

CATEGORY 1

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ACCESSION NBR: 9612160224 DOC. DATE: 96/11/27 NOTARIZED: NO DOCKET #
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 50-389 St. Lucie Plant, Unit 2, Florida Power & Light Co. 05000389
 AUTH. NAME AUTHOR AFFILIATION
 KNECHT, W.G. Anchor/Darling Valve Co.
 RECIP. NAME RECIPIENT AFFILIATION
 CARTER, J. NRC - No Detailed Affiliation Given

SUBJECT: Part 21 rept re 2"-1878 globe piston check valves. A/DV plans
 to include philosophy of both enhancement w/smaller piston
 check valves. A/DV evaluated found condition of piston check
 valve, stuck open.

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INTERNAL:	<u>FILE CENTER</u>	<u>01</u>	1	1	NRR/DISP/PSIB/B		1	1
			1	1	PDR WARD, M.		1	1
			1	1	RGN1		1	1
			1	1	RGN2		1	1
			1	1	RGN3		1	1
EXTERNAL:	INPO RECORD	CTR	1	1	NOAC SILVER, E		1	1
	NRC PDR		1	1	NUDOCS FULL TXT		1	1

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Anchor/Darling

Valve Company • Williamsport, PA 17701

W. G. KNECHT
Technical Director

November 27, 1996

Mr. Jerry Carter
US NRC
Events Assessment Branch
Washington DC 20555

Subject: A/DV 1878 Class Piston Check Valves

Dear Mr. Carter:

Per our discussion this date the enclosure is the latest copy of our report to FP&L regarding the piston check valve problem.

Should you have any questions please do not hesitate to call Floyd Bensinger, our Engineering Manager, or the writer.

Sincerely,

ANCHOR/DARLING VALVE COMPANY



William G. Knecht
Technical Director

WGKjs

cc: F. A. Bensinger

Enclosure

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Anchor/Darling

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Page 1 of 4

Florida Power and Light Company
St. Lucie Plant
P.O. Box 128
Fort Pierce, FL 24954

November 20, 1996

Attention: D.J. Denver
St. Lucie Engineering Manager

Subject: A/DV 2"-1878# Piston Check Valves

Reference:

1. FP&L JPN-SPSL-96-0372, August 16, 1996 Letter
2. A/DV S.O.'s ET401 and RZ814
3. A/DV Test Report No.'s RZ814, Test Report of Flow Test on a 2"-1878# Globe Piston Check Valve, October 2, 1996

Gentlemen:

A/DV apologizes for the delay in responding to the referenced FP&L letter. We had hoped to receive application responses to our notification letters but as of this writing we have not received any complete information.

A/DV has performed a design review of the piston check valve with the intent to address the functional and re-assembly problems experienced at St. Lucie. The following areas were addressed as noted:

A. Pressure Seal / Bonnet Area Items

1. **Bonnet Retainer Capscrews**

FP&L reported having difficulty in sealing the ADVanseal using the capscrew without pressure. The current capscrew is a 5/16" diameter capscrew. A 1/2" diameter capscrew will be used in the future. This will provide approximately three (3) times the gasket load.

2. **Galling of the Bonnet Retainer Threads**

FP&L has experienced galling of the bonnet retainer threads. The current retainer is made of 316 stainless steel with chrome plated 12 series threads. ADV is evaluating replacing this design with a 17-4PH bonnet retainer (no chrome plating) with 8 series threads. Assuming successful completion of the new bonnet retainer evaluation, this design will be put in place.

ADV plans to include the philosophy of both enhancement with the smaller piston check valves. These two (2) enhancements will affect inventory and part interchangeability.

B. Cleaning / Drying of Valves Prior to Shipment

ADV has evaluated several methods to assure complete drying of the piston check valves prior to shipment, i.e. disassembly, baking, etc. We have concluded that the most effective method is to disassemble the valves after hydrostatic testing, dry the parts and reassemble without the gasket and anti-rotation pin (Part No. 258) installed. The gasket and anti-rotation pin will be packaged with the valve and a tag placed on the valve requiring installation of these two (2) parts after valve installation.

C. Valve Performance / Functional Items

1. **Disc Guide Area of Body Neck Bore**

We evaluated this area to determine if the body guides could be improved. Several methods were evaluated, i.e., sleeving the body bore with hardened material, reshaping the exhaust port, etc. All methods are costly. The conclusion was reached that the above changes were cost prohibitive and the better resolution is to use a smaller valve for oscillating flow application in order to place the disc in a more open position where it is better guided by the body.

C. Valve Performance / Functional Items (Continued)

2. **Disc - Body Material Couple**

It was stated by FP&L that fretting is more apt to occur where a large difference in material hardness exists. A/DV selected the body-disc material couple for wear resistance, galling resistance and castability, weldability of the bodies.

A more important factor to reduce the potential for fretting is reduced stress levels. A/DV does not plan to change the body or disc materials. As discussed in A.1. above and in the later root cause analysis, use of a smaller valve would resolve this situation.

3. **Rough Machining left in the Body Neck Bore**

In May, 1993, A/DV had changed its rough machining process to setup and rough cut the neck bore and seat pocket using the same setup method and single point tooling-boring as the finish machining process. Prior to this time the neck bore was rough machined on a radial drill. This drilling process was not always performed on the same centerline as the final machining and the drill had a tendency to tail off center. This area has been resolved as described above in May, 1993.

4. **Ratio Guide Length - Disc Diameter**

A/DV's design criteria limits the potential disc tilt to less than $1/2^\circ$ and requires a ratio of one (1) or greater for the disc, guide length to diameter. The 2"-1878# Piston Check disc has a ratio of 1.12:1. Both A/DV's design criteria and the 2"-1878# design are representative of A/DV and competitive valve designs which have been proven to be successful in most services.

Root Cause

A/DV evaluated the as found condition of the piston check valve that stuck open. To assist in our root cause analysis, we performed flow tests on two (2) 2"-1878# Piston Check valves (one (1) valve returned from FP&L, S/N ET401-9-6). Reference No. 3 Report, enclosed, documents the task and results. The testing was performed to evaluate valve performance at various forward flow rates. The test conclusion was the valve always closed when forward flow ended.

Root Cause (Continued)

As a result of our evaluation of the FP&L failed valve and our testing, we have concluded that the root cause is the disc oscillation, caused by the reciprocating pump, causing fretting to take place in the valve body disc guide area. The fretting area provides a configuration in the body guide that allows the disc to stick open without forward flow and with reverse flow.

A/DV's recommendations to eliminate the valve operational problem are (preferred listed first):

- A. Use of in-line check valves in reciprocating pump applications. This valve design provides better wear resistant materials as disc guides throughout the entire valve stroke.
- B. Use of smaller piston check valve (valve size or reduced port) in reciprocating pump applications to more fully open the disc where better body-disc guiding is available. Attached are graphs of flow rate versus disc position and Cv versus disc position to be used to evaluate T-pattern piston check valve size selection. Where a smaller T-pattern piston check valve produces too high a pressure drop, use of a Y-pattern piston check valve may resolve this concern.

T-pattern and Y-pattern piston check valves and in-line check valves are within A/DV's product lines. Availability of Y-pattern piston check valves is scheduled for the second quarter of 1997.

If further discussion is required on the above, please feel free to contact us.

ANCHOR/DARLING VALVE COMPANY



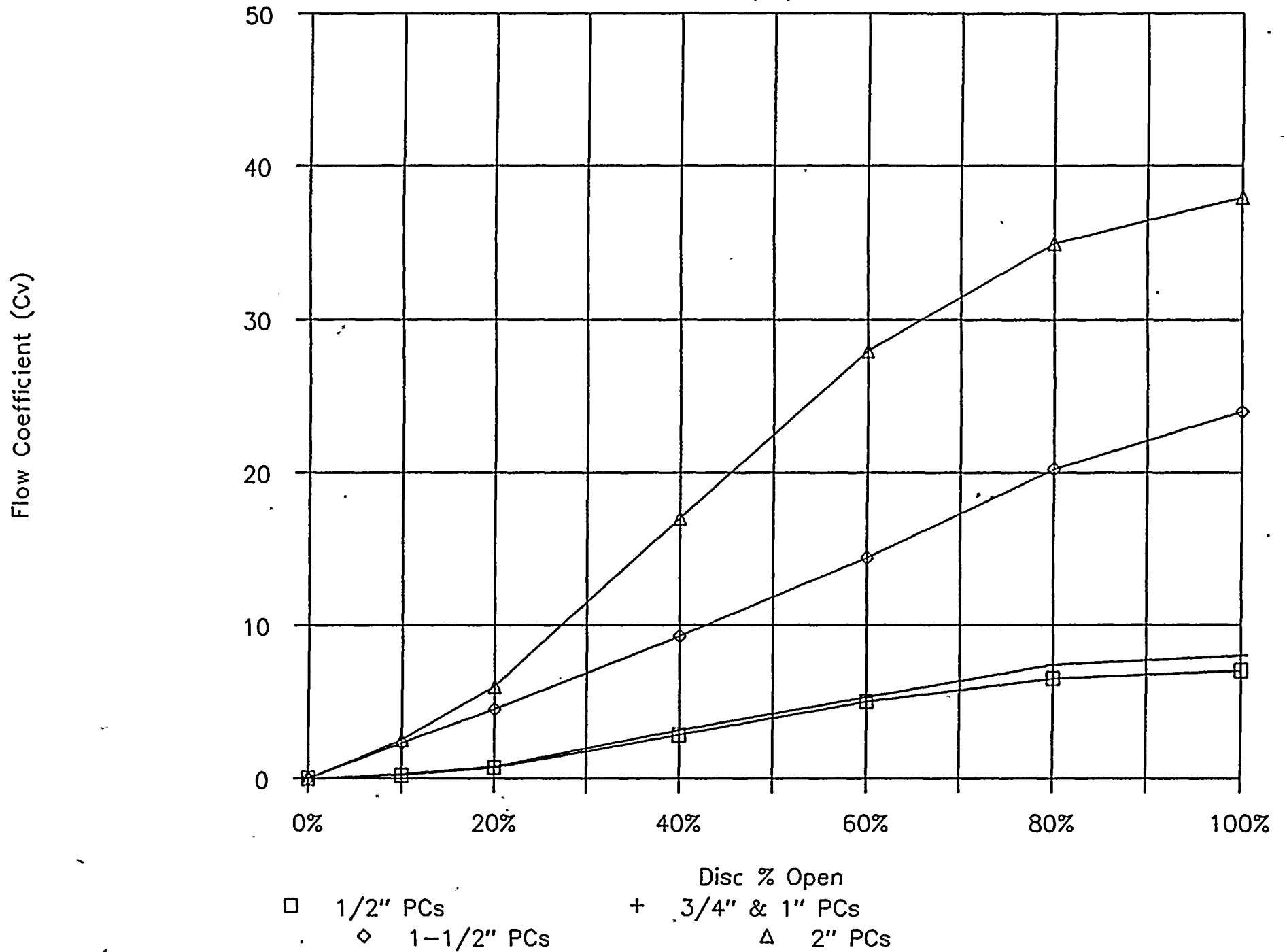
Floyd A. Bensinger, P.E.
Manager - Engineering

bcc: J. Chappell G. Parks
 T. Johnson J. Tarbutton
 W. Knecht H. Wescott
 G. Kneiser F. Velez
 R. Maietta

2" & Smaller T-Piston Check Valves

FAB
01-Nov-96

Flow Coefficient (Cv) vs. Disc Position

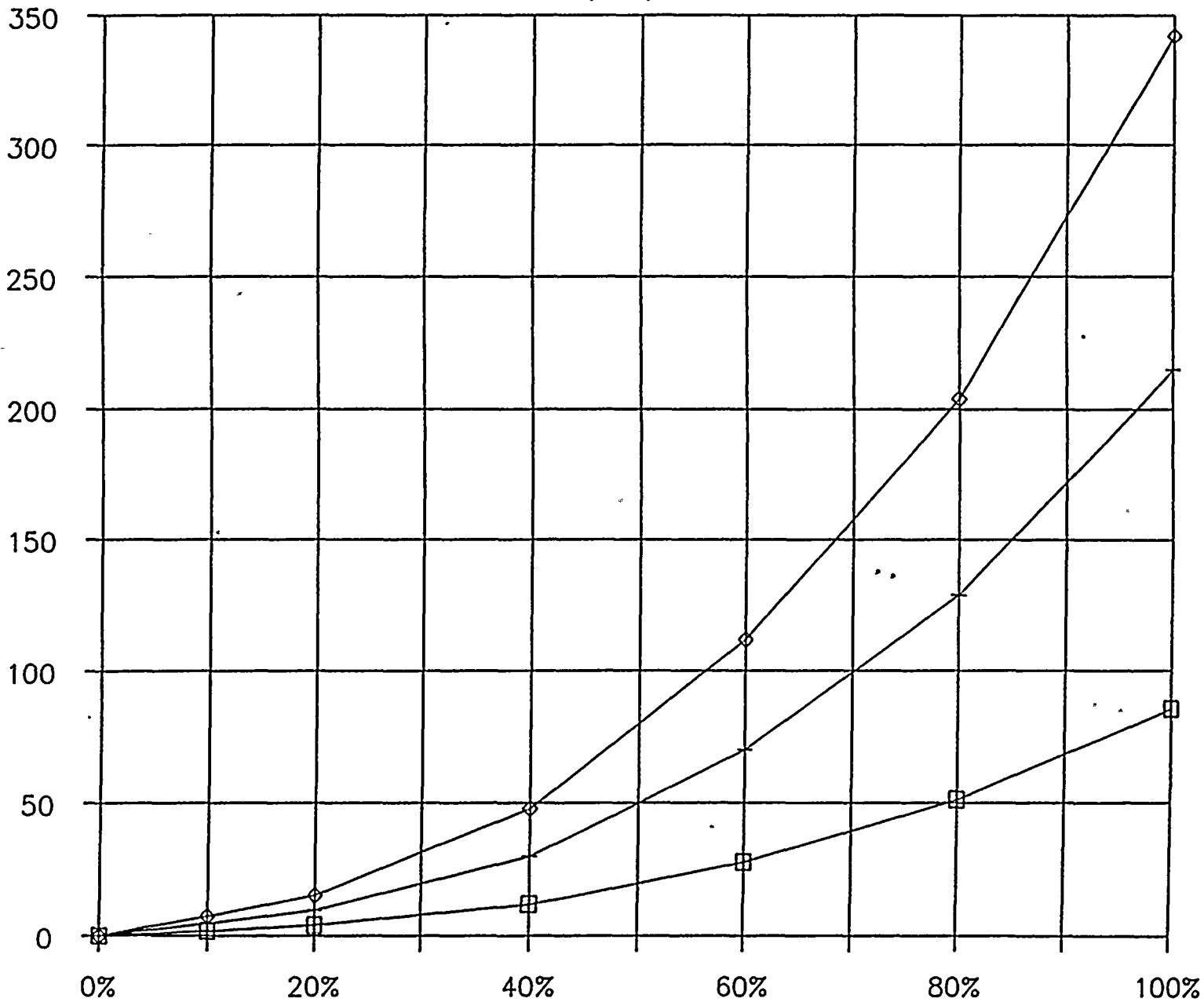


2" & Smaller T-Piston Check Valves

FAB
01-Nov-96

Air Flow Rate (cfm) vs. Disc Position

Air Flow Rate (cfm, 100 psig/115F)



□ 1/2", 3/4" & 1" PCs

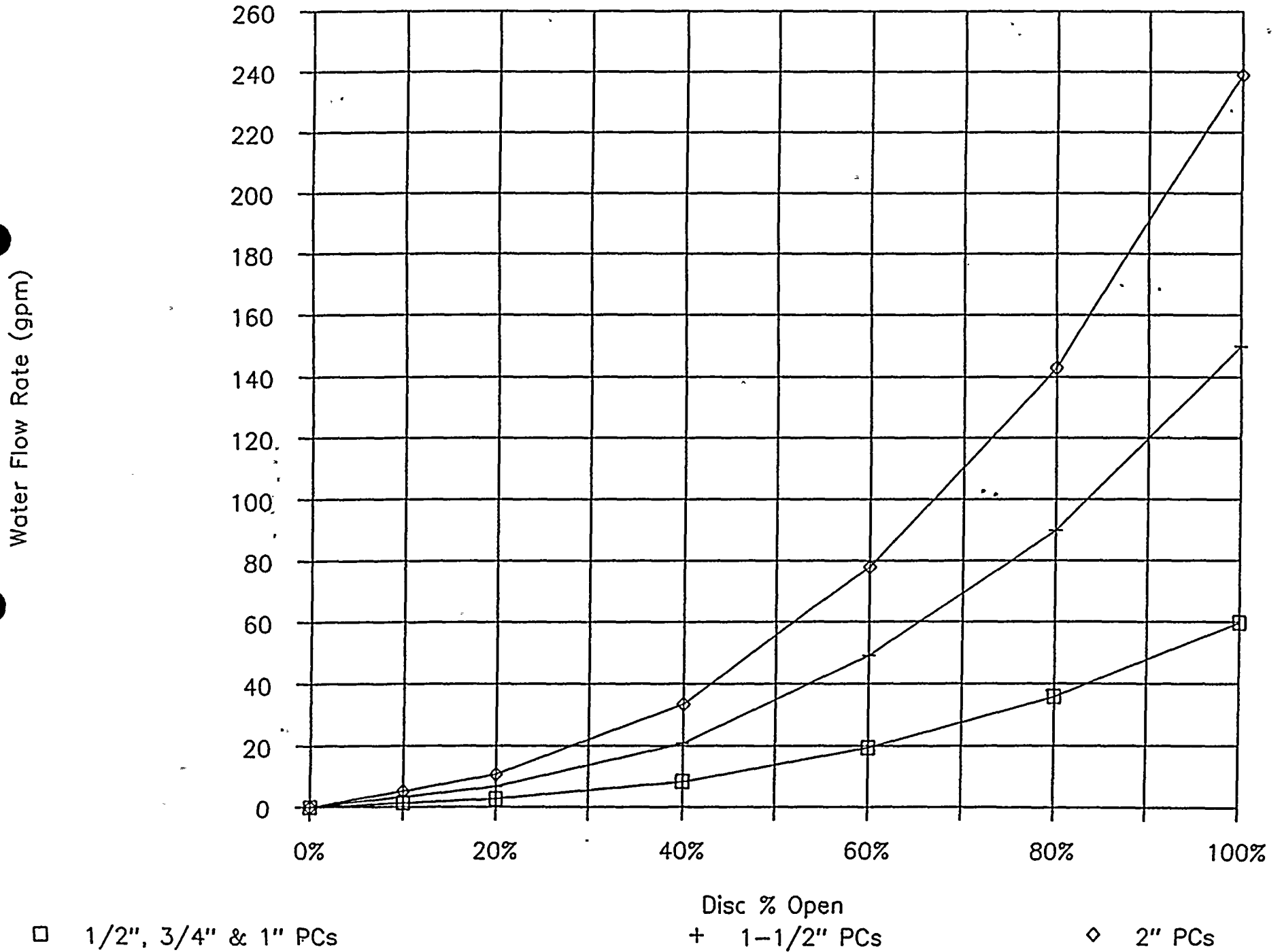
+ 1-1/2" PCs

◇ 2" PCs

2" & Smaller T-Piston Check Valves

FAB
01-Nov-96

Water Flow Rate (gpm) vs. Disc Position



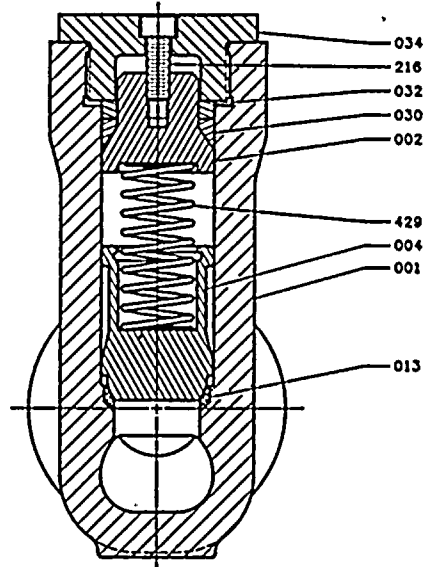
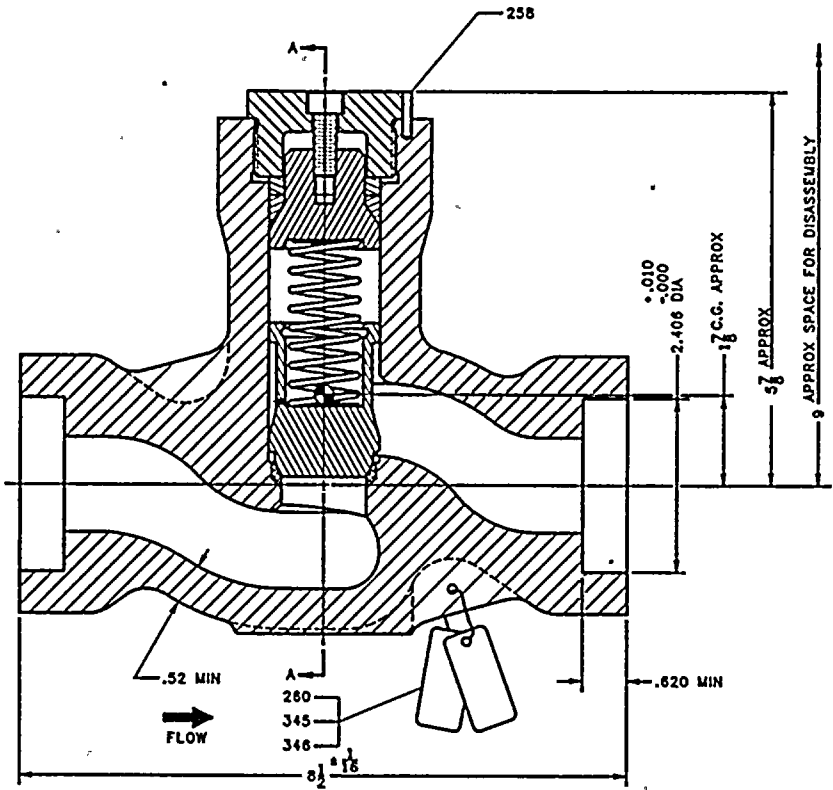
PART NO	QTY	DESCRIPTION	MATERIAL	REV	REVISIONS	BY DATE	APPD BY DATE
001	1	BODY	SA351-CF8M				
002	1	BONNET	SA479-316				
004	1	DISC	SA639-660 TYPE 1				
013	1	SEAT RING	A276-S21800A	A	DELETED NOTE 6: A/DV S/N. ADDED NOTES 6 THRU 10. CUSTOMER NOTE-ADDED UNITS AND VALVE DATA SHEET NO. DELETED CUST. P.O. NO. & MOVED A/DV S.O. NO. TITLE BLOCK: DELETED "GLOBE"	ACW 11-92	238 12-92
030	1	PRESSURE SEAL GASKET	GRAPHITE				
032	1	SPACER RING	A479-316				
034	1	BONNET RETAINER	SA479-316				
216	1	BONNET CAPSCREW	A574				
258	1	ANTI-ROTATION PIN	AISI 302 (SPRING TYPE)				
260	1	WIRE	ER316				
345	1	NAMEPLATE	AISI 304				
346	1	IDENTIFICATION PLATE	AISI 304				
429	1	SPRING	INCONEL X				

NOTES

1. VALVE IS ASME CLASS 1 PER 1986 ASME SECTION II
2. APPROX VALVE WEIGHT = 24 LBS
3. APPROX $C_v = 38$
4. PISTON CHECK VALVE DESIGNED FOR MOUNTING IN A HORIZONTAL RUN OF PIPE WITH VALVE ENDS HORIZONTAL AND BONNET ON TOP
5. VALVE DESIGN PRESSURE IS 2735 PSI AT 680°F
6. MINIMUM FLOW DIAMETER = 1.500
SEAT RING INSIDE DIAMETER = 1.500

7. Δ - ASME PRESSURE BOUNDARY PART
8. CRACKING PRESSURE = 5 PSI
9. ANSI 1878 STANDARD INTERPOLATED PRESSURE CLASS
10. HYDROSTATIC TEST INFORMATION:

	SHELL	SEAT
PRESSURE (PSI)	6775	4958
ALLOWABLE LEAKAGE (CC/HR)	0	3
DURATION (MIN)	10	5



SECTION A-A

FLORIDA POWER & LIGHT COMPANY
ST. LUCIE UNITS 1 & 2
SPECIFICATION NO.: MN 3.08
VALVE DATA SHEET: VDS-PSL-010 Rev. 4

ANCHOR/DARLING VALVE COMPANY			
2"-1878 FULL PORT SOCKET ENDS STAINLESS STEEL PISTON CHECK VALVE NON-COBALT TRIM			
DWN BY: HLD	DATE: 9-23-92	DRAWING TYPE: CCA	REV: 1
CHK BY: BDK	DATE: 10-1-92	W: 9 2 2 3 8 7 0	A
APPD BY: RFB	DATE: 10-19-92	1 2 3 4 5 6 7 8 9	

