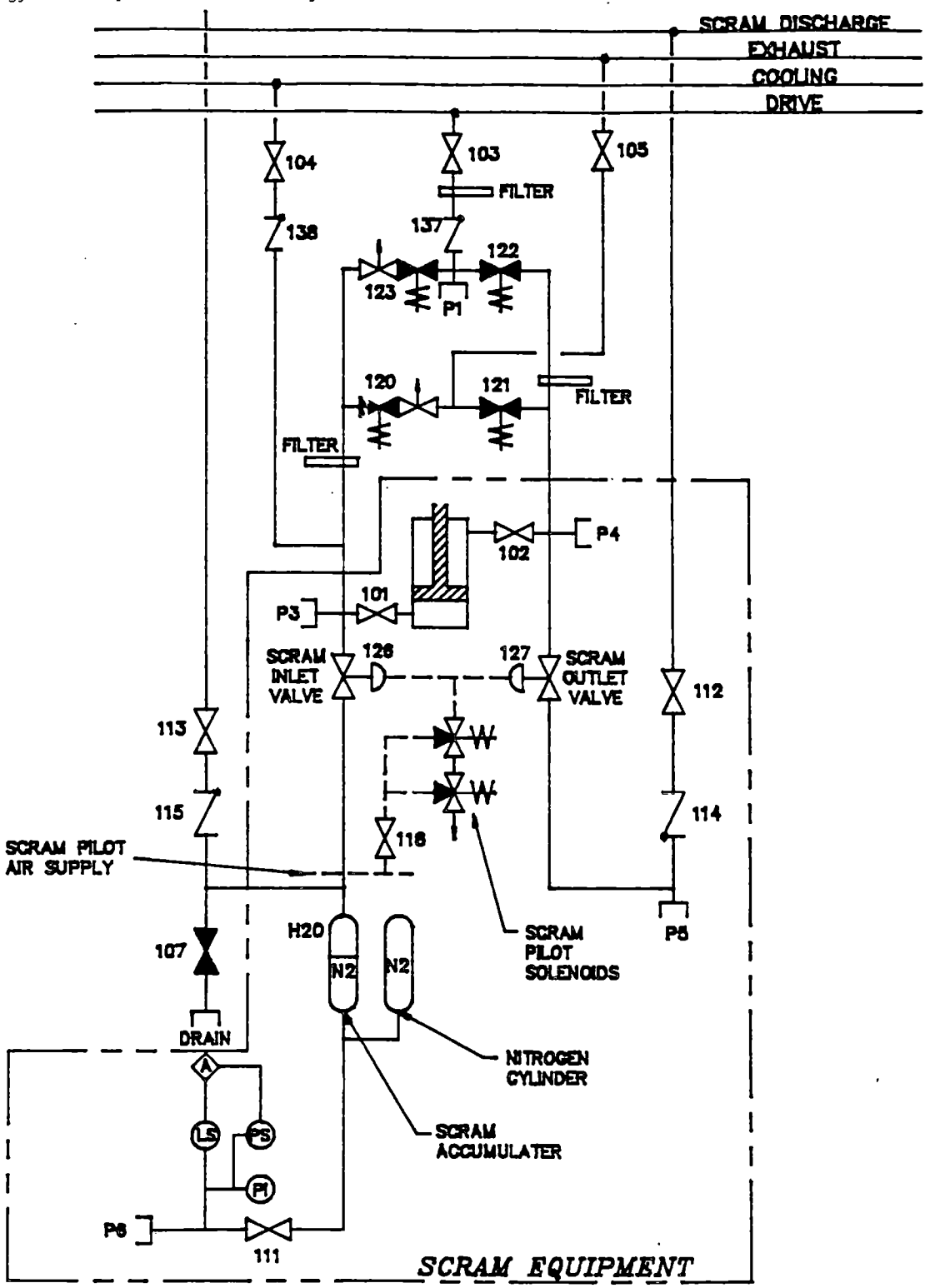

-COLLET AND PISTON
-SEAL RING, EXTERNAL
-SEAL RING, INTERNAL
-CYLINDER, TUBE AND FLANGE
-COLLET SPRING
-BARREL
-GUIDE CAP
-PLUG (TYPICAL, 3 PLACES)
-SCREW, GUIDE CAP PLUG (TYPICAL, 3 PLACES)
Collet Housing
SPUD
Index Tube

Figure 2



SCRAM

CRD Hydraulic Control Unit (piping diagram)

Figure 3