

JUL 24 1998

ENGINEERING DATA TRANSMITTAL

Page 1 of 1
1. EDT 622236

Station 4 / 25 4

2. To: (Receiving Organization) Distribution		3. From: (Originating Organization) TWRS Projects/SST Retrieval		4. Related EDT No.: n/a	
5. Proj./Prog./Dept./Div.: W-320 TWRS/TCPN #-D2MA1		6. Design Authority/ Design Agent/Cog. Engr.: JW Bailey, NHC		7. Purchase Order No.: n/a	
8. Originator Remarks: For approval and release of a new supporting document. This document has been generated to ensure retrievability of the Project W-320 "Piping Calculations, Vol. 8".					
11. Receiver Remarks: 11A. Design Baseline Document? <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No				9. Equip./Component No.: n/a	
				10. System/Bldg./Facility: 241-C-106	
				12. Major Assm. Dwg. No.: n/a	
				13. Permit/Permit Application No.: n/a	
				14. Required Response Date:	

15.		DATA TRANSMITTED				(F)	(G)	(H)	(I)
(A) Item No.	(B) Document/Drawing No.	(C) Sheet No.	(D) Rev. No.	(E) Title or Description of Data Transmitted	Approval Designator	Reason for Transmittal	Originator Disposition	Receiver Disposition	
1	HNF-2478	-	0	Project W-320, 241-C-106 Sluicing, Piping Calculations, Vol. 8	NA			-	

16. KEY

Approval Designator (F)	Reason for Transmittal (G)	Disposition (H) & (I)	
E, S, Q, D or N/A (see WHC-CM-3-5, Sec.12.7)	1. Approval 2. Release 3. Information 4. Review 5. Post-Review 6. Dist. (Receipt Acknow. Required)	1. Approved 2. Approved w/comment 3. Disapproved w/comment	4. Reviewed no/comment 5. Reviewed w/comment 6. Receipt acknowledged

17. SIGNATURE/DISTRIBUTION
(See Approval Designator for required signatures)

(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN	(G) Reason	(H) Disp.	(J) Name	(K) Signature	(L) Date	(M) MSIN
2	1	Design Authority	JW Bailey	7/24/98	S2-48						
2	1	Design Agent	MC Davenport	7/23/98							
2	1	Cog. Eng.	RE Graves		S2-48						
2	1	Cog. Mgr.	JW Bailey	7/24/98	S2-48						
		QA									
		Safety									
		Env.									

18. MC Davenport C.E./Graves Signature of EDT Date 7/23/98 Originator		19. Authorized Representative Date for Receiving Organization		20. JW Bailey Signature Date 7/24/98 Design Authority/ Cognizant Manager		21. DOE APPROVAL (if required) Ctrl. No. <input type="checkbox"/> Approved <input type="checkbox"/> Approved w/comments <input type="checkbox"/> Disapproved w/comments	
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Project W-320, 241-C-106 Sluicing Piping Calculations, Vol. 8

John W. Bailey
Numatec Hanford Co., Richland, WA 99352
U.S. Department of Energy Contract DE-AC09-96RL13200

EDT/ECN: 622236 UC: 506
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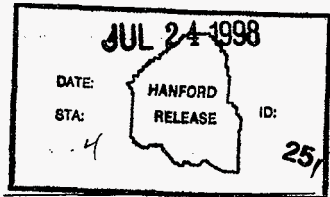
Key Words: W-320, Sluicing, Tank 241-C-106, Tank 241-AY-102, WRSS, calculations, piping.

Abstract: This supporting document has been prepared to make the FDNW calculations for Project W-320, readily retrievable.

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John W. Bailey
Release Approval 7/24/98
Date



Approved for Public Release

Project W-320, 241-C-106 Sluicing Piping Calculations, Vol. 8

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W320-27-048	Slurry/Supernate Hydraulic Analysis	i

This sheet shows the status and description of the attached Design Analysis sheets.

Discipline: (27) Piping

WO/Job No.: E09141/W-320

Calculation No.: W320-27-048

Project No. & Name: W-320 Tank 241-C-106 Waste Retrieval

Calculation Item: Slurry/Supernate Hydraulic Analysis

These calculations apply to:

Dwg. No.: See References

Rev. No.

Dwg. No.:

Rev. No.

Other (Study, CDR):

Rev. No.

The status of these calculations is:

- Preliminary Calculations
- Final Calculations
- Check Calculations (On Calculation Dated)
- Void Calculation (Reason Voided)

Incorporated in Final Drawings?

Yes No

This calculation verified by independent "check" calculations?

Yes No

Original and Revised Calculation Approvals:

	Rev. 0 Signature/Date	Rev. 1 Signature/Date	Rev. 2 Signature/Date
Originator	Kelly L. Hanson 11/6/97		
Checked by	Ken Wood 3/5/98		
Approved by	D.P. Evans 4/11/98		
Checked Against Approved Vendor Data	R. Ahmed 4.11.98		

INDEX

Design Analysis Page No.	Description
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Appx B	Pipe-Flo Results for Supernate Line
Appx C	Pipe-Flo Results for Slurry Line
Appx D	Pipe-Flo Results for Supernate Line (for system curves)
Appx E	Pipe-Flo Results for Slurry Line (for system curves)
Appx F	References

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/07

By: Kelly Hayase

Location: 241-C/241-AY

Checked: 3/5/98

By: Y. J. Lee

Revised:

By:

OBJECTIVE:

The objective of this calculation is to perform the hydraulic analysis on the slurry line and the supernate line for W-320. This calculation will use the As-Built conditions (~~as of 10/30/97~~) of the slurry line and the supernate line. Booster Pump Curves vs System Curves shall be generated for the supernate system and the slurry system.

DESIGN INPUTS:

CRITERIA AND SOURCE:

1. HNF-SD-W320-FDC-001, Rev. 4.

GIVEN OR KNOWN DATA:

1. The slurry piping system shall be capable of transferring abrasive fluids up to 30% solids (1.2 specific gravity). The sluice piping system (referred to supernate piping system in this calculation) shall be capable of transferring abrasive fluids up to 10% solids (1.12 specific gravity). (Ref. #1)
2. The WRSS shall be capable of transferring a minimum of 250 gpm. (Ref. #1)
3. The minimum pipeline transfer velocity shall be 6 ft/sec. (Ref. #1)
4. The normal fluid operating temperature range is 60 to 120°F. (Ref. #1)

ASSUMPTIONS:

1. The analysis assumes that the slurry behaves as a Newtonian fluid.
2. The viscosity correction for the immersible pump was neglected for the analysis. The head of the immersible pump when pumping the 30% solids slurry (viscosity = 93.45 cp) at 350 gpm, is approximately 5 ft less than the head when pumping water. This translates to a 5 ft difference in the head of the booster pump, or 2% at 350 gpm, which is negligible.
3. The normal fluid operating temperature is assumed to be 90°F, which is the midpoint of the normal fluid operating temperature range.
4. The design flow rate is assumed to be 350 gpm.
5. The siphon holes on the slurry piping system would allow air to be introduced into the pipeline because of the negative pressure at this point. Because Pipe-Flo does not analyze two phase flow, the siphon holes were not included in the analysis.

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 3/5/98

By: *[Signature]*

Location: 241-C/241-AY

Revised:

By:

METHODS TO BE USED:

The computer program Pipe-Flo (Ref. #2) shall be used for this calculation. Pipe-Flo uses the Darcy-Weisbach equation to calculate the pressure drop in a pipe. Refer to the Pipe-Flo manual for a more detailed discussion of the methods used by the program.

REFERENCES/SOURCES:

1. HNF-SD-W320-FDC-001, Rev. 4.
2. Pipe-Flo Computer Program Version 5.01, by Engineered Software Inc.
3. Crane Technical Paper No. 410, 1991.
4. Micro Motion, Model CMF300 Mass Flow and Density Sensor, Catalog Data. (Appx F-1)
5. PBM, Two-Way Ball Valves SP-Series, Catalog Data. (Appx F-2)
6. PBM, Multi-Port Ball Valves, Catalog Data. (Appx F-3)
7. Lawrence Pumps, Inc., immersible pump (P-1361) dimensional drawing and pump curves. (Appx F-4 to F-6)
8. Lawrence Pumps, Inc., booster pump (P-1362) dimensional drawing and pump curves. (Appx F-7 to F-14)
9. ANSI/HI 1.1-1.5-1994, Centrifugal Pumps, viscosity correction curves. (Appx F-15 to F-18)
10. Drawing Numbers:

H-2-818495, Sht 1, Rev. 0	H-2-818498, Sht 1, Rev. 0
H-2-818501, Sht 1, Rev. 2	H-2-818503, Sht 1, Rev. 2
H-2-818505, Sht 1, Rev. 0	H-2-818508, Sht 1, Rev. 0
H-2-818515, Sht 1, Rev. 0	H-2-818520, Sht 1, Rev. 0
H-2-818521, Sht 1, Rev. 0	H-2-818524, Sht 1, Rev. 0
H-2-818524, Sht 2, Rev. 0	H-2-818526, Sht 1, Rev. 0
H-2-818526, Sht 2, Rev. 0	H-2-818533, Sht 1, Rev. 0
H-2-818534, Sht 1, Rev. 0	H-2-818537, Sht 1, Rev. 1
H-2-818537, Sht 2, Rev. 1	H-2-818540, Sht 1, Rev. 1
H-2-818541, Sht 1, Rev. 1	H-2-818542, Sht 1, Rev. 1
H-2-818544, Sht 1, Rev. 0	H-2-818544, Sht 2, Rev. 1
H-2-818545, Sht 1, Rev. 1	H-2-818549, Sht 1, Rev. 0
H-2-818551, Sht 1, Rev. 0	H-2-818551, Sht 2, Rev. 0
H-2-818551, Sht 3, Rev. 0	H-2-818551, Sht 4, Rev. 0
H-2-818551, Sht 6, Rev. 0	H-2-818551, Sht 7, Rev. 0

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 2/5/98

By: V. Col

Location: 241-C/241-AY

Revised:

By:

CONCLUSIONS:

As shown by the analysis, the system is capable of transferring a minimum of 250 gpm and maintaining the minimum velocity above 6 ft/sec. This calculation used the As-Built conditions (as of 10/30/97) of the slurry line and the supernate line.

The Booster Pump Curve vs System Curve for the supernate system is shown in Figure 1 on Appendix page A-1.

The Booster Pump Curve vs System Curve for the slurry system is shown in Figure 2 on Appendix page A-2.

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 3/5/98

 By: *W. Col*

Location: 241-C/241-AY

Revised:

By:

CALCULATIONS:

The following information shall be used as input into the Pipe-Flo program.

Table 1: Fluid Properties

	Specific Gravity	Density (lb/ft ³)	Absolute Viscosity (cp) (2)	Temperature (°F)	Kinematic Viscosity	
					(cs)	(SSU)
0% solids	1.0	62.37	4.16	60	4.16	39.5
5% solids	1.06 (1)	66.11	7.12	90	6.72	48
10% solids	1.12	69.85	11.57	90	10.33	60
20% solids	1.16 (1)	72.35	35.6	90	30.69	142
30% solids	1.20	74.84	93.45	90	77.88	360

Notes: (1) Assumed straight line interpolation between values given in FDC.

(2) Viscosity at T = viscosity at 68°F(1-0.005(T-68°F)) (Ref. #1)

Table 2: Micro Motion Pressure Drop (1)

	0 lb/min	50 lb/min	3000 lb/min	5000 lb/min
	0 lb/hr	3000 lb/hr	180,000 lb/hr	300,000 lb/hr
0% solids	0 psi	0.003 psi	5 psi	14 psi
10% solids	0 psi	0.013 psi	6.25 psi	16.1 psi
20% solids	0 psi	0.017 psi	7.76 psi	17.2 psi
30% solids	0 psi	0.083 psi	12.5 psi	25 psi

Note: (1) Ref. Appx F-1.

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 3/5/98

By: *[Signature]*

Location: 241-C/241-AY

Revised:

By:

Table 3: Immersible Pump Performance (1)

gpm	0	195	292	370	486
Head	145	138	133	127	119

Note: (1) Ref. Appx F-5 and F-6. See also assumption #2.

Determine the resistance coefficient K for ball valves:

$$K = 891(d^4)/(Cv)^2 \quad (\text{Ref. \#3, Page 3-4, Eq 3-16})$$

PBM SP-Series 4" ball valve

$$Cv = 675 \quad (\text{Ref. Appx F-2})$$

$$K = 891(4.026^4)/(675)^2 = 0.5$$

PBM MP Series 3" 3-way ball valve, straight through

$$Cv = 228 \quad (\text{Ref. Appx F-3})$$

$$K = 891(3.068^4)/(228)^2 = 1.5$$

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 2/5/98

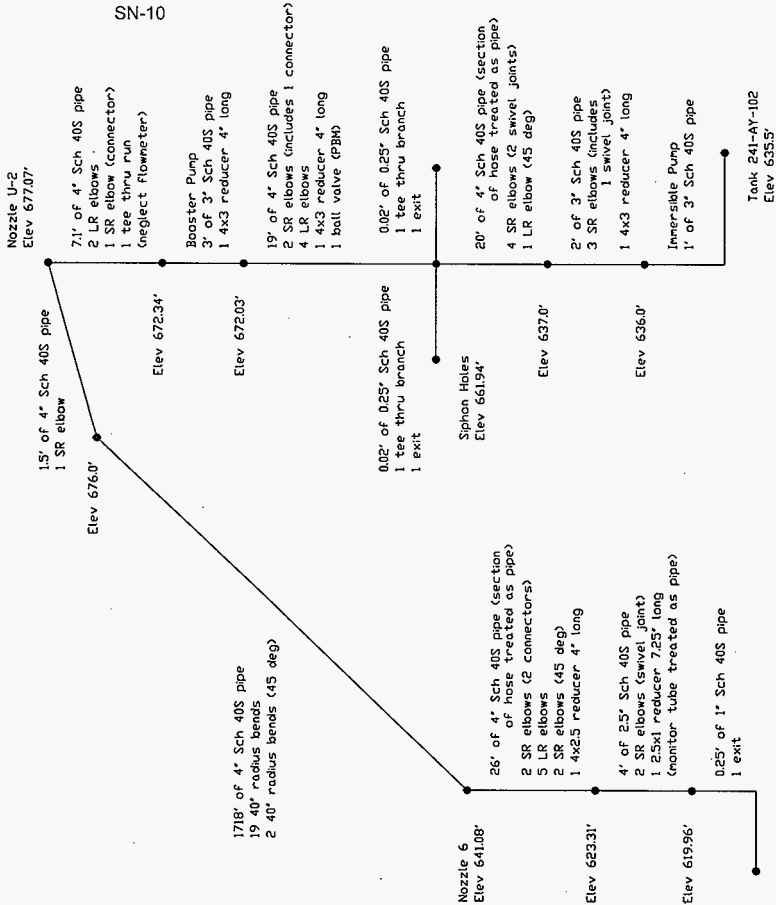
By: *K. J. [Signature]*

Location: 241-C/241-AY

Revised:

By:

Supernate Line
Pipe-Flo Models: SN-00
SN-05
SN-10



DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 2/5/98

By: Kim [Signature]

Location: 241-C/241-AY

Revised:

By:

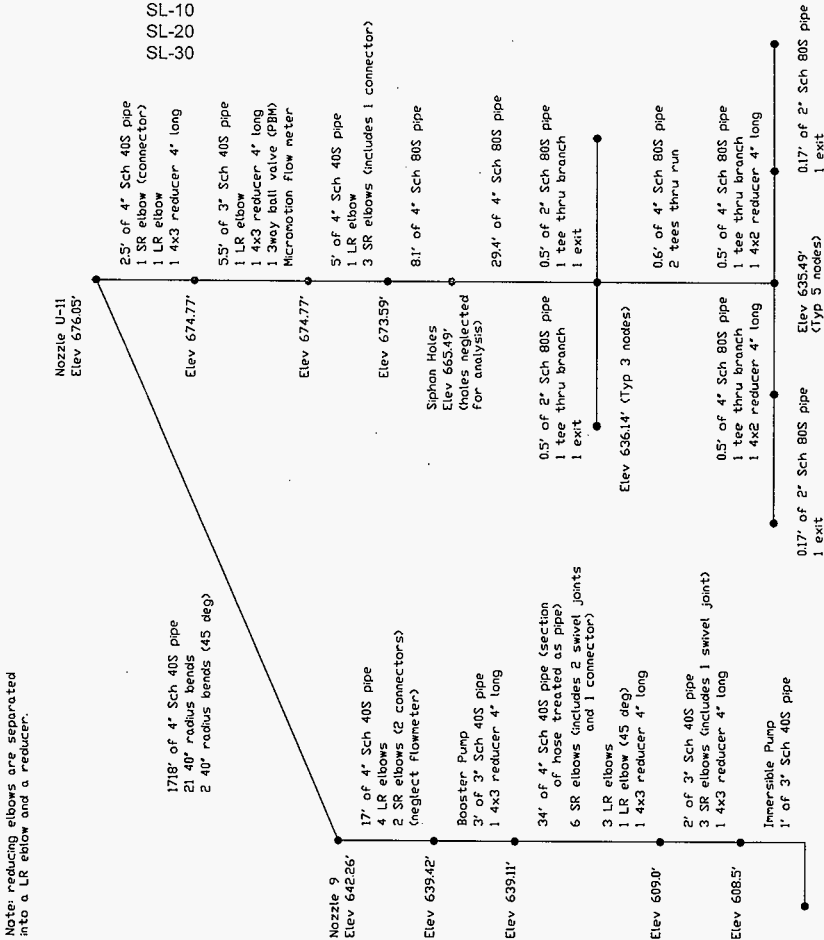
Slurry Line

Pipe-Flo Models: SL-00

SL-10

SL-20

SL-30



DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date: 11/6/97

By: Kelly Hayase

Checked: 3/5/98

By: *K. Coak*

Location: 241-C/241-AY

Revised:

By:

Discussion of the Pipe-Flo analysis:

- 1) The pipe flow models in Appendix B (SN-00, SN-05, and SN-10) analyze the supernate system for 0%, 5%, and 10% solids, respectively, at the assumed design flow rate of 350 gpm.
- 2) The pipe flow models in Appendix C (SL-00, SL-10, SL-20, and SL-30) analyze the slurry system for 0%, 10%, 20%, and 30% solids, respectively, at the assumed design flow rate of 350 gpm.
- 3) The pipe flow results in Appendix D show the TDH of the booster pump at various flow rates of the three cases, 0%, 5%, and 10% solids, for the supernate system.
- 4) The pipe flow results in Appendix E show the TDH of the booster pump at various flow rates of the four cases, 0%, 10%, 20%, and 30% solids, for the slurry system.
- 5) The supernate piping system curves shown in Figure 1 (Appx A-1) were plotted from the values determined in Appendix D. The slurry piping system curves shown in Figure 2 (Appx A-2) were plotted from the values determined in Appendix E. The booster pump curves were regenerated from the pump curves provided by Lawrence Pumps (Ref. Appx F-8 to F-14). The viscosity correction factors (Ref. Appx F-15 to F-18) were applied to the pump curves as shown in Figures 1 and 2.

Discussion of the Pipe-Flo results:

- 1) The exit pressures at the nozzle (supernate line) and the distributor (slurry line) are assumed to be atmospheric pressure. While this is true for the nozzle, the distributor will see a range of exit pressures. The pressure will range from atmospheric pressure to a maximum of 20 ft of water. This would increase the TDH of the booster pump by 20 ft, however, due to the large excess capacity of the slurry booster pump, this is acceptable.
- 2) Because Pipe-Flo does not analyze two-phase flow, the siphon holes were not included in the analysis of the slurry line (assumption #5). Therefore, the actual pressure drop resulting from two-phase flow was not considered. Due to the large excess capacity of the slurry booster pump, this difference is not critical.
- 3) The results of this calculation show that in the slurry line, downstream of the micro motion flow sensor, negative pressures exist. Under certain flow conditions, these negative pressures fall below the vapor pressure of water. Damage resulting from cavitation would be localized near this region (Nozzle A in Pump Pit 241-AY-02A). Over the 2 year life of the project, this damage would be negligible.

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date:

By: Kelly Hayase

Checked: 3/5/98

By: *[Signature]*

Location: 241-C/241-AY

Revised:

By:

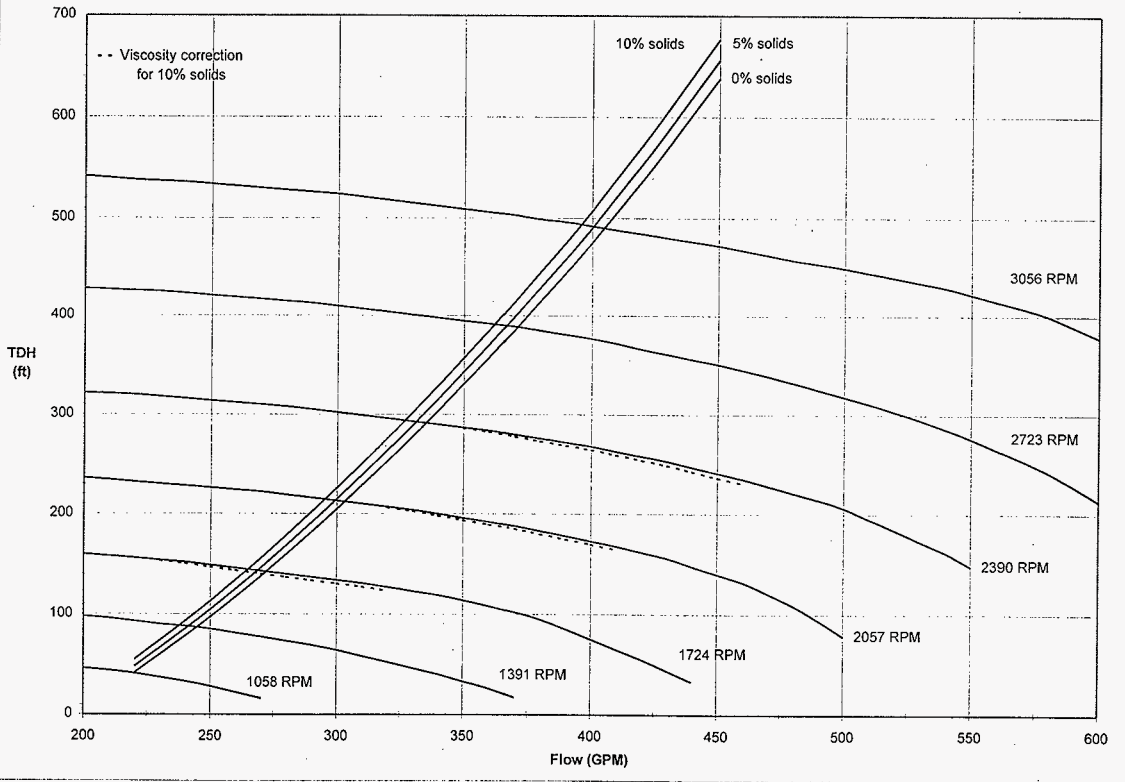
APPENDIX A

Figure 1
Figure 2

Page A-1
Page A-2

W-320 Tank 241-C-106 Waste Retrieval

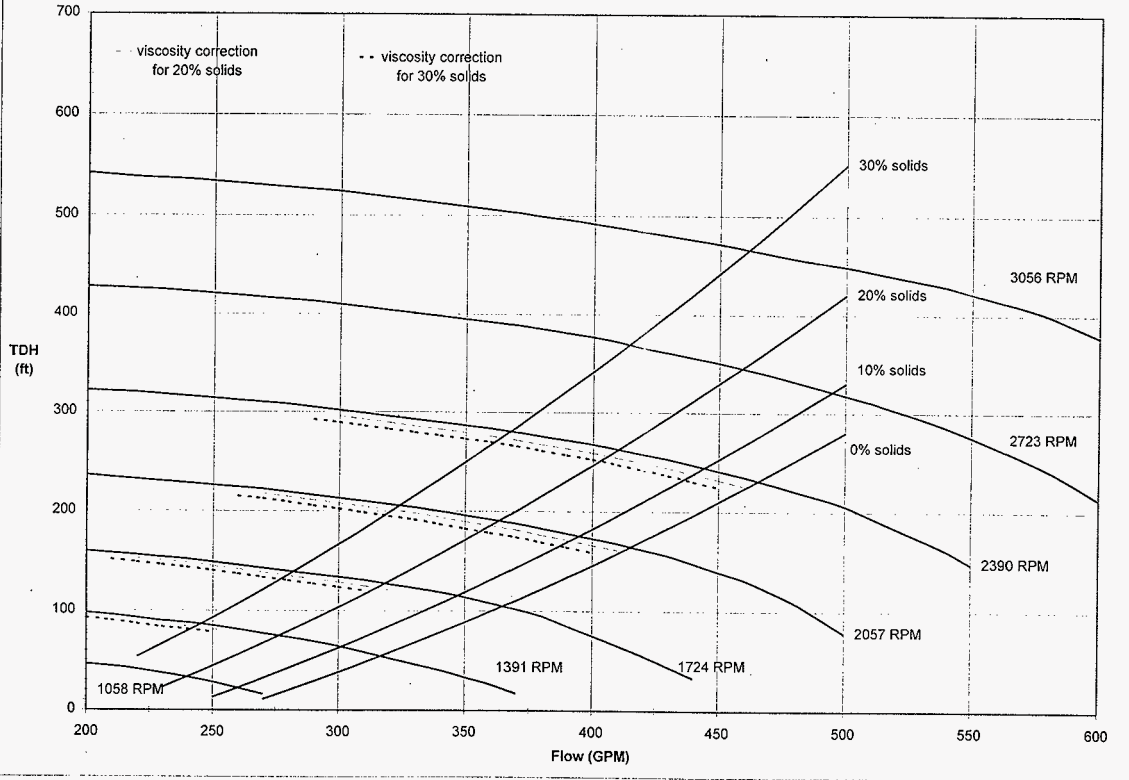
Figure 1: Booster Pump Curve vs System Curve Supernate



HMF-2478, Rev. 0

W-320 Tank 241-C-106 Waste Retrieval

Figure 2: Booster Pump Curve vs System Curve
Slurry



HMF-2478, Rev. 0

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date:

By: Kelly Hayase

Checked: 3/5/98

By: *D. J. Wei*

Location: 241-C/241-AY

Revised:

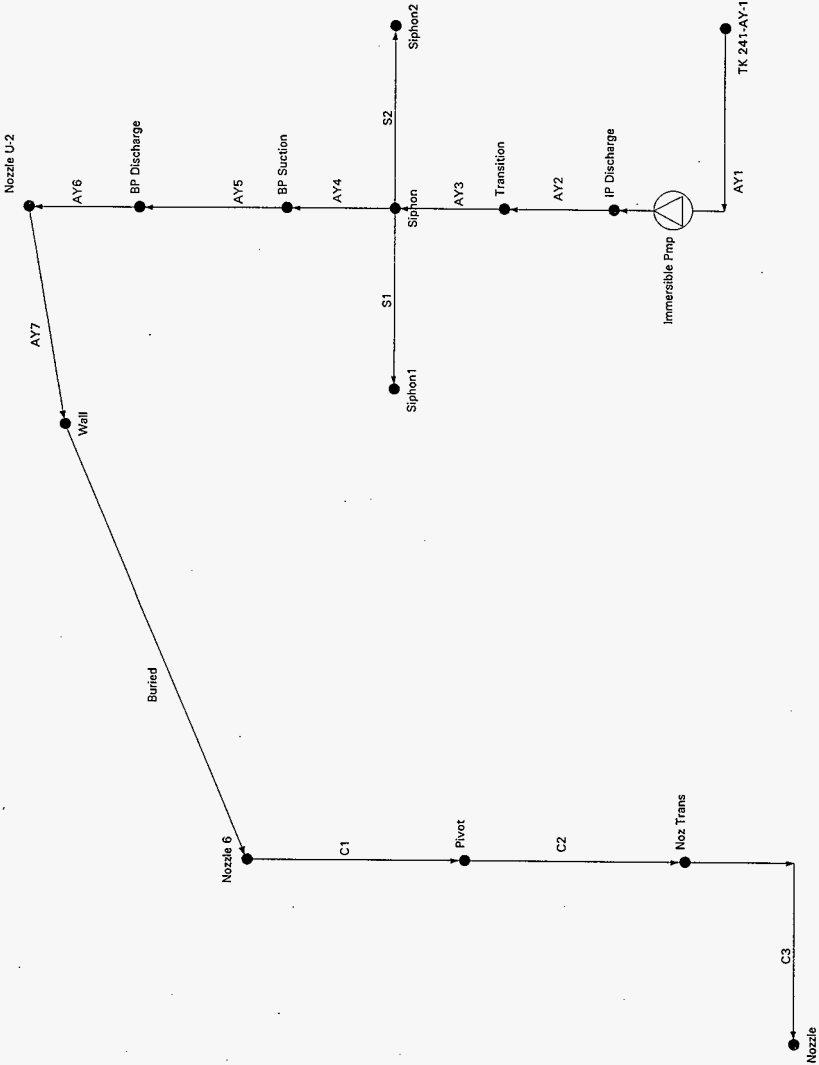
By:

APPENDIX B

Pipe-Flo Results SN-00
Pipe-Flo Results SN-05
Pipe-Flo Results SN-10

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Page B-15
Page B-29

B-1 of B-42



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 12:17 pm LineList: SN-00 Lineup: flow rate: gpm pressure: psig level & grade: ft</p>
--	--

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:17 pm
System: SN-00
rev: 10/22/97 9:55 am

B-2 of B-2

SYSTEM REPORT

Created: 10/15/97 11:34 am
Design file:
Pipe Specs: 1

Pipes: 13
Nodes: 14
Pumps/Comps: 1

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
BP Discharge	672.34	AY5	AY6
BP Suction	672.03	AY4	AY5
IP Discharge	636	AY1	AY2
Noz Trans	619.96	C2	C3
Nozzle	619.71	C3	
Nozzle 6	641.08	Buried	C1
Nozzle U-2	677.07	AY6	AY7
Pivot	623.31	C1	C2
Siphon	661.94	AY3	AY4 S1 S2
Siphon1	661.94	S1	
Siphon2	661.94	S2	
TK 241-AY-102	635.5		AY1
Transition	637	AY2	AY3
Wall	676	AY7	Buried

SYSTEM PIPES

10/27/97 12:17 pm

B-3 of B-4

PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	01	TK 241-AY-102	IP Discharge	Immersible Pmp
AY2	01	IP Discharge	Transition	
AY3	01	Transition	Siphon	
AY4	01	Siphon	BP Suction	
AY5	01	BP Suction	BP Discharge	
AY6	01	BP Discharge	Nozzle U-2	
AY7	01	Nozzle U-2	Wall	
Buried	01	Wall	Nozzle 6	
C1	01	Nozzle 6	Pivot	
C2	01	Pivot	Noz Trans	
C3	01	Noz Trans	Nozzle	
S1	01	Siphon	Siphon1	
S2	01	Siphon	Siphon2	

HNF-2478, Rev. 0-

B-4-f B-4

PUMP/COMP

PERFORMANCE DATA

Immersible Pmp

gpm:	0	195	292	370	486
ft:	145	138	133	127	119
eqn:	145 - 0.00325666 Q ^ 1.45285				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:18 pm
System: SN-00
rev: 10/22/97 9:55 am
B-5 of B-A2

PIPELIST REPORT

Created: 10/15/97 11:34 am
Design file:
Pipe Specs: 1

Pipes: 13
Nodes: 14
Pumps/Comps: 1

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
01 SN-0%-Sch40S rev: 10/21/97 1:02 pm	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	0% solids 60 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	01	SSteel 3 in / 40S	1	0% solids 60 °F / 0 psi g	0
AY2	01	SSteel 3 in / 40S	2	0% solids 60 °F / 0 psi g	1.094
AY3	01	SSteel 4 in / 40S	20	0% solids 60 °F / 0 psi g	1.465
AY4	01	SSteel 4 in / 40S	19	0% solids 60 °F / 0 psi g	2.183
AY5	01	SSteel 3 in / 40S	3	0% solids 60 °F / 0 psi g	0.05435
AY6	01	SSteel 4 in / 40S	7.1	0% solids 60 °F / 0 psi g	1.108
AY7	01	SSteel 4 in / 40S	1.5	0% solids 60 °F / 0 psi g	0.326
Buried	01	SSteel 4 in / 40S	1718	0% solids 60 °F / 0 psi g	9.896
C1	01	SSteel 4 in / 40S	26	0% solids 60 °F / 0 psi g	2.943
C2	01	SSteel 2.5 in / 40S	4	0% solids 60 °F / 0 psi g	2.69
C3	01	SSteel 1 in / 40S	0.25	0% solids 60 °F / 0 psi g	1
S1	01	SSteel 0.25 in / 40S	0.02	0% solids 60 °F / 0 psi g	2.818
S2	01	SSteel 0.25 in / 40S	0.02	0% solids 60 °F / 0 psi g	2.818

MATERIALS REPORT

Created: 10/15/97 11:34 am
 Design file:
 Pipe Specs: 1

Pipes: 13
 Nodes: 14
 Pumps/Comps: 1

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
AY1	01	SSteel 3 in / 40S	1	
AY2	01	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
AY3	01	SSteel 4 in / 40S	20	4-Elbow Short - r/d 1 @ 90° 1-Elbow Long - r/d 1.5 @ 45°
AY4	01	SSteel 4 in / 40S	19	2-Elbow Short - r/d 1 @ 90° 4-Elbow Long - r/d 1.5 @ 90° 1-Reducer Contraction 4 X 3 1-Fixed K 0.5
AY5	01	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
AY6	01	SSteel 4 in / 40S	7.1	2-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Tee Flow Thru Run
AY7	01	SSteel 4 in / 40S	1.5	1-Elbow Short - r/d 1 @ 90°
Buried	01	SSteel 4 in / 40S	1718	19-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	01	SSteel 4 in / 40S	26	2-Elbow Short - r/d 1 @ 90° 5-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 45° 1-Reducer Contraction 4 X 2.5
C2	01	SSteel 2.5 in / 40S	4	2-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 2.5 X 1
C3	01	SSteel 1 in / 40S	0.25	1-Exit Sharp-Edged
S1	01	SSteel 0.25 in / 40S	0.02	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
S2	01	SSteel	0.02	1-Tee Flow Thru Branch

PIPE MATERIALS LIST

10/27/97 12:18 pm

B-8 of 3-42
1/24/98

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
		0.25 in / 40S		1-Exit Sharp-Edged

B-9 of B-42

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
SSteel	40S	0.25 in	0.04 ft
		1 in	0.25 ft
		2.5 in	4 ft
		3 in	6 ft
		4 in	1791.6 ft

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
01 SN-0%-Sch40S	SSteel	40S	2-Tee Flow Thru Branch
			2-Exit Sharp-Edged
			1-Exit Sharp-Edged
			2-Elbow Short - r/d 1 @ 90°
			1-Reducer Contraction 2.5 X 1
Size: 3 in	SSteel	40S	3-Elbow Short - r/d 1 @ 90°
			2-Reducer Enlargement 4 X 3
Size: 4 in	SSteel	40S	10-Elbow Short - r/d 1 @ 90°
			1-Elbow Long - r/d 1.5 @ 45°
			11-Elbow Long - r/d 1.5 @ 90°
			1-Reducer Contraction 4 X 3
			1-Fixed K 0.5
			1-Tee Flow Thru Run
			19-Pipe Bend r/d 10 @ 90°
2-Pipe Bend r/d 10 @ 45°			
			2-Elbow Short - r/d 1 @ 45°
			1-Reducer Contraction 4 X 2.5

PIPELINE REPORT

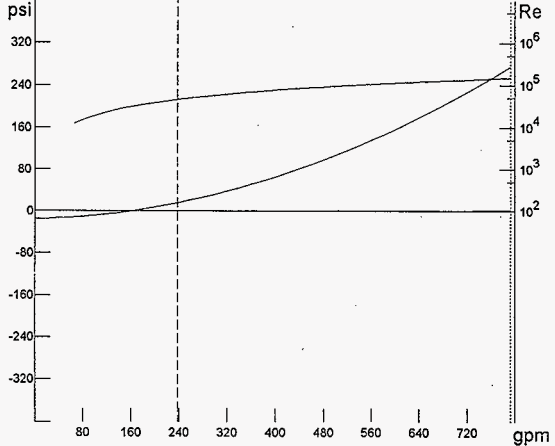
Buried rev: 10/22/97 9:54 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 676 ft
 out: 641.08 ft

SPECIFICATION: SN-0%-Sch40S
 SIZING Criteria: 6 ft/sec
 LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g
 FLUID 0% solids at tmp: 60 °F
 pres: 0 psi g
 den: 62.37 lb/ft³
 vsc: 4.16 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0214	8.828	47.48
0	.0000	0	-15.12
66.08	.0300	1.667	-12.07
132.2	.0256	3.333	-4.588
198.2	.0236	5	6.865
264.3	.0224	6.667	22.13
330.4	.0216	8.333	41.14
396.5	.0210	10	63.82
462.5	.0206	11.67	90.14
528.6	.0202	13.33	120.1
594.7	.0199	15	153.6
660.8	.0196	16.67	190.7
726.9	.0194	18.33	231.4
792.9	.0192	20	275.7

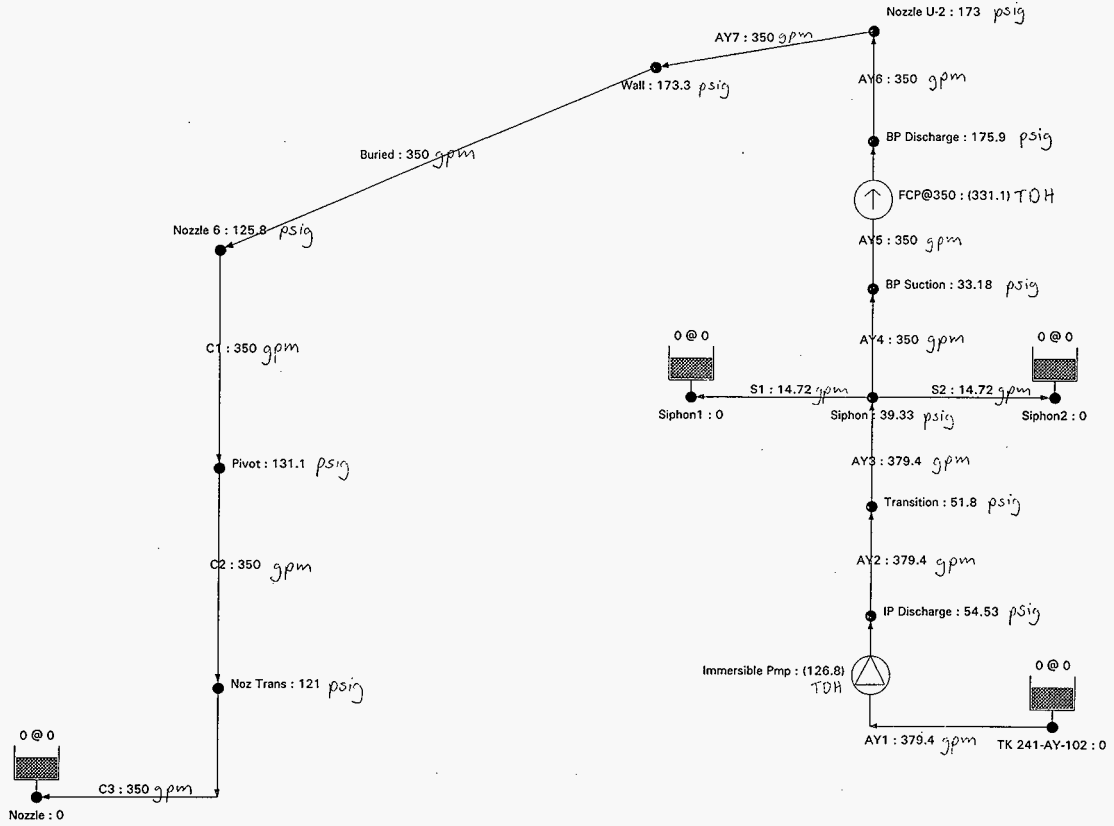
PIPELINE RESISTANCE CURVE



VALVES and FITTINGS

VALVE / FITTING	K-VALUE	VALVE / FITTING	K-VALUE
Pipe Bend r/d 10 90°	19@0.489	Pipe Bend r/d 10 45°	2@0.3027
FFT: 0.0163	TOTAL K: 9.896	Avg Percent of Total Loss: 8 %	

HNF-2478, Rev. 0



B-11, f. 5-42

Company: Fluor Daniel Northwest	10/27/97 12:19 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

B-12 of B-42

System: SN-00
rev: 10/22/97 9:55 am

Deviation: 0.000252 %
after: 8 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE	FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
C3	>>> 350	Nozzle	0	0
S1	>>> 14.72	Siphon1	0	0
S2	>>> 14.72	Siphon2	0	0
AY1	<<< 379.4	TK 241-AY-102	0	0

Flows IN: 379.4 gpm
Flows OUT: 379.4 gpm
NET FLOWS: 0 gpm

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
BP Discharge	672.34		175.9	1079
BP Suction	672.03		33.18	748.7
IP Discharge	636		54.53	762
Noz Trans	619.96		121	899.6
Nozzle	619.71		0 (source)	619.7
Nozzle 6	641.08		125.8	931.7
Nozzle U-2	677.07		173	1077
Pivot	623.31		131.1	926.1
Siphon	661.94		39.33	752.8
Siphon1	661.94		0 (source)	661.9
Siphon2	661.94		0 (source)	661.9
TK 241-AY-102	635.5		0 (source)	635.5
Transition	637		51.8	756.7
Wall	676		173.3	1076

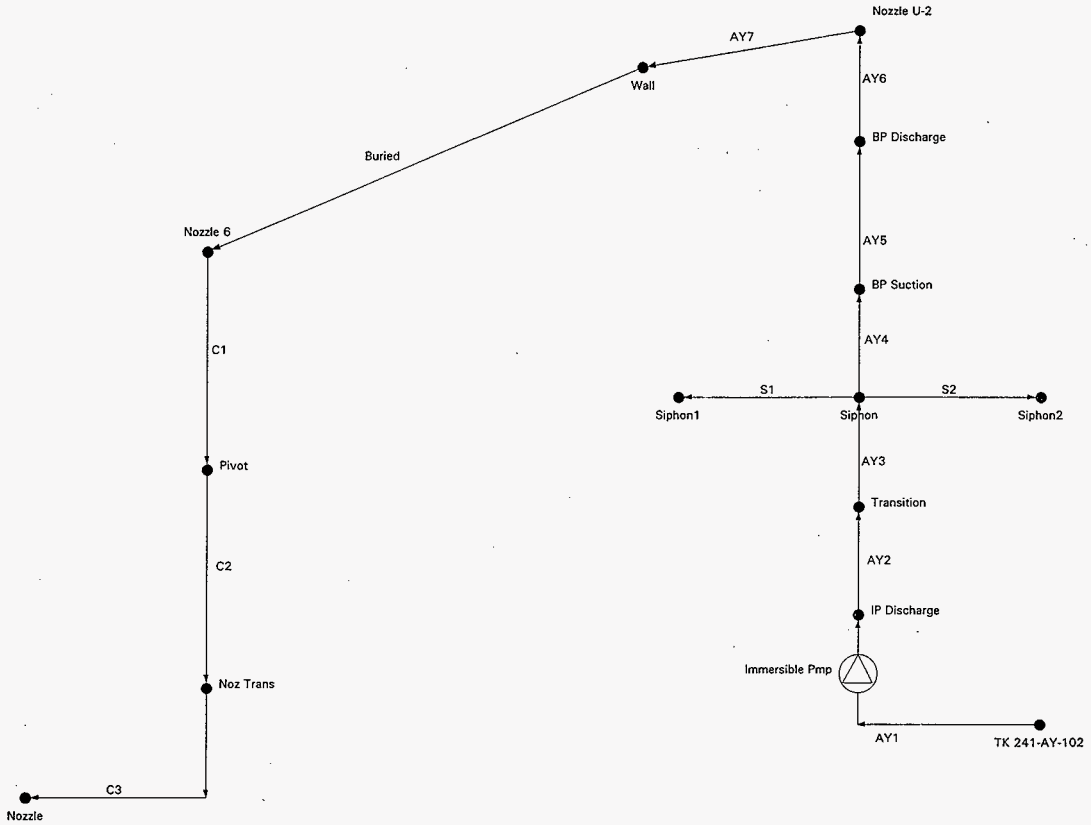
LINEUP PIPELINES

10/27/97 12:21 pm

B-12 of B-A2

PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	TK 241-AY-102	IP Discharge	379.4	16.48	(54.53)	(126.5)
	----- Immersible Pmp ----- dP: (54.89) HL: (126.8)					
AY2	IP Discharge	Transition	379.4	16.48	2.727	5.299
AY3	Transition	Siphon	379.4	9.57	12.47	3.874
AY4	Siphon	BP Suction	350	8.828	6.145	4.106
AY5	BP Suction	BP Discharge	350	15.2	0.604	1.084
	----- FCP@350 ----- dP: (143.3) HL: (331.1)					
AY6	BP Discharge	Nozzle U-2	350	8.828	2.865	1.888
AY7	Nozzle U-2	Wall	350	8.828	(0.242)	0.510
Buried	Wall	Nozzle 6	350	8.828	47.48	144.6
C1	Nozzle 6	Pivot	350	8.828	(5.283)	5.565
C2	Pivot	Noz Trans	350	* 23.47	10.03	26.51
C3	Noz Trans	Nozzle	350	* 130	121	279.9
S1	Siphon	Siphon1	14.72	* 45.41	39.33	90.85
S2	Siphon	Siphon2	14.72	* 45.41	39.33	90.85

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B-15 of B-42

Company: Fluor Daniel Northwest	10/27/97 12:19 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup:
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
	level & grade: ft
Version: PIPE-FLO ver 5.01	

SYSTEM REPORT

Created: 10/15/97 11:34 am
Design file:
Pipe Specs: 1

Pipes: 13
Nodes: 14
Pumps/Comps: 1

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
BP Discharge	672.34	AY5	AY6
BP Suction	672.03	AY4	AY5
IP Discharge	636	AY1	AY2
Noz Trans	619.96	C2	C3
Nozzle	619.71	C3	
Nozzle 6	641.08	Buried	C1
Nozzle U-2	677.07	AY6	AY7
Pivot	623.31	C1	C2
Siphon	661.94	AY3	AY4 S1 S2
Siphon1	661.94	S1	
Siphon2	661.94	S2	
TK 241-AY-102	635.5		AY1
Transition	637	AY2	AY3
Wall	676	AY7	Buried

SYSTEM PIPES

10/27/97 12:19 pm

B-17 of B-42

PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	02	TK 241-AY-102	IP Discharge	Immersible Pmp
AY2	02	IP Discharge	Transition	
AY3	02	Transition	Siphon	
AY4	02	Siphon	BP Suction	
AY5	02	BP Suction	BP Discharge	
AY6	02	BP Discharge	Nozzle U-2	
AY7	02	Nozzle U-2	Wall	
Buried	02	Wall	Nozzle 6	
C1	02	Nozzle 6	Pivot	
C2	02	Pivot	Noz Trans	
C3	02	Noz Trans	Nozzle	
S1	02	Siphon	Siphon1	
S2	02	Siphon	Siphon2	

SYSTEM COMPONENTS

10/27/97 12:19 pm

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PUMP/COMP

PERFORMANCE DATA

Immersible Pmp

gpm:	0	195	292	370	486
ft:	145	138	133	127	119
eqn:	145 - 0.00325666 Q ^ 1.45285				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:20 pm
System: SN-05
rev: 10/22/97 9:56 am

B-19 of B-42

PIPELIST REPORT

Created: 10/15/97 11:34 am
Design file:
Pipe Specs: 1

Pipes: 13
Nodes: 14
Pumps/Comps: 1

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
02 SN-5%-Sch40S rev: 10/21/97 1:02 pm	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	5% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

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PIPELIST

10/27/97 12:20 pm

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PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	02	SSteel 3 in / 40S	1	5% solids 90 °F / 0 psi g	0
AY2	02	SSteel 3 in / 40S	2	5% solids 90 °F / 0 psi g	1.094
AY3	02	SSteel 4 in / 40S	20	5% solids 90 °F / 0 psi g	1.465
AY4	02	SSteel 4 in / 40S	19	5% solids 90 °F / 0 psi g	2.183
AY5	02	SSteel 3 in / 40S	3	5% solids 90 °F / 0 psi g	0.05435
AY6	02	SSteel 4 in / 40S	7.1	5% solids 90 °F / 0 psi g	1.108
AY7	02	SSteel 4 in / 40S	1.5	5% solids 90 °F / 0 psi g	0.326
Buried	02	SSteel 4 in / 40S	1718	5% solids 90 °F / 0 psi g	9.896
C1	02	SSteel 4 in / 40S	26	5% solids 90 °F / 0 psi g	2.943
C2	02	SSteel 2.5 in / 40S	4	5% solids 90 °F / 0 psi g	2.69
C3	02	SSteel 1 in / 40S	0.25	5% solids 90 °F / 0 psi g	1
S1	02	SSteel 0.25 in / 40S	0.02	5% solids 90 °F / 0 psi g	2.818
S2	02	SSteel 0.25 in / 40S	0.02	5% solids 90 °F / 0 psi g	2.818

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B-21.fB-A2

MATERIALS REPORT

Created: 10/15/97 11:34 am
 Design file:
 Pipe Specs: 1

Pipes: 13
 Nodes: 14
 Pumps/Comps: 1

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
AY1	02	SSteel 3 in / 40S	1	
AY2	02	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
AY3	02	SSteel 4 in / 40S	20	4-Elbow Short - r/d 1 @ 90° 1-Elbow Long - r/d 1.5 @ 45°
AY4	02	SSteel 4 in / 40S	19	2-Elbow Short - r/d 1 @ 90° 4-Elbow Long - r/d 1.5 @ 90° 1-Reducer Contraction 4 X 3 1-Fixed K 0.5
AY5	02	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
AY6	02	SSteel 4 in / 40S	7.1	2-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Tee Flow Thru Run
AY7	02	SSteel 4 in / 40S	1.5	1-Elbow Short - r/d 1 @ 90°
Buried	02	SSteel 4 in / 40S	1718	19-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	02	SSteel 4 in / 40S	26	2-Elbow Short - r/d 1 @ 90° 5-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 45° 1-Reducer Contraction 4 X 2.5
C2	02	SSteel 2.5 in / 40S	4	2-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 2.5 X 1
C3	02	SSteel 1 in / 40S	0.25	1-Exit Sharp-Edged
S1	02	SSteel 0.25 in / 40S	0.02	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
S2	02	SSteel	0.02	1-Tee Flow Thru Branch

PIPE MATERIALS LIST

10/27/97 12:20 pm

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PIPELINE

SPEC

MATERIAL
Size / Sch

LENGTH
ft

VALVES & FITTINGS

0.25 in / 40S

1-Exit Sharp-Edged

PIPE SUMMARY

10/27/97 12:20 pm

B-23 of 5-42

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
SSteel	40S	0.25 in	0.04 ft
		1 in	0.25 ft
		2.5 in	4 ft
		3 in	6 ft
		4 in	1791.6 ft

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
02 SN-5%-Sch40S	SSteel	40S	
	Size: 0.25 in		2-Tee Flow Thru Branch 2-Exit Sharp-Edged
	Size: 1 in		1-Exit Sharp-Edged
	Size: 2.5 in		2-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 2.5 X 1
	Size: 3 in		3-Elbow Short - r/d 1 @ 90° 2-Reducer Enlargement 4 X 3
	Size: 4 in		10-Elbow Short - r/d 1 @ 90° 1-Elbow Long - r/d 1.5 @ 45° 11-Elbow Long - r/d 1.5 @ 90° 1-Reducer Contraction 4 X 3 1-Fixed K 0.5 1-Tee Flow Thru Run 19-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45° 2-Elbow Short - r/d 1 @ 45° 1-Reducer Contraction 4 X 2.5

Company: Fluor Daniel Northwest
 Project: W-320
 by: K Hayase

10/27/97 12:24 pm
 System: SN-05
 rev: 10/22/97 9:56 am
 B-24 of 5-42

PIPELINE REPORT

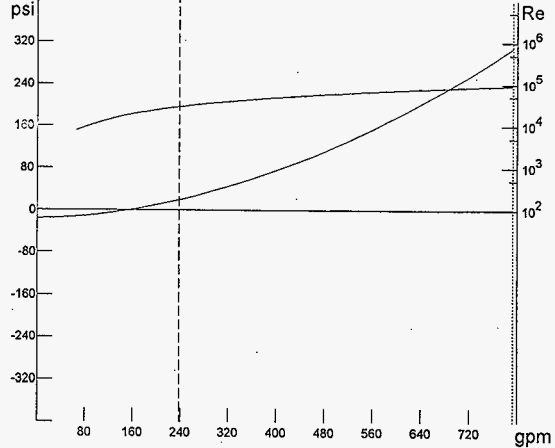
Buried rev: 10/22/97 9:56 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 676 ft
 out: 641.08 ft

SPECIFICATION: SN-5%-Sch40S
 SIZING Criteria: 6 ft/sec
 LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g
 FLUID 5% solids at tmp: 90 °F
 pres: 0 psi g
 den: 66.11 lb/ft³
 vsc: 7.12 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0232	8.828	55.51
0	.0000	0	-16.03
66.08	.0340	1.667	-12.39
132.2	.0285	3.333	-3.695
198.2	.0260	5	9.459
264.3	.0245	6.667	26.85
330.4	.0235	8.333	48.35
396.5	.0227	10	73.88
462.5	.0221	11.67	103.4
528.6	.0217	13.33	136.8
594.7	.0213	15	174.2
660.8	.0209	16.67	215.4
726.9	.0206	18.33	260.5
792.9	.0204	20	309.4

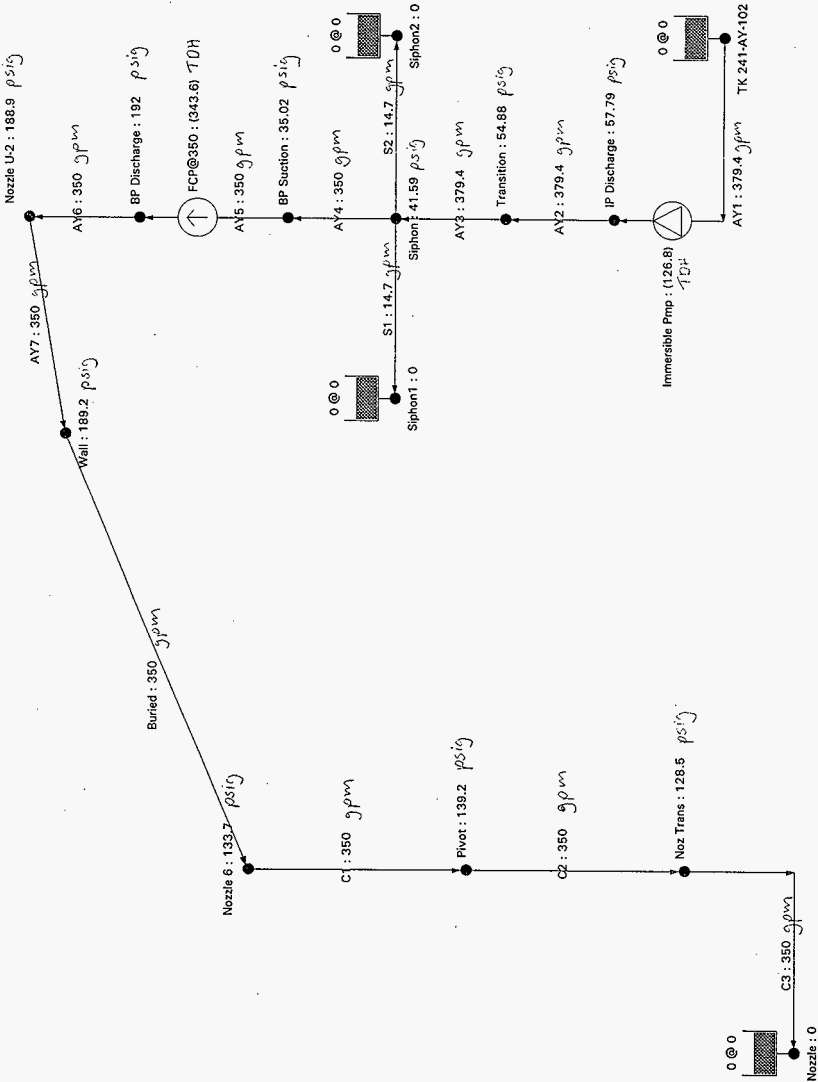
PIPELINE RESISTANCE CURVE



VALVES and FITTINGS

VALVE / FITTING	K-VALUE	VALVE / FITTING	K-VALUE
Pipe Bend r/d 10 90°	19@0.489	Pipe Bend r/d 10 45°	2@0.3027
FFT: 0.0163	TOTAL K: 9.896	Avg Percent of Total Loss: 8 %	

B-25 5-42



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 12:20 pm Line1st: SN-05 Lineup: SN-05 flow rate: gpm pressure: psig level & grade: ft</p>
--	---

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:21 pm
Lineup: SN-05 *B-26 of B-42*
rev: 10/27/97 12:20 pm

System: SN-05
rev: 10/22/97 9:56 am

Deviation: 0.000276 %
after: 8 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE	FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
C3	>>> 350	Nozzle	0	0
S1	>>> 14.7	Siphon1	0	0
S2	>>> 14.7	Siphon2	0	0
AY1	<<< 379.4	TK 241-AY-102	0	0

Flows IN: 379.4 gpm

Flows OUT: 379.4 gpm

NET FLOWS: 0 gpm

LINEUP NODES

10/27/97 12:21 pm

B-27 of B-42

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
BP Discharge	672.34		192	1091
BP Suction	672.03		35.02	748.3
IP Discharge	636		57.79	761.9
Noz Trans	619.96		128.5	900
Nozzle	619.71		0 (source)	619.7
Nozzle 6	641.08		133.7	932.4
Nozzle U-2	677.07		188.9	1089
Pivot	623.31		139.2	926.7
Siphon	661.94		41.59	752.6
Siphon1	661.94		0 (source)	661.9
Siphon2	661.94		0 (source)	661.9
TK 241-AY-102	635.5		0 (source)	635.5
Transition	637		54.88	756.6
Wall	676		189.2	1088

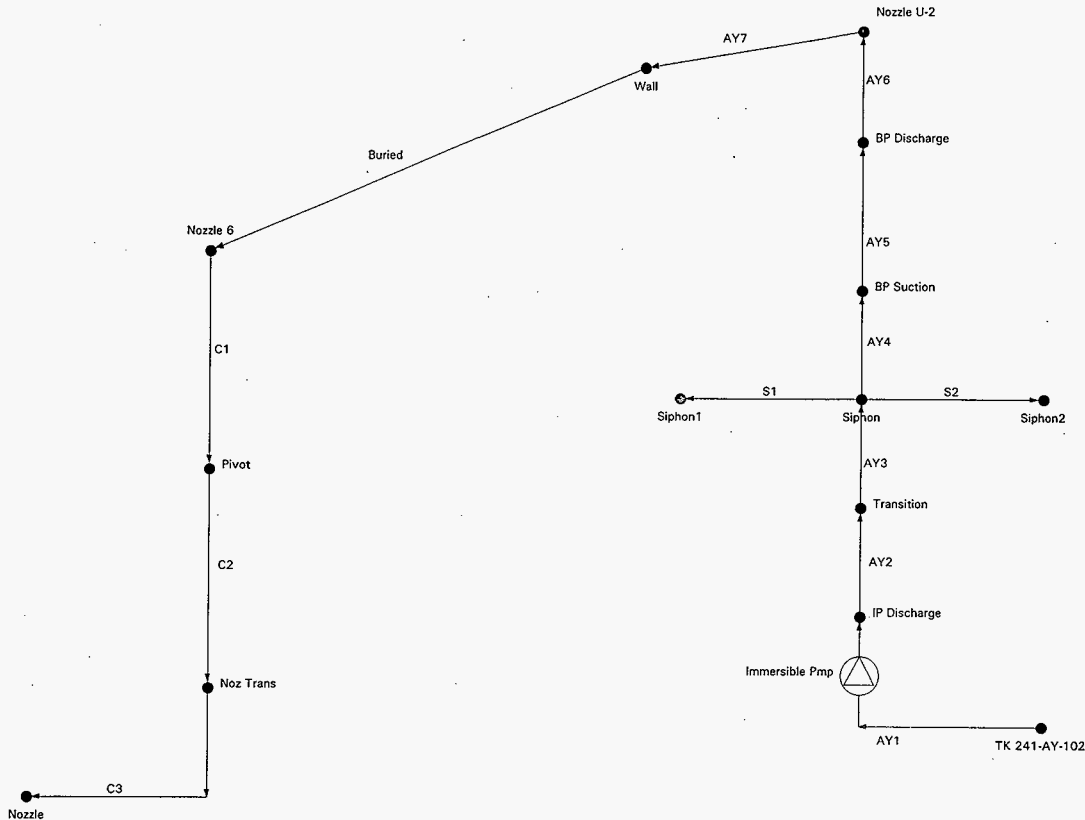
LINEUP PIPELINES

10/27/97 12:21 pm

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PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	TK 241-AY-102	IP Discharge	379.4	16.48	(57.79)	(126.4)
	---- Immersible Pmp ---- dP: (58.19) HL: (126.8)					
AY2	IP Discharge	Transition	379.4	16.48	2.911	5.345
AY3	Transition	Siphon	379.4	9.569	13.29	4.021
AY4	Siphon	BP Suction	350	8.828	6.571	4.231
AY5	BP Suction	BP Discharge	350	15.2	0.669	1.147
	---- FCP@350 ---- dP: (157.6) HL: (343.6)					
AY6	BP Discharge	Nozzle U-2	350	8.828	3.058	1.934
AY7	Nozzle U-2	Wall	350	8.828	(0.252)	0.520
Buried	Wall	Nozzle 6	350	8.828	55.51	155.9
C1	Nozzle 6	Pivot	350	8.828	(5.522)	5.736
C2	Pivot	Noz Trans	350	* 23.47	10.72	26.72
C3	Noz Trans	Nozzle	350	* 130	128.5	280.2
S1	Siphon	Siphon1	14.7	* 45.35	41.59	90.64
S2	Siphon	Siphon2	14.7	* 45.35	41.59	90.64

HNJ-2478, Rev. 0



B-29 of B-42

Company: Fluor Daniel Northwest	10/27/97 12:21 pm
Project: W-320	Line list: SN-10
by: K Hayase	Lineup:
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:21 pm
System: SN-10
rev: 10/22/97 9:57 am
B-30 of B-42

SYSTEM REPORT

Created: 10/15/97 11:34 am
Design file:
Pipe Specs: 1

Pipes: 13
Nodes: 14
Pumps/Comps: 1

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
BP Discharge	672.34	AY5	AY6
BP Suction	672.03	AY4	AY5
IP Discharge	636	AY1	AY2
Noz Trans	619.96	C2	C3
Nozzle	619.71	C3	
Nozzle 6	641.08	Buried	C1
Nozzle U-2	677.07	AY6	AY7
Pivot	623.31	C1	C2
Siphon	661.94	AY3	AY4 S1 S2
Siphon1	661.94	S1	
Siphon2	661.94	S2	
TK 241-AY-102	635.5		AY1
Transition	637	AY2	AY3
Wall	676	AY7	Buried

SYSTEM PIPES

10/27/97 12:21 pm

B-31 of B-42

PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	03	TK 241-AY-102	IP Discharge	Immersible Pmp
AY2	03	IP Discharge	Transition	
AY3	03	Transition	Siphon	
AY4	03	Siphon	BP Suction	
AY5	03	BP Suction	BP Discharge	
AY6	03	BP Discharge	Nozzle U-2	
AY7	03	Nozzle U-2	Wall	
Buried	03	Wall	Nozzle 6	
C1	03	Nozzle 6	Pivot	
C2	03	Pivot	Noz Trans	
C3	03	Noz Trans	Nozzle	
S1	03	Siphon	Siphon1	
S2	03	Siphon	Siphon2	

PUMP/COMP

PERFORMANCE DATA

Immersible Pmp

gpm:	0	195	292	370	486
ft:	145	138	133	127	119
eqn:	145 - 0.00325666 Q ^ 1.45285				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:21 pm
System: SN-10
rev: 10/22/97 9:57 am

B-33 of B-42

PIPELIST REPORT

Created: 10/15/97 11:34 am
Design file:
Pipe Specs: 1

Pipes: 13
Nodes: 14
Pumps/Comps: 1

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
03 SN-10%-Sch40S rev: 10/21/97 1:03 pm	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	10% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

PIPELIST

10/27/97 12:21 pm

B-34 of B-42

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	03	SSteel 3 in / 40S	1	10% solids 90 °F / 0 psi g	0
AY2	03	SSteel 3 in / 40S	2	10% solids 90 °F / 0 psi g	1.094
AY3	03	SSteel 4 in / 40S	20	10% solids 90 °F / 0 psi g	1.465
AY4	03	SSteel 4 in / 40S	19	10% solids 90 °F / 0 psi g	2.183
AY5	03	SSteel 3 in / 40S	3	10% solids 90 °F / 0 psi g	0.05435
AY6	03	SSteel 4 in / 40S	7.1	10% solids 90 °F / 0 psi g	1.108
AY7	03	SSteel 4 in / 40S	1.5	10% solids 90 °F / 0 psi g	0.326
Buried	03	SSteel 4 in / 40S	1718	10% solids 90 °F / 0 psi g	9.896
C1	03	SSteel 4 in / 40S	26	10% solids 90 °F / 0 psi g	2.943
C2	03	SSteel 2.5 in / 40S	4	10% solids 90 °F / 0 psi g	2.69
C3	03	SSteel 1 in / 40S	0.25	10% solids 90 °F / 0 psi g	1
S1	03	SSteel 0.25 in / 40S	0.02	10% solids 90 °F / 0 psi g	2.818
S2	03	SSteel 0.25 in / 40S	0.02	10% solids 90 °F / 0 psi g	2.818

B-35 of 5-42

MATERIALS REPORT

Created: 10/15/97 11:34 am
 Design file:
 Pipe Specs: 1

Pipes: 13
 Nodes: 14
 Pumps/Comps: 1

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size./ Sch	LENGTH ft	VALVES & FITTINGS
AY1	03	SSteel 3 in / 40S	1	
AY2	03	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
AY3	03	SSteel 4 in / 40S	20	4-Elbow Short - r/d 1 @ 90° 1-Elbow Long - r/d 1.5 @ 45°
AY4	03	SSteel 4 in / 40S	19	2-Elbow Short - r/d 1 @ 90° 4-Elbow Long - r/d 1.5 @ 90° 1-Reducer Contraction 4 X 3 1-Fixed K 0.5
AY5	03	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
AY6	03	SSteel 4 in / 40S	7.1	2-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Tee Flow Thru Run
AY7	03	SSteel 4 in / 40S	1.5	1-Elbow Short - r/d 1 @ 90°
Buried	03	SSteel 4 in / 40S	1718	19-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	03	SSteel 4 in / 40S	26	2-Elbow Short - r/d 1 @ 90° 5-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 45° 1-Reducer Contraction 4 X 2.5
C2	03	SSteel 2.5 in / 40S	4	2-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 2.5 X 1
C3	03	SSteel 1 in / 40S	0.25	1-Exit Sharp-Edged
S1	03	SSteel 0.25 in / 40S	0.02	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
S2	03	SSteel	0.02	1-Tee Flow Thru Branch

B-3 of B-4

PIPELINE

SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
	0.25 in / 40S		1-Exit Sharp-Edged

PIPE MATERIAL

SCHEDULE

SIZE

LENGTH

B-37 of 5-4

SSteel

40S

0.25 in

0.04 ft

1 in

0.25 ft

2.5 in

4 ft

3 in

6 ft

4 in

1791.6 ft

VALVE & FITTING SUMMARY

SPECIFICATION

MATERIAL

SCHEDULE

VALVES & FITTINGS

03 SN-10%-Sch40S

SSteel

40S

Size: 0.25 in

2-Tee Flow Thru Branch

2-Exit Sharp-Edged

Size: 1 in

1-Exit Sharp-Edged

Size: 2.5 in

2-Elbow Short - r/d 1 @ 90°

1-Reducer Contraction 2.5 X 1

Size: 3 in

3-Elbow Short - r/d 1 @ 90°

2-Reducer Enlargement 4 X 3

Size: 4 in

10-Elbow Short - r/d 1 @ 90°

1-Elbow Long - r/d 1.5 @ 45°

11-Elbow Long - r/d 1.5 @ 90°

1-Reducer Contraction 4 X 3

1-Fixed K 0.5

1-Tee Flow Thru Run

19-Pipe Bend r/d 10 @ 90°

2-Pipe Bend r/d 10 @ 45°

2-Elbow Short - r/d 1 @ 45°

1-Reducer Contraction 4 X 2.5

PIPELINE REPORT

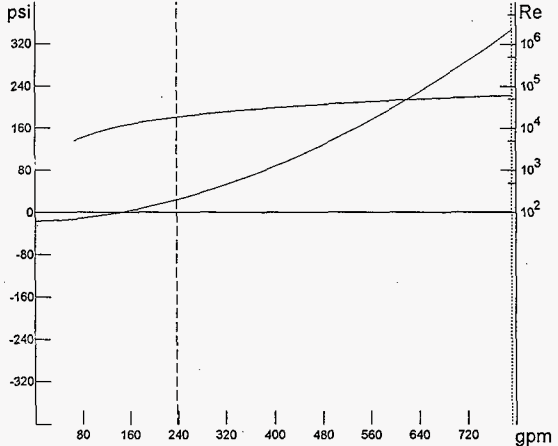
Buried rev: 10/22/97 7:42 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 676 ft
 out: 641.08 ft

SPECIFICATION: SN-10%-Sch40S
 SIZING Criteria: 6 ft/sec
 LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g
 FLUID 10% solids at tmp: 90 °F
 pres: 0 psi g
 den: 69.85 lb/ft³
 vsc: 11.57 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0253	8.828	64.77
0	.0000	0	-16.93
66.08	.0383	1.667	-12.62
132.2	.0317	3.333	-2.541
198.2	.0287	5	12.55
264.3	.0269	6.667	32.35
330.4	.0256	8.333	56.69
396.5	.0247	10	85.47
462.5	.0239	11.67	118.6
528.6	.0233	13.33	156
594.7	.0228	15	197.7
660.8	.0224	16.67	243.6
726.9	.0221	18.33	293.6
792.9	.0217	20	347.8

PIPELINE RESISTANCE CURVE

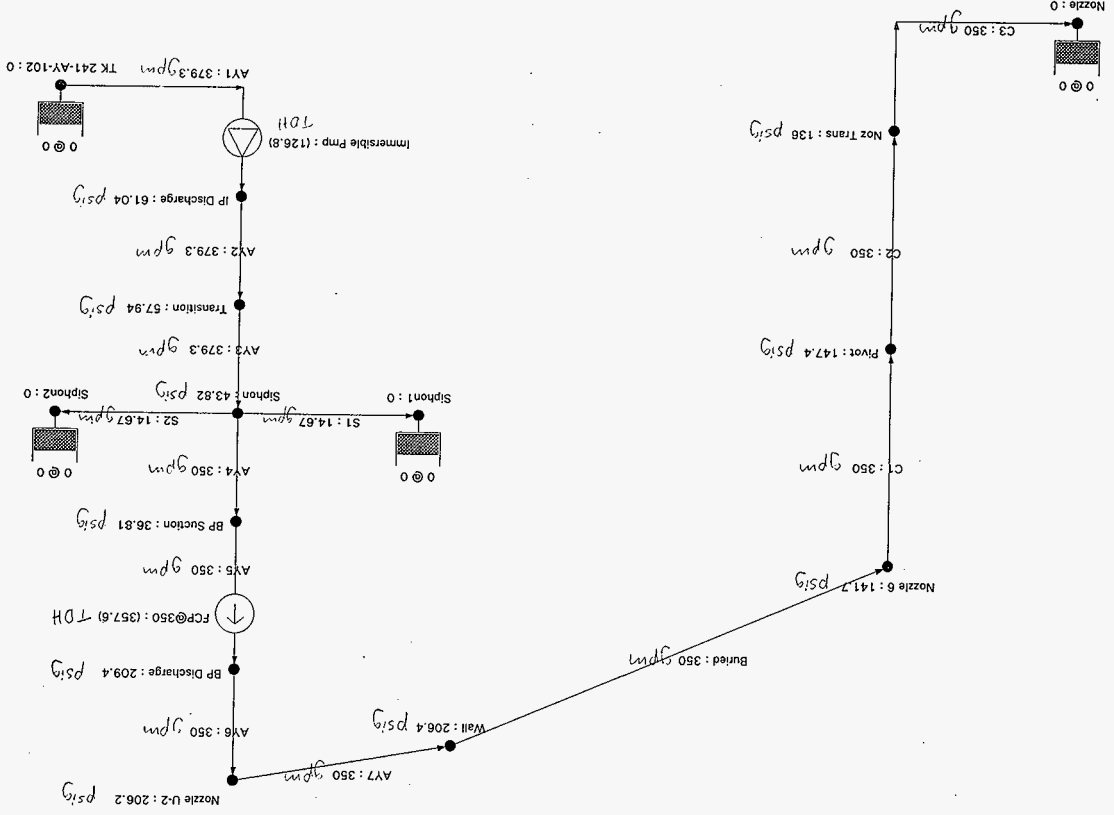


VALVES and FITTINGS

VALVE / FITTING	K-VALUE	VALVE / FITTING	K-VALUE
Pipe Bend r/d 10 90°	19@0.489	Pipe Bend r/d 10 45°	2@0.3027
FFT: 0.0163	TOTAL K: 9.896	Avg Percent of Total Loss: 7 %	

239.6-47

Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-Z7-048
by: K Hayase	
Lineists: SN-10	
Lineup: SN-10	
10/27/97 12:22 pm	
level & grade: ft	
pressure: psig	
flow rate: gpm	



System: SN-10
rev: 10/22/97 9:57 am

Deviation: 0.000307 %
after: 8 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE		FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
C3	>>>	350	Nozzle	0	0
S1	>>>	14.67	Siphon1	0	0
S2	>>>	14.67	Siphon2	0	0
AY1	<<<	379.3	TK 241-AY-102	0	0

Flows IN: 379.3 gpm
Flows OUT: 379.3 gpm

NET FLOWS: 0 gpm

B-41 of B-42

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
BP Discharge	672.34		209.4	1104
BP Suction	672.03		36.81	748
IP Discharge	636		61.04	761.9
Noz Trans	619.96		136	900.4
Nozzle	619.71		0 (source)	619.7
Nozzle 6	641.08		141.7	933.3
Nozzle U-2	677.07		206.2	1102
Pivot	623.31		147.4	927.4
Siphon	661.94		43.82	752.3
Siphon1	661.94		0 (source)	661.9
Siphon2	661.94		0 (source)	661.9
TK 241-AY-102	635.5		0 (source)	635.5
Transition	637		57.94	756.5
Wall	676		206.4	1102

LINEUP PIPELINES

10/27/97 12:22 pm

B-42 of B-42

PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	TK 241-AY-102	IP Discharge	379.3	16.48	(61.04)	(126.4)
	---- Immersible Pmp ---- dP: (61.48) HL: (126.8)					
AY2	IP Discharge	Transition	379.3	16.48	3.102	5.398
AY3	Transition	Siphon	379.3	9.568	14.12	4.187
AY4	Siphon	BP Suction	350	8.828	7.01	4.371
AY5	BP Suction	BP Discharge	350	15.2	0.741	1.22
	---- FCP@350 ---- dP: (173.4) HL: (357.6)					
AY6	BP Discharge	Nozzle U-2	350	8.828	3.256	1.987
AY7	Nozzle U-2	Wall	350	8.828	(0.261)	0.531
Buried	Wall	Nozzle 6	350	8.828	64.77	168.5
C1	Nozzle 6	Pivot	350	8.828	(5.741)	5.927
C2	Pivot	Noz Trans	350	* 23.47	11.45	26.96
C3	Noz Trans	Nozzle	350	* 130	136	280.7
S1	Siphon	Siphon1	14.67	* 45.28	43.82	90.39
S2	Siphon	Siphon2	14.67	* 45.28	43.82	90.39

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date:

By: Kelly Hayase

Checked: 3/5/98

By:

Location: 241-C/241-AY

Revised:

By:

APPENDIX C

Pipe-Flo Results SL-00

Page C-1

Pipe-Flo Results SL-10

Page C-15

Pipe-Flo Results SL-20

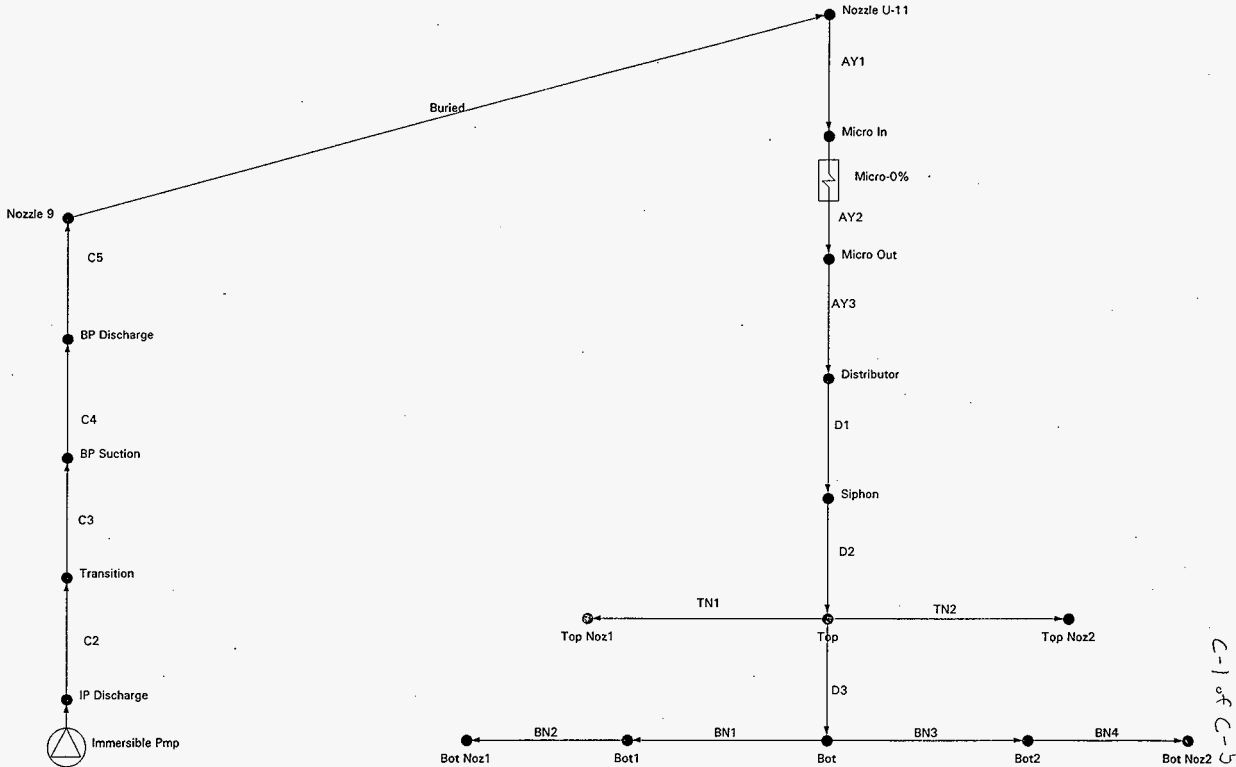
Page C-29

Pipe-Flo Results SL-30

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HNF-2478, Rev. 0

Tank 241-C-106



C-1 of C-7

Company: Fluor Daniel Northwest	10/27/97 12:29 pm
Project: W-320	Linelist: SL-00
by: K Hayase	Lineup:
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:29 pm
System: SL-00
rev: 10/22/97 9:43 am
C-2 of C-58

SYSTEM REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
Bot	635.49	D3	BN1 BN3
Bot Noz1	635.49	BN2	
Bot Noz2	635.49	BN4	
Bot1	635.49	BN1	BN2
Bot2	635.49	BN3	BN4
BP Discharge	639.42	C4	C5
BP Suction	639.11	C3	C4
Distributor	673.59	AY3	D1
IP Discharge	608.5	C1	C2
Micro In	674.77	AY1	AY2
Micro Out	674.77	AY2	AY3
Nozzle 9	642.26	C5	Buried
Nozzle U-11	676.05	Buried	AY1
Siphon	665.49	D1	D2
Tank 241-C-106	608		C1
Top	636.14	D2	D3 TN1 TN2
Top Noz1	636.14	TN1	
Top Noz2	636.14	TN2	
Transition	609	C2	C3

SYSTEM PIPES

10/27/97 12:29 pm

C-3 of C-5?

PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	01	Nozzle U-11	Micro In	
AY2	01	Micro In	Micro Out	Micro-0%
AY3	01	Micro Out	Distributor	
BN1	02	Bot	Bot1	
BN2	02	Bot1	Bot Noz1	
BN3	02	Bot	Bot2	
BN4	02	Bot2	Bot Noz2	
Buried	01	Nozzle 9	Nozzle U-11	
C1	01	Tank 241-C-106	IP Discharge	Immersible Pmp
C2	01	IP Discharge	Transition	
C3	01	Transition	BP Suction	
C4	01	BP Suction	BP Discharge	
C5	01	BP Discharge	Nozzle 9	
D1	02	Distributor	Siphon	
D2	02	Siphon	Top	
D3	02	Top	Bot	
TN1	02	Top	Top Noz1	
TN2	02	Top	Top Noz2	

PUMP/COMP

PERFORMANCE DATA

Immersible Pmp

gpm:	0	195	292	370	486
ft:	145	138	133	127	119
eqn:	145 - 0.00325666 Q ^ 1.45285				

Micro-0%

lb/hr:	0	3000	180000	300000	
psi:	0	0.003	5	14	
eqn:	1.33662e-009 Q ^ 1.82583				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:29 pm
System: SL-00
rev: 10/22/97 9:43 am

C-5 of C-55

PIPELIST REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
01 SL-0%-Sch40S rev: 10/21/97 11:58 am	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	0% solids 60 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g
02 SL-0%-Sch80S rev: 10/21/97 11:58 am	SSteel Sch 80S 0.0018 in Size for: 6 ft/sec	0% solids 60 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

HNF-2478, Rev. 0

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	01	SSteel 4 in / 40S	2.5	0% solids 60 °F / 0 psi g	0.6725
AY2	01	SSteel 3 in / 40S	5.5	0% solids 60 °F / 0 psi g	1.797
AY3	01	SSteel 4 in / 40S	5	0% solids 60 °F / 0 psi g	1.206
BN1	02	SSteel 4 in / 80S	0.5	0% solids 60 °F / 0 psi g	3.058
BN2	02	SSteel 2 in / 80S	0.17	0% solids 60 °F / 0 psi g	1
BN3	02	SSteel 4 in / 80S	0.5	0% solids 60 °F / 0 psi g	3.058
BN4	02	SSteel 2 in / 80S	0.17	0% solids 60 °F / 0 psi g	1
Buried	01	SSteel 4 in / 40S	1718	0% solids 60 °F / 0 psi g	10.87
C1	01	SSteel 3 in / 40S	1	0% solids 60 °F / 0 psi g	0
C2	01	SSteel 3 in / 40S	2	0% solids 60 °F / 0 psi g	1.094
C3	01	SSteel 4 in / 40S	34	0% solids 60 °F / 0 psi g	2.92
C4	01	SSteel 3 in / 40S	3	0% solids 60 °F / 0 psi g	0.05435
C5	01	SSteel 4 in / 40S	17	0% solids 60 °F / 0 psi g	1.565
D1	02	SSteel 4 in / 80S	8.1	0% solids 60 °F / 0 psi g	0
D2	02	SSteel 4 in / 80S	29.4	0% solids 60 °F / 0 psi g	0
D3	02	SSteel 4 in / 80S	0.6	0% solids 60 °F / 0 psi g	0.6594
TN1	02	SSteel 2 in / 80S	0.5	0% solids 60 °F / 0 psi g	2.158
TN2	02	SSteel 2 in / 80S	0.5	0% solids 60 °F / 0 psi g	2.158

C-7 of C-56

MATERIALS REPORT

Created: 10/15/97 10:22 am
 Design file:
 Pipe Specs: 2

Pipes: 18
 Nodes: 19
 Pumps/Comps: 2

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
AY1	01	SSteel 4 in / 40S	2.5	1-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 4 X 3
AY2	01	SSteel 3 in / 40S	5.5	1-Elbow Long - r/d 1.5 @ 90° 1-Fixed K 1.5 1-Reducer Enlargement 4 X 3
AY3	01	SSteel 4 in / 40S	5	1-Elbow Long - r/d 1.5 @ 90° 3-Elbow Short - r/d 1 @ 90°
BN1	02	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN2	02	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
BN3	02	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN4	02	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
Buried	01	SSteel 4 in / 40S	1718	21-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	01	SSteel 3 in / 40S	1	
C2	01	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
C3	01	SSteel 4 in / 40S	34	6-Elbow Short - r/d 1 @ 90° 3-Elbow Long - r/d 1.5 @ 90° 1-Elbow Long - r/d 1.5 @ 45° 1-Reducer Contraction 4 X 3
C4	01	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
C5	01	SSteel 4 in / 40S	17	4-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 90°

PIPE MATERIALS LIST

10/27/97 12:29 pm

C-8 of C-56

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
D1	02	SSteel 4 in / 80S	8.1	
D2	02	SSteel 4 in / 80S	29.4	
D3	02	SSteel 4 in / 80S	0.6	2-Tee Flow Thru Run
TN1	02	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
TN2	02	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
SSteel	40S	3 in	11.5 ft
		4 in	1776.5 ft
SSteel	80S	2 in	1.34 ft
		4 in	39.1 ft

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
01 SL-0%-Sch40S	SSteel	40S	1-Elbow Long - r/d 1.5 @ 90°
			1-Fixed K 1.5
	Size: 3 in		3-Reducer Enlargement 4 X 3
			3-Elbow Short - r/d 1 @ 90°
	Size: 4 in		9-Elbow Long - r/d 1.5 @ 90°
			12-Elbow Short - r/d 1 @ 90°
			2-Reducer Contraction 4 X 3
			21-Pipe Bend r/d 10 @ 90°
			2-Pipe Bend r/d 10 @ 45°
			1-Elbow Long - r/d 1.5 @ 45°
02 SL-0%-Sch80S	SSteel	80S	4-Exit Sharp-Edged
			2-Tee Flow Thru Branch
	Size: 2 in		2-Tee Flow Thru Branch
	Size: 4 in		2-Reducer Contraction 4 X 2
			2-Tee Flow Thru Run

PIPELINE REPORT

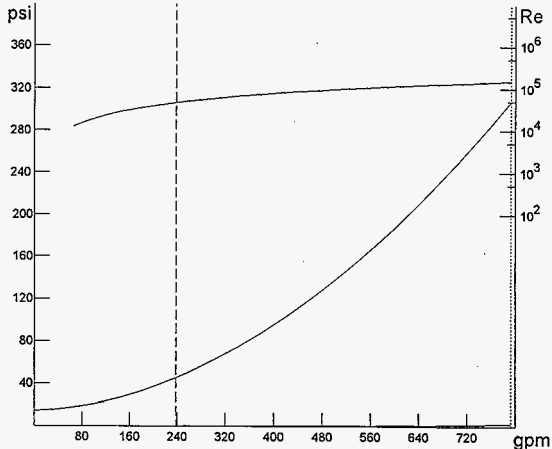
Buried rev: 10/22/97 9:17 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 642.26 ft
 out: 676.05 ft

SPECIFICATION: SL-0%-Sch40S
 SIZING Criteria: 6 ft/sec
 LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g
 FLUID 0% solids at tmp: 60 °F
 pres: 0 psi g
 den: 62.37 lb/ft³
 vsc: 4.16 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0214	8.828	77.75
0	.0000	0	14.63
66.08	.0300	1.667	17.7
132.2	.0256	3.333	25.24
198.2	.0236	5	36.78
264.3	.0224	6.667	52.18
330.4	.0216	8.333	71.34
396.5	.0210	10	94.22
462.5	.0206	11.67	120.8
528.6	.0202	13.33	151
594.7	.0199	15	184.8
660.8	.0196	16.67	222.3
726.9	.0194	18.33	263.4
792.9	.0192	20	308.1

PIPELINE RESISTANCE CURVE



VALVES and FITTINGS

VALVE / FITTING
 Pipe Bend r/d 10 90°
 FFT: 0.0163

K-VALUE
 21@0.489

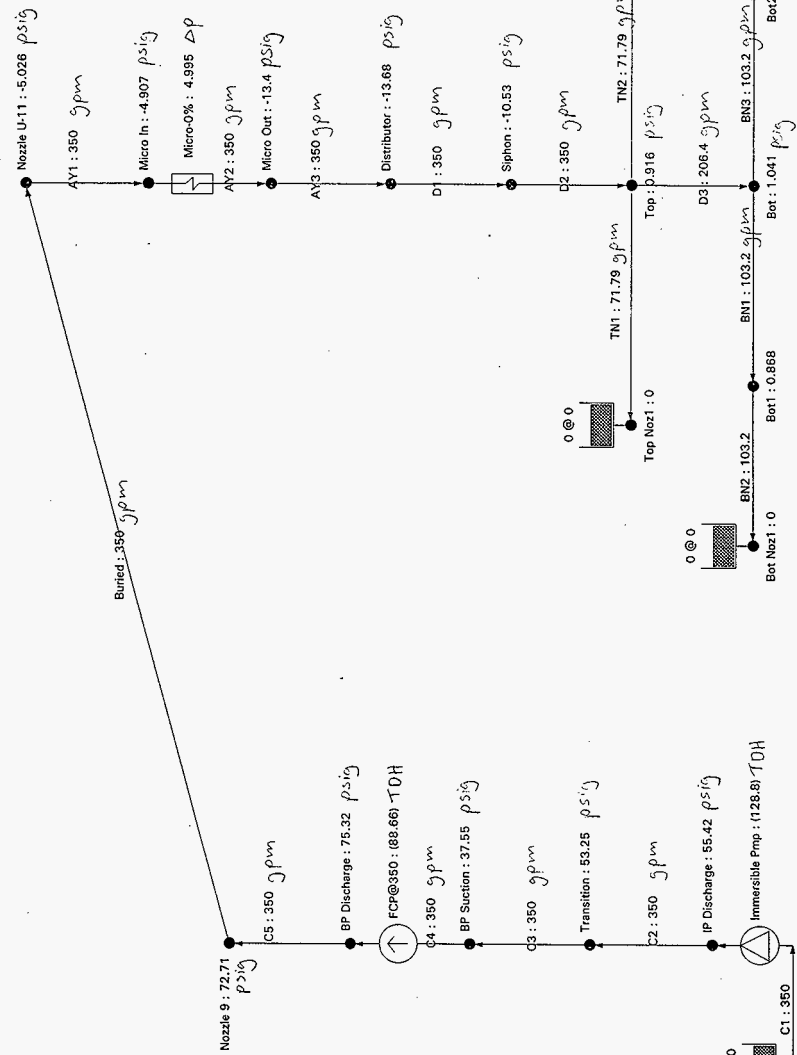
VALVE / FITTING
 Pipe Bend r/d 10 45°

K-VALUE
 2@0.3027

TOTAL K: 10.87

Avg Percent of Total Loss: 9 %

C-11 of C-56



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 12:30 pm Line1ist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
--	--

System: SL-00
rev: 10/22/97 9:43 am

Deviation: 0.0067 %
after: 4 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE	FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
BN2	>>> 103.2	Bot Noz1	0	0
BN4	>>> 103.2	Bot Noz2	0	0
C1	<<< 350	Tank 241-C-106	0	0
TN1	>>> 71.79	Top Noz1	0	0
TN2	>>> 71.79	Top Noz2	0	0

Flows IN: 350 gpm
Flows OUT: 350 gpm
NET FLOWS: 0 gpm

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
Bot	635.49		1.041	637.9
Bot Noz1	635.49		0 (source)	635.5
Bot Noz2	635.49		0 (source)	635.5
Bot1	635.49		0.868	637.5
Bot2	635.49		0.868	637.5
BP Discharge	639.42		75.32	813.4
BP Suction	639.11		37.55	725.9
Distributor	673.59		-13.68	642
IP Discharge	608.5		55.42	736.5
Micro In	674.77		-4.907	663.4
Micro Out	674.77		-13.4	643.8
Nozzle 9	642.26		72.71	810.2
Nozzle U-11	676.05		-5.026	664.4
Siphon	665.49		-10.53	641.2
Tank 241-C-106	608		0 (source)	608
Top	636.14		0.916	638.3
Top Noz1	636.14		0 (source)	636.1
Top Noz2	636.14		0 (source)	636.1
Transition	609		53.25	732

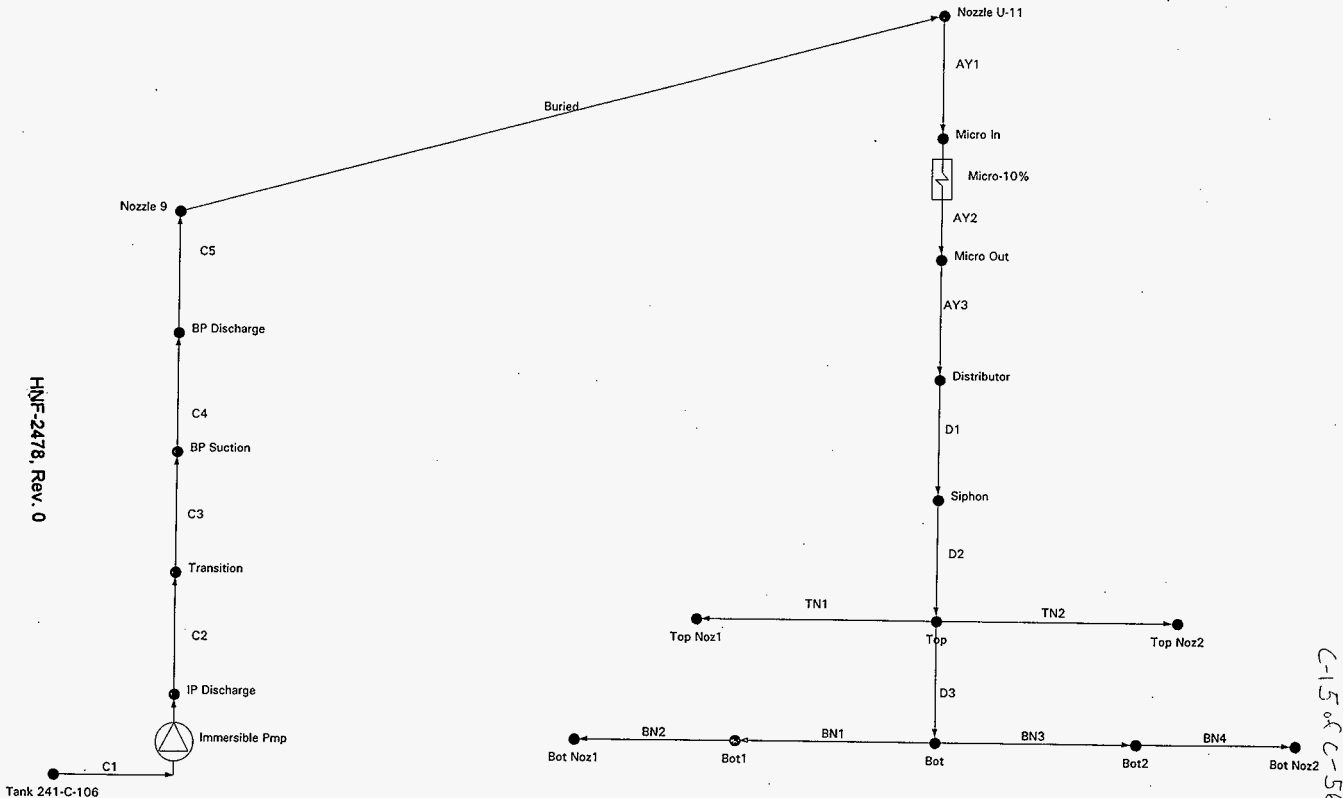
LINEUP PIPELINES

10/27/97 12:30 pm

C-14 of C-56

PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	Nozzle U-11	Micro In	350	8.828	(0.119)	1.006
AY2	Micro In	Micro Out	350	15.2	8.489	19.61
	---- Micro-0% ---- dP: 4.995 HL: 11.54					
AY3	Micro Out	Distributor	350	8.828	0.287	1.844
BN1	Bot	Bot1	103.2	2.882	0.173	0.400
BN2	Bot1	Bot Noz1	103.2	11.22	0.868	2.005
BN3	Bot	Bot2	103.2	2.882	0.173	0.400
BN4	Bot2	Bot Noz2	103.2	11.22	0.868	2.005
Buried	Nozzle 9	Nozzle U-11	350	8.828	77.73	145.8
C1	Tank 241-C-106	IP Discharge	350	15.2	(55.42)	(128.5)
	---- Immersible Pmp ---- dP: (55.76) HL: (128.8)					
C2	IP Discharge	Transition	350	15.2	2.171	4.515
C3	Transition	BP Suction	350	8.828	15.7	6.155
C4	BP Suction	BP Discharge	350	15.2	0.604	1.084
	---- FCP@350 ---- dP: (38.38) HL: (88.66)					
C5	BP Discharge	Nozzle 9	350	8.828	2.617	3.205
D1	Distributor	Siphon	350	9.775	(3.158)	0.804
D2	Siphon	Top	350	9.775	(11.44)	2.918
D3	Top	Bot	206.4	5.765	(0.124)	0.363
TN1	Top	Top Noz1	71.79	7.806	0.916	2.117
TN2	Top	Top Noz2	71.79	7.806	0.916	2.117

HNF-2478, Rev. 0



Company: Fluor Daniel Northwest	10/27/97 12:31 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup:
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

SYSTEM REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
Bot	635.49	D3	BN1 BN3
Bot Noz1	635.49	BN2	
Bot Noz2	635.49	BN4	
Bot1	635.49	BN1	BN2
Bot2	635.49	BN3	BN4
BP Discharge	639.42	C4	C5
BP Suction	639.11	C3	C4
Distributor	673.59	AY3	D1
IP Discharge	608.5	C1	C2
Micro In	674.77	AY1	AY2
Micro Out	674.77	AY2	AY3
Nozzle 9	642.26	C5	Buried
Nozzle U-11	676.05	Buried	AY1
Siphon	665.49	D1	D2
Tank 241-C-106	608		C1
Top	636.14	D2	D3 TN1 TN2
Top Noz1	636.14	TN1	
Top Noz2	636.14	TN2	
Transition	609	C2	C3

HNF-2478, Rev. 0

SYSTEM PIPES

10/27/97 12:31 pm

C-17 of C-56

PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	03	Nozzle U-11	Micro In	
AY2	03	Micro In	Micro Out	Micro-10%
AY3	03	Micro Out	Distributor	
BN1	04	Bot	Bot1	
BN2	04	Bot1	Bot Noz1	
BN3	04	Bot	Bot2	
BN4	04	Bot2	Bot Noz2	
Buried	03	Nozzle 9	Nozzle U-11	
C1	03	Tank 241-C-106	IP Discharge	Immersible Pmp
C2	03	IP Discharge	Transition	
C3	03	Transition	BP Suction	
C4	03	BP Suction	BP Discharge	
C5	03	BP Discharge	Nozzle 9	
D1	04	Distributor	Siphon	
D2	04	Siphon	Top	
D3	04	Top	Bot	
TN1	04	Top	Top Noz1	
TN2	04	Top	Top Noz2	

HNF-2478, Rev. 0

PUMP/COMP

PERFORMANCE DATA

Immersible Pmp	gpm:	0	195	292	370	486
	ft:	145	138	133	127	119
	eqn:	145 - 0.00325666 Q ^ 1.45285				
Micro-10%	lb/hr:	0	3000	180000	300000	
	psi:	0	0.013	6.25	16.1	
	eqn:	6.07485e-008 Q ^ 1.53179				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:31 pm
System: SL-10 C-19 of C-50
rev: 10/22/97 9:48 am

PIPELIST REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
03 SL-10%-Sch40S rev: 10/21/97 11:57 am	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	10% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g
04 SL-10%-Sch80S rev: 10/21/97 11:57 am	SSteel Sch 80S 0.0018 in Size for: 6 ft/sec	10% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	03	SSteel 4 in / 40S	2.5	10% solids 90 °F / 0 psi g	0.6725
AY2	03	SSteel 3 in / 40S	5.5	10% solids 90 °F / 0 psi g	1.797
AY3	03	SSteel 4 in / 40S	5	10% solids 90 °F / 0 psi g	1.206
BN1	04	SSteel 4 in / 80S	0.5	10% solids 90 °F / 0 psi g	3.058
BN2	04	SSteel 2 in / 80S	0.17	10% solids 90 °F / 0 psi g	1
BN3	04	SSteel 4 in / 80S	0.5	10% solids 90 °F / 0 psi g	3.058
BN4	04	SSteel 2 in / 80S	0.17	10% solids 90 °F / 0 psi g	1
Buried	03	SSteel 4 in / 40S	1718	10% solids 90 °F / 0 psi g	10.87
C1	03	SSteel 3 in / 40S	1	10% solids 90 °F / 0 psi g	0
C2	03	SSteel 3 in / 40S	2	10% solids 90 °F / 0 psi g	1.094
C3	03	SSteel 4 in / 40S	34	10% solids 90 °F / 0 psi g	2.92
C4	03	SSteel 3 in / 40S	3	10% solids 90 °F / 0 psi g	0.05435
C5	03	SSteel 4 in / 40S	17	10% solids 90 °F / 0 psi g	1.565
D1	04	SSteel 4 in / 80S	8.1	10% solids 90 °F / 0 psi g	0
D2	04	SSteel 4 in / 80S	29.4	10% solids 90 °F / 0 psi g	0
D3	04	SSteel 4 in / 80S	0.6	10% solids 90 °F / 0 psi g	0.6594
TN1	04	SSteel 2 in / 80S	0.5	10% solids 90 °F / 0 psi g	2.158
TN2	04	SSteel 2 in / 80S	0.5	10% solids 90 °F / 0 psi g	2.158

MATERIALS REPORT

Created: 10/15/97 10:22 am
 Design file:
 Pipe Specs: 2

Pipes: 18
 Nodes: 19
 Pumps/Comps: 2

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
AY1	03	SSteel 4 in / 40S	2.5	1-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 4 X 3
AY2	03	SSteel 3 in / 40S	5.5	1-Elbow Long - r/d 1.5 @ 90° 1-Fixed K 1.5 1-Reducer Enlargement 4 X 3
AY3	03	SSteel 4 in / 40S	5	1-Elbow Long - r/d 1.5 @ 90° 3-Elbow Short - r/d 1 @ 90°
BN1	04	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN2	04	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
BN3	04	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN4	04	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
Buried	03	SSteel 4 in / 40S	1718	21-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	03	SSteel 3 in / 40S	1	
C2	03	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
C3	03	SSteel 4 in / 40S	34	6-Elbow Short - r/d 1 @ 90° 3-Elbow Long - r/d 1.5 @ 90° 1-Elbow Long - r/d 1.5 @ 45° 1-Reducer Contraction 4 X 3
C4	03	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
C5	03	SSteel 4 in / 40S	17	4-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 90°

PIPE MATERIALS LIST

10/27/97 12:31 pm

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PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
D1	04	SSteel 4 in / 80S	8.1	
D2	04	SSteel 4 in / 80S	29.4	
D3	04	SSteel 4 in / 80S	0.6	2-Tee Flow Thru Run
TN1	04	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
TN2	04	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged

HNF-2478, Rev. C

PIPE SUMMARY

10/27/97 12:31 pm

C-23 & C-56

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
SSteel	40S	3 in	11.5 ft
		4 in	1776.5 ft
SSteel	80S	2 in	1.34 ft
		4 in	39.1 ft

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
03 SL-10%-Sch40S	SSteel	40S	1-Elbow Long - r/d 1.5 @ 90°
			1-Fixed K 1.5
	Size: 3 in		3-Reducer Enlargement 4 X 3
			3-Elbow Short - r/d 1 @ 90°
	Size: 4 in		9-Elbow Long - r/d 1.5 @ 90°
			12-Elbow Short - r/d 1 @ 90°
			2-Reducer Contraction 4 X 3
			21-Pipe Bend r/d 10 @ 90°
			2-Pipe Bend r/d 10 @ 45°
			1-Elbow Long - r/d 1.5 @ 45°
04 SL-10%-Sch80S	SSteel	80S	4-Exit Sharp-Edged
			2-Tee Flow Thru Branch
			2-Tee Flow Thru Branch
	Size: 2 in		2-Reducer Contraction 4 X 2
	Size: 4 in		2-Tee Flow Thru Run

HNF-2478; Rev. 0

PIPELINE REPORT

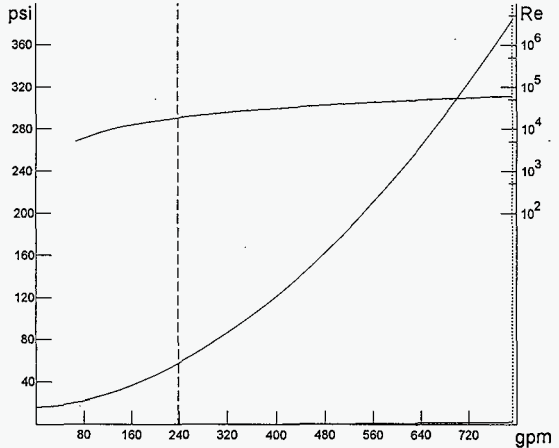
Buried rev: 10/22/97 9:44 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 642.26 ft
 out: 676.05 ft

SPECIFICATION: SL-10%-Sch40S
 SIZING Criteria: 6 ft/sec
 LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g
 FLUID 10% solids at tmp: 90 °F
 pres: 0 psi g
 den: 69.85 lb/ft³
 vsc: 11.57 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0253	8.828	98.67
0	.0000	0	16.39
66.08	.0383	1.667	20.72
132.2	.0317	3.333	30.86
198.2	.0287	5	46.05
264.3	.0269	6.667	65.99
330.4	.0256	8.333	90.52
396.5	.0247	10	119.5
462.5	.0239	11.67	152.9
528.6	.0233	13.33	190.6
594.7	.0228	15	232.7
660.8	.0224	16.67	278.9
726.9	.0221	18.33	329.4
792.9	.0217	20	384.1

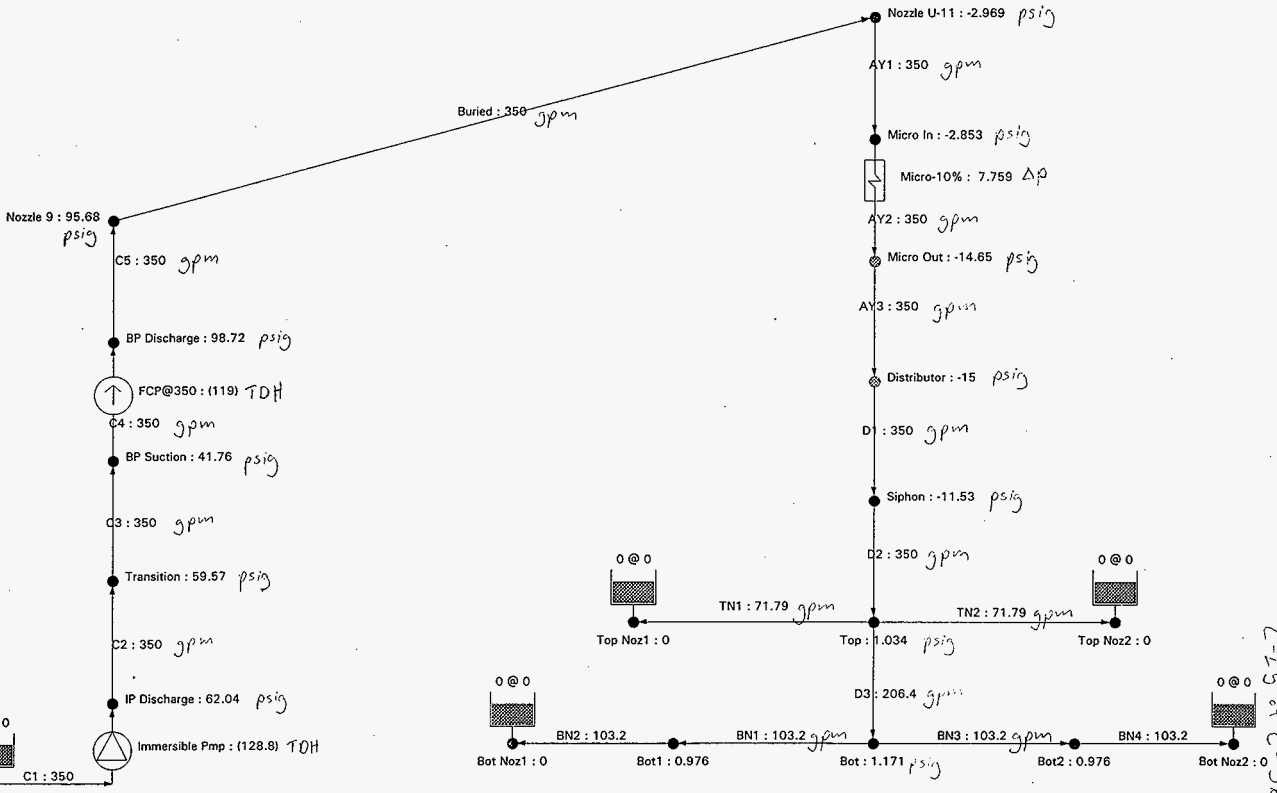
PIPELINE RESISTANCE CURVE



VALVES and FITTINGS

VALVE / FITTING	K-VALUE	VALVE / FITTING	K-VALUE
Pipe Bend r/d 10 90°	21@0.489	Pipe Bend r/d 10 45°	2@0.3027
FFT: 0.0163	TOTAL K: 10.87	Avg Percent of Total Loss: 8 %	

HNF-2478, Rev. 0



C-17 of C-56

ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 12:32 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

System: SL-10
rev: 10/22/97 9:48 am

Deviation: 0.00747 %
after: 4 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE	FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
BN2	>>> 103.2	Bot Noz1	0	0
BN4	>>> 103.2	Bot Noz2	0	0
C1	<<< 350	Tank 241-C-106	0	0
TN1	>>> 71.79	Top Noz1	0	0
TN2	>>> 71.79	Top Noz2	0	0

Flows IN: 350 gpm
Flows OUT: 350 gpm

NET FLOWS: 0 gpm

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
Bot	635.49		1.171	637.9
Bot Noz1	635.49		0 (source)	635.5
Bot Noz2	635.49		0 (source)	635.5
Bot1	635.49		0.976	637.5
Bot2	635.49		0.976	637.5
BP Discharge	639.42		98.72	843.1
BP Suction	639.11		41.76	725.2
Distributor	673.59		-15 ***	642.6
IP Discharge	608.5		62.04	736.5
Micro In	674.77		-2.853	668.9
Micro Out	674.77		-14.65 ***	644.6
Nozzle 9	642.26		95.68	839.6
Nozzle U-11	676.05		-2.969	669.9
Siphon	665.49		-11.53	641.7
Tank 241-C-106	608		0 (source)	608
Top	636.14		1.034	638.3
Top Noz1	636.14		0 (source)	636.1
Top Noz2	636.14		0 (source)	636.1
Transition	609		59.57	731.9

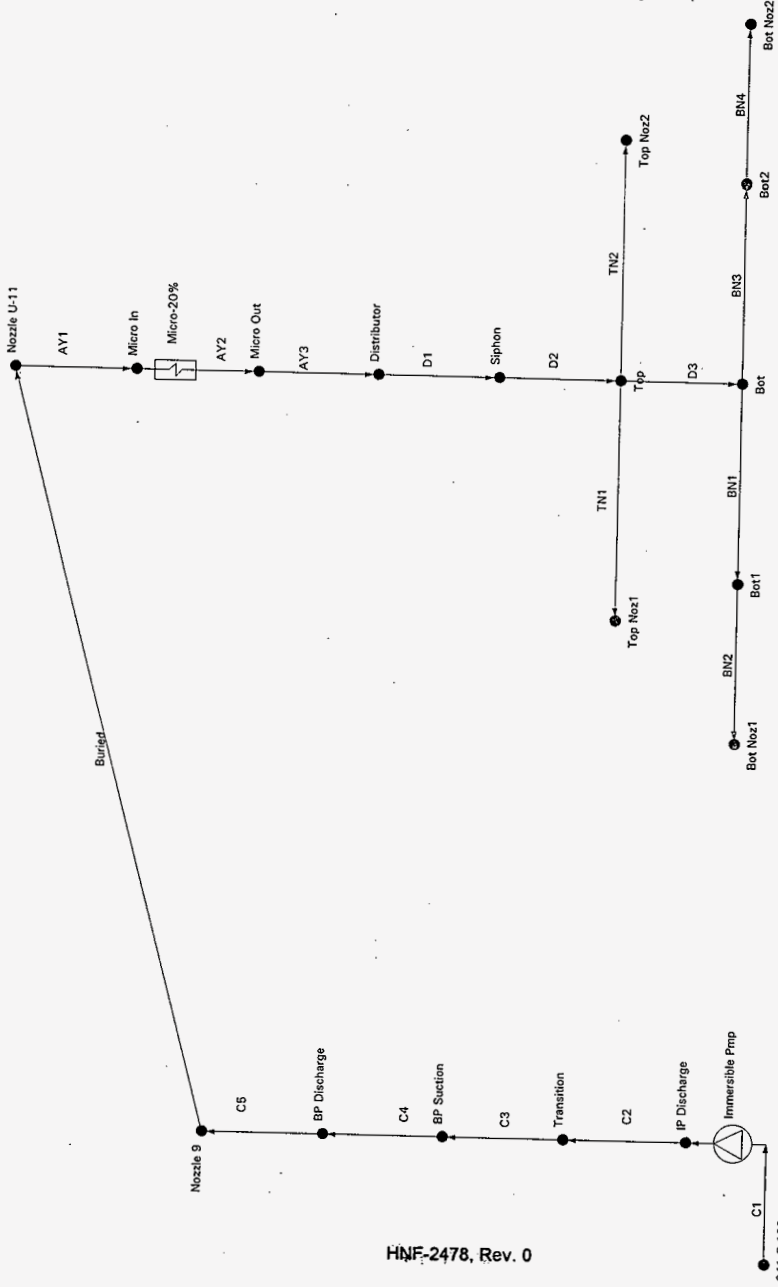
LINEUP PIPELINES

10/27/97 12:32 pm

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PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	Nozzle U-11	Micro In	350	8.828	(0.116)	1.041
AY2	Micro In	Micro Out	350	15.2	11.79	24.33
	--- Micro-10% --- dP: 7.759 HL: 16					
AY3	Micro Out	Distributor	350	8.828	0.356	1.914
BN1	Bot	Bot1	103.2	2.883	0.194	0.401
BN2	Bot1	Bot Noz1	103.2	11.22	0.976	2.014
BN3	Bot	Bot2	103.2	2.883	0.194	0.401
BN4	Bot2	Bot Noz2	103.2	11.22	0.976	2.014
Buried	Nozzle 9	Nozzle U-11	350	8.828	98.65	169.7
C1	Tank 241-C-106	IP Discharge	350	15.2	(62.04)	(128.5)
	--- Immersible Pmp --- dP: (62.45) HL: (128.8)					
C2	IP Discharge	Transition	350	15.2	2.475	4.605
C3	Transition	BP Suction	350	8.828	17.81	6.628
C4	BP Suction	BP Discharge	350	15.2	0.741	1.22
	--- FCP@350 --- dP: (57.71) HL: (119)					
C5	BP Discharge	Nozzle 9	350	8.828	3.045	3.441
D1	Distributor	Siphon	350	9.775	(3.469)	0.945
D2	Siphon	Top	350	9.775	(12.57)	3.429
D3	Top	Bot	206.4	5.765	(0.137)	0.367
TN1	Top	Top Noz1	71.79	7.806	1.034	2.132
TN2	Top	Top Noz2	71.79	7.806	1.034	2.132

C-29 of C-56



Company: Fluor Daniel Northwest
 Project: W-320
 by: K Hayase
 Comments: Calculation W320-27-048
 Version: PIPE-FLO ver 5.01

10/27/97 12:32 pm
 Linelist: SL-20
 Lineup:
 flow rate: gpm
 pressure: psig
 level & grade: ft

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:32 pm
System: SL-20
rev: 10/22/97 9:52 am

C-30 of C-52

SYSTEM REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
Bot	635.49	D3	BN1 BN3
Bot Noz1	635.49	BN2	
Bot Noz2	635.49	BN4	
Bot1	635.49	BN1	BN2
Bot2	635.49	BN3	BN4
BP Discharge	639.42	C4	C5
BP Suction	639.11	C3	C4
Distributor	673.59	AY3	D1
IP Discharge	608.5	C1	C2
Micro In	674.77	AY1	AY2
Micro Out	674.77	AY2	AY3
Nozzle 9	642.26	C5	Buried
Nozzle U-11	676.05	Buried	AY1
Siphon	665.49	D1	D2
Tank 241-C-106	608		C1
Top	636.14	D2	D3 TN1 TN2
Top Noz1	636.14	TN1	
Top Noz2	636.14	TN2	
Transition	609	C2	C3

SYSTEM PIPES

10/27/97 12:32 pm

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PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	05	Nozzle U-11	Micro In	
AY2	05	Micro In	Micro Out	Micro-20%
AY3	05	Micro Out	Distributor	
BN1	06	Bot	Bot1	
BN2	06	Bot1	Bot Noz1	
BN3	06	Bot	Bot2	
BN4	06	Bot2	Bot Noz2	
Buried	05	Nozzle 9	Nozzle U-11	
C1	05	Tank 241-C-106	IP Discharge	Immersible Pmp
C2	05	IP Discharge	Transition	
C3	05	Transition	BP Suction	
C4	05	BP Suction	BP Discharge	
C5	05	BP Discharge	Nozzle 9	
D1	06	Distributor	Siphon	
D2	06	Siphon	Top	
D3	06	Top	Bot	
TN1	06	Top	Top Noz1	
TN2	06	Top	Top Noz2	

HNF-2478, Rev. 0

PUMP/COMP

PERFORMANCE DATA

Inmersible Pmp

gpm:	0	195	292	370	486
ft:	145	138	133	127	119
eqn:	145 - 0.00325666 Q ^ 1.45285				

Micro-20%

lb/hr:	0	3000	180000	300000	
psi:	0	0.017	7.76	17.2	
eqn:	1.03379e-007 Q ^ 1.49988				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:32 pm
System: SL-20
rev: 10/22/97 9:52 am
C-33 of C-56

PIPELIST REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
05 SL-20%-Sch40S rev: 10/21/97 11:59 am	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	20% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g
06 SL-20%-Sch80S rev: 10/21/97 11:59 am	SSteel Sch 80S 0.0018 in Size for: 6 ft/sec	20% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

HNF-2478, Rev. 0

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	05	SSteel 4 in / 40S	2.5	20% solids 90 °F / 0 psi g	0.6725
AY2	05	SSteel 3 in / 40S	5.5	20% solids 90 °F / 0 psi g	1.797
AY3	05	SSteel 4 in / 40S	5	20% solids 90 °F / 0 psi g	1.206
BN1	06	SSteel 4 in / 80S	0.5	20% solids 90 °F / 0 psi g	3.058
BN2	06	SSteel 2 in / 80S	0.17	20% solids 90 °F / 0 psi g	1
BN3	06	SSteel 4 in / 80S	0.5	20% solids 90 °F / 0 psi g	3.058
BN4	06	SSteel 2 in / 80S	0.17	20% solids 90 °F / 0 psi g	1
Buried	05	SSteel 4 in / 40S	1718	20% solids 90 °F / 0 psi g	10.87
C1	05	SSteel 3 in / 40S	1	20% solids 90 °F / 0 psi g	0
C2	05	SSteel 3 in / 40S	2	20% solids 90 °F / 0 psi g	1.094
C3	05	SSteel 4 in / 40S	34	20% solids 90 °F / 0 psi g	2.92
C4	05	SSteel 3 in / 40S	3	20% solids 90 °F / 0 psi g	0.05435
C5	05	SSteel 4 in / 40S	17	20% solids 90 °F / 0 psi g	1.565
D1	06	SSteel 4 in / 80S	8.1	20% solids 90 °F / 0 psi g	0
D2	06	SSteel 4 in / 80S	29.4	20% solids 90 °F / 0 psi g	0
D3	06	SSteel 4 in / 80S	0.6	20% solids 90 °F / 0 psi g	0.6594
TN1	06	SSteel 2 in / 80S	0.5	20% solids 90 °F / 0 psi g	2.158
TN2	06	SSteel 2 in / 80S	0.5	20% solids 90 °F / 0 psi g	2.158

C-35 of C-56

MATERIALS REPORT

Created: 10/15/97 10:22 am
 Design file:
 Pipe Specs: 2

Pipes: 18
 Nodes: 19
 Pumps/Comps: 2

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
AY1	05	SSteel 4 in / 40S	2.5	1-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 4 X 3
AY2	05	SSteel 3 in / 40S	5.5	1-Elbow Long - r/d 1.5 @ 90° 1-Fixed K 1.5 1-Reducer Enlargement 4 X 3
AY3	05	SSteel 4 in / 40S	5	1-Elbow Long - r/d 1.5 @ 90° 3-Elbow Short - r/d 1 @ 90°
BN1	06	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN2	06	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
BN3	06	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN4	06	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
Buried	05	SSteel 4 in / 40S	1718	21-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	05	SSteel 3 in / 40S	1	
C2	05	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
C3	05	SSteel 4 in / 40S	34	6-Elbow Short - r/d 1 @ 90° 3-Elbow Long - r/d 1.5 @ 90° 1-Elbow Long - r/d 1.5 @ 45° 1-Reducer Contraction 4 X 3
C4	05	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
C5	05	SSteel 4 in / 40S	17	4-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 90°

PIPE MATERIALS LIST

10/27/97 12:32 pm

C-36 of C-56

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
D1	06	SSteel 4 in / 80S	8.1	
D2	06	SSteel 4 in / 80S	29.4	
D3	06	SSteel 4 in / 80S	0.6	2-Tee Flow Thru Run
TN1	06	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
TN2	06	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged

HNF-2478, Rev. 0

PIPE SUMMARY

10/27/97 12:32 pm

C-37 of C-56

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
SSteel	40S	3 in	11.5 ft
		4 in	1776.5 ft
SSteel	80S	2 in	1.34 ft
		4 in	39.1 ft

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
05 SL-20%-Sch40S	SSteel	40S	1-Elbow Long - r/d 1.5 @ 90°
			1-Fixed K 1.5
	Size: 3 in		3-Reducer Enlargement 4 X 3
			3-Elbow Short - r/d 1 @ 90°
	Size: 4 in		9-Elbow Long - r/d 1.5 @ 90°
			12-Elbow Short - r/d 1 @ 90°
			2-Reducer Contraction 4 X 3
			21-Pipe Bend r/d 10 @ 90°
			2-Pipe Bend r/d 10 @ 45°
			1-Elbow Long - r/d 1.5 @ 45°
06 SL-20%-Sch80S	SSteel	80S	4-Exit Sharp-Edged
			2-Tee Flow Thru Branch
	Size: 2 in		2-Tee Flow Thru Branch
	Size: 4 in		2-Reducer Contraction 4 X 2
			2-Tee Flow Thru Run

HNF-2478, Rev. 0

PIPELINE REPORT

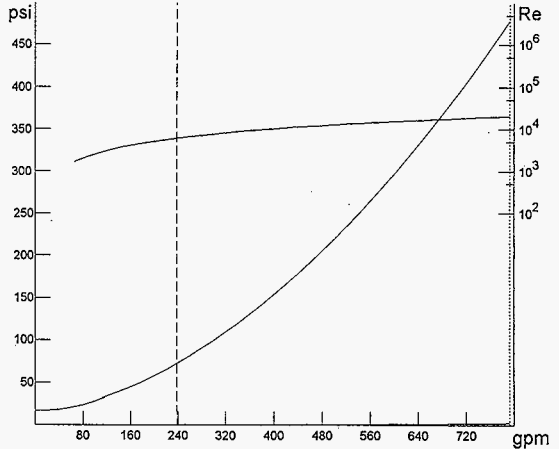
Buried rev: 10/22/97 9:50 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 642.26 ft
 out: 676.05 ft

SPECIFICATION: SL-20%-Sch40S
 SIZING Criteria: 6 ft/sec
 LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g
 FLUID 20% solids at tmp: 90 °F
 pres: 0 psi g
 den: 72.35 lb/ft³
 vsc: 35.6 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0327	8.828	125.1
0	.0000	0	16.97
66.08	.0378	1.667	21.4
132.2	.0432	3.333	37.08
198.2	.0382	5	57.23
264.3	.0352	6.667	83.2
330.4	.0332	8.333	114.7
396.5	.0316	10	151.6
462.5	.0304	11.67	193.6
528.6	.0294	13.33	240.8
594.7	.0286	15	292.9
660.8	.0279	16.67	349.9
726.9	.0273	18.33	411.8
792.9	.0268	20	478.5

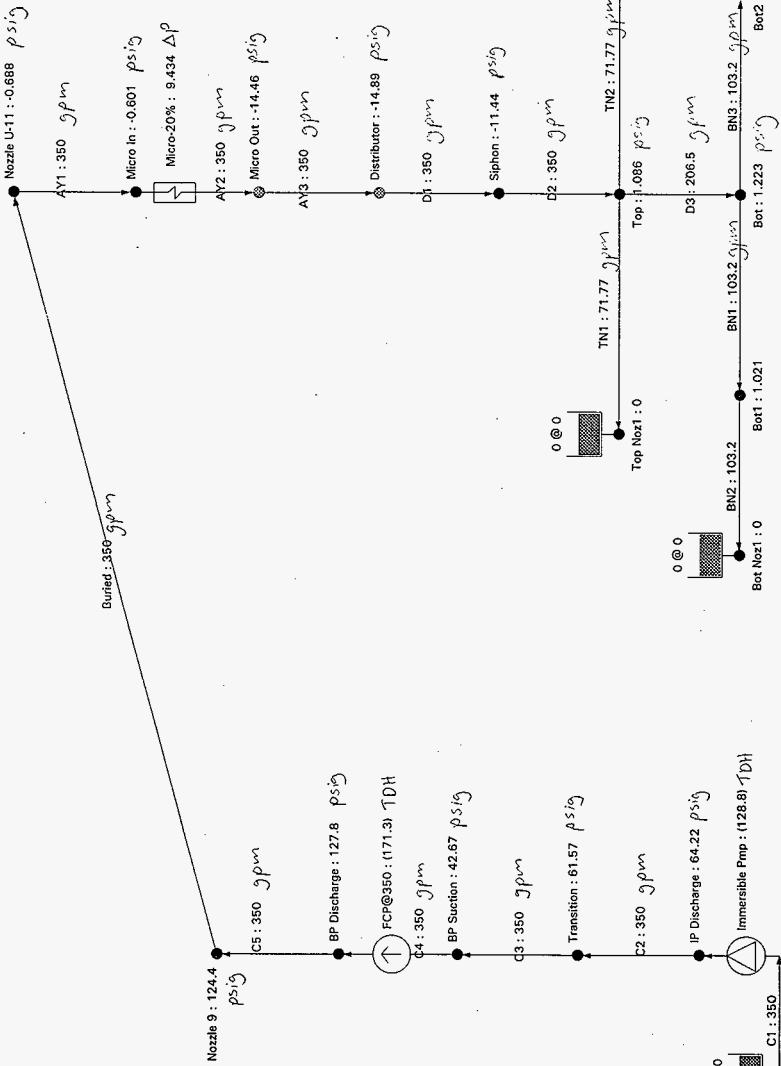
PIPELINE RESISTANCE CURVE



VALVES and FITTINGS

VALVE / FITTING	K-VALUE	VALVE / FITTING	K-VALUE
Pipe Bend r/d 10 90°	21@0.489	Pipe Bend r/d 10 45°	2@0.3027
FFT: 0.0163	TOTAL K: 10.87	Avg Percent of Total Loss: 6 %	

C-39 of C-56



<p>Company: Filor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 12:33 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
---	--

Version: PIPE-FLO ver 5.01

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:33 pm
Lineup: SL-20 C-40 of C-38
rev: 10/27/97 12:33 pm 7/24/02

System: SL-20
rev: 10/22/97 9:52 am

Deviation: 0.00883 %
after: 4 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE		FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
BN2	>>>	103.2	Bot Noz1	0	0
BN4	>>>	103.2	Bot Noz2	0	0
C1	<<<	350	Tank 241-C-106	0	0
TN1	>>>	71.77	Top Noz1	0	0
TN2	>>>	71.77	Top Noz2	0	0

Flows IN: 350 gpm
Flows OUT: 349.9 gpm

NET FLOWS IN: 0.100 gpm

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
Bot	635.49		1.223	637.9
Bot Noz1	635.49		0 (source)	635.5
Bot Noz2	635.49		0 (source)	635.5
Bot1	635.49		1.021	637.5
Bot2	635.49		1.021	637.5
BP Discharge	639.42		127.8	893.9
BP Suction	639.11		42.67	724.1
Distributor	673.59		-14.89 ***	643.9
IP Discharge	608.5		64.22	736.4
Micro In	674.77		-0.601	673.6
Micro Out	674.77		-14.46 ***	646
Nozzle 9	642.26		124.4	890
Nozzle U-11	676.05		-0.688	674.7
Siphon	665.49		-11.44	642.7
Tank 241-C-106	608		0 (source)	608
Top	636.14		1.086	638.3
Top Noz1	636.14		0 (source)	636.1
Top Noz2	636.14		0 (source)	636.1
Transition	609		61.57	731.6

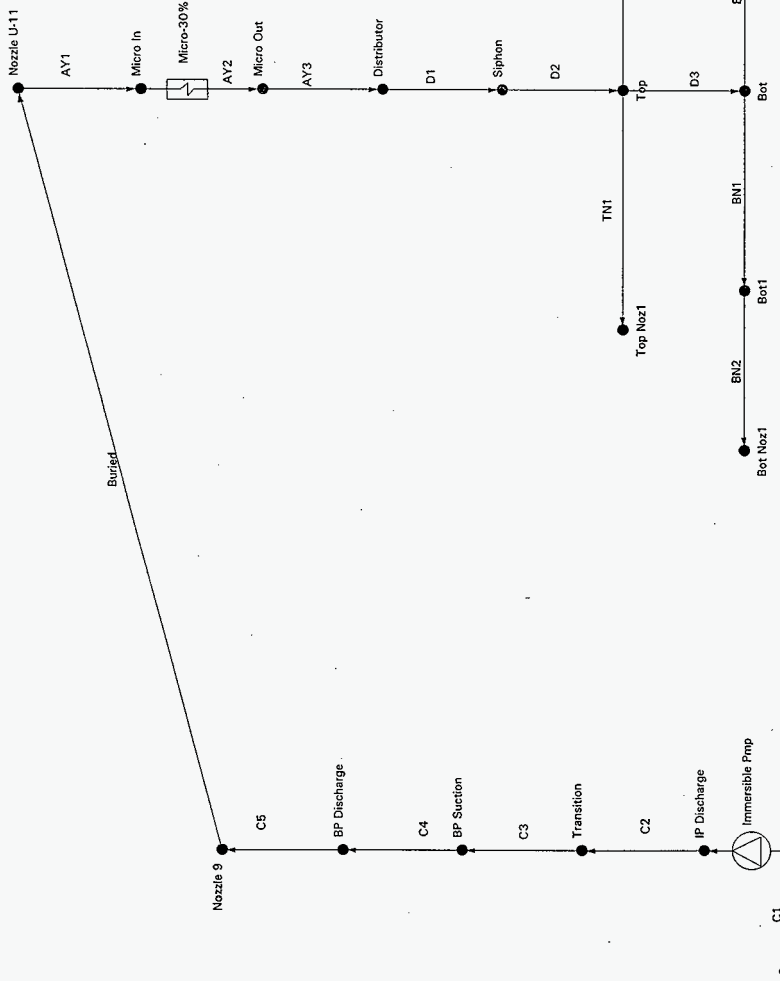
LINEUP PIPELINES

10/27/97 12:33 pm

C-42 of C-56

PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	Nozzle U-11	Micro In	350	8.828	(0.087)	1.107
AY2	Micro In	Micro Out	350	15.2	13.86	27.6
	---- Micro-20% ---- dP: 9.434 HL: 18.79					
AY3	Micro Out	Distributor	350	8.828	0.435	2.046
BN1	Bot	Bot1	103.2	2.883	0.203	0.404
BN2	Bot1	Bot Noz1	103.2	11.22	1.021	2.033
BN3	Bot	Bot2	103.2	2.883	0.203	0.404
BN4	Bot2	Bot Noz2	103.2	11.22	1.021	2.033
Buried	Nozzle 9	Nozzle U-11	350	8.828	125.1	215.3
C1	Tank 241-C-106	IP Discharge	350	15.2	(64.22)	(128.4)
	---- Immersible Pmp ---- dP: (64.69) HL: (128.8)					
C2	IP Discharge	Transition	350	15.2	2.653	4.783
C3	Transition	BP Suction	350	8.828	18.9	7.531
C4	BP Suction	BP Discharge	350	15.2	0.902	1.487
	---- FCP@350 ---- dP: (86.02) HL: (171.3)					
C5	BP Discharge	Nozzle 9	350	8.828	3.381	3.893
D1	Distributor	Siphon	350	9.775	(3.457)	1.215
D2	Siphon	Top	350	9.775	(12.52)	4.41
D3	Top	Bot	206.5	5.766	(0.137)	0.376
TN1	Top	Top Noz1	71.77	7.805	1.086	2.163
TN2	Top	Top Noz2	71.77	7.805	1.086	2.162

C-43 of C-56



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 12:33 pm Line list: SL-30 Lineup: flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	

SYSTEM REPORT

Created: 10/15/97 10:22 am
 Design file:
 Pipe Specs: 2

Pipes: 18
 Nodes: 19
 Pumps/Comps: 2

SYSTEM NODES

NODE	ELEVATION ft	PIPELINES IN	PIPELINES OUT
Bot	635.49	D3	BN1 BN3
Bot Noz1	635.49	BN2	
Bot Noz2	635.49	BN4	
Bot1	635.49	BN1	BN2
Bot2	635.49	BN3	BN4
BP Discharge	639.42	C4	C5
BP Suction	639.11	C3	C4
Distributor	673.59	AY3	D1
IP Discharge	608.5	C1	C2
Micro In	674.77	AY1	AY2
Micro Out	674.77	AY2	AY3
Nozzle 9	642.26	C5	Buried
Nozzle U-11	676.05	Buried	AY1
Siphon	665.49	D1	D2
Tank 241-C-106	608		C1
Top	636.14	D2	D3 TN1 TN2
Top Noz1	636.14	TN1	
Top Noz2	636.14	TN2	
Transition	609	C2	C3

SYSTEM PIPES

10/27/97 12:34 pm

C-45 of C-52

PIPELINE	SPEC	FROM_NODE	TO_NODE	PUMP/COMP
AY1	07	Nozzle U-11	Micro In	
AY2	07	Micro In	Micro Out	Micro-30%
AY3	07	Micro Out	Distributor	
BN1	08	Bot	Bot1	
BN2	08	Bot1	Bot Noz1	
BN3	08	Bot	Bot2	
BN4	08	Bot2	Bot Noz2	
Buried	07	Nozzle 9	Nozzle U-11	
C1	07	Tank 241-C-106	IP Discharge	Immersible Pmp
C2	07	IP Discharge	Transition	
C3	07	Transition	BP Suction	
C4	07	BP Suction	BP Discharge	
C5	07	BP Discharge	Nozzle 9	
D1	08	Distributor	Siphon	
D2	08	Siphon	Top	
D3	08	Top	Bot	
TN1	08	Top	Top Noz1	
TN2	08	Top	Top Noz2	

PUMP/COMP

PERFORMANCE DATA

Immersible Pmp

gpm:	0	195	292	370	486
ft:	145	138	133	127	119
eqn:	145 - 0.00325666 Q ^ 1.45285				

Micro-30%

lb/hr:	0	3000	180000	300000	
psi:	0	0.083	12.5	25	
eqn:	4.24016e-006 Q ^ 1.23381				

Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase

10/27/97 12:34 pm
System: SL-30 C-47 of C-52
rev: 10/22/97 9:53 am

PIPELIST REPORT

Created: 10/15/97 10:22 am
Design file:
Pipe Specs: 2

Pipes: 18
Nodes: 19
Pumps/Comps: 2

SPECIFICATIONS

SPECIFICATION	PIPE MATERIAL Sch / Roughness	FLUID Temp / Pres	VALVE TABLE	DESIGN LIMITS Vel / Pres
07 SL-30%-Sch40S rev: 10/21/97 12:01 pm	SSteel Sch 40S 0.0018 in Size for: 6 ft/sec	30% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g
08 SL-30%-Sch80S rev: 10/21/97 12:01 pm	SSteel Sch 80S 0.0018 in Size for: 6 ft/sec	30% solids 90 °F 0 psi g	Standard Standard	0 - 20 ft/sec -14.4 - 400 psi g

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	FLUID Temp / Pres	VALVES Total-K
AY1	07	SSteel 4 in / 40S	2.5	30% solids 90 °F / 0 psi g	0.6725
AY2	07	SSteel 3 in / 40S	5.5	30% solids 90 °F / 0 psi g	1.797
AY3	07	SSteel 4 in / 40S	5	30% solids 90 °F / 0 psi g	1.206
BN1	08	SSteel 4 in / 80S	0.5	30% solids 90 °F / 0 psi g	3.058
BN2	08	SSteel 2 in / 80S	0.17	30% solids 90 °F / 0 psi g	1
BN3	08	SSteel 4 in / 80S	0.5	30% solids 90 °F / 0 psi g	3.058
BN4	08	SSteel 2 in / 80S	0.17	30% solids 90 °F / 0 psi g	1
Buried	07	SSteel 4 in / 40S	1718	30% solids 90 °F / 0 psi g	10.87
C1	07	SSteel 3 in / 40S	1	30% solids 90 °F / 0 psi g	0
C2	07	SSteel 3 in / 40S	2	30% solids 90 °F / 0 psi g	1.094
C3	07	SSteel 4 in / 40S	34	30% solids 90 °F / 0 psi g	2.92
C4	07	SSteel 3 in / 40S	3	30% solids 90 °F / 0 psi g	0.05435
C5	07	SSteel 4 in / 40S	17	30% solids 90 °F / 0 psi g	1.565
D1	08	SSteel 4 in / 80S	8.1	30% solids 90 °F / 0 psi g	0
D2	08	SSteel 4 in / 80S	29.4	30% solids 90 °F / 0 psi g	0
D3	08	SSteel 4 in / 80S	0.6	30% solids 90 °F / 0 psi g	0.6594
TN1	08	SSteel 2 in / 80S	0.5	30% solids 90 °F / 0 psi g	2.158
TN2	08	SSteel 2 in / 80S	0.5	30% solids 90 °F / 0 psi g	2.158

MATERIALS REPORT

Created: 10/15/97 10:22 am
 Design file:
 Pipe Specs: 2

Pipes: 18
 Nodes: 19
 Pumps/Comps: 2

PIPE MATERIALS LIST

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
AY1	07	SSteel 4 in / 40S	2.5	1-Elbow Long - r/d 1.5 @ 90° 1-Elbow Short - r/d 1 @ 90° 1-Reducer Contraction 4 X 3
AY2	07	SSteel 3 in / 40S	5.5	1-Elbow Long - r/d 1.5 @ 90° 1-Fixed K 1.5 1-Reducer Enlargement 4 X 3
AY3	07	SSteel 4 in / 40S	5	1-Elbow Long - r/d 1.5 @ 90° 3-Elbow Short - r/d 1 @ 90°
BN1	08	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN2	08	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
BN3	08	SSteel 4 in / 80S	0.5	1-Tee Flow Thru Branch 1-Reducer Contraction 4 X 2
BN4	08	SSteel 2 in / 80S	0.17	1-Exit Sharp-Edged
Buried	07	SSteel 4 in / 40S	1718	21-Pipe Bend r/d 10 @ 90° 2-Pipe Bend r/d 10 @ 45°
C1	07	SSteel 3 in / 40S	1	
C2	07	SSteel 3 in / 40S	2	3-Elbow Short - r/d 1 @ 90° 1-Reducer Enlargement 4 X 3
C3	07	SSteel 4 in / 40S	34	6-Elbow Short - r/d 1 @ 90° 3-Elbow Long - r/d 1.5 @ 90° 1-Elbow Long - r/d 1.5 @ 45° 1-Reducer Contraction 4 X 3
C4	07	SSteel 3 in / 40S	3	1-Reducer Enlargement 4 X 3
C5	07	SSteel 4 in / 40S	17	4-Elbow Long - r/d 1.5 @ 90° 2-Elbow Short - r/d 1 @ 90°

PIPELINE	SPEC	MATERIAL Size / Sch	LENGTH ft	VALVES & FITTINGS
D1	08	SSteel 4 in / 80S	8.1	
D2	08	SSteel 4 in / 80S	29.4	
D3	08	SSteel 4 in / 80S	0.6	2-Tee Flow Thru Run
TN1	08	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged
TN2	08	SSteel 2 in / 80S	0.5	1-Tee Flow Thru Branch 1-Exit Sharp-Edged

C-51 of C-56

PIPE MATERIAL	SCHEDULE	SIZE	LENGTH
SSteel	40S	3 in	11.5 ft
		4 in	1776.5 ft
SSteel	80S	2 in	1.34 ft
		4 in	39.1 ft

VALVE & FITTING SUMMARY

SPECIFICATION	MATERIAL	SCHEDULE	VALVES & FITTINGS
07 SL-30%-Sch40S	SSteel	40S	1-Elbow Long - r/d 1.5 @ 90°
			1-Fixed K 1.5
	Size: 3 in		3-Reducer Enlargement 4 X 3
			3-Elbow Short - r/d 1 @ 90°
	Size: 4 in		9-Elbow Long - r/d 1.5 @ 90°
			12-Elbow Short - r/d 1 @ 90°
			2-Reducer Contraction 4 X 3
			21-Pipe Bend r/d 10 @ 90°
			2-Pipe Bend r/d 10 @ 45°
			1-Elbow Long - r/d 1.5 @ 45°
08 SL-30%-Sch80S	SSteel	80S	4-Exit Sharp-Edged
			2-Tee Flow Thru Branch
	Size: 2 in		2-Tee Flow Thru Branch
	Size: 4 in		2-Reducer Contraction 4 X 2
			2-Tee Flow Thru Run

Company: Fluor Daniel Northwest
 Project: W-320
 by: K Hayase

10/27/97 12:34 pm
 System: SL-30
 rev: 10/22/97 9:53 am
 C-52 of C-52

PIPELINE REPORT

Buried rev: 10/22/97 8:58 am

PIPING MATERIAL: SSteel
 Schedule: 40S
 abs roughness: 0.0018 in
 PIPE SIZE: 4 in
 dia: 4.026 in
 LENGTH: 1718 ft
 ELEVATION in: 642.26 ft
 out: 676.05 ft

SPECIFICATION: SL-30%-Sch40S

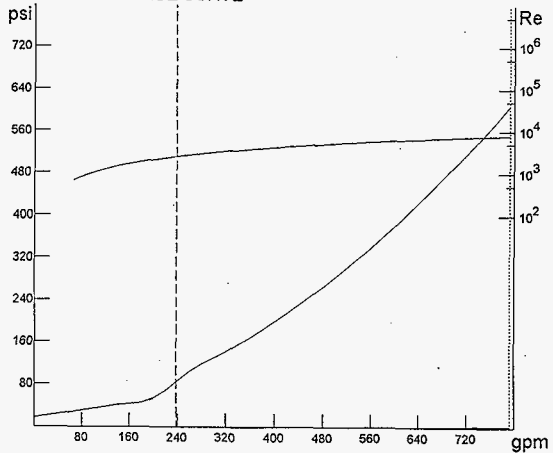
SIZING Criteria: 6 ft/sec

LIMITS Velocity: 0 to 20 ft/sec
 Pressure: -14.4 to 400 psi g

FLUID 30% solids at tmp: 90 °F
 pres: 0 psi g
 den: 74.84 lb/ft³
 vsc: 93.45 cpois

Flow gpm	ffp	Vel ft/sec	dP psi
350	.0427	8.828	161.6
0	.0000	0	17.56
66.08	.0960	1.667	28.81
132.2	.0480	3.333	40.55
198.2	.0320	5	52.77
264.3	.0467	6.667	107.1
330.4	.0435	8.333	148.2
396.5	.0411	10	195.8
462.5	.0392	11.67	249.6
528.6	.0377	13.33	309.6
594.7	.0364	15	375.6
660.8	.0354	16.67	447.4
726.9	.0345	18.33	525
792.9	.0337	20	608.2

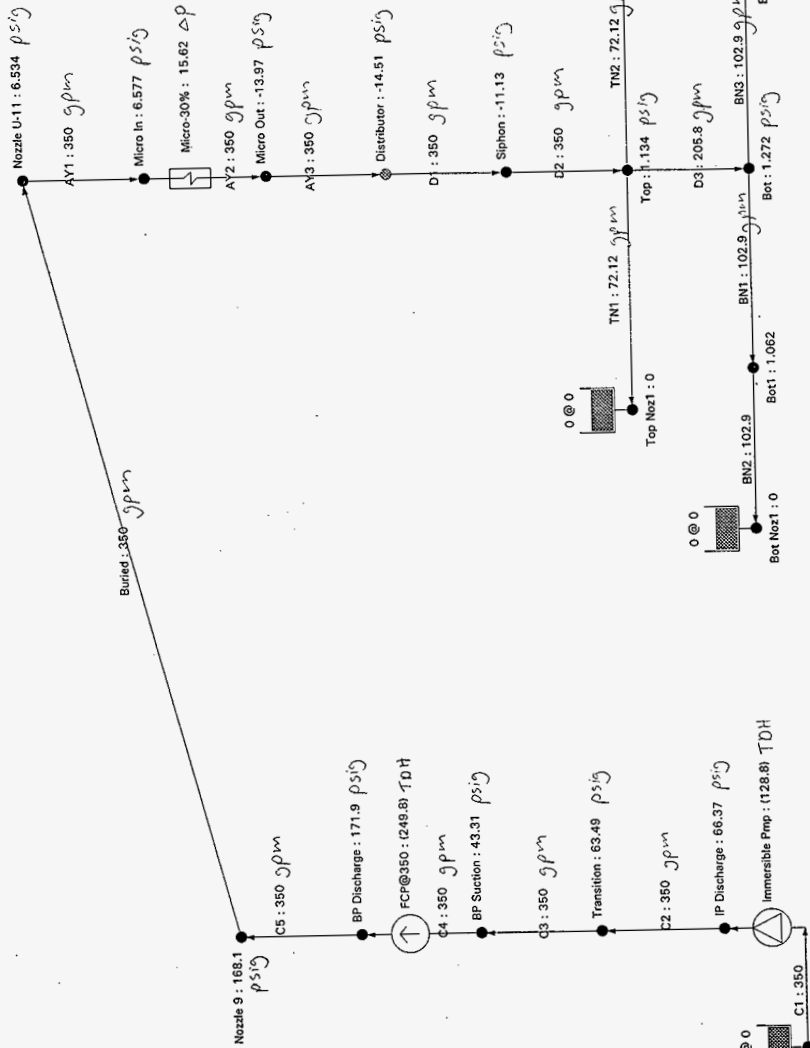
PIPELINE RESISTANCE CURVE



VALVES and FITTINGS

VALVE / FITTING	K-VALUE	VALVE / FITTING	K-VALUE
Pipe Bend r/d 10 90°	21@0.489	Pipe Bend r/d 10 45°	2@0.3027
FFT: 0.0163	TOTAL K: 10.87	Avg Percent of Total Loss: 5 %	

C-53 of C-50



HNF-2478, Rev. 0

<p>10/27/97 12:35 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>	<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>
---	---

ank 241-C-106 : 0

System: SL-30
rev: 10/22/97 9:53 am

Deviation: 0.000485 %
after: 5 iterations

Volumetric flow rates require constant fluid properties in all pipelines. Fluid properties in the first specification were used in this calculation.

LINEUP SUMMARIES

PIPELINE	FLOW gpm	PRESSURE SOURCE	SET psi g	LEVEL ft
BN2	>>> 102.9	Bot Noz1	0	0
BN4	>>> 102.9	Bot Noz2	0	0
C1	<<< 350	Tank 241-C-106	0	0
TN1	>>> 72.12	Top Noz1	0	0
TN2	>>> 72.12	Top Noz2	0	0

Flows IN: 350 gpm
Flows OUT: 350 gpm
NET FLOWS: 0 gpm

LINEUP NODES

10/27/97 12:35 pm

C-55 of C-58

NODE	ELEVATION ft	DEMAND gpm	PRESSURE psi g	H GRADE ft
Bot	635.49		1.272	637.9
Bot Noz1	635.49		0 (source)	635.5
Bot Noz2	635.49		0 (source)	635.5
Bot1	635.49		1.062	637.5
Bot2	635.49		1.062	637.5
BP Discharge	639.42		171.9	970.5
BP Suction	639.11		43.31	722.5
Distributor	673.59		-14.51 ***	645.7
IP Discharge	608.5		66.37	736.3
Micro In	674.77		6.577	687.4
Micro Out	674.77		-13.97	647.9
Nozzle 9	642.26		168.1	965.9
Nozzle U-11	676.05		6.534	688.6
Siphon	665.49		-11.13	644.1
Tank 241-C-106	608		0 (source)	608
Top	636.14		1.134	638.3
Top Noz1	636.14		0 (source)	636.1
Top Noz2	636.14		0 (source)	636.1
Transition	609		63.49	731.2

LINEUP PIPELINES

10/27/97 12:35 pm

C-56 of C-52

PIPELINE	FROM	TO	FLOW gpm	VEL ft/sec	dP psi g	HL ft
AY1	Nozzle U-11	Micro In	350	8.828	(0.043)	1.197
AY2	Micro In	Micro Out	350	15.2	20.55	39.55
	---- Micro-30% ---- dP: 15.62 HL: 30.07					
AY3	Micro Out	Distributor	350	8.828	0.544	2.227
BN1	Bot	Bot1	102.9	2.873	0.210	0.403
BN2	Bot1	Bot Noz1	102.9	11.19	1.062	2.045
BN3	Bot	Bot2	102.9	2.873	0.210	0.403
BN4	Bot2	Bot Noz2	102.9	11.19	1.062	2.045
Buried	Nozzle 9	Nozzle U-11	350	8.828	161.6	277.3
C1	Tank 241-C-106	IP Discharge	350	15.2	(66.37)	(128.3)
	---- Immersible Pmp ---- dP: (66.91) HL: (128.8)					
C2	IP Discharge	Transition	350	15.2	2.872	5.028
C3	Transition	BP Suction	350	8.828	20.19	8.758
C4	BP Suction	BP Discharge	350	15.2	1.124	1.854
	---- FCP@350 ---- dP: (129.8) HL: (249.8)					
C5	BP Discharge	Nozzle 9	350	8.828	3.816	4.506
D1	Distributor	Siphon	350	9.775	(3.385)	1.583
D2	Siphon	Top	350	9.775	(12.26)	5.744
D3	Top	Bot	205.8	5.746	(0.137)	0.386
TN1	Top	Top Noz1	72.12	7.842	1.134	2.184
TN2	Top	Top Noz2	72.12	7.842	1.134	2.184

DESIGN ANALYSIS

Client: Numatec

Subject: Slurry/Supernate Hydraulic Analysis

Location: 241-C/241-AY

WO/Job No.: E09141/W-320

Date:

Checked: 3/5/98

Revised:

By: Kelly Hayase

By: *K. Hayase*

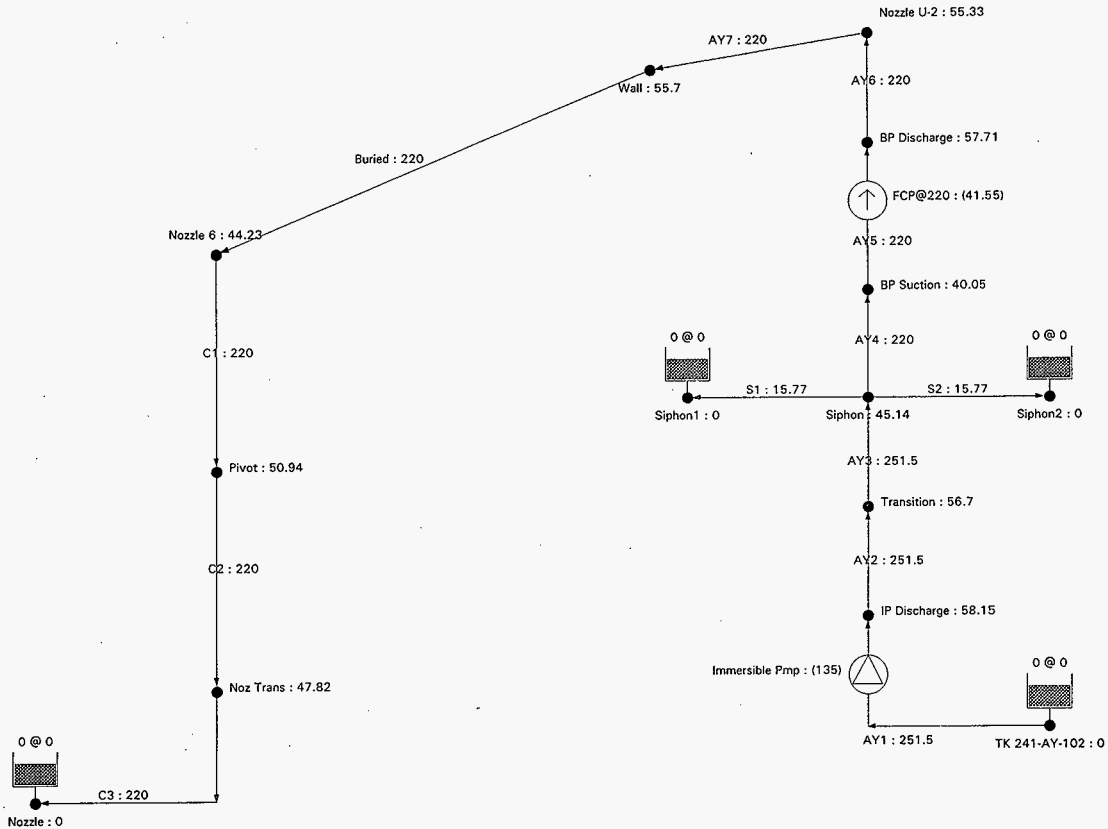
By:

APPENDIX D

Pipe-Flo Results (for system curves) SN-00
Pipe-Flo Results (for system curves) SN-05
Pipe-Flo Results (for system curves) SN-10

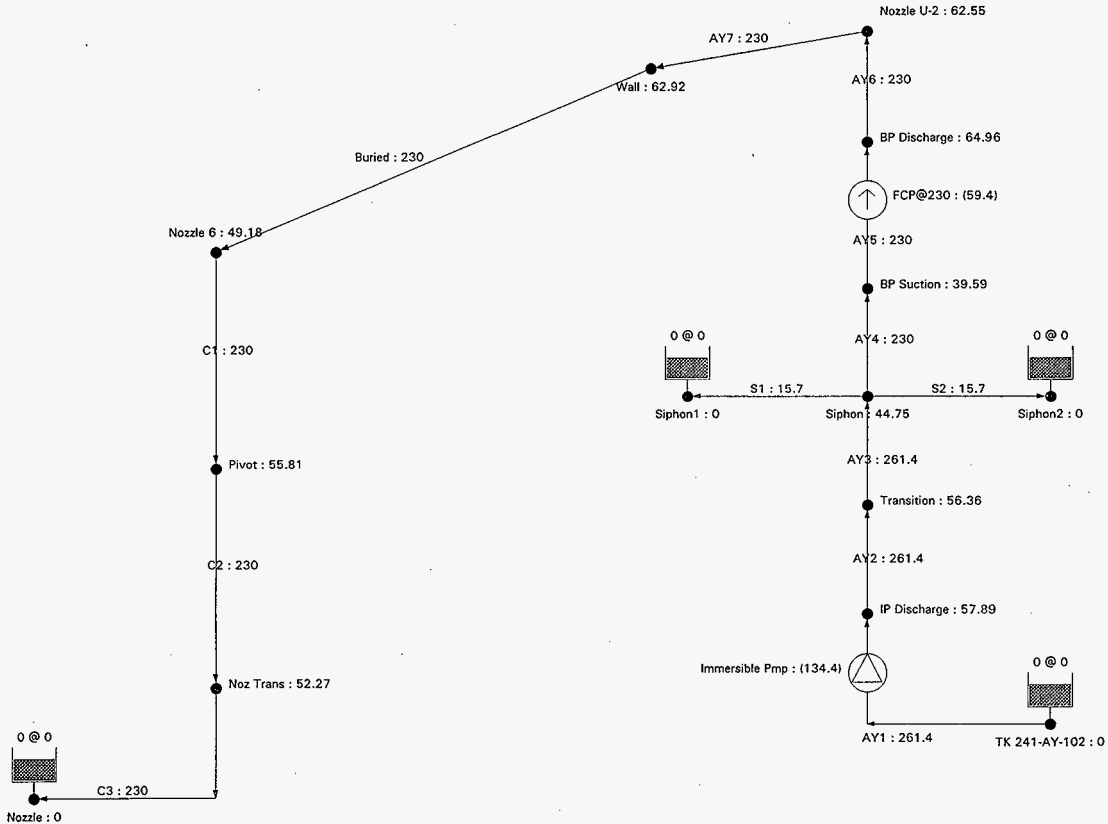
Page D-1
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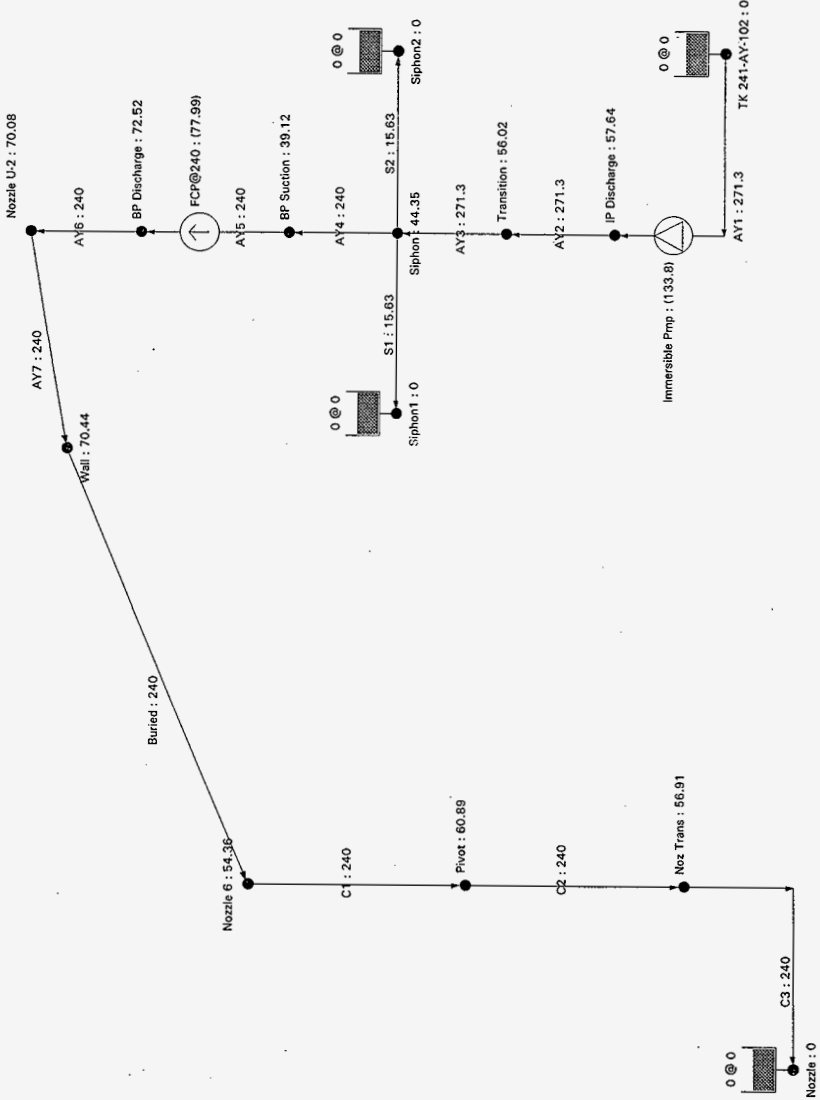
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Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



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Company: Fluor Daniel Northwest	10/27/97 12:47 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

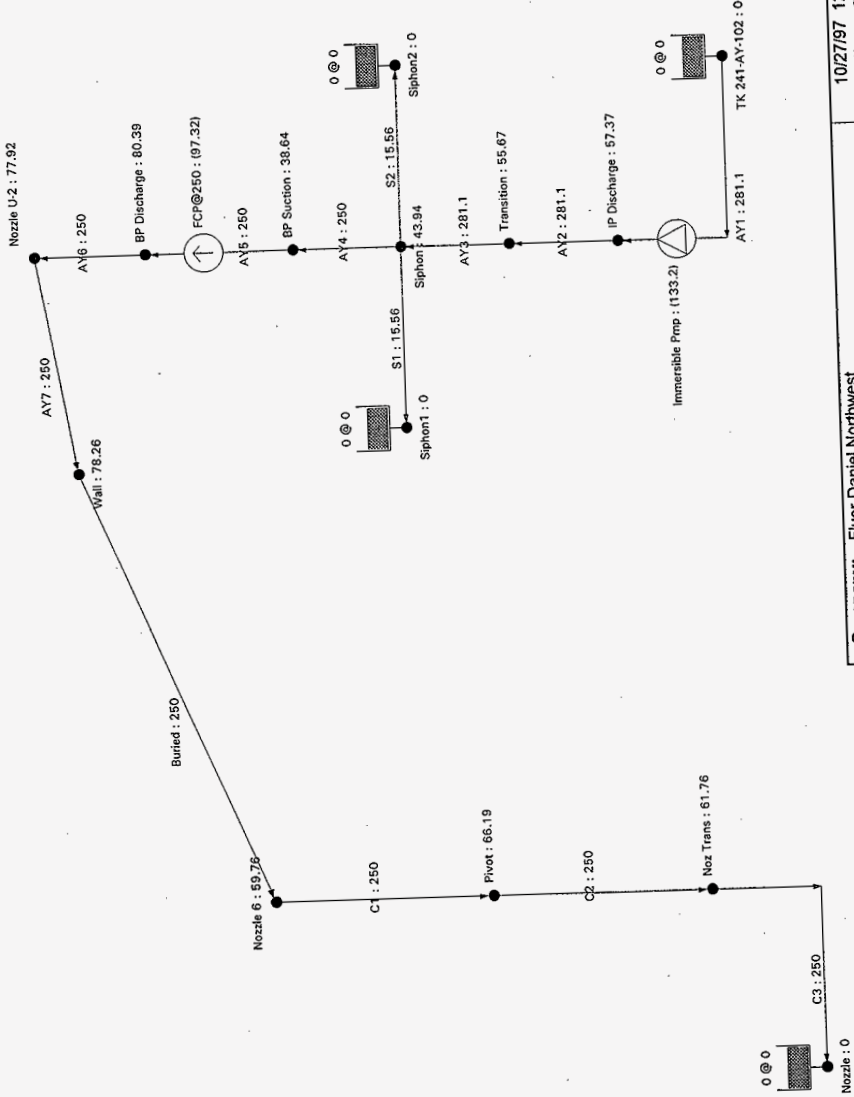
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Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01

10/27/97 12:47 pm
Linelist: SN-00
Lineup: SN-00
flow rate: gpm
pressure: psig
level & grade: ft

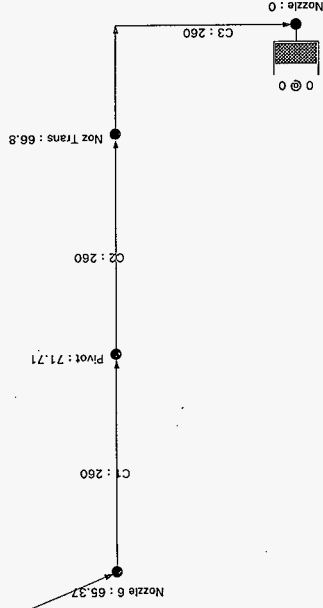
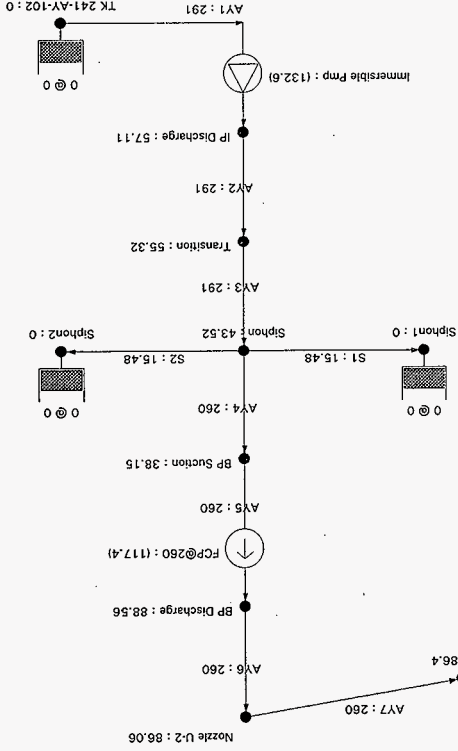
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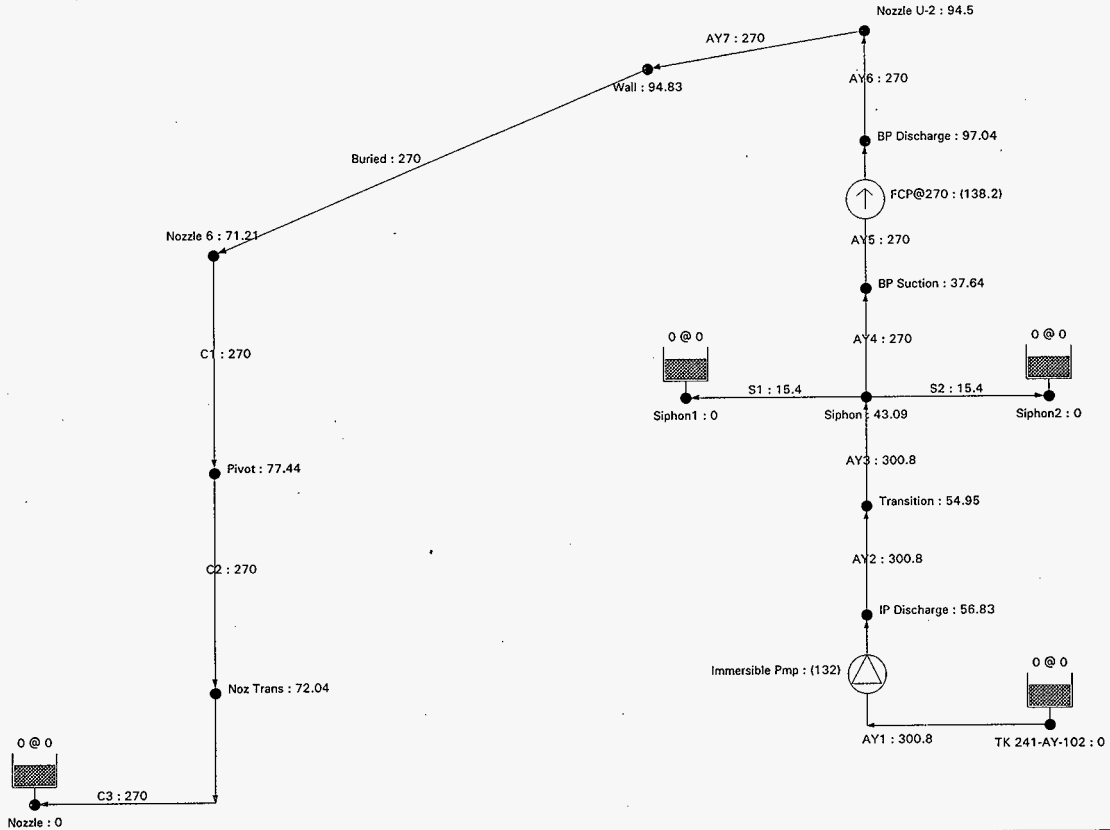


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 12:48 pm Linelist: SN-00 Lineup: SN-00 flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	

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Company: Fluor Daniel Northwest	Project: W-320
by: K Hayase	Comments: Calculation W320-Z7-048
Version: PIPE-FLOW ver 5.01	
Level & grade: ft	
pressure: psig	
flow rate: gpm	
Lineup: SN-00	
Linelist: SN-00	
10/27/97 12:48 pm	

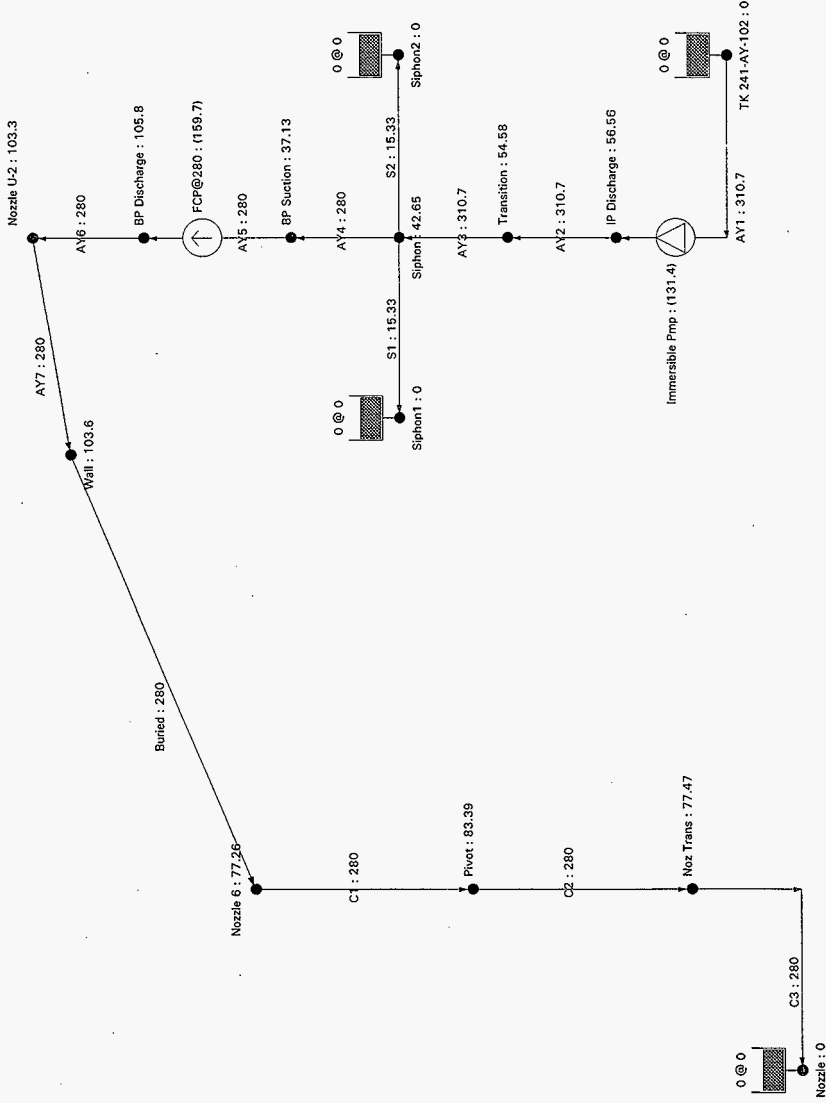




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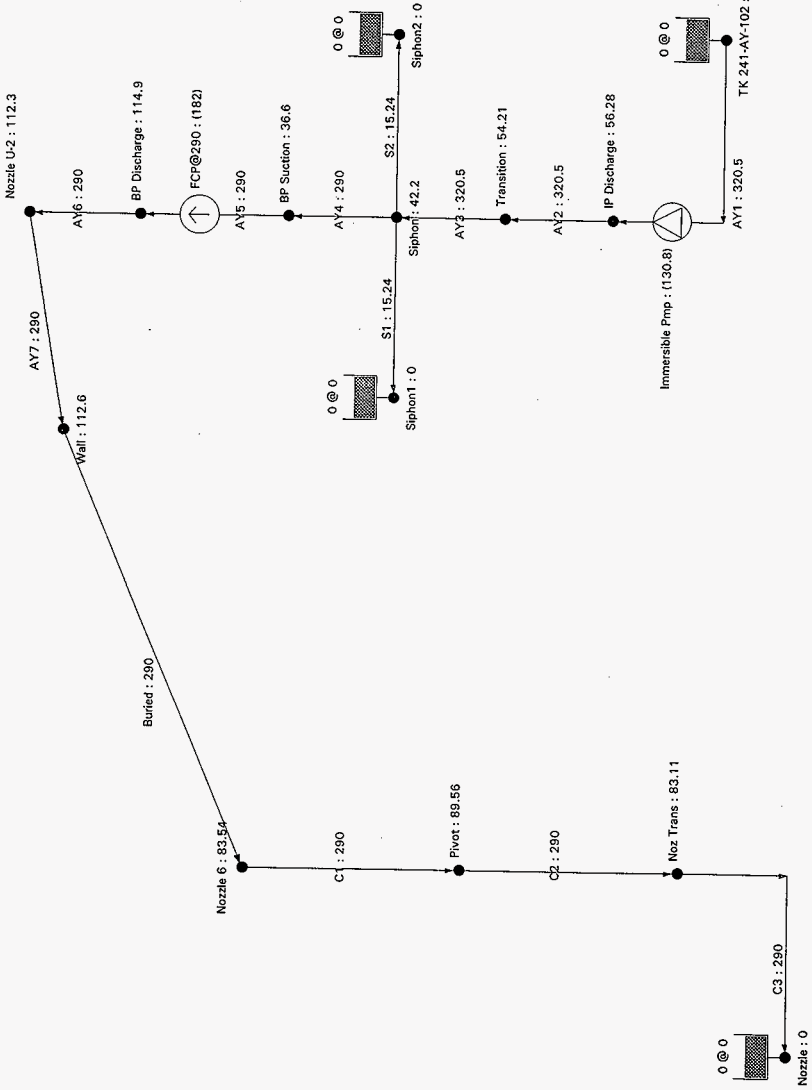
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Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psi _g
	level & grade: ft

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 12:48 pm Linelist: SN-00 Lineup: SN-00 flow rate: gpm pressure: psig level & grade: ft</p>
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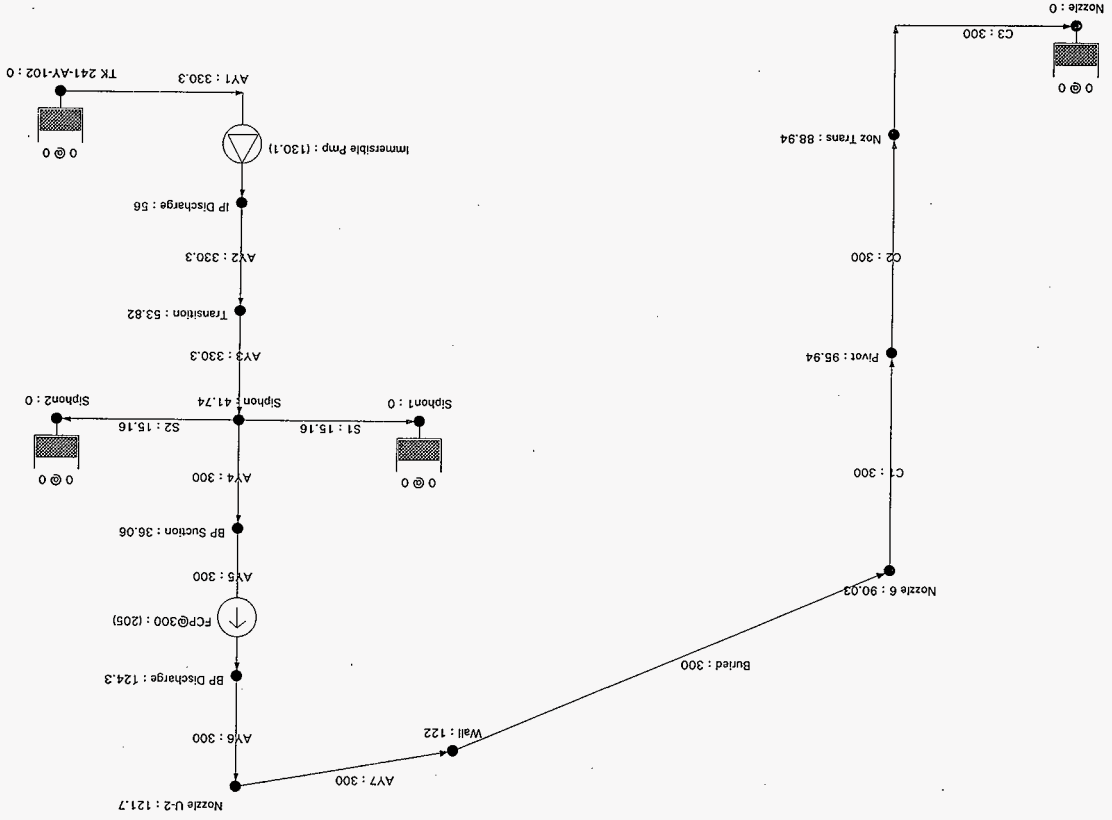


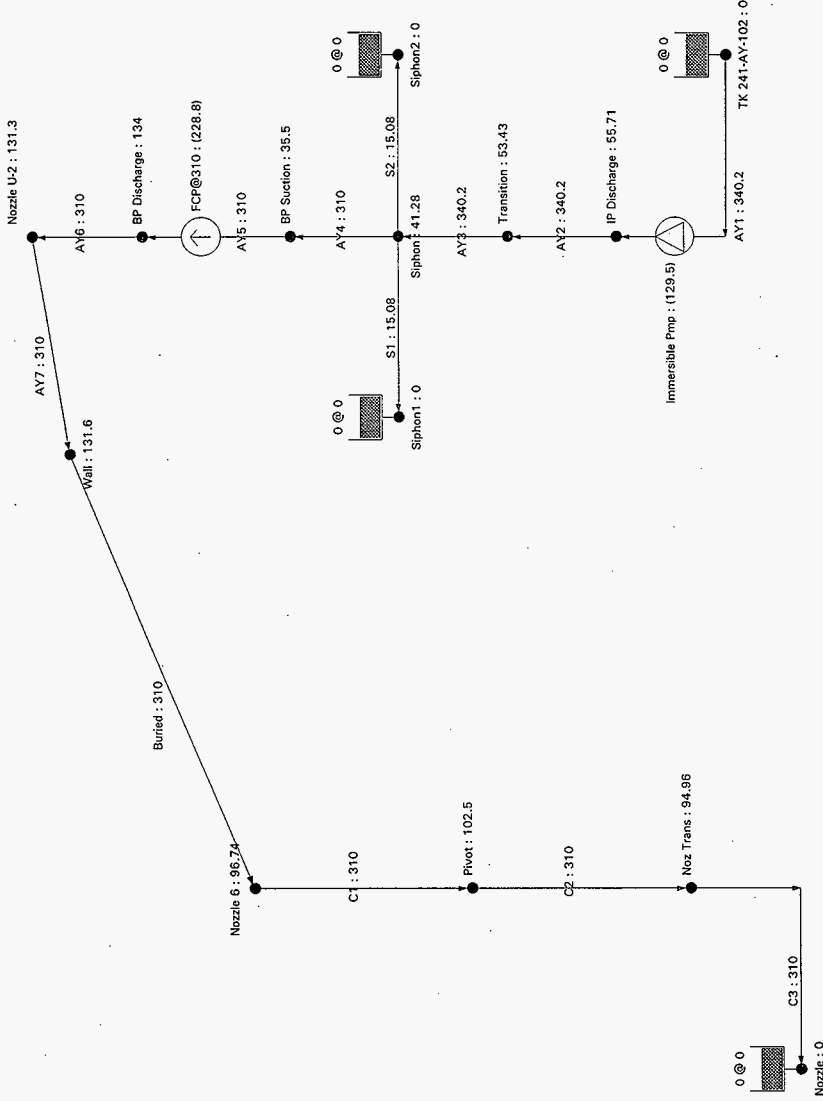
Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01

10/27/97 12:48 pm
LineList: SN-00
Lineup: SN-00
flow rate: gpm
pressure: psig
level & grade: ft

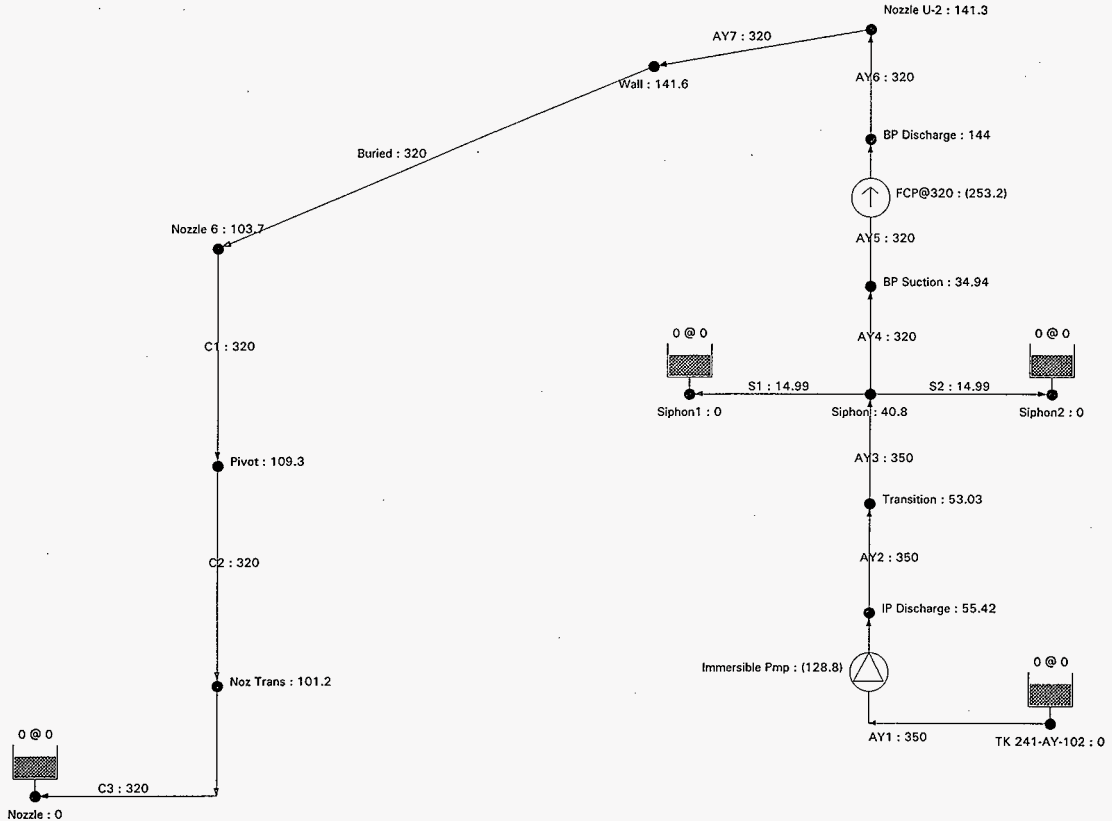
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Company: Fluor Daniel Northwest	Project: W-320
by: K Hayase	Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01	level & grade: ft
Lineup: SN-00	flow rate: gpm
Lineists: SN-00	pressure: psfg
10/27/97 12:49 pm	





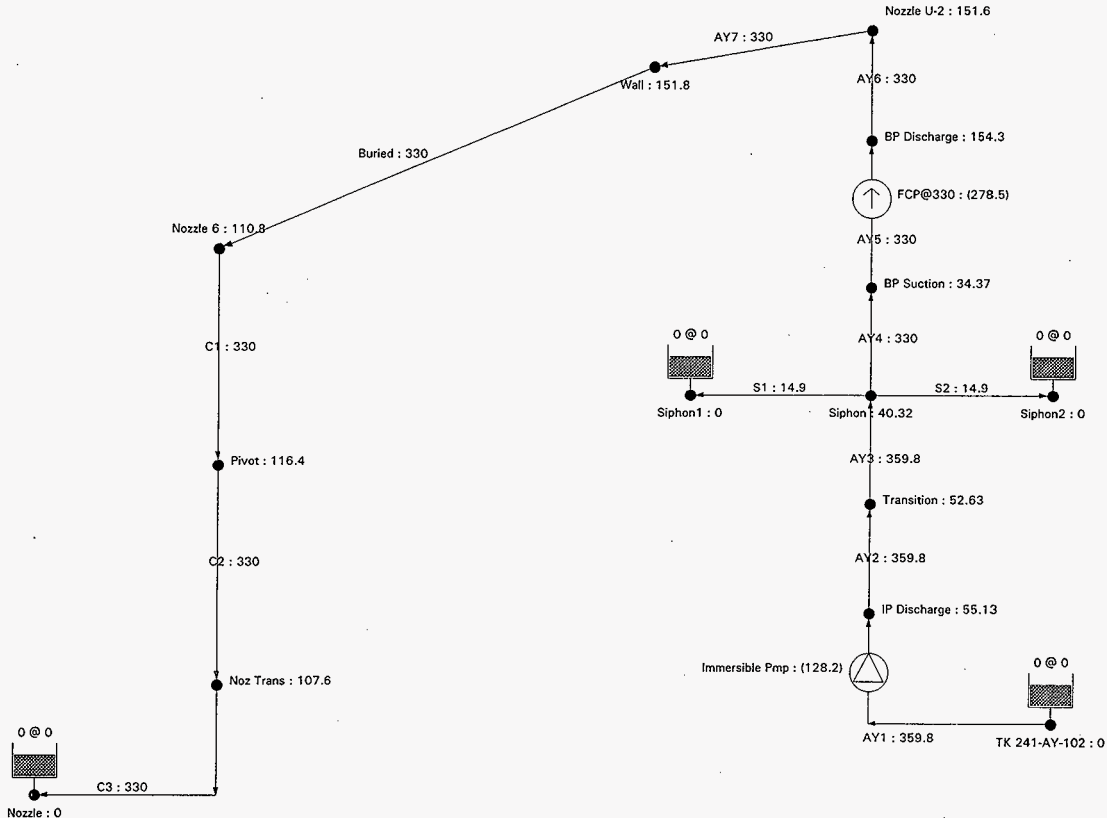
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Company: Fluor Daniel Northwest	10/27/97 12:49 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

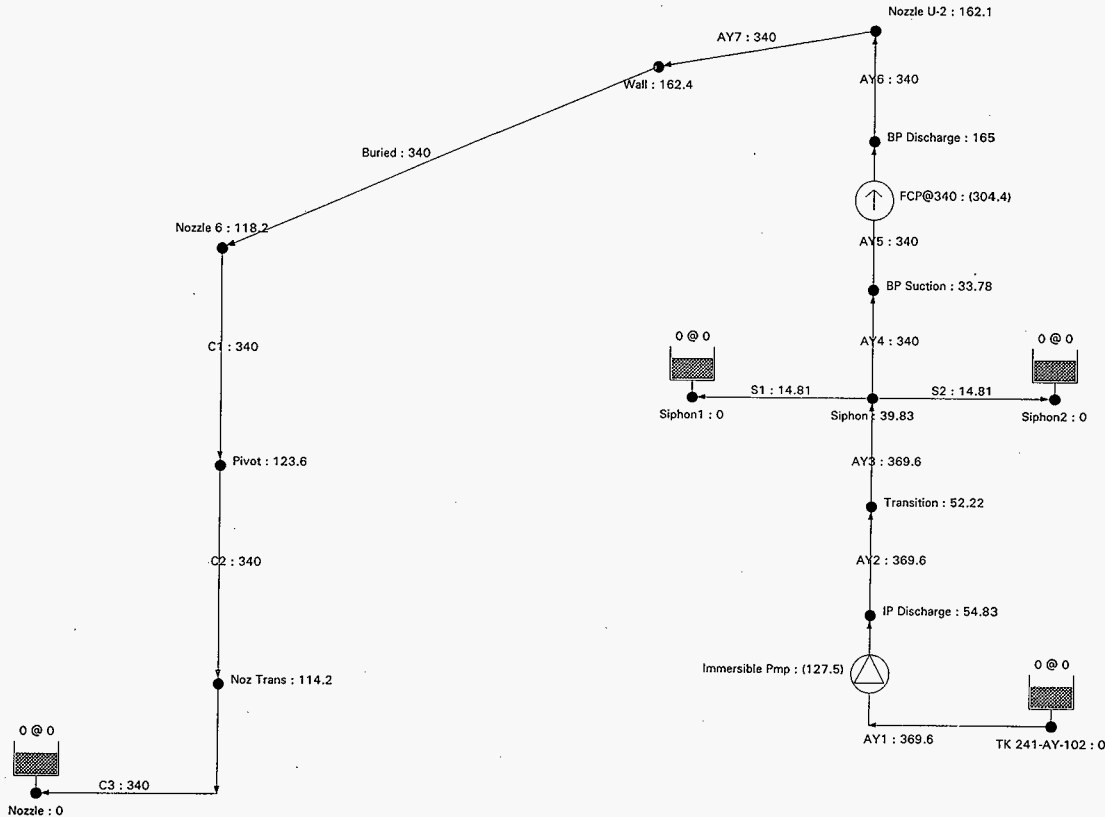
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Company: Fluor Daniel Northwest	10/27/97 12:50 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psi _g
	level & grade: ft

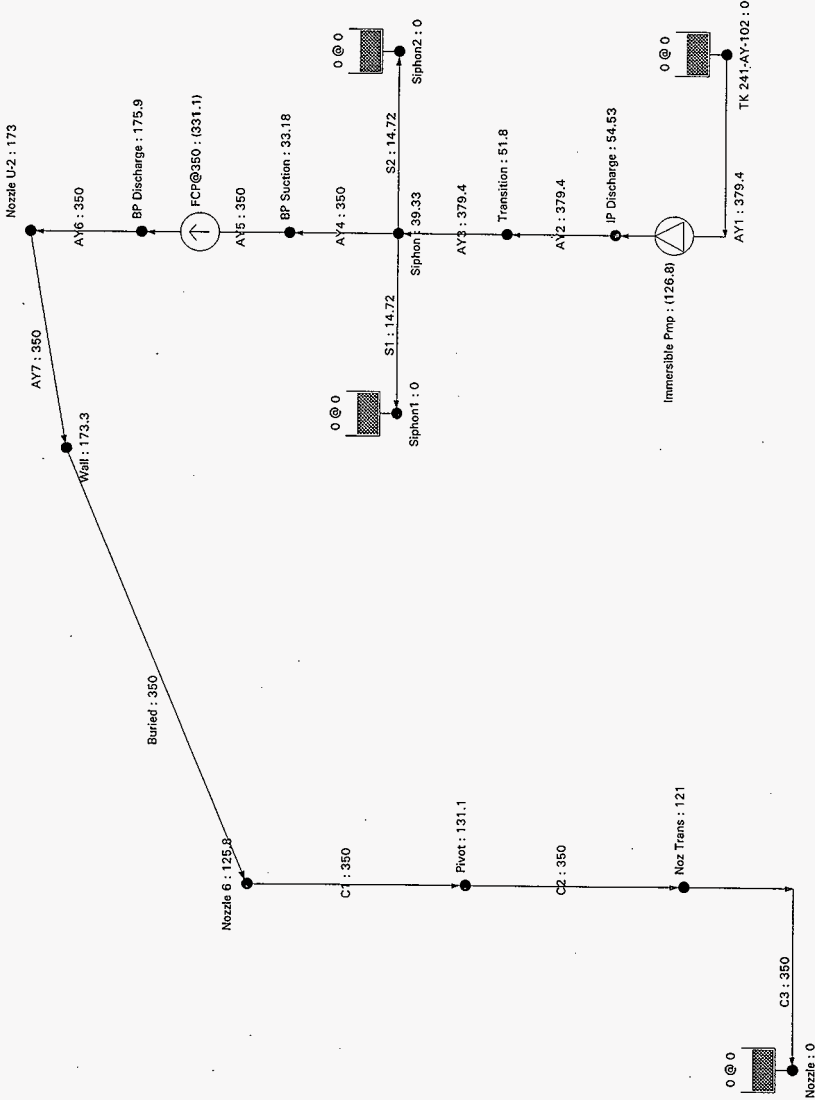
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Company: Fluor Daniel Northwest	10/27/97 12:50 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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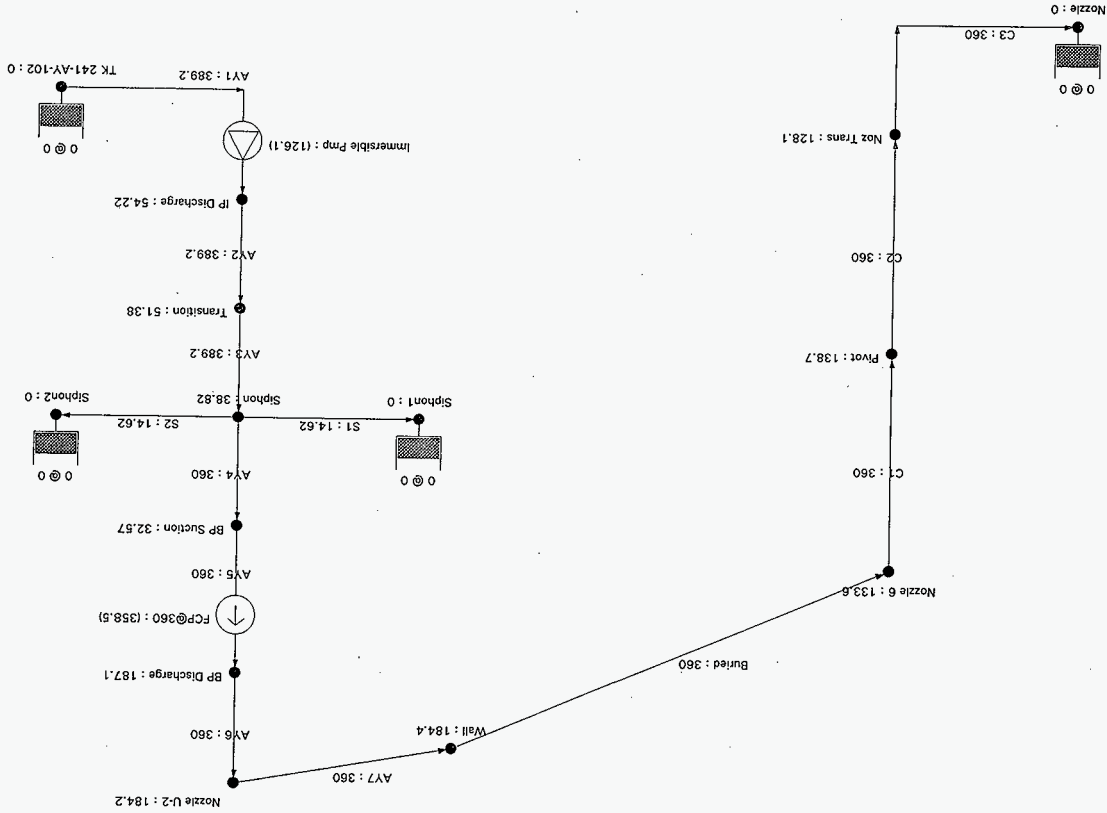


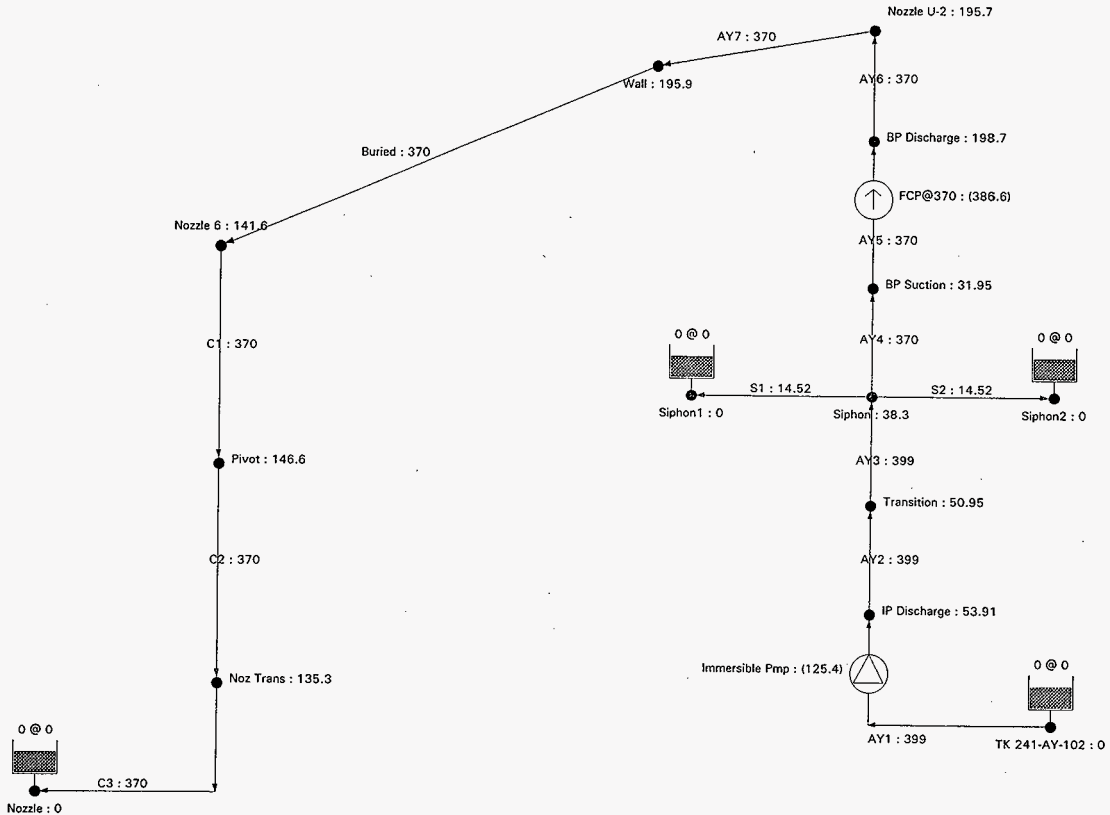
Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01

10/27/97 12:50 pm
Linelist: SN-00
Lineup: SN-00
flow rate: gpm
pressure: psig
level & grade: ft

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Version: PIPE-FLO ver 5.01	level & grade: ft
Comments: Calculation W320-Z7-048	pressure: psig
by: K Hayase	flow rate: gpm
Project: W-320	Lineup: SN-00
Company: Fluor Daniel Northwest	LineList: SN-00
	10/27/97 12:50 pm

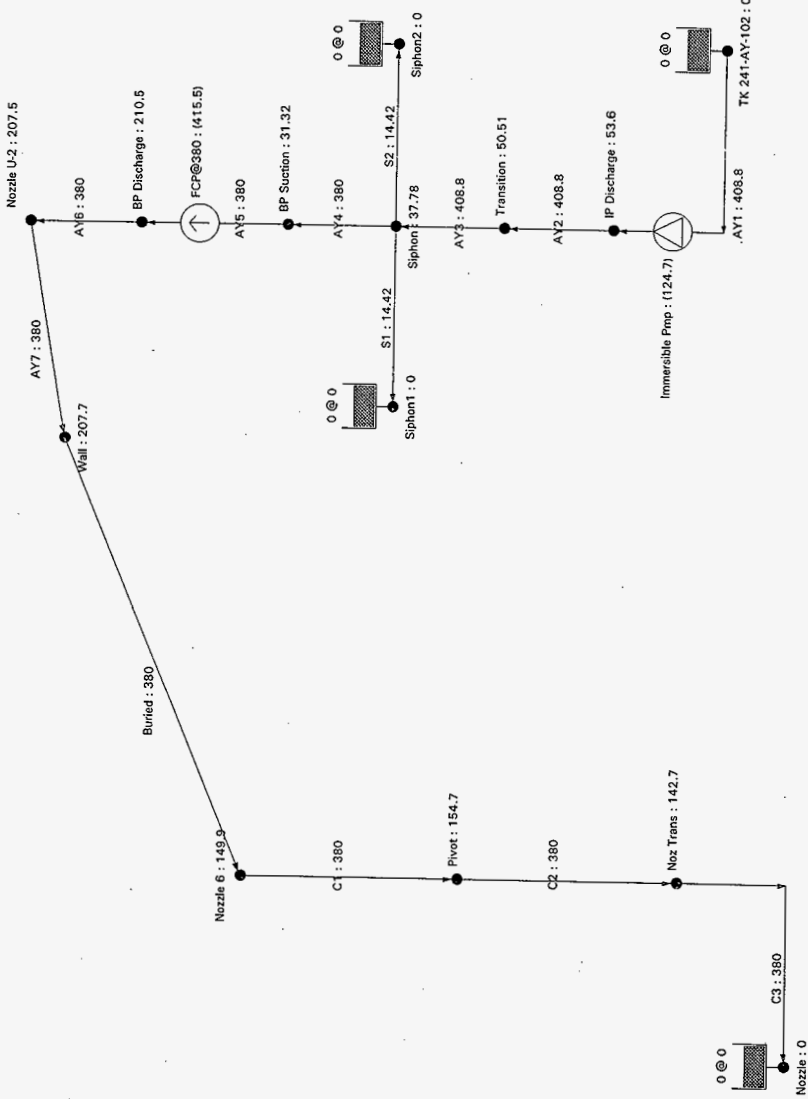




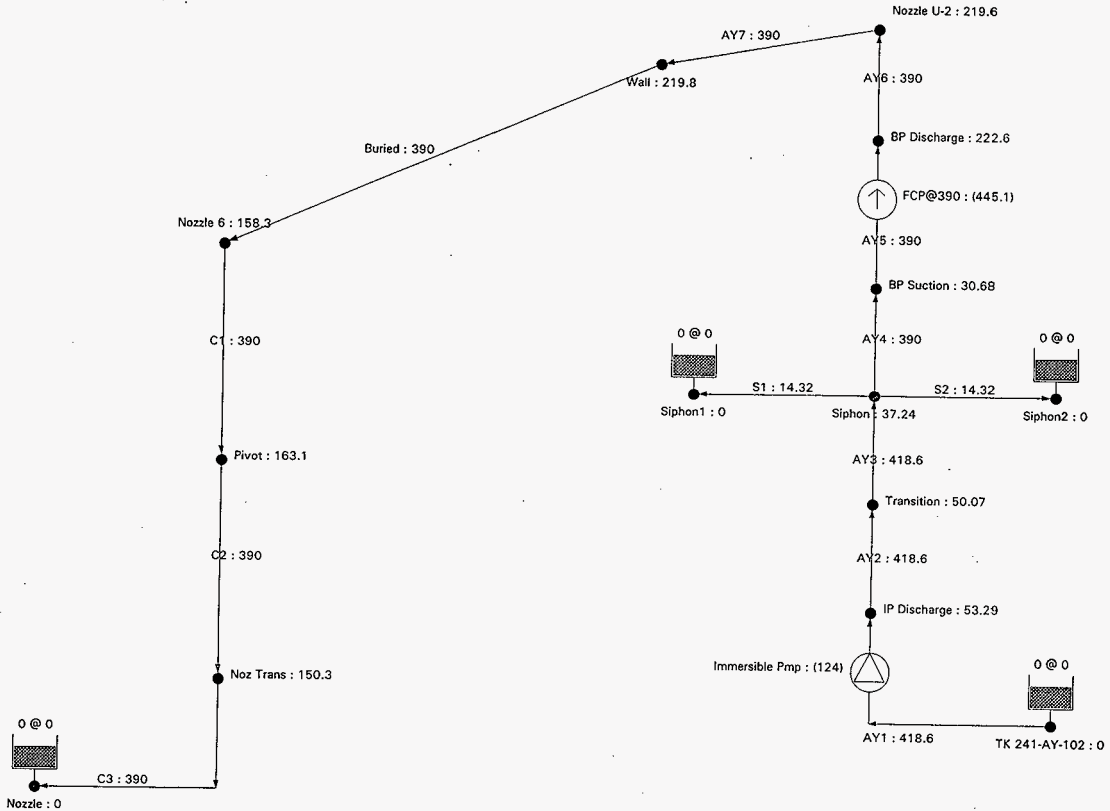
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Company: Fluor Daniel Northwest	10/27/97 12:50 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

D-17.0-72



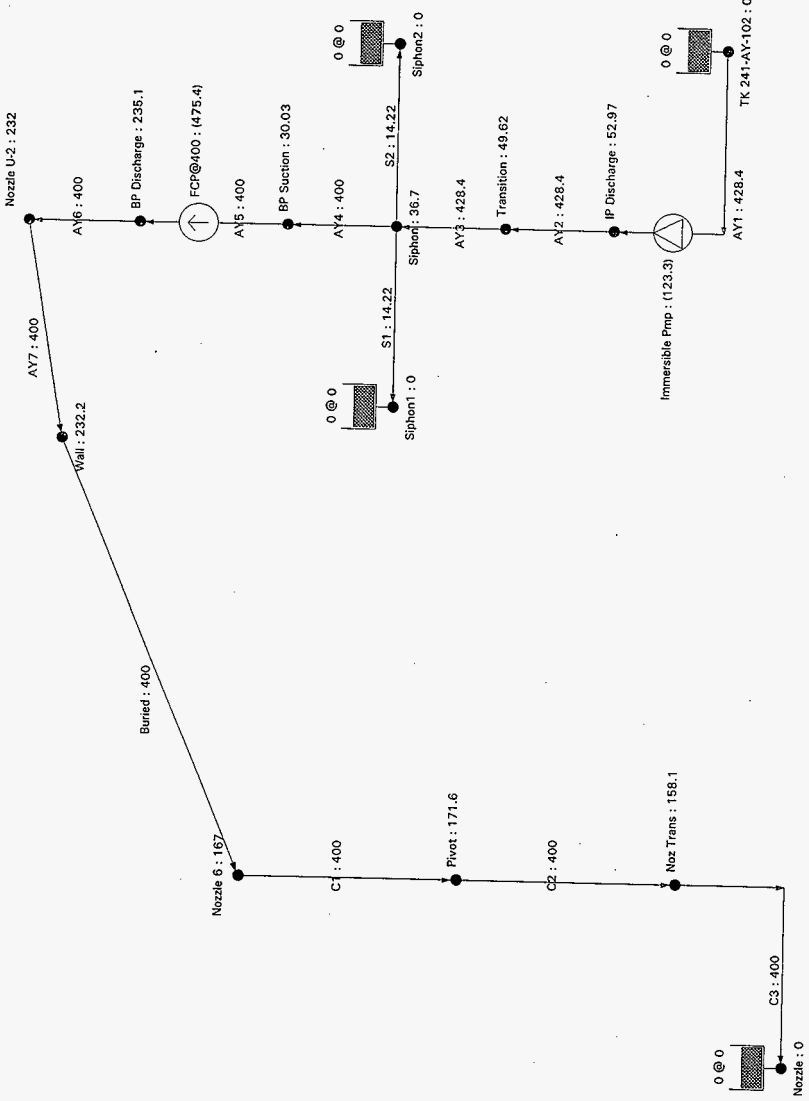
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 12:51 pm Linelist: SN-00 Lineup: SN-00 flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	



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Company: Fluor Daniel Northwest	10/27/97 12:51 pm
Project: W-320	Linelist: SN-00
by: K Hayase	Lineup: SN-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

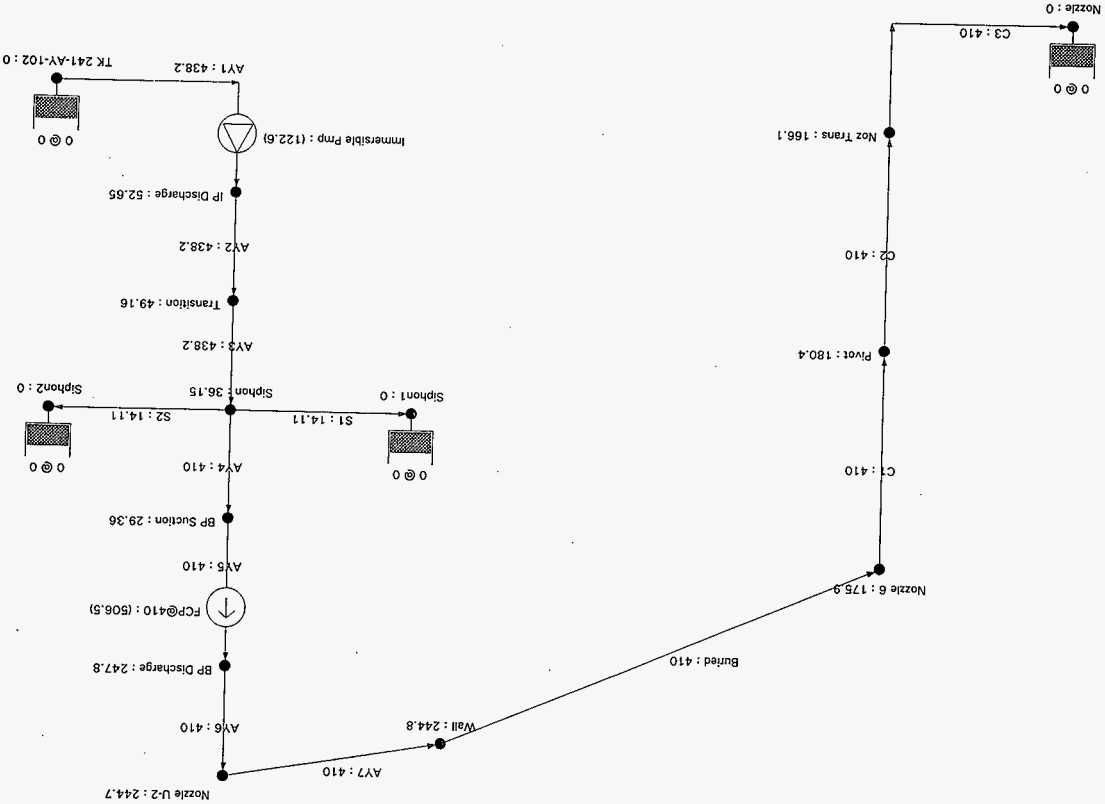
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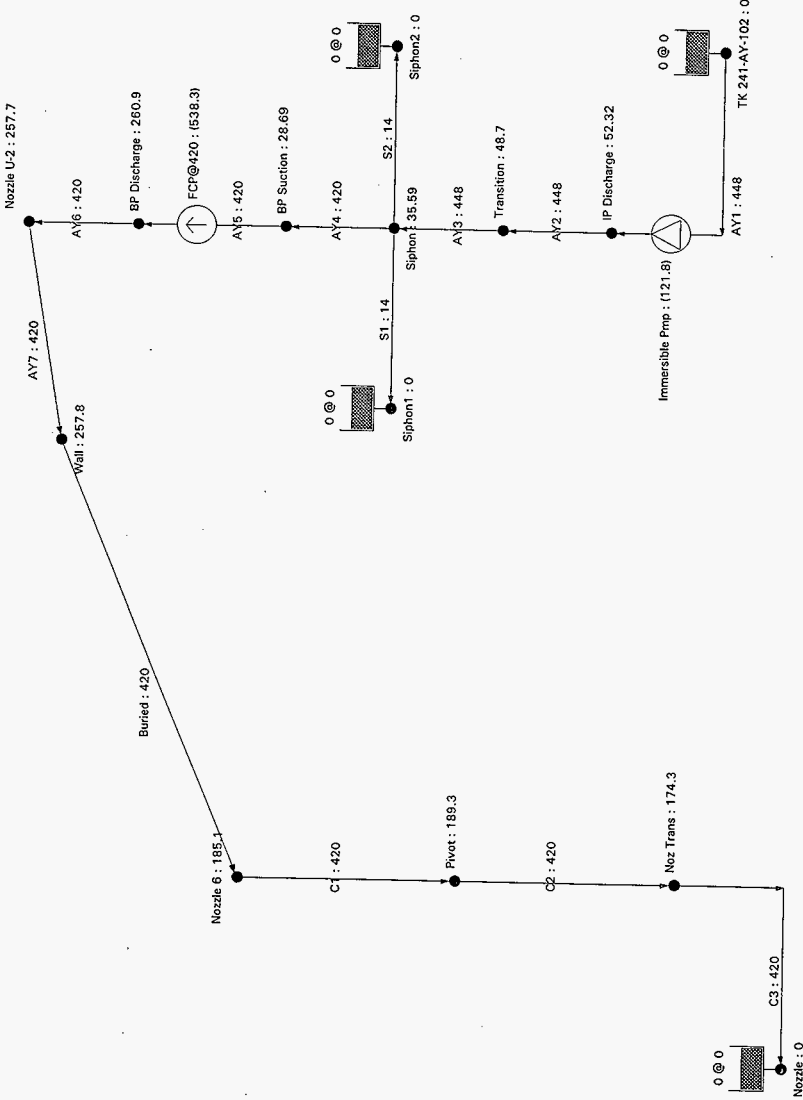
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Company: Fluor Daniel Northwest	Project: W-320	Lineist: SN-00	10/27/97 12:51 pm
by: K Hayase	Comments: Calculation W320-27-048	Lineup: SN-00	
Version: PIPE-FLO ver 5.01		flow rate: gpm	level & grade: ft
		pressure: psig	

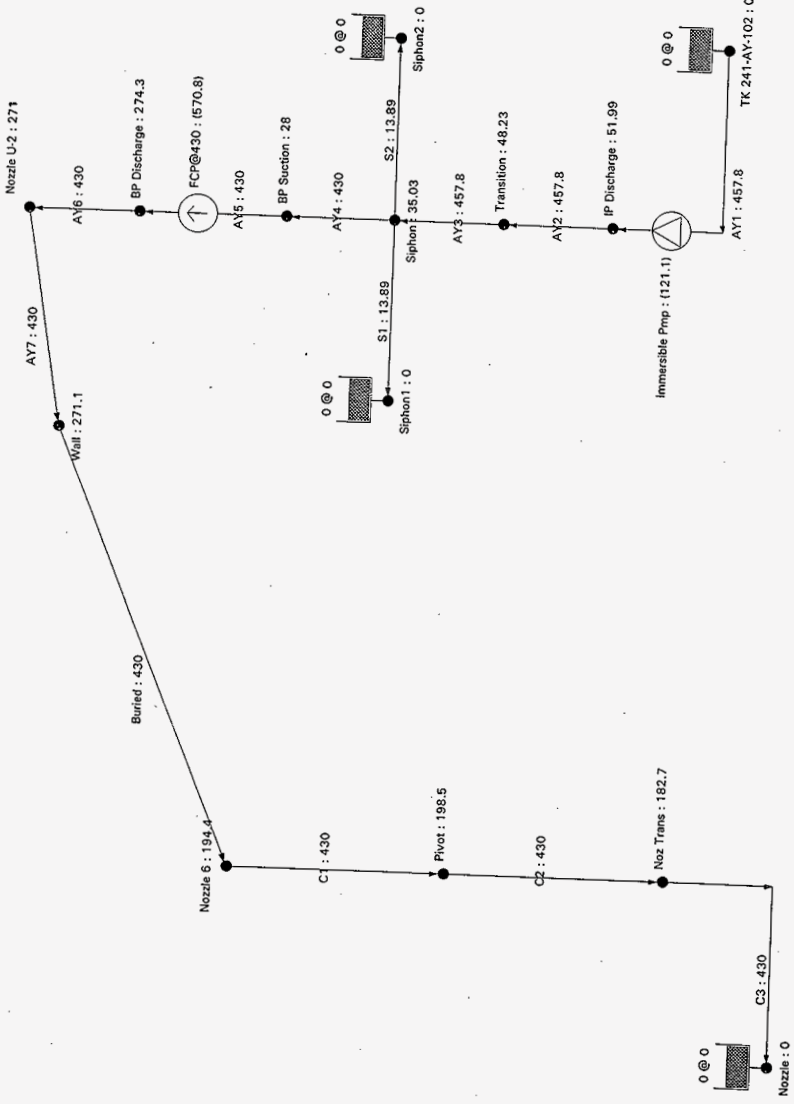


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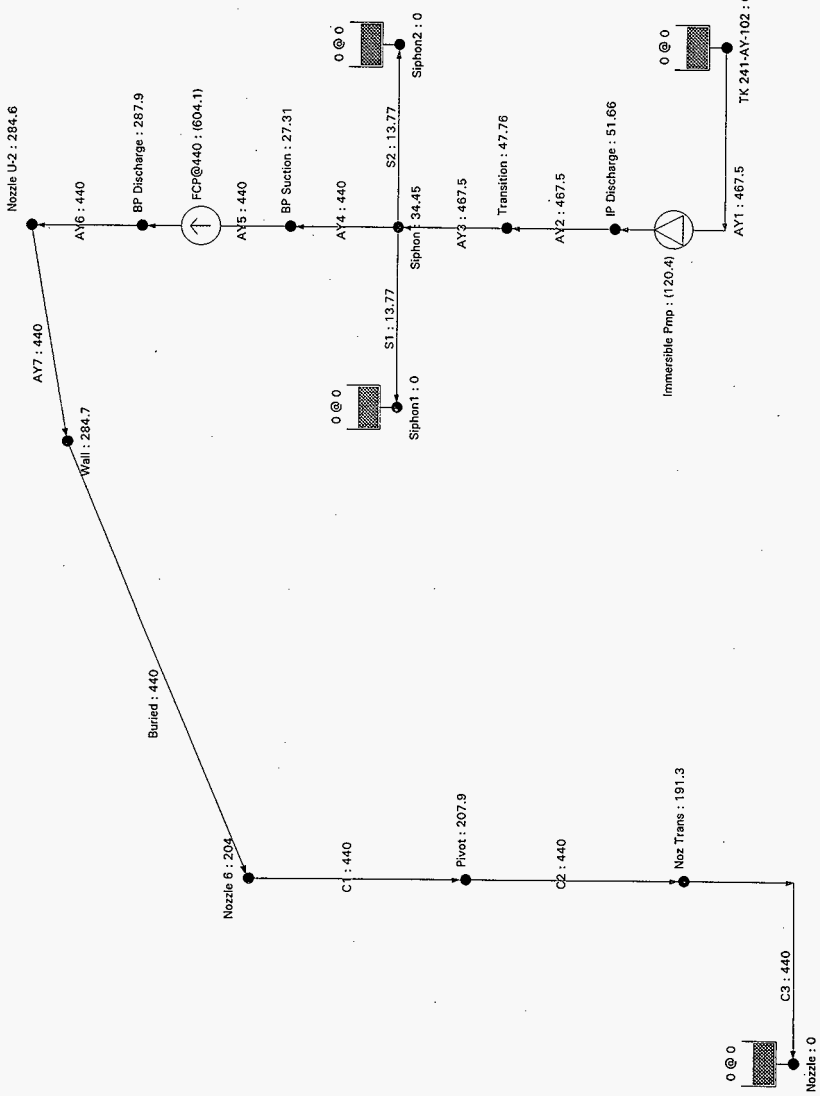
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<p>Version: PIPE-FLO ver 5.01</p>	

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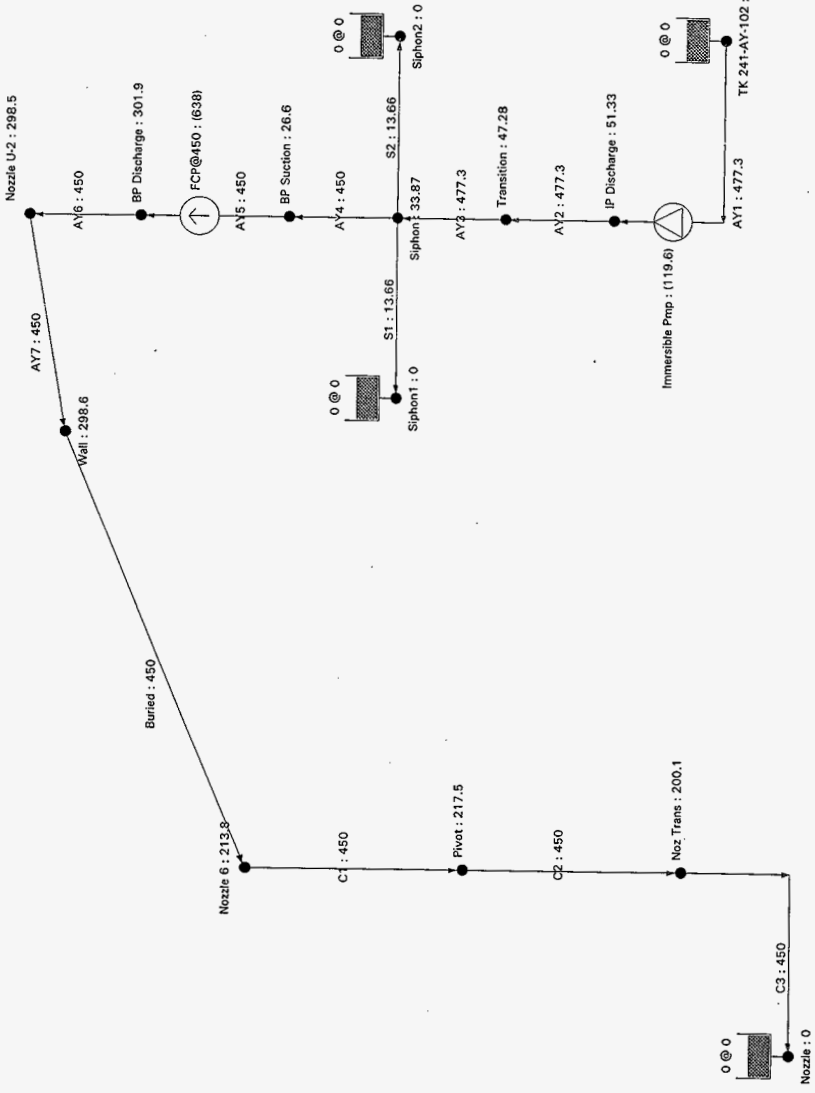
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D-23-fD-72



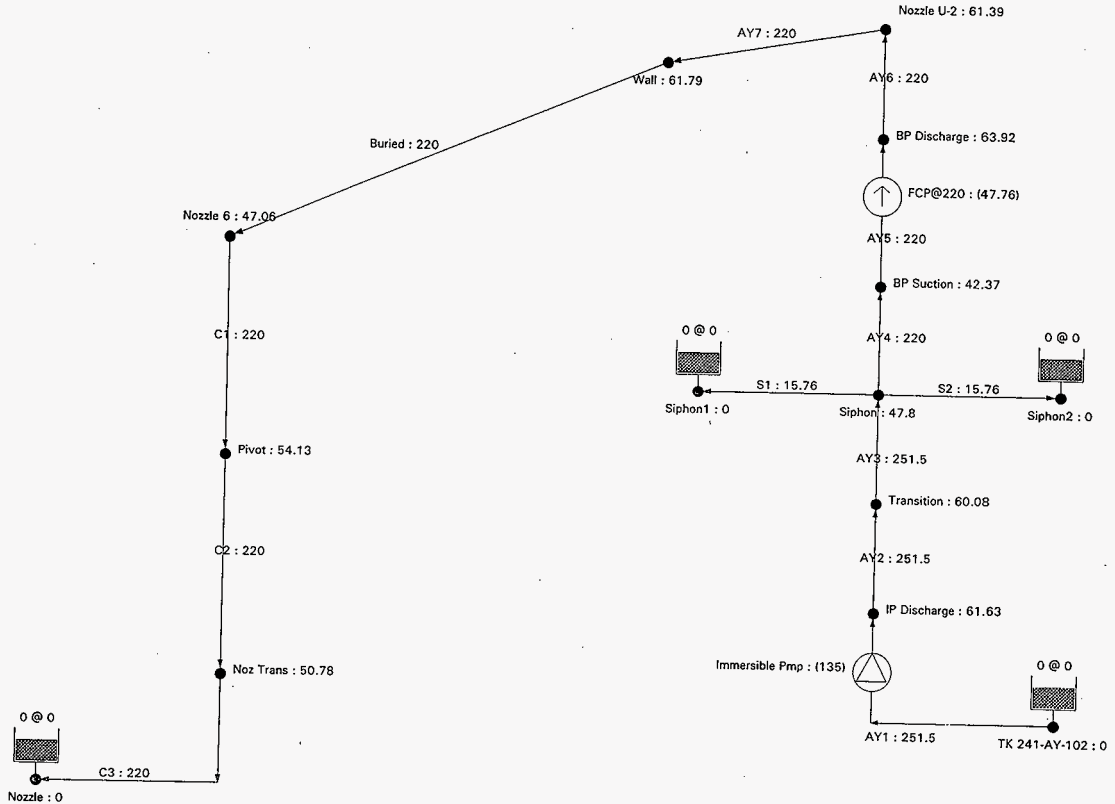
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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 12:57 pm Linelist: SN-00 Lineup: SN-00 flow rate: gpm pressure: psig level & grade: ft</p>
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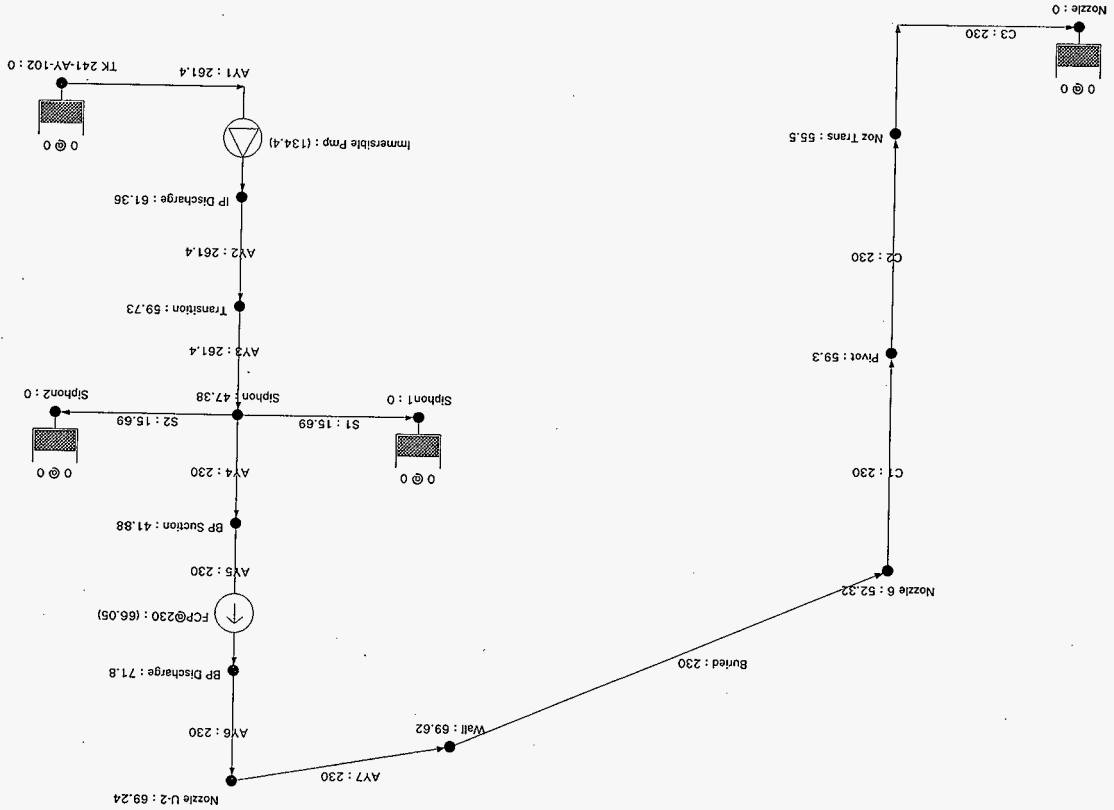


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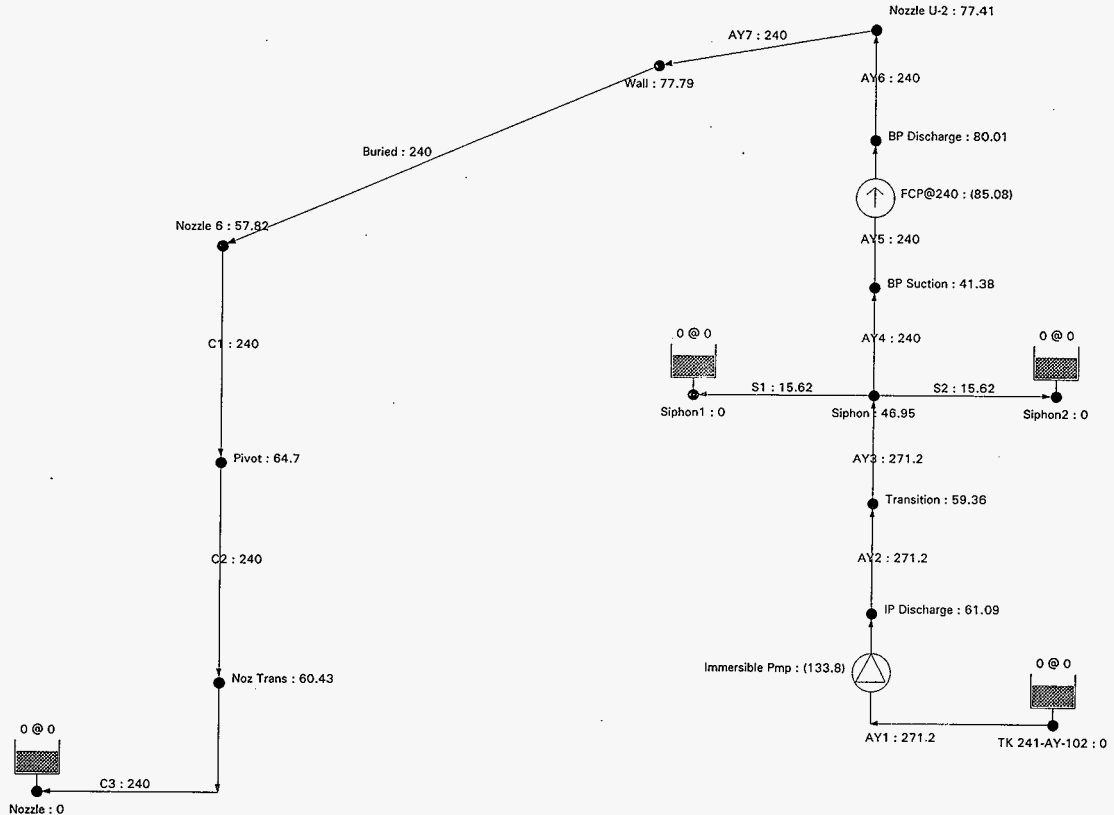
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Project: W-320	Lineist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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Company: Fluor Daniel Northwest	Version: PIPE-FLOW ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SN-05	
Line list: SN-05	
10/27/97 1:01 pm	
level & grade: ft	
pressure: psig	
flow rate: gpm	



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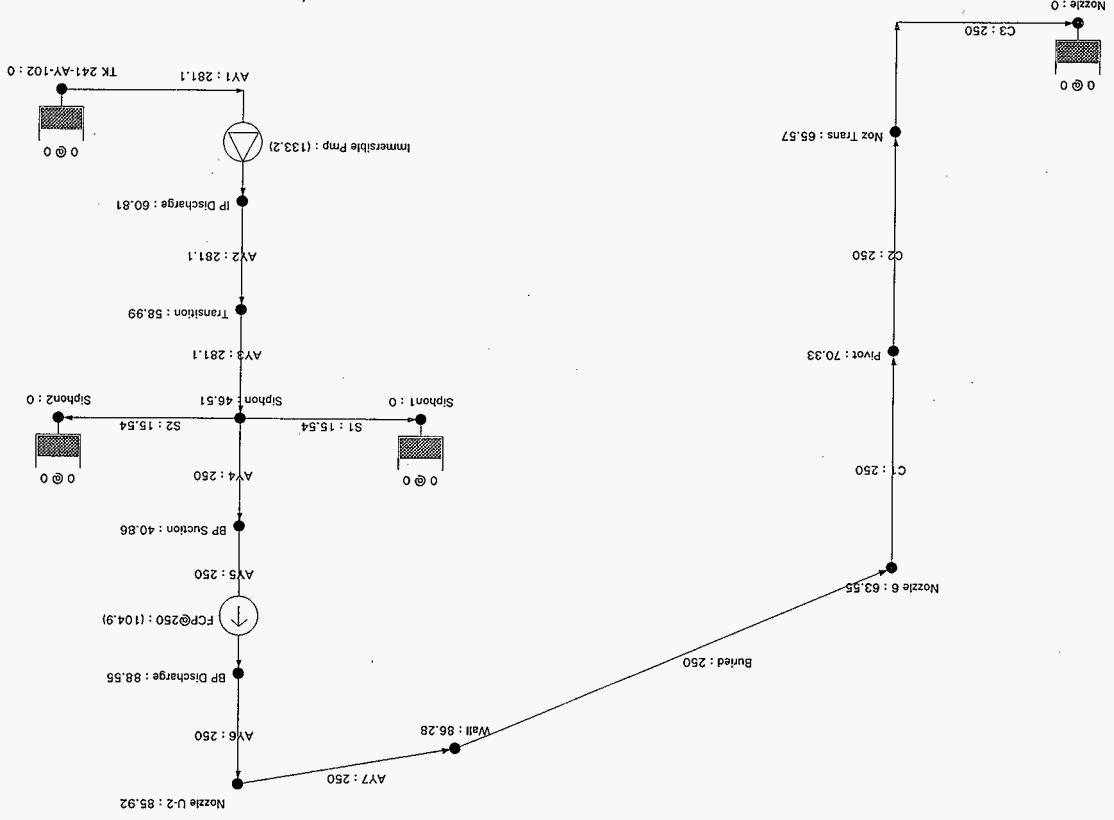


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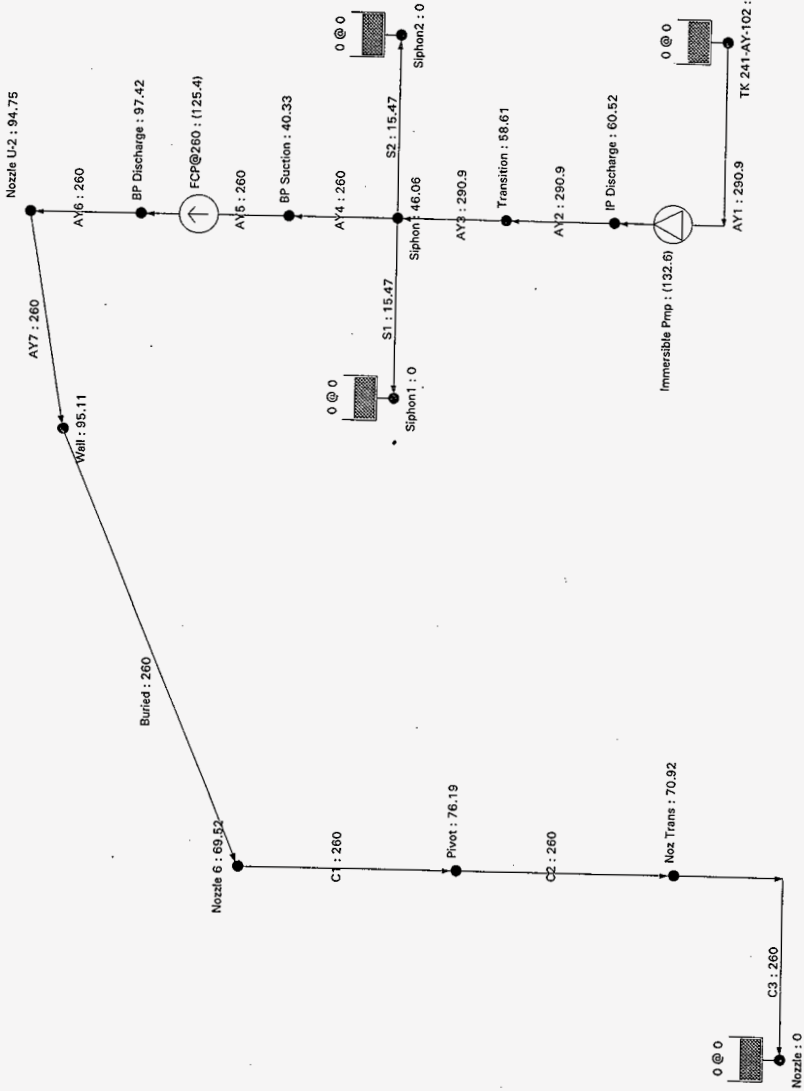
Company: Fluor Daniel Northwest	10/27/97 1:01 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

Company: Fluor Daniel Northwest	Project: W-320	Linefist: SN-05	10/27/97 1:01 pm
by: K Hayase	Comments: Calculation W320-Z7-048	Flow rate: gpm	pressure: psfg
Version: PIPE-FLO ver 5.01		level & grade: ft	

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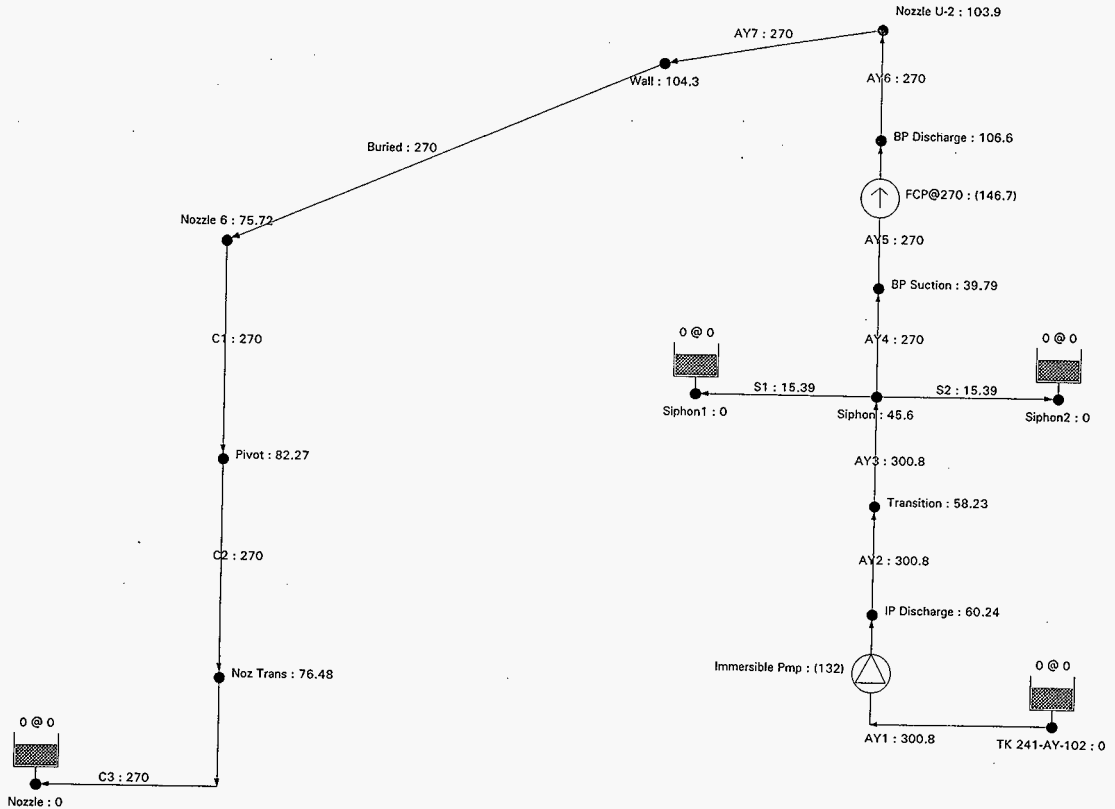
D-29.08 D-72



Company: Fluor Daniel Northwest
 Project: W-320
 by: K Hayase
 Comments: Calculation W320-27-048
 Version: PIPE-FLO ver 5.01

10/27/97 1:01 pm
 Linelist: SN-05
 Lineup: SN-05
 flow rate: gpm
 pressure: psig
 level & grade: ft

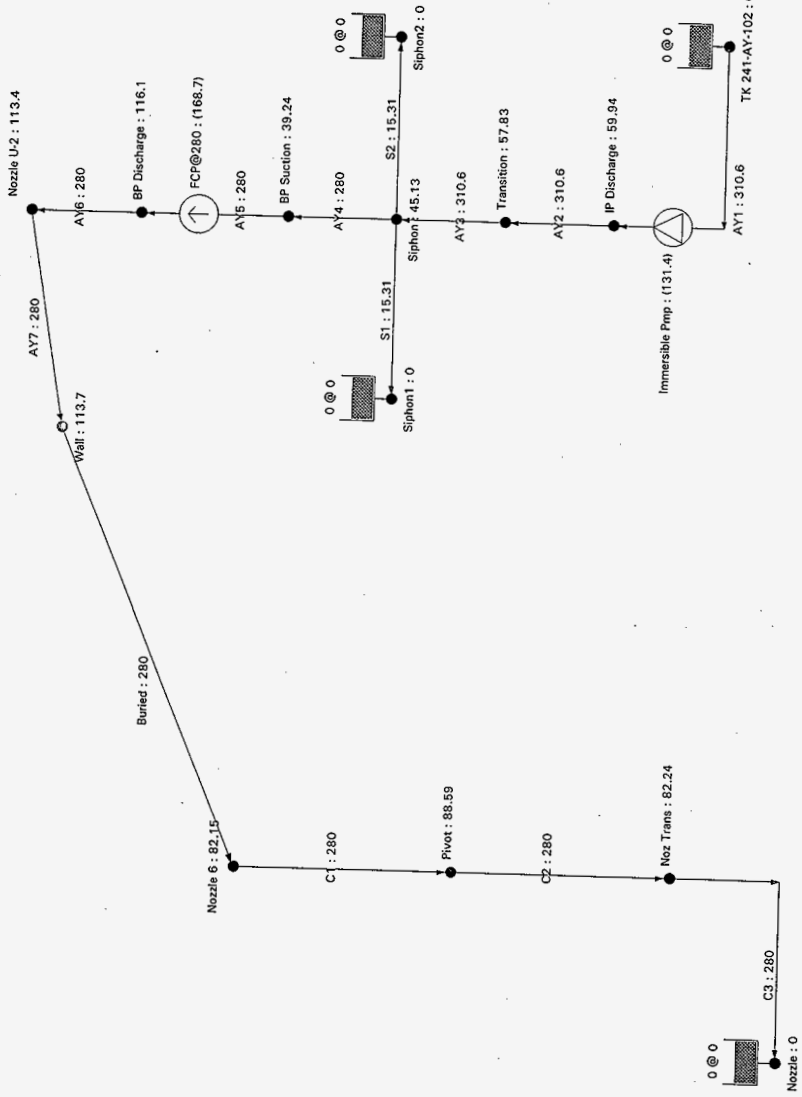
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D-30-FD-72

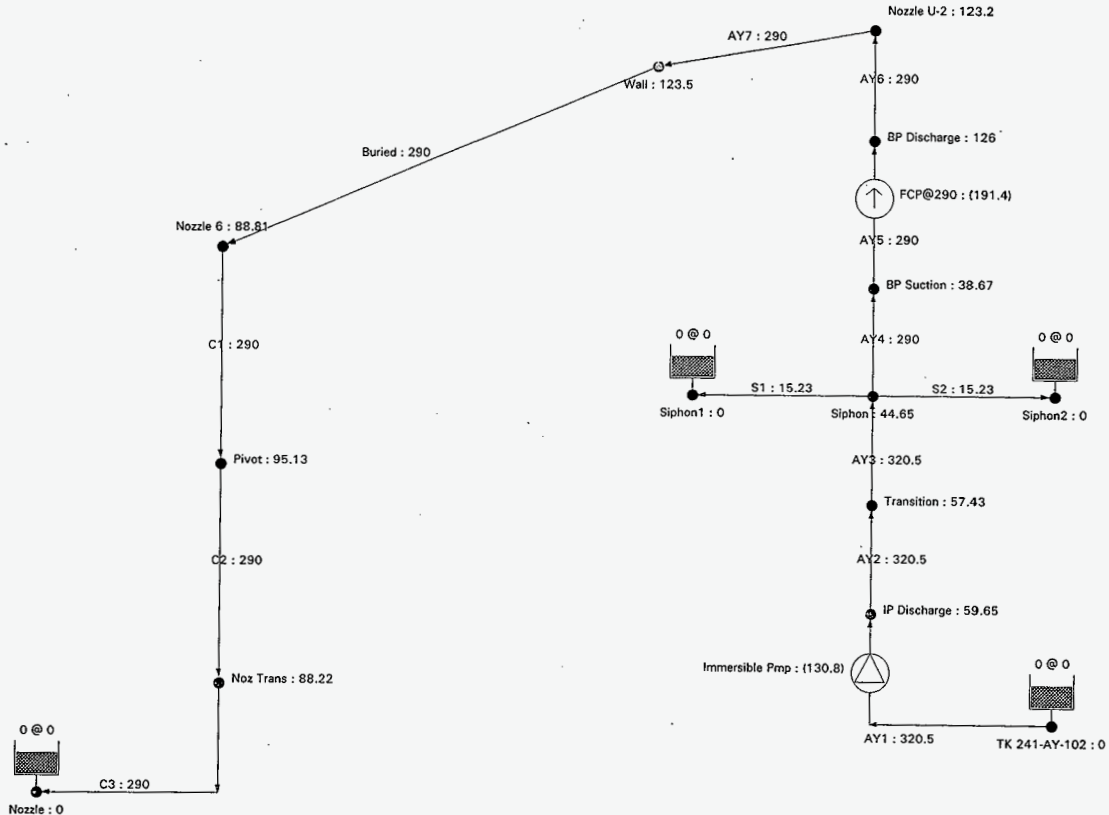
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Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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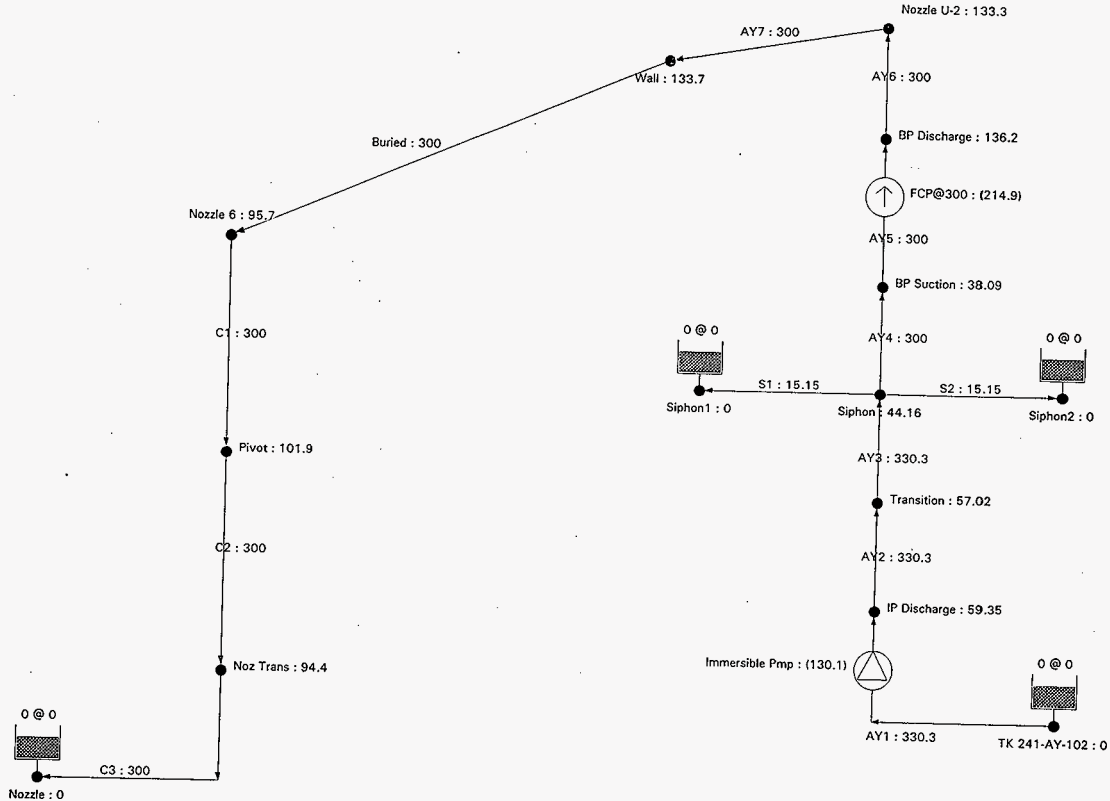
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<p>Version: PIPE-FLO ver 5.01</p>	

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Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01	10/27/97 1:02 pm
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	Lineup: SN-05
	flow rate: gpm
	pressure: psi _g
	level & grade: ft

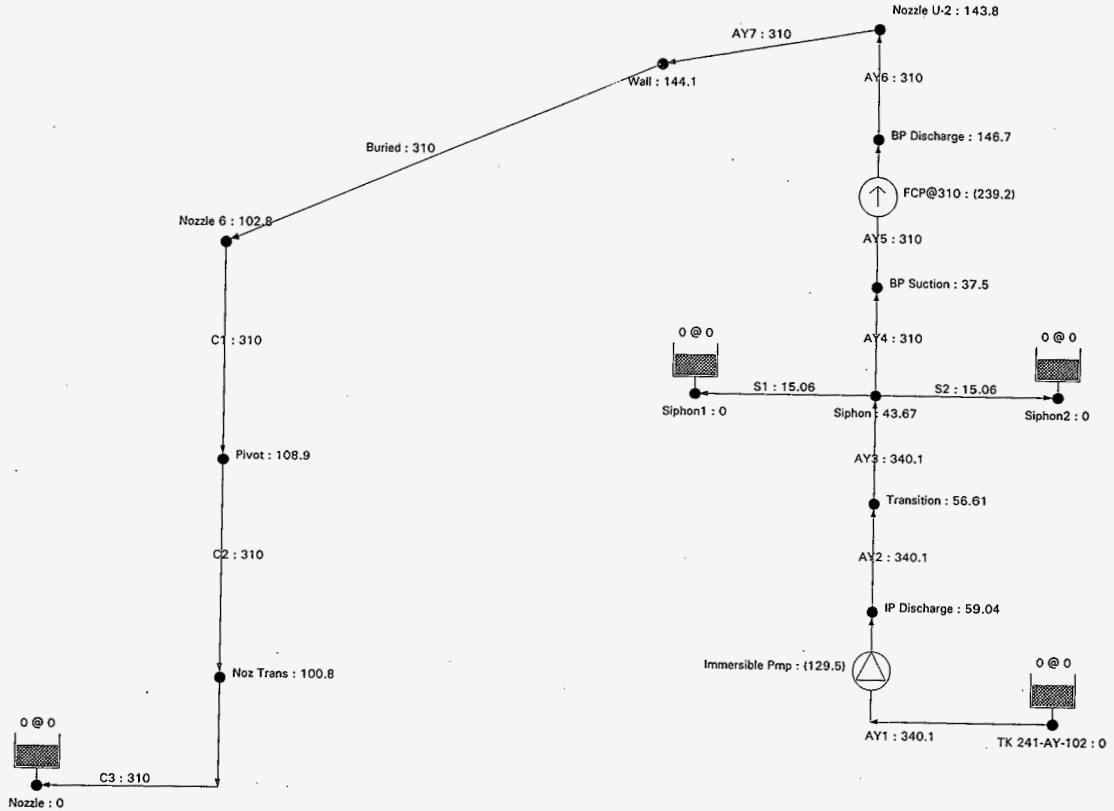


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Company: Fluor Daniel Northwest	10/27/97 1:02 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

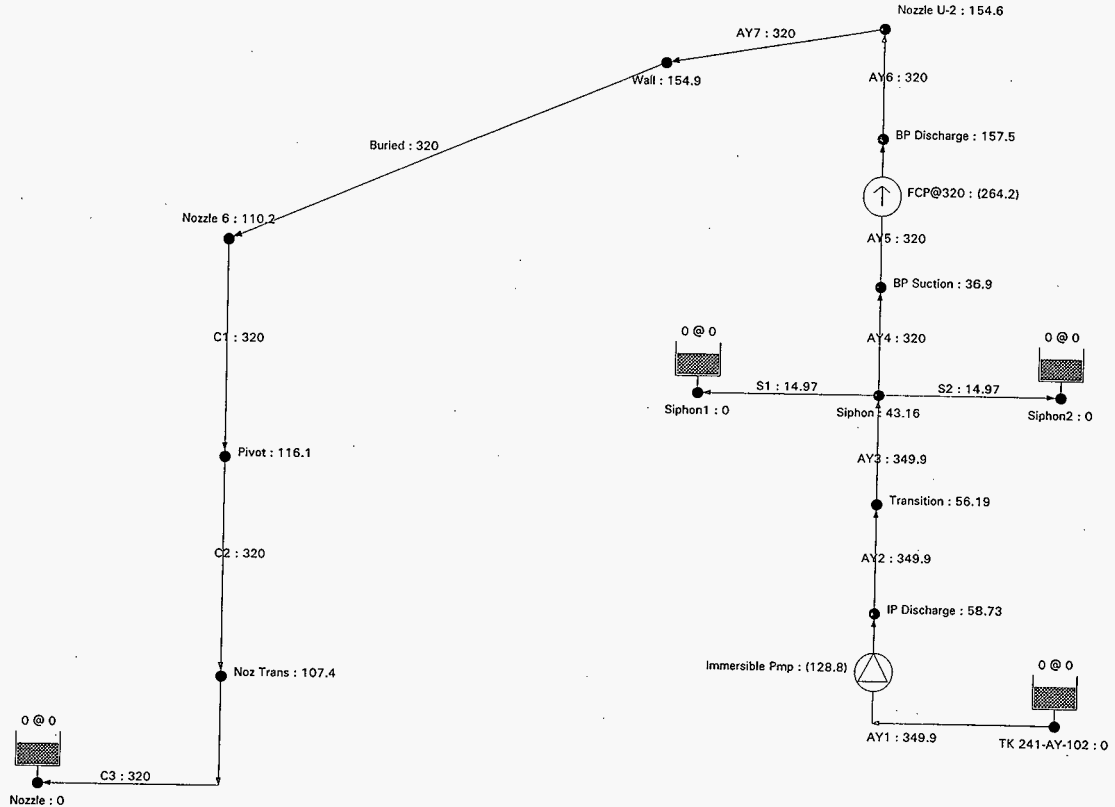
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Company: Fluor Daniel Northwest	10/27/97 1:02 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

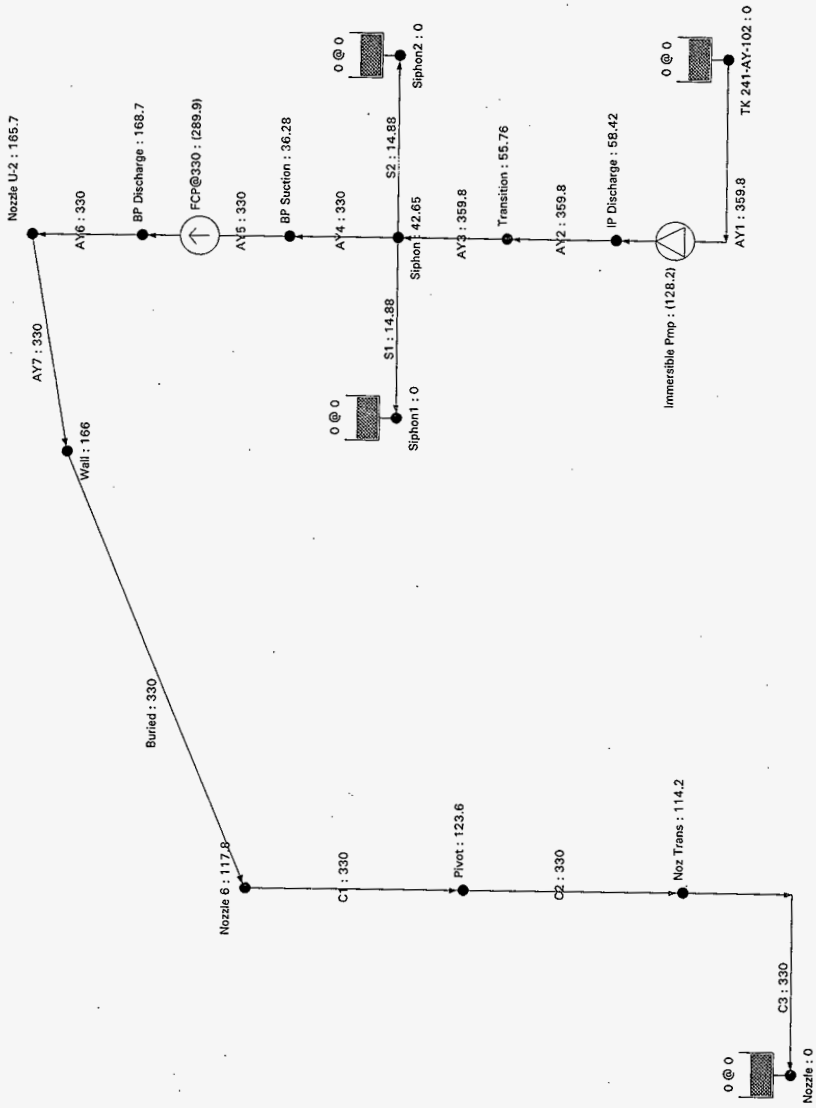
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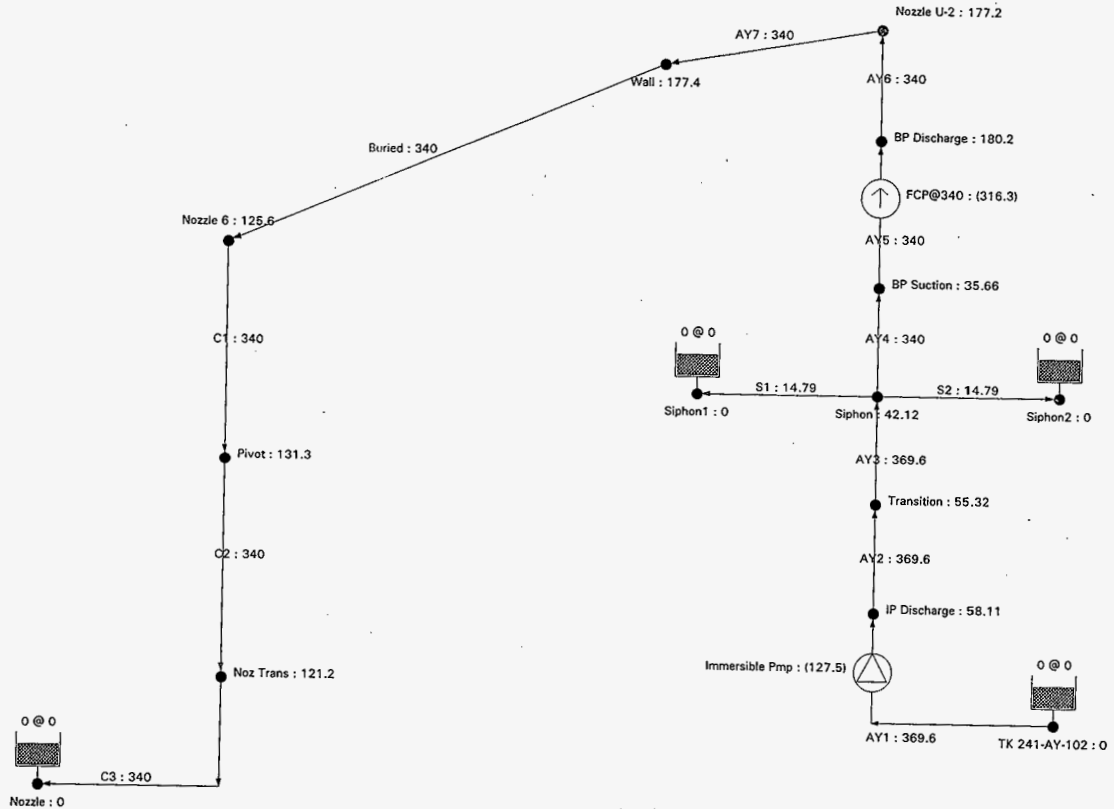
Company: Fluor Daniel Northwest	10/27/97 1:11 pm
Project: W-320	Lineist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:12 pm Lineelist: SN-05 Lineup: SN-05 flow rate: gpm pressure: psig level & grade: ft</p>
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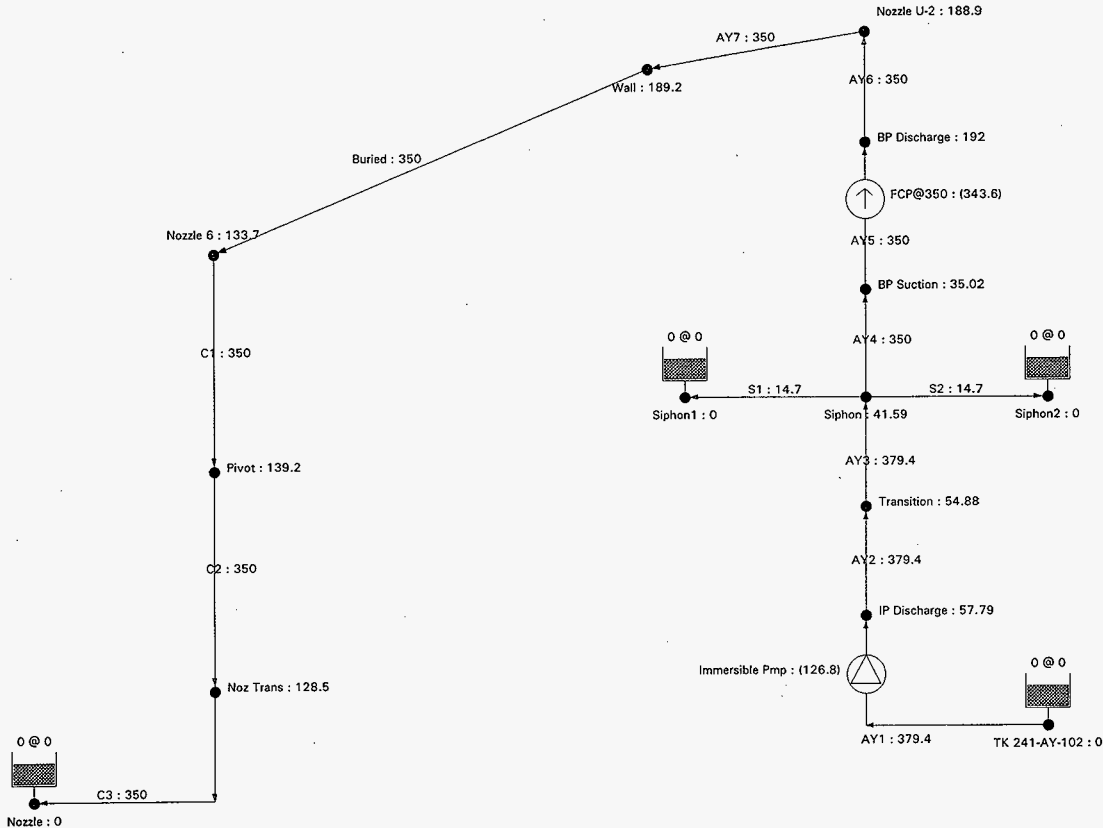
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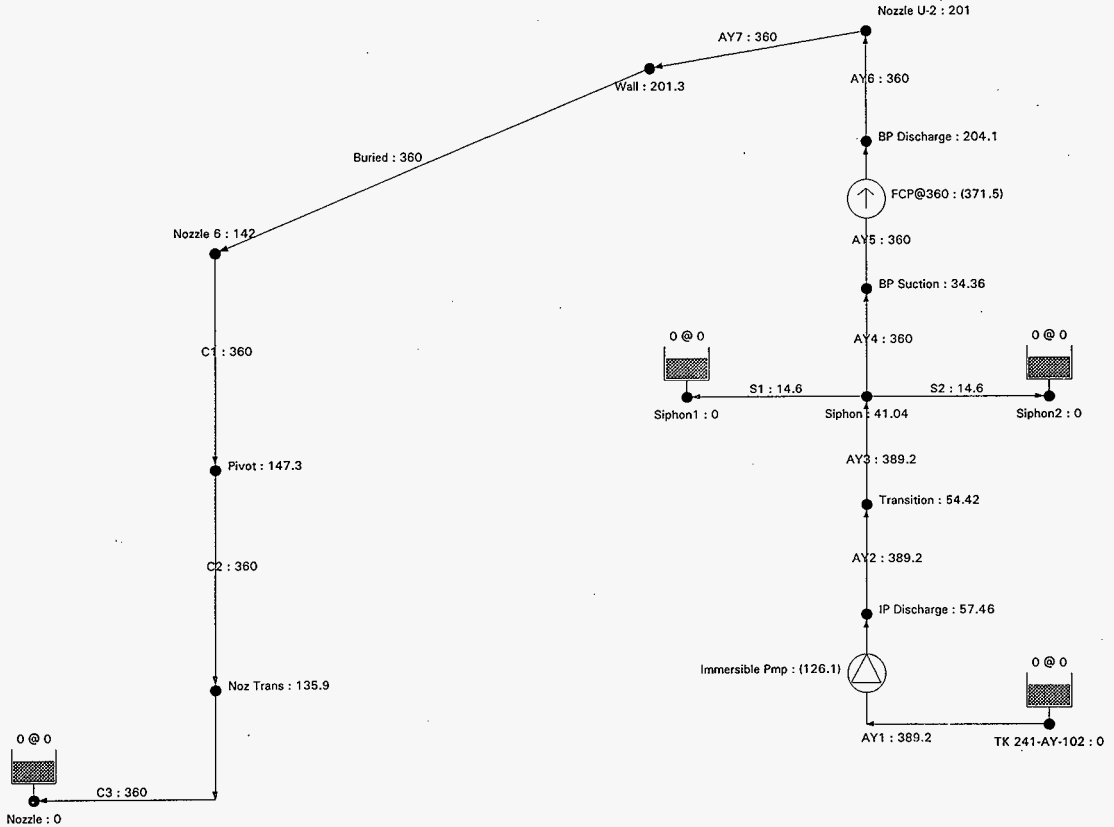
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:12 pm Linelist: SN-05 Lineup: SN-05 flow rate: gpm pressure: psi_g level & grade: ft</p>
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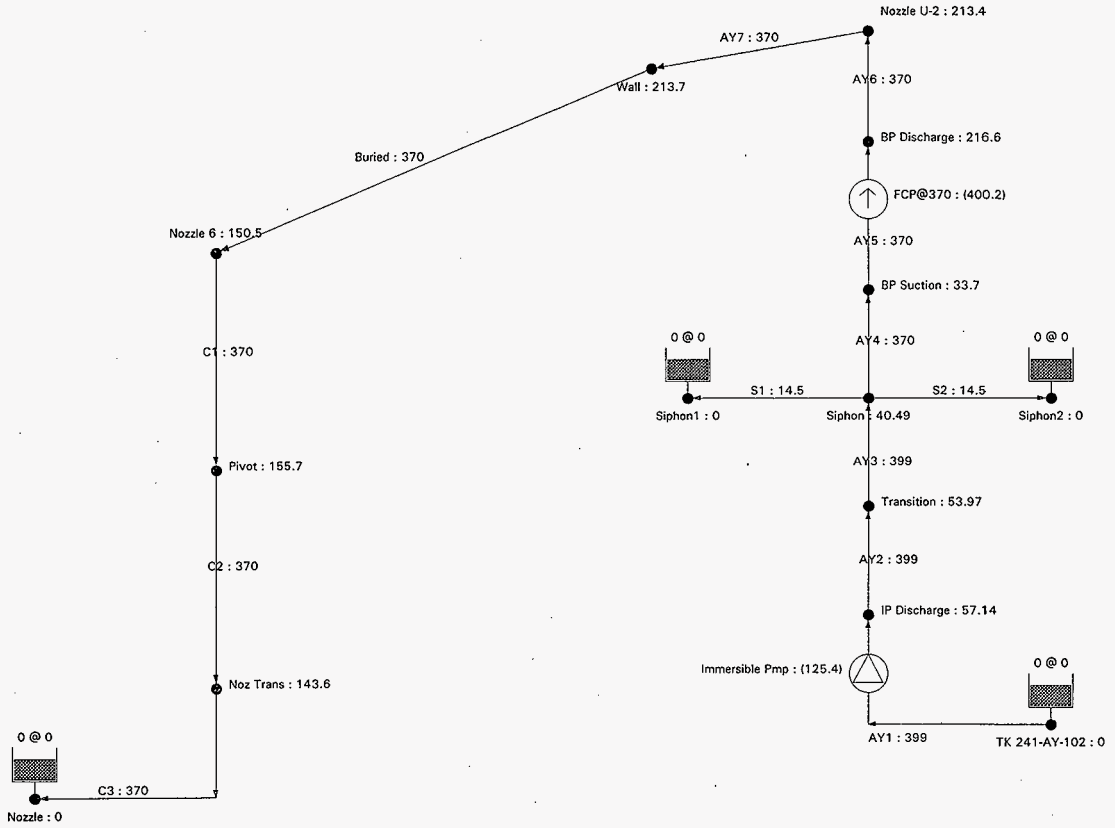
Company: Fluor Daniel Northwest	10/27/97 1:12 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



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Company: Fluor Daniel Northwest	10/27/97 1:12 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

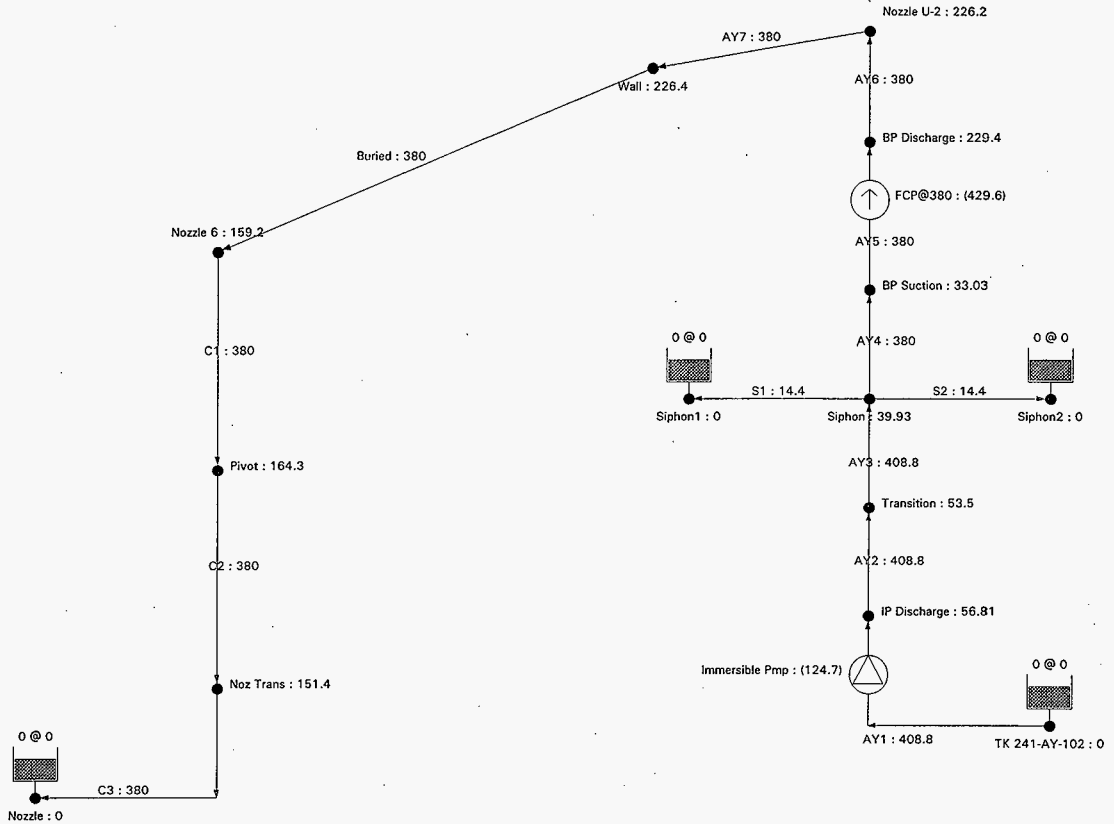
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Company: Fluor Daniel Northwest	10/27/97 1:12 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

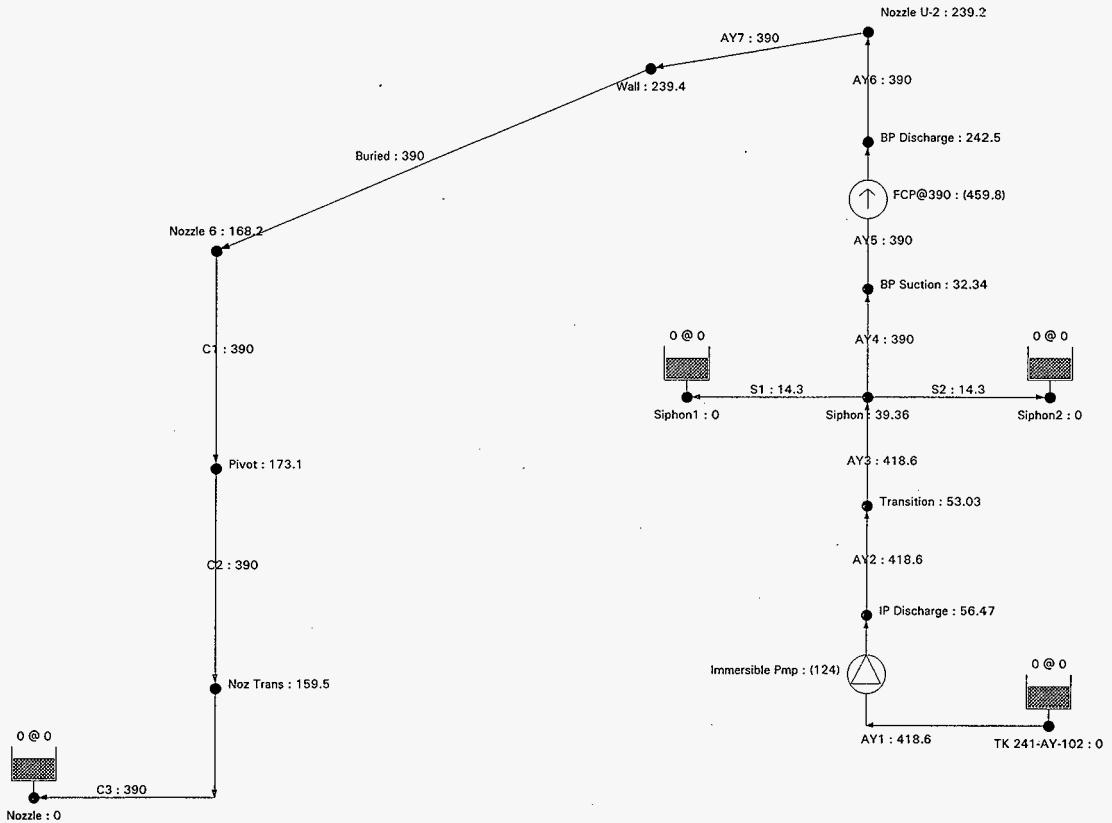
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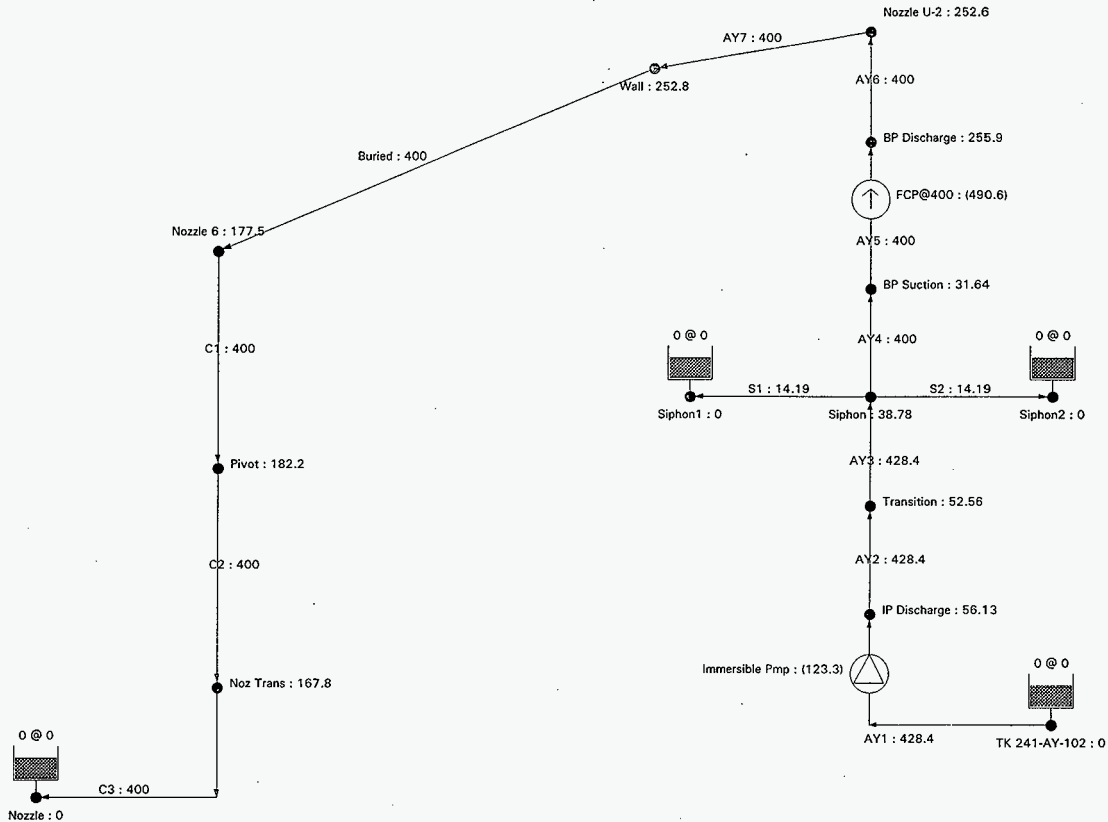
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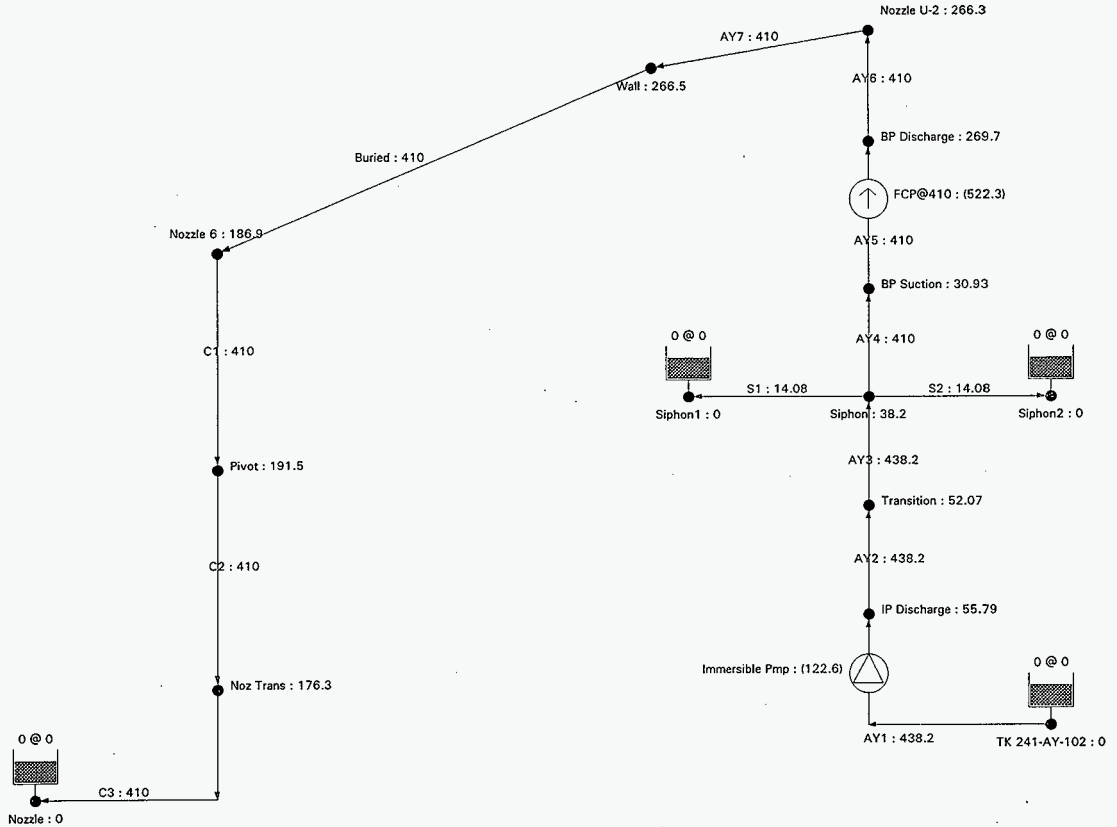
Company: Fluor Daniel Northwest	10/27/97 1:13 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



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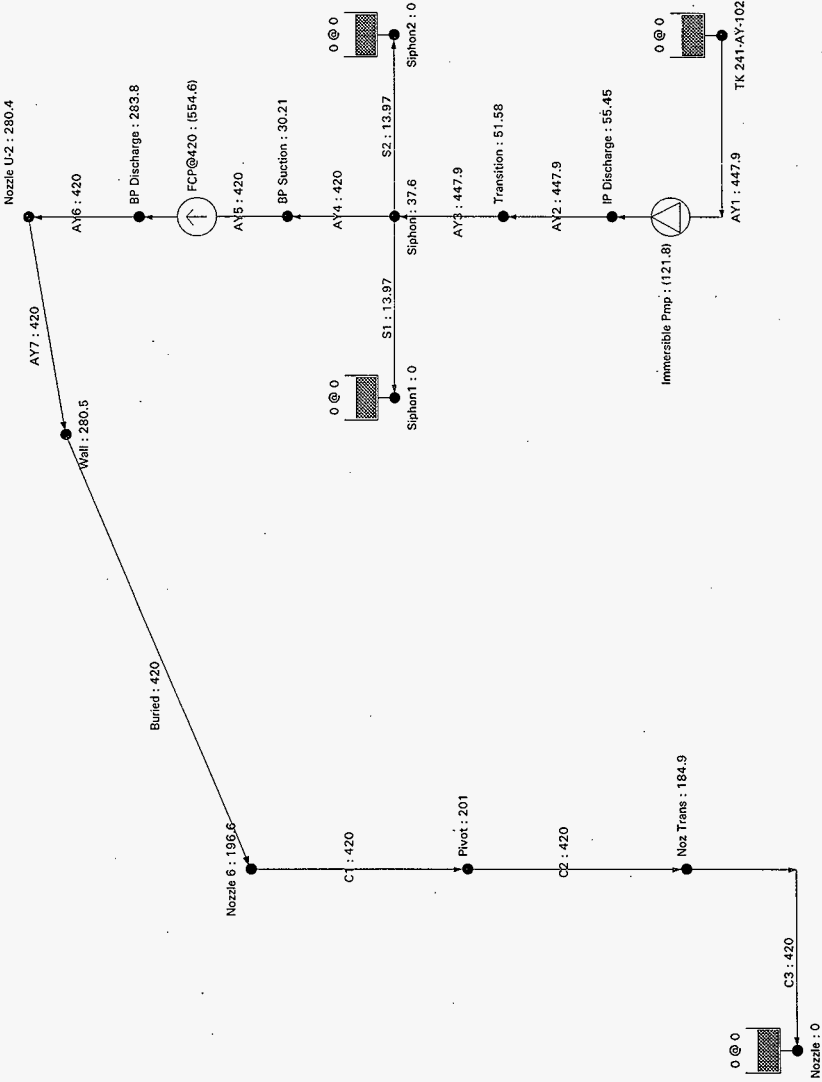
Company: Fluor Daniel Northwest	10/27/97 1:13 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft



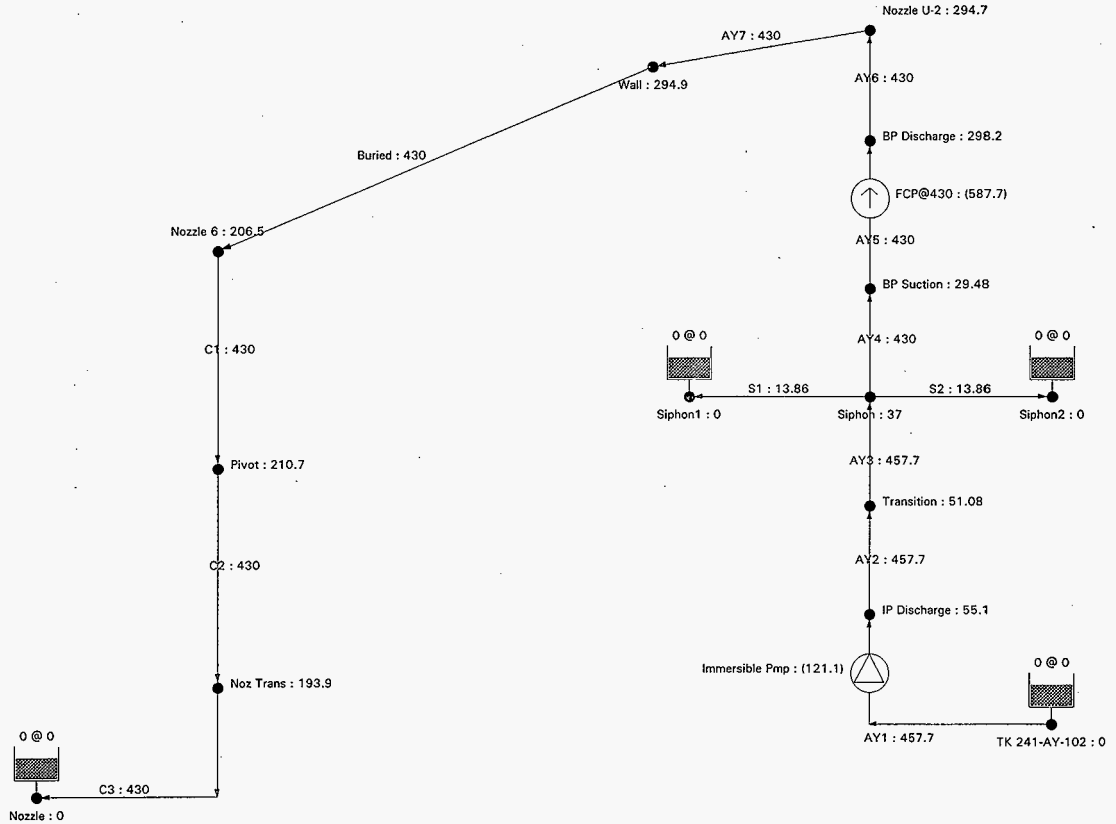
D-44 of D-72

Company: Fluor Daniel Northwest	10/27/97 1:13 pm
Project: W-320	Lineist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

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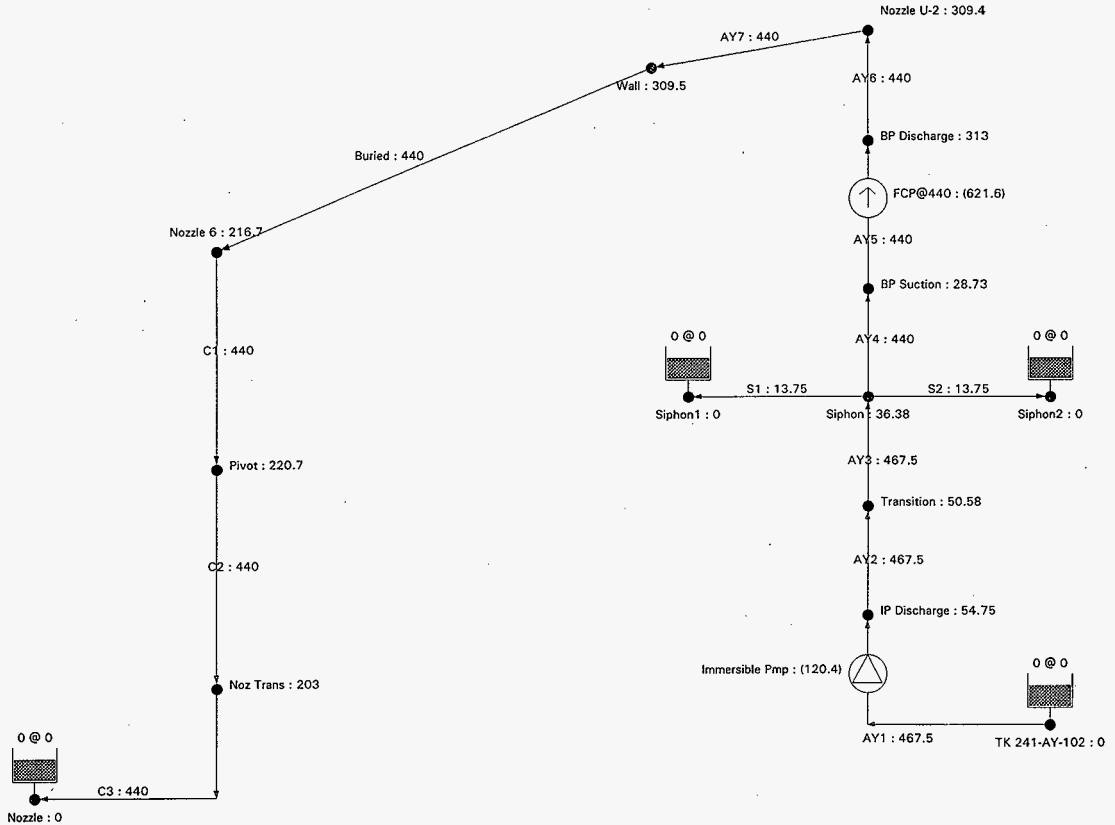
Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048	Version: PIPE-FLO ver 5.01
10/27/97 1:13 pm Line list: SN-05 Lineup: SN-05 flow rate: gpm pressure: psig level & grade: ft	



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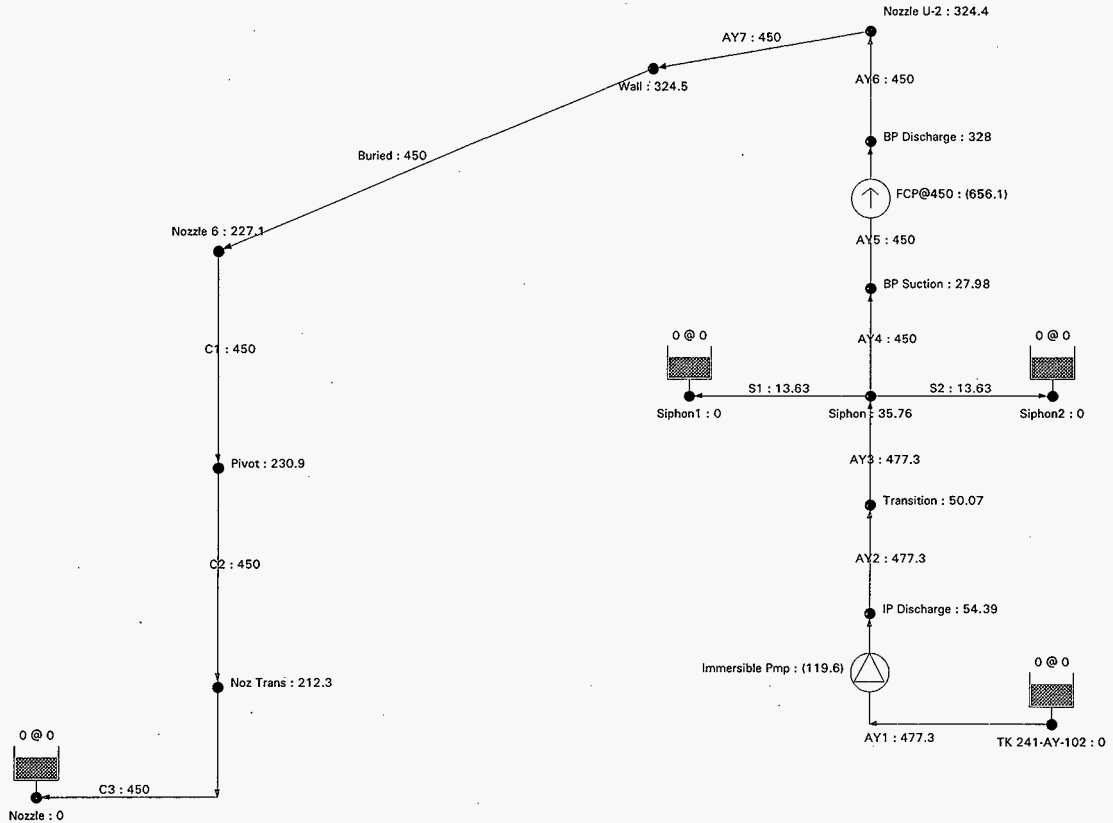
Company: Fluor Daniel Northwest	10/27/97 1:13 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

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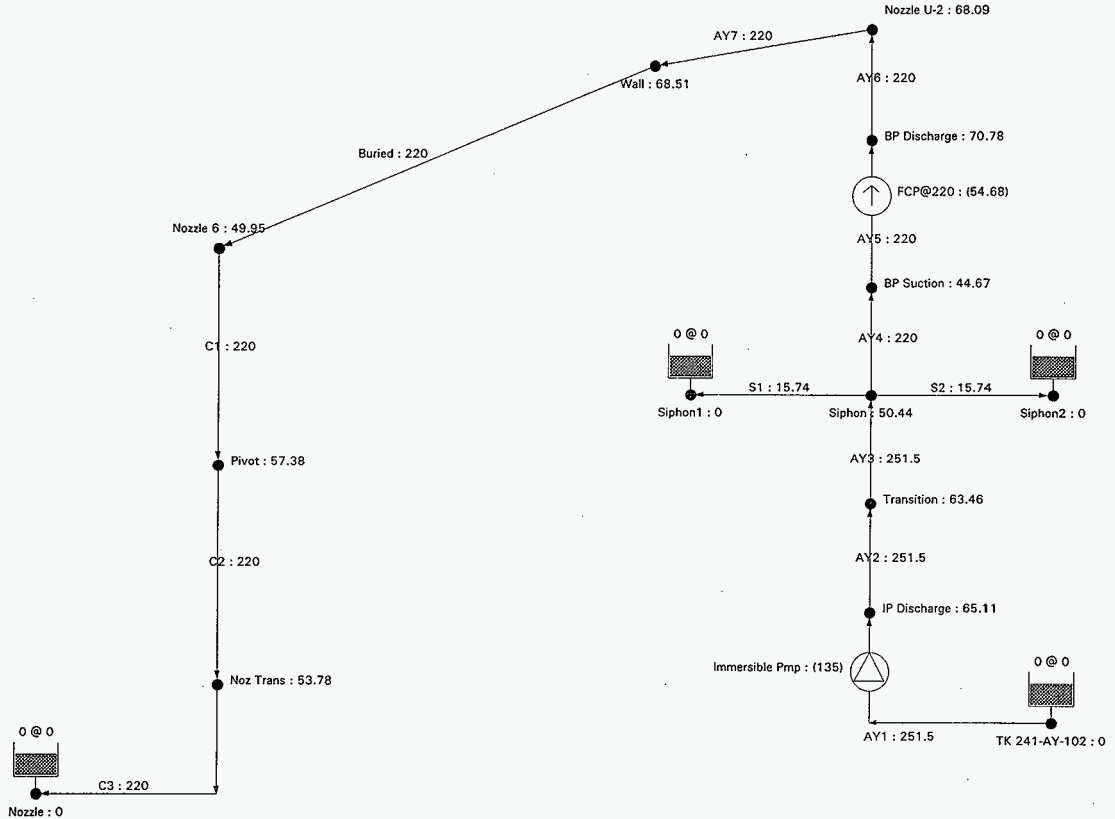
D-47 of 0-72

Company: Fluor Daniel Northwest	10/27/97 1:13 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft



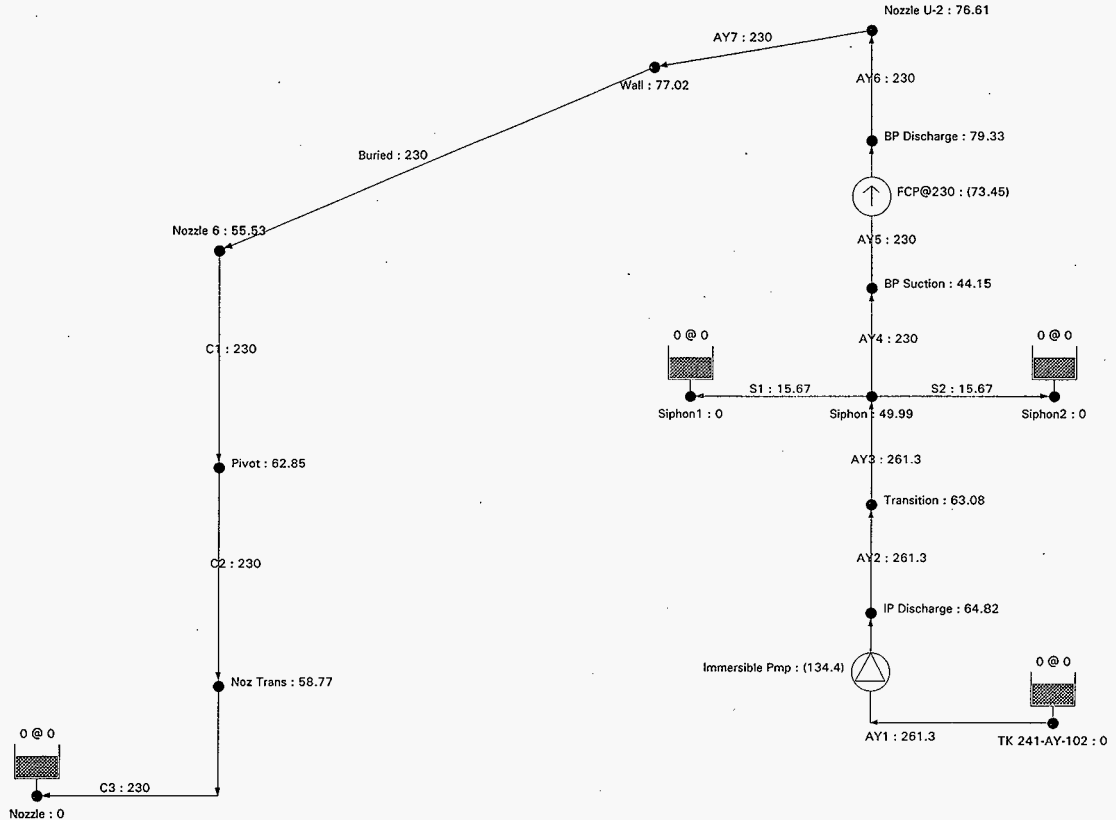
0-48 of 0-72

Company: Fluor Daniel Northwest	10/27/97 1:14 pm
Project: W-320	Linelist: SN-05
by: K Hayase	Lineup: SN-05
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft



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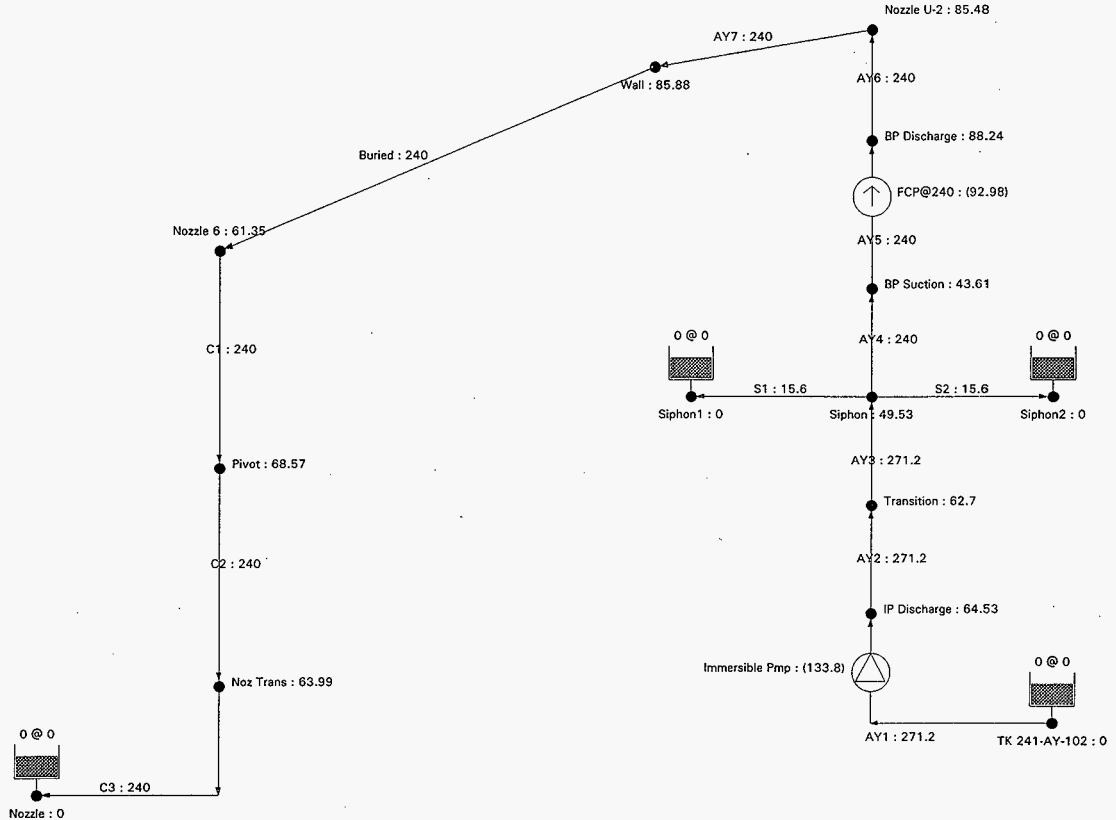
Company: Fluor Daniel Northwest	10/27/97 1:19 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft



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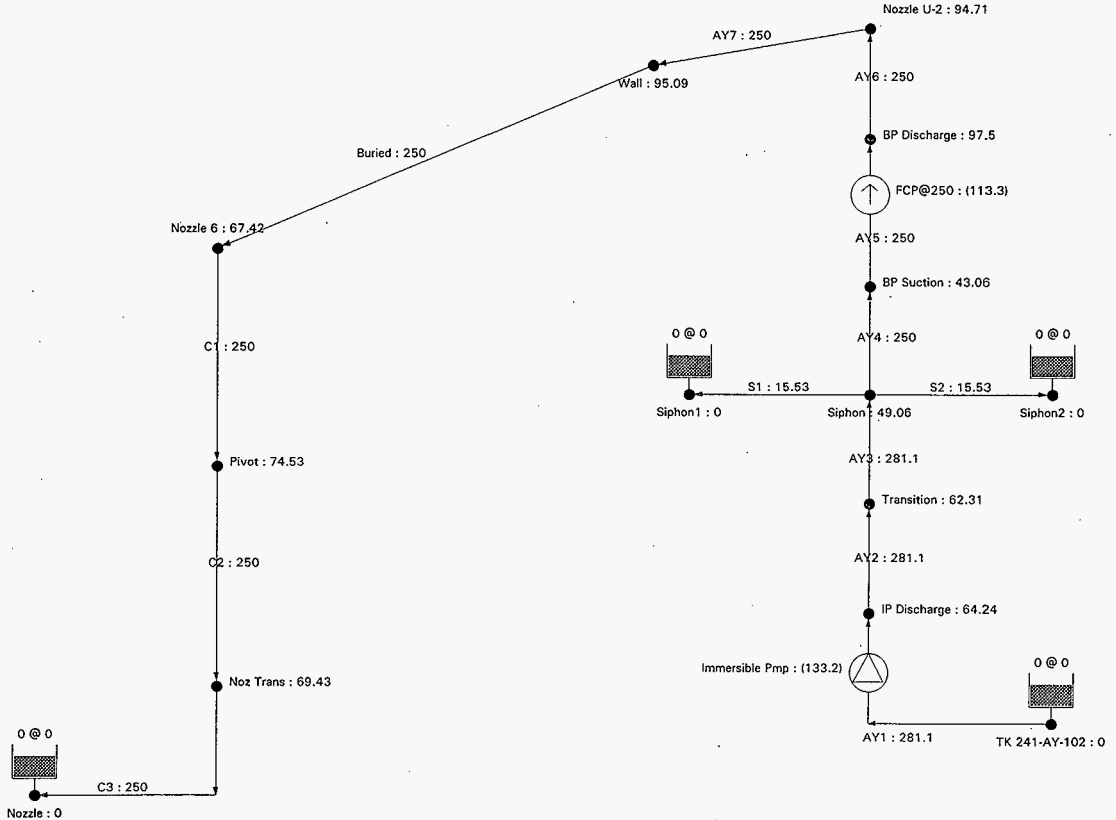
Company: Fluor Daniel Northwest	10/27/97 1:20 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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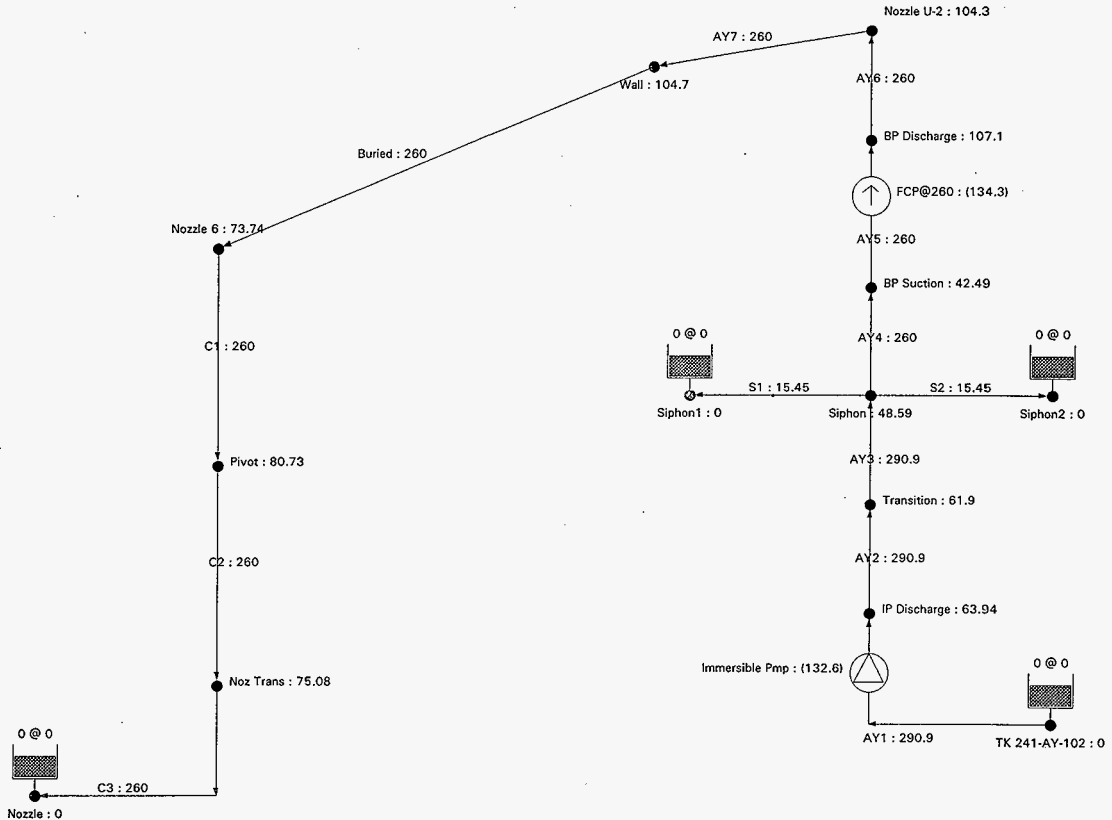
Company: Fluor Daniel Northwest	10/27/97 1:20 pm
Project: W-320	Lineist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft



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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:20 pm Linelist: SN-10 Lineup: SN-10 flow rate: gpm pressure: psig level & grade: ft</p>
--	---

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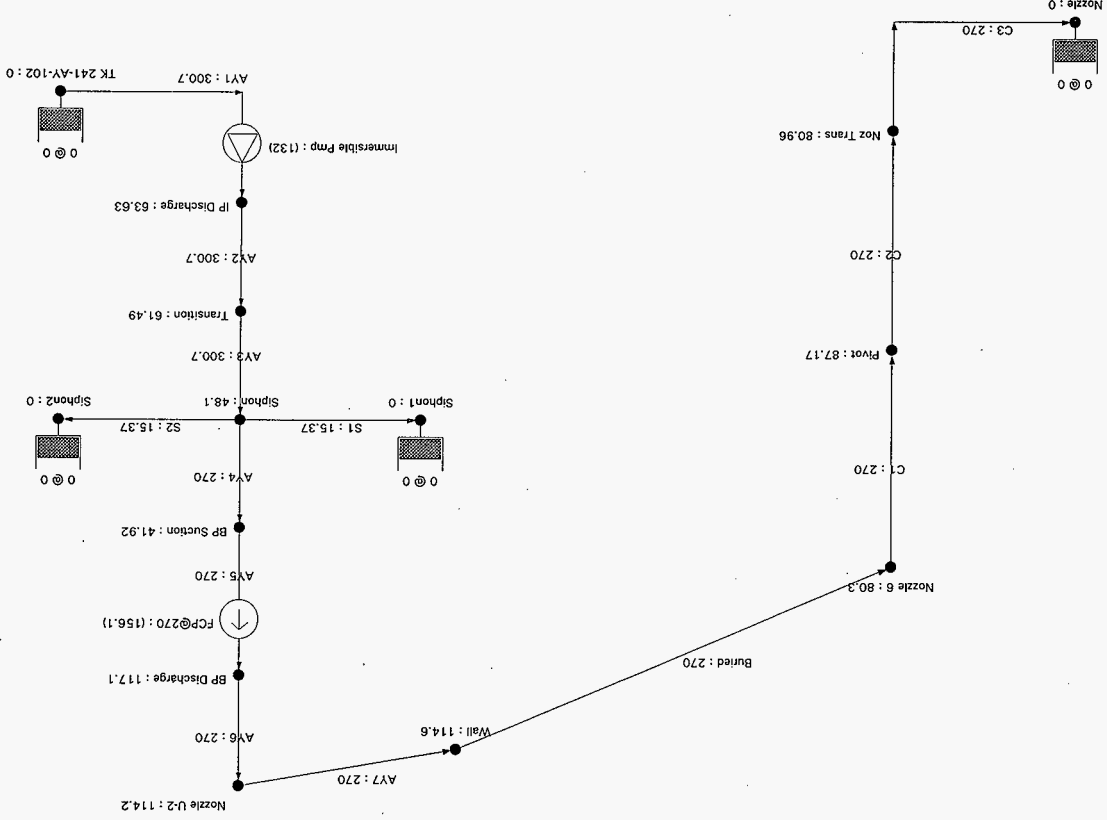


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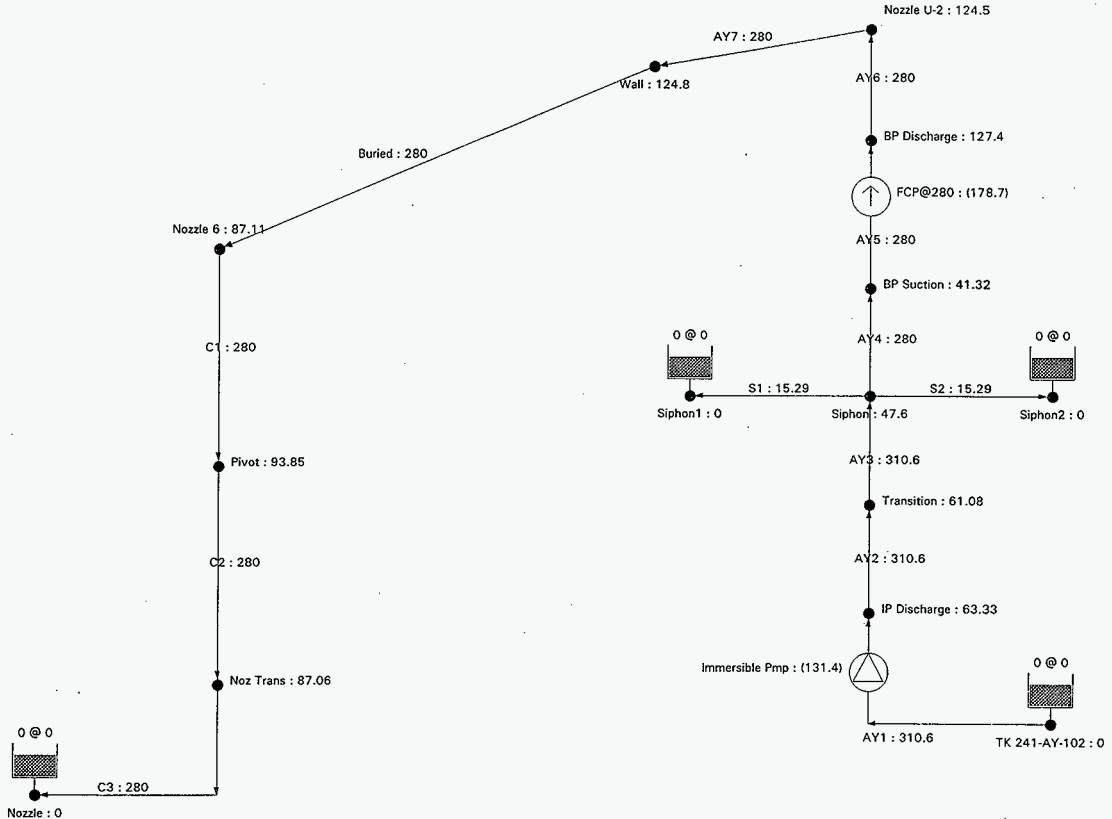
Company: Fluor Daniel Northwest	10/27/97 1:20 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SN-10	
Lineists: SN-10	
10/27/97 1:20 pm	
level & grade: ft	
pressure: psig	
flow rate: gpm	



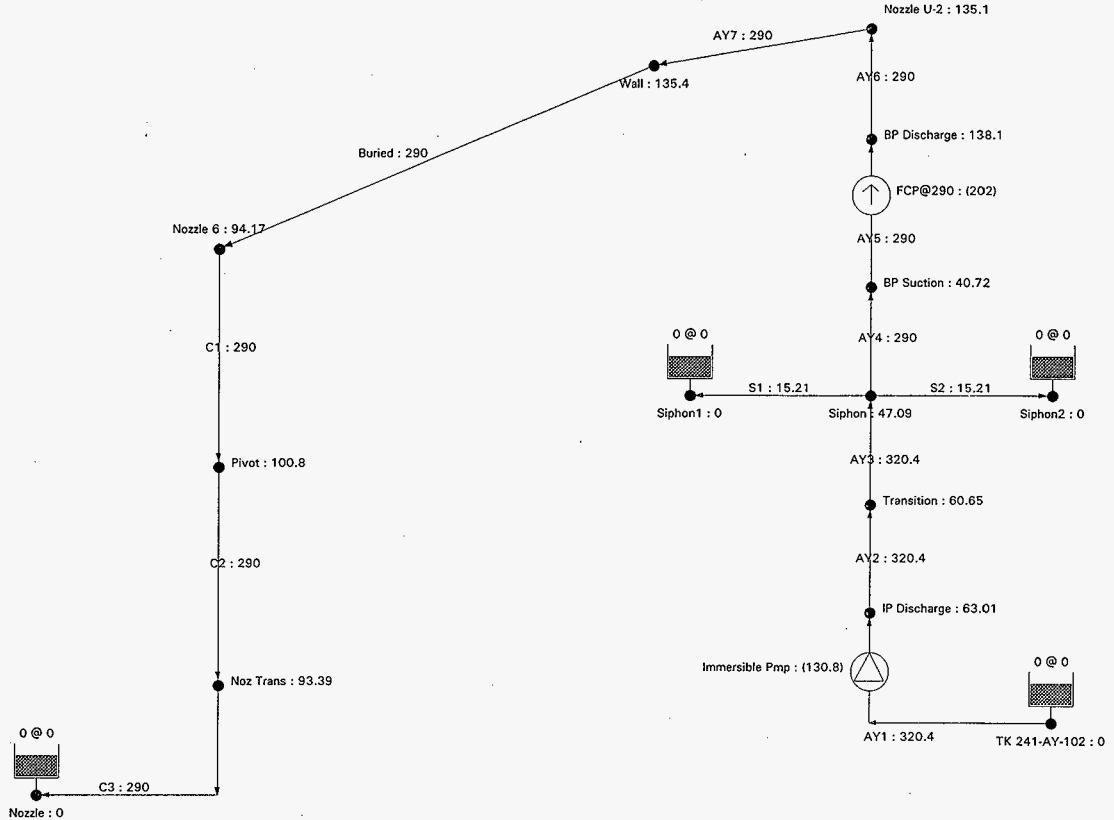
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Company: Fluor Daniel Northwest	10/27/97 1:20 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

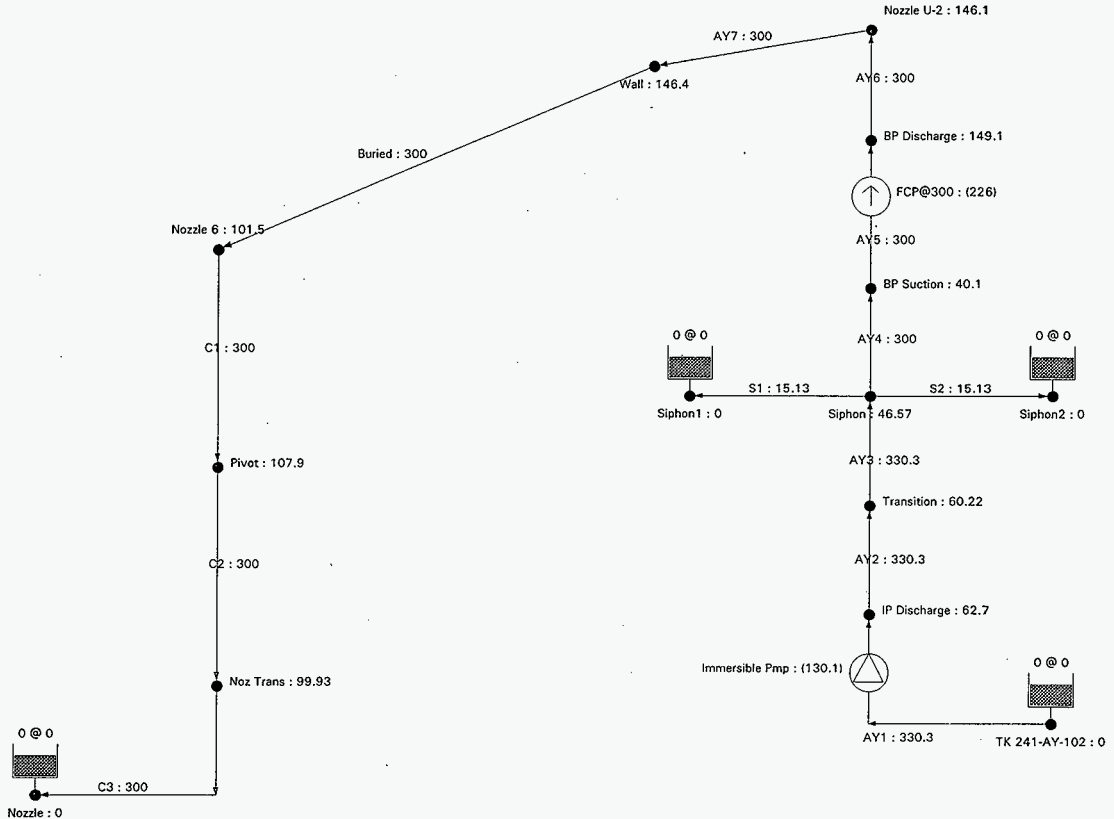
HNF-2478, Rev. 0



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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:21 pm Lineist: SN-10 Lineup: SN-10 flow rate: gpm pressure: psig level & grade: ft</p>
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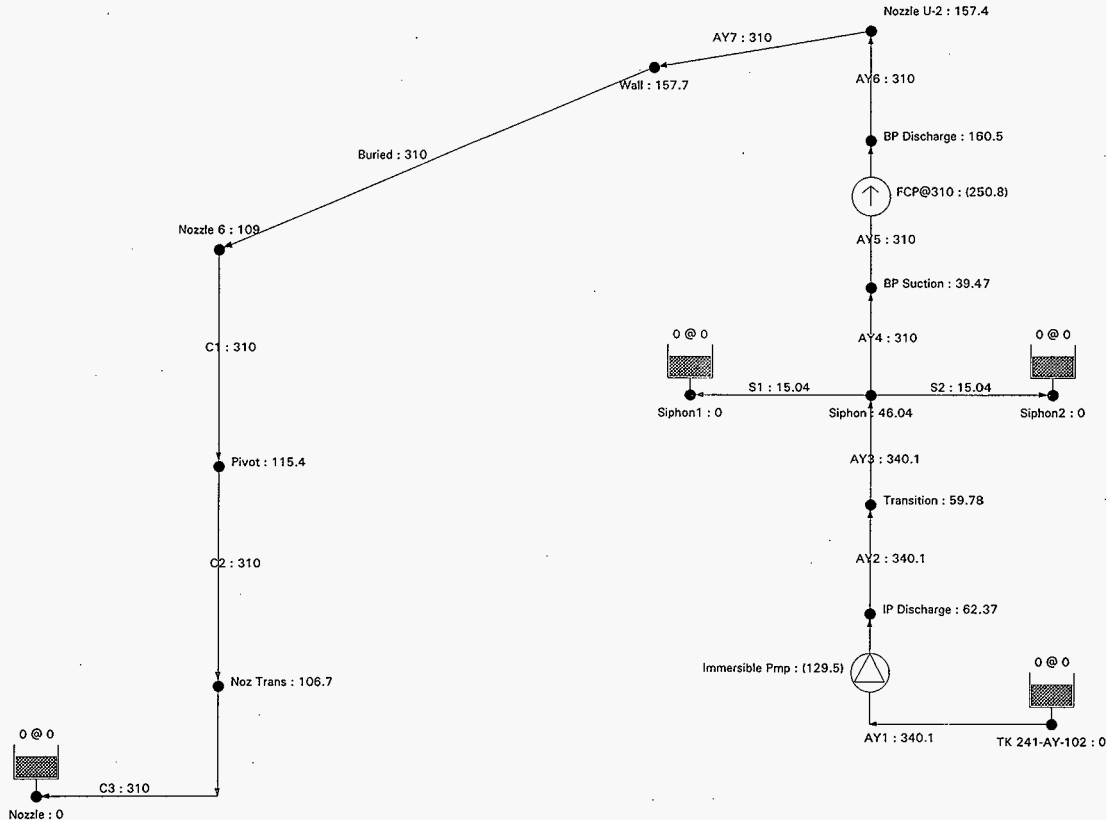
HNF-2478, Rev. 0



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Company: Fluor Daniel Northwest	10/27/97 1:21 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

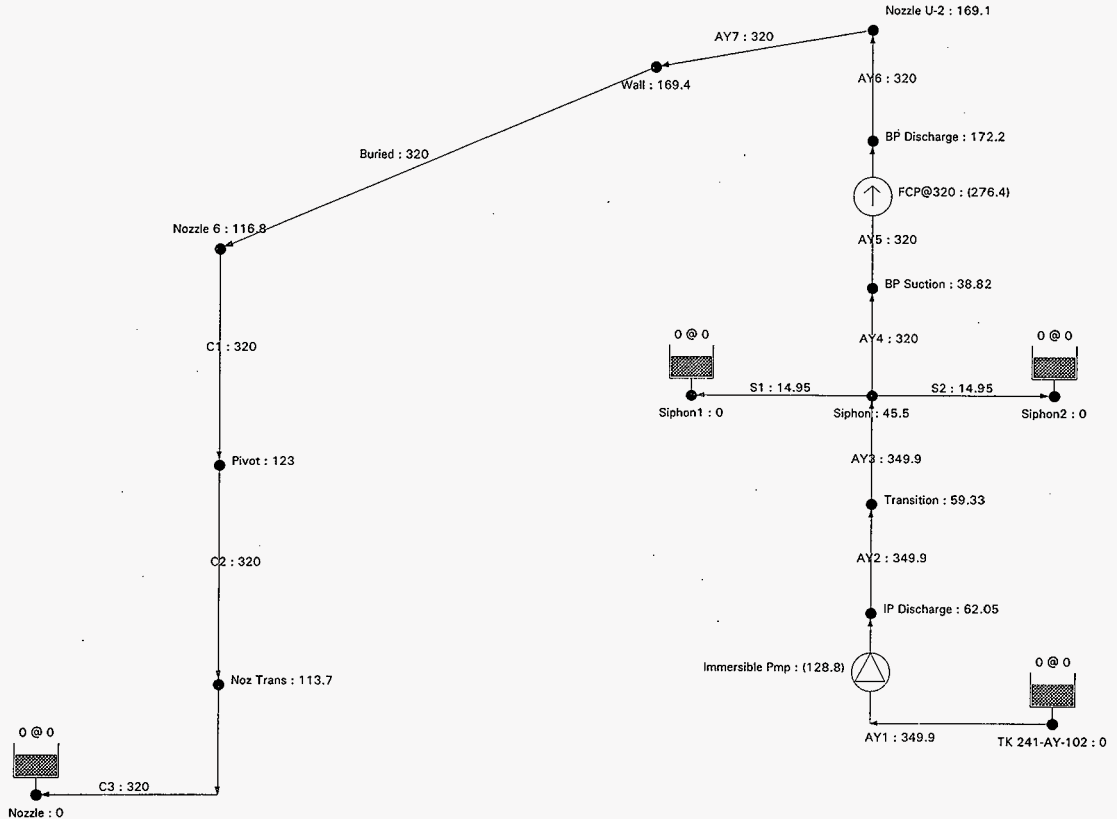
HNF-2478, Rev. 0



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Company: Fluor Daniel Northwest	10/27/97 1:21 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

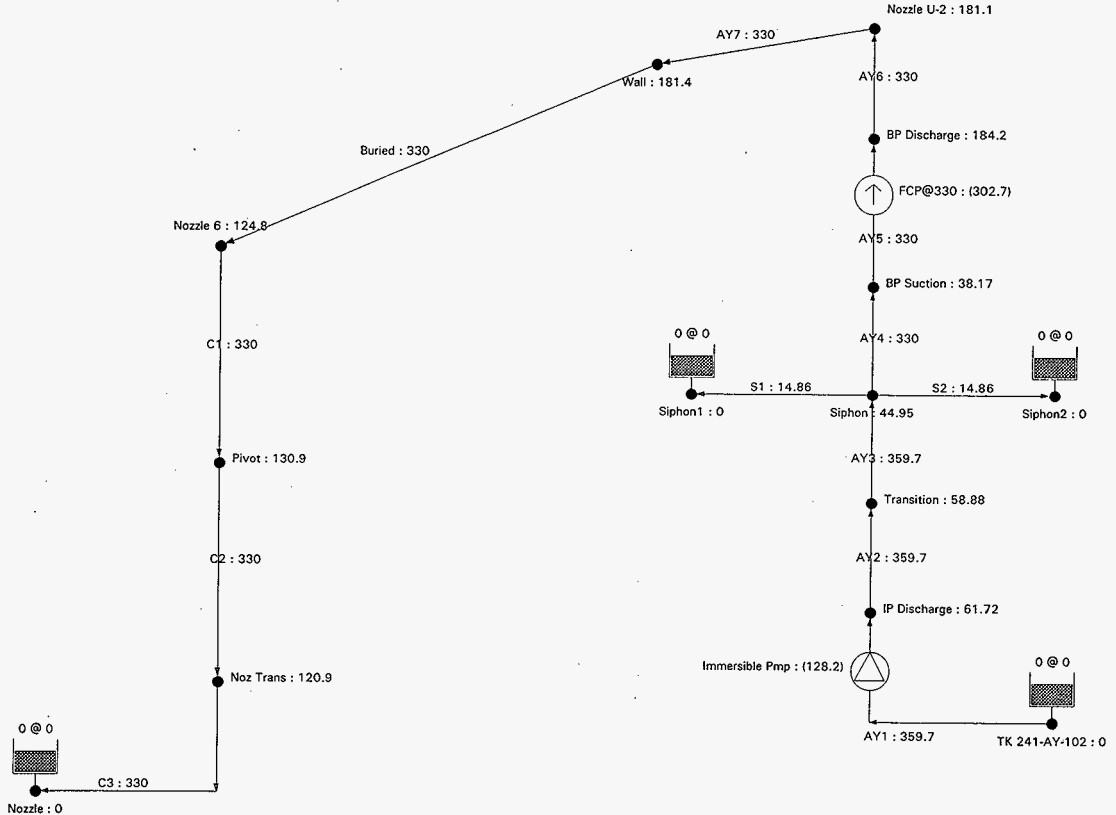
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Company: Fluor Daniel Northwest	10/27/97 1:21 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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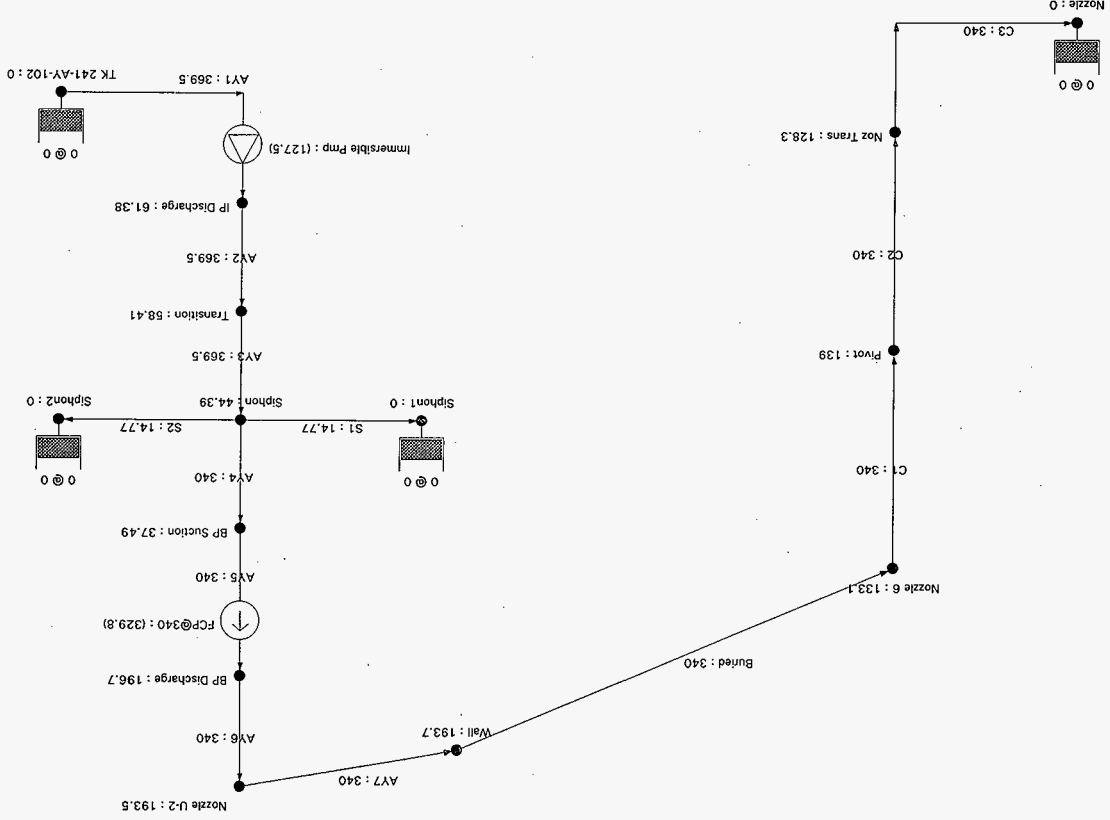


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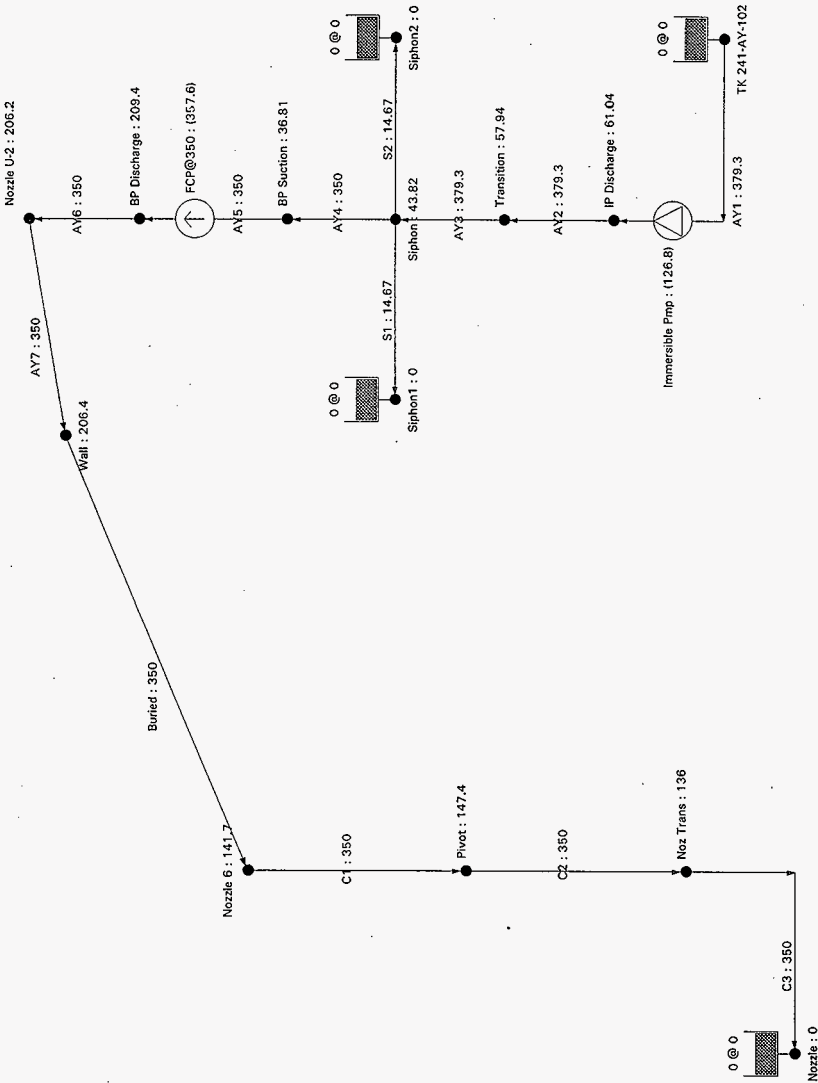
Company: Fluor Daniel Northwest	10/27/97 1:21 pm
Project: W-320	Lineist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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Company: Fluor Daniel Northwest	Project: W-320
by: K Hayase	Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01	flow rate: gpm
	pressure: psig
	lineup: SN-10
	line lists: SN-10
	level & grade: ft
	10/27/97 1:21 pm



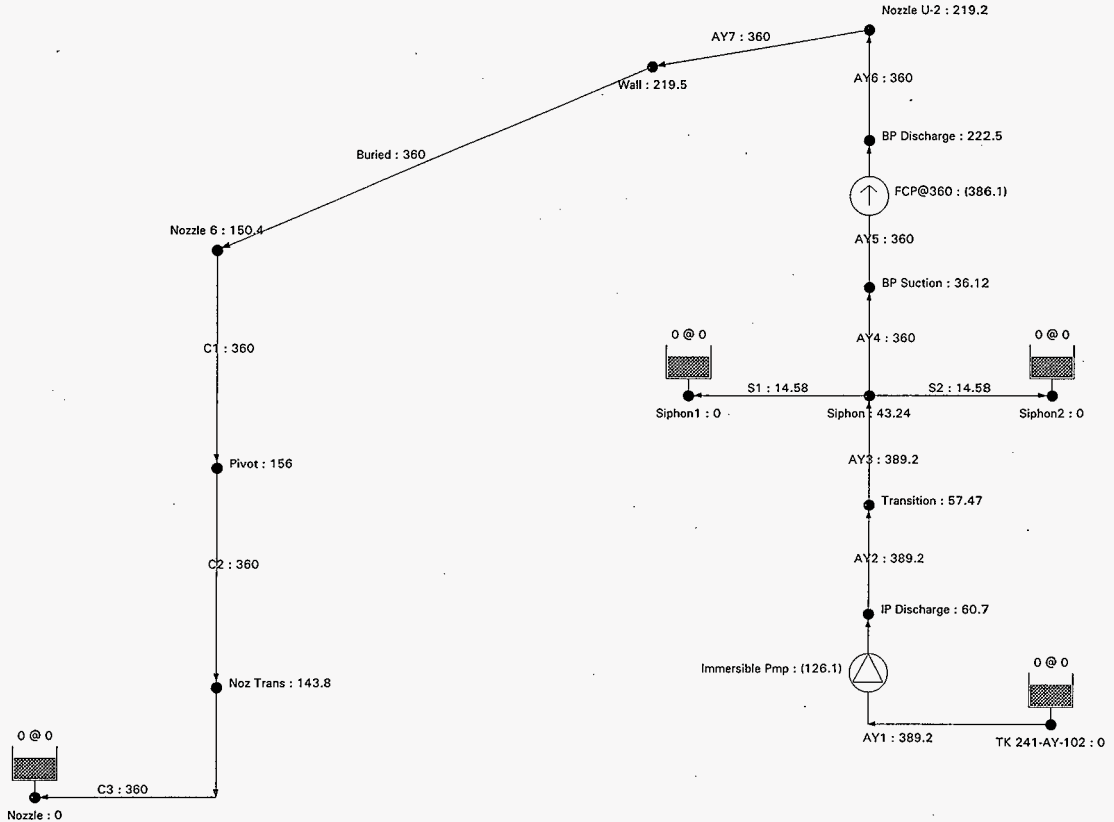
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Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01

10/27/97 1:22 pm
Lineist: SN-10
Lineup: SN-10
flow rate: gpm
pressure: psig
level & grade: ft

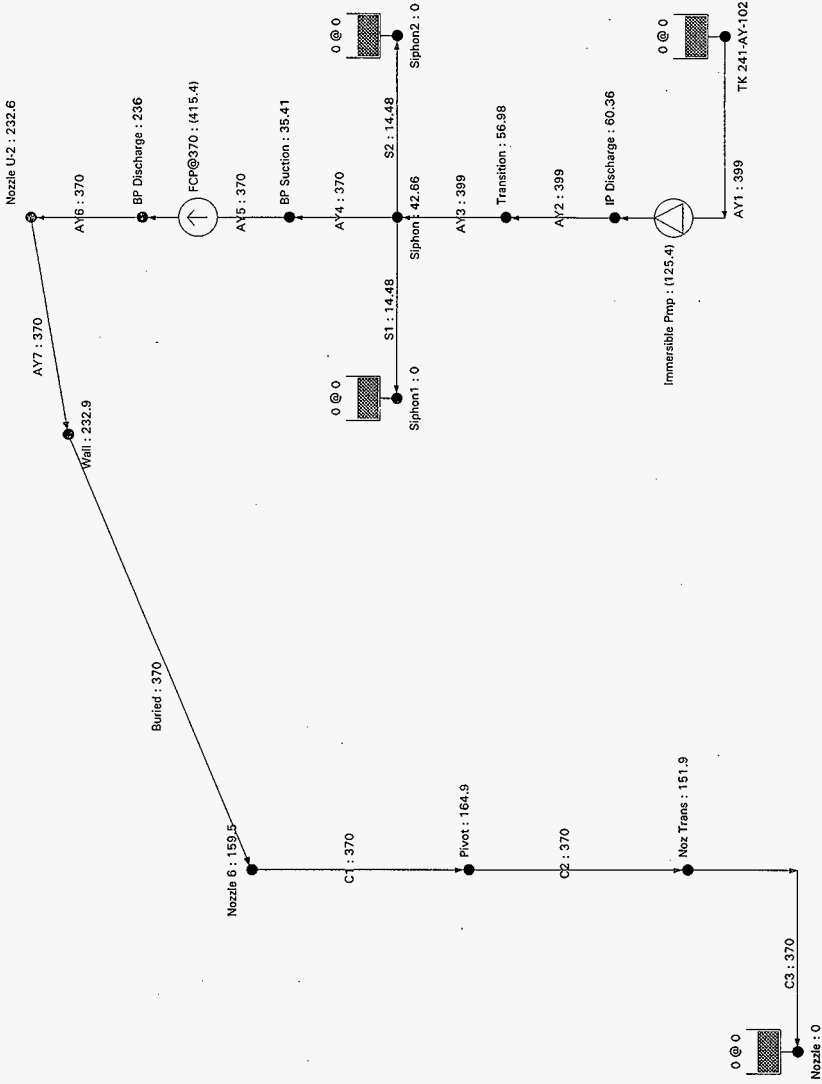
HNF-2478, Rev. 0



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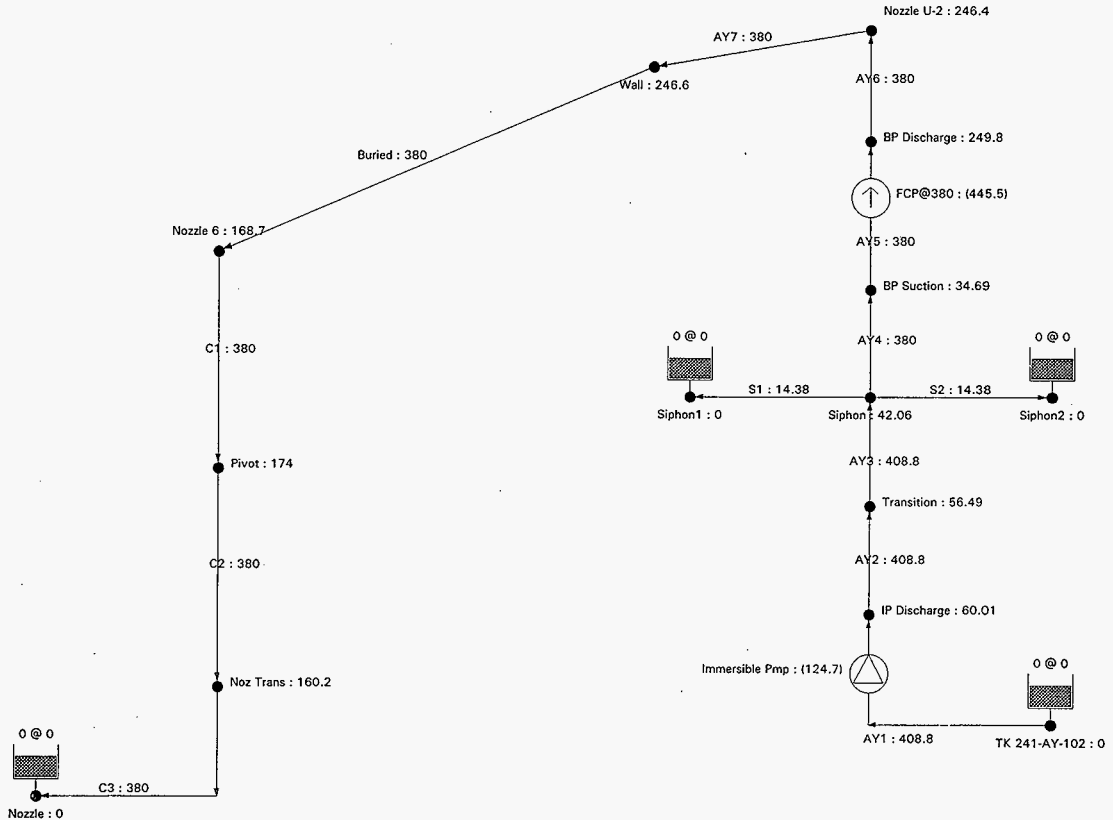
Company: Fluor Daniel Northwest	10/27/97 1:22 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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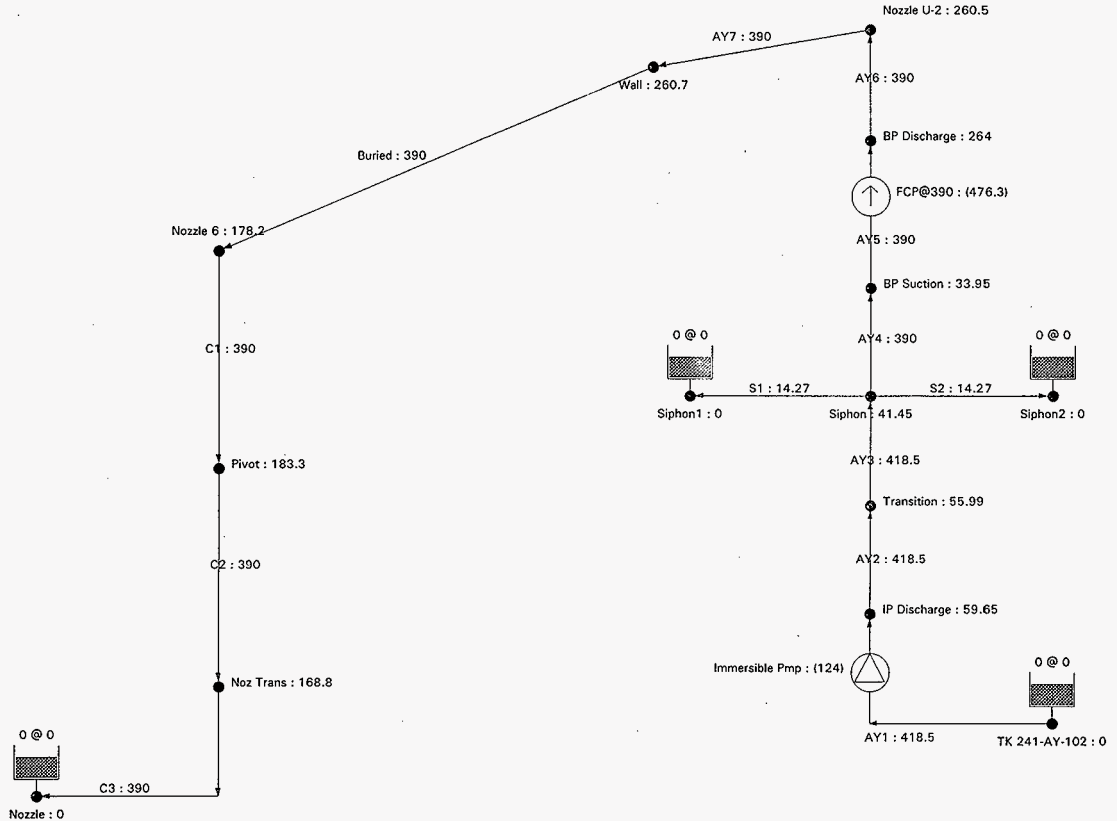
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:22 pm Lineelist: SN-10 Lineup: SN-10 flow rate: gpm pressure: psig level & grade: ft</p>
---	--

HNP 2478, Rev. 0



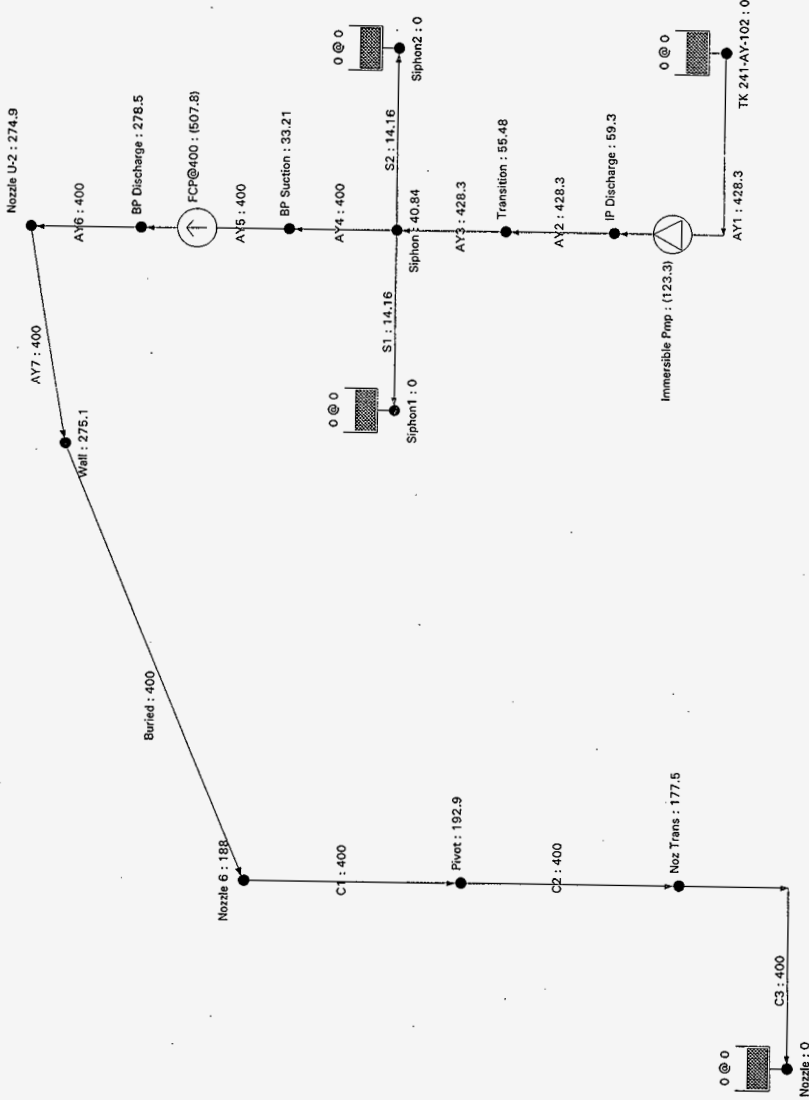
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Company: Fluor Daniel Northwest	10/27/97 1:22 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft



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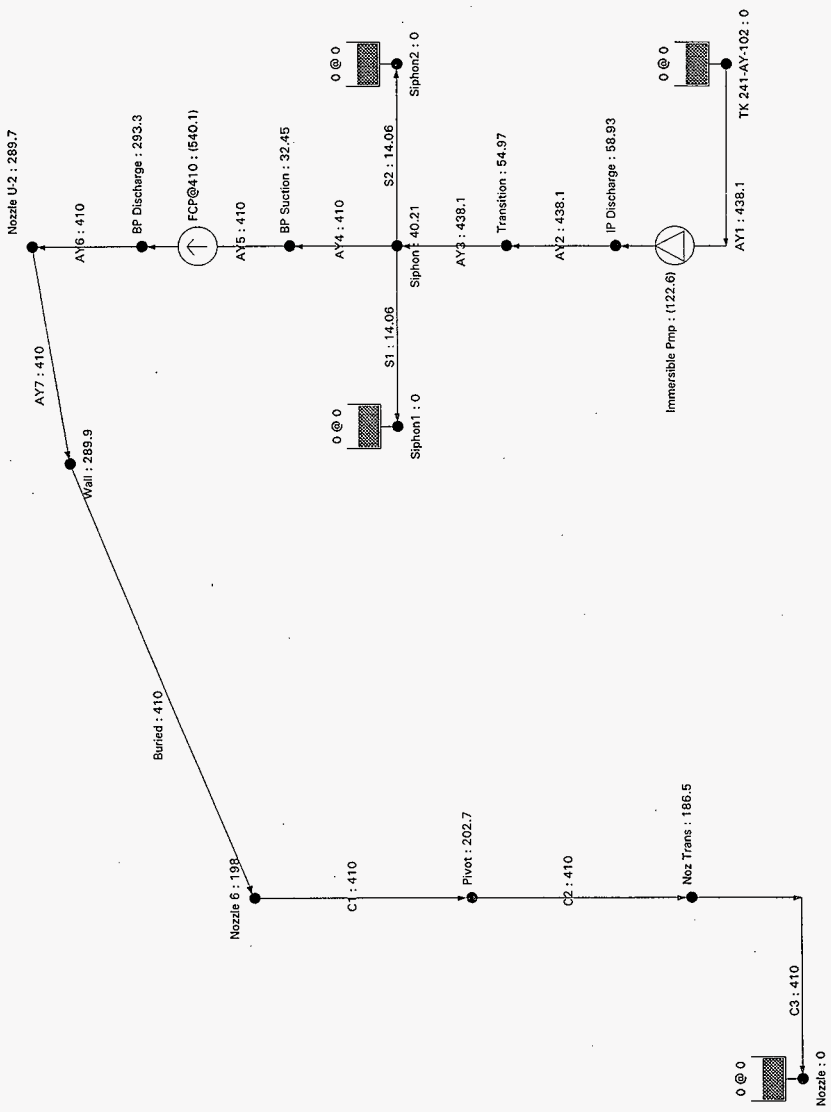
Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01	10/27/97 1:22 pm
	Linelist: SN-10
	Lineup: SN-10
	flow rate: gpm
	pressure: psig
level & grade: ft	



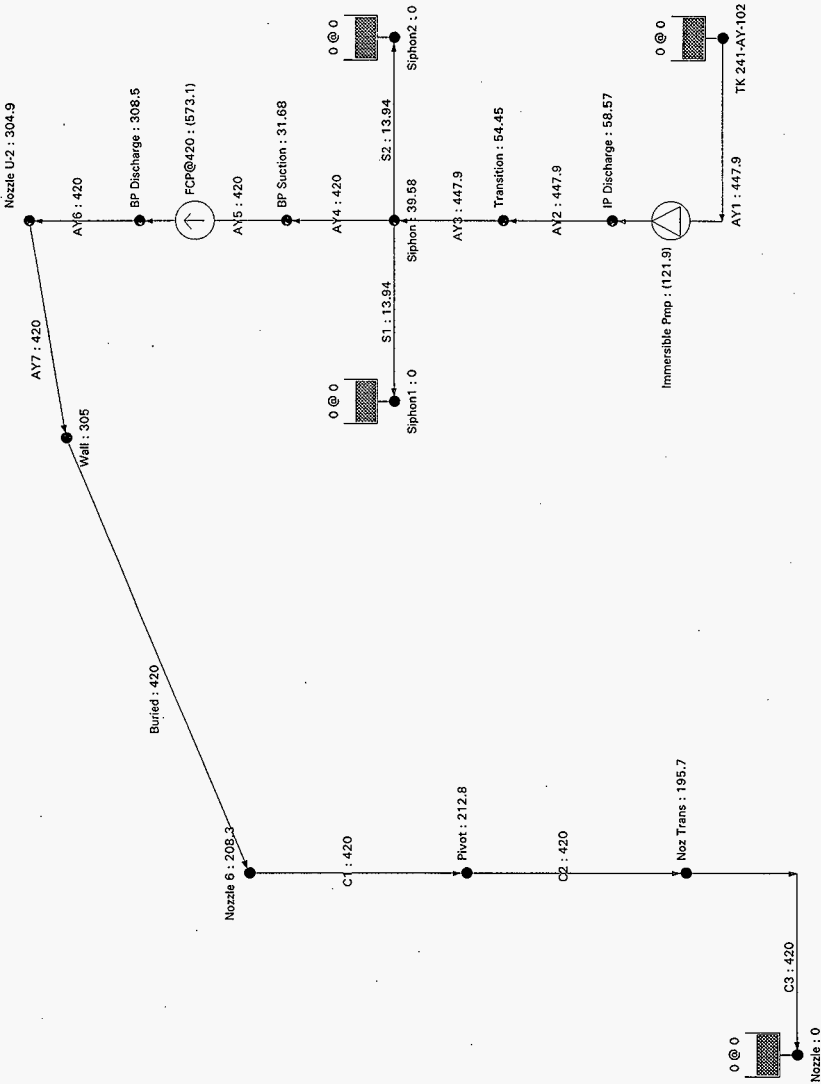
Company: Fluor Daniel Northwest
 Project: W-320
 by: K Hayase
 Comments: Calculation W320-27-048
 Version: PIPE-FLO ver 5.01

10/27/97 1:23 pm
 Linelist: SN-10
 Lineup: SN-10
 flow rate: gpm
 pressure: psig
 level & grade: ft

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:23 pm Lineelist: SN-10 Lineup: SN-10 flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	

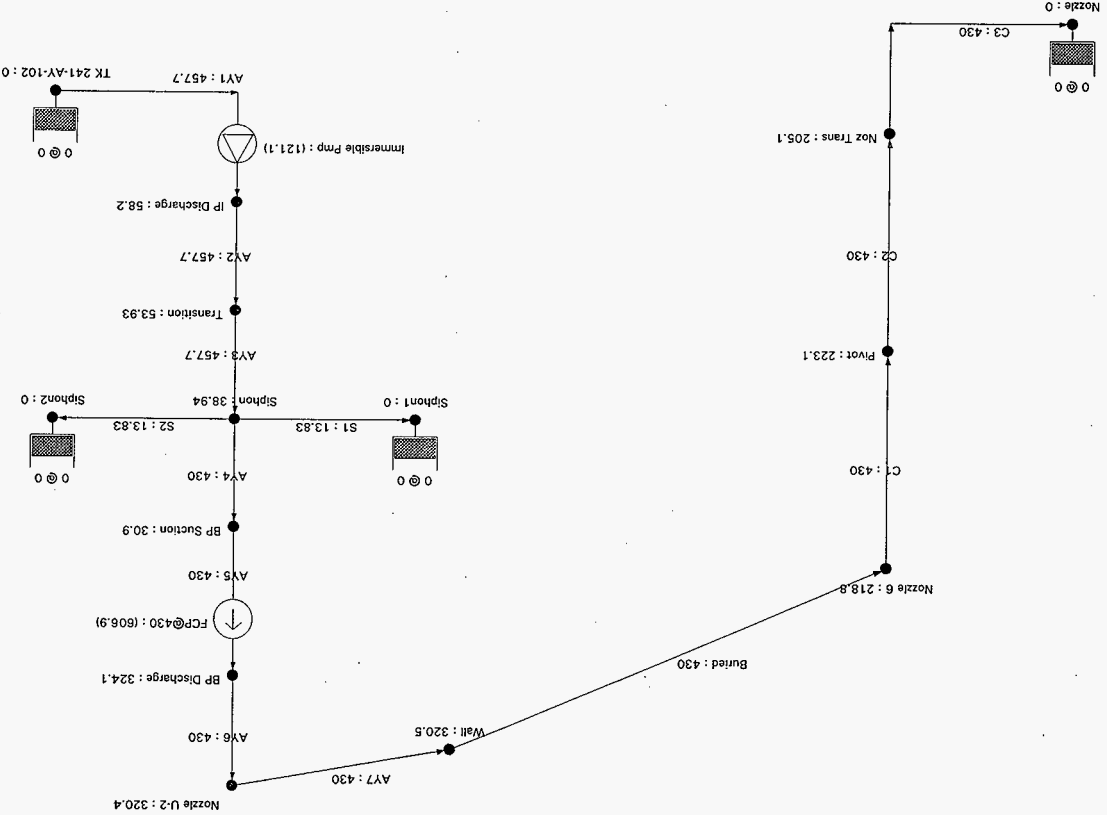


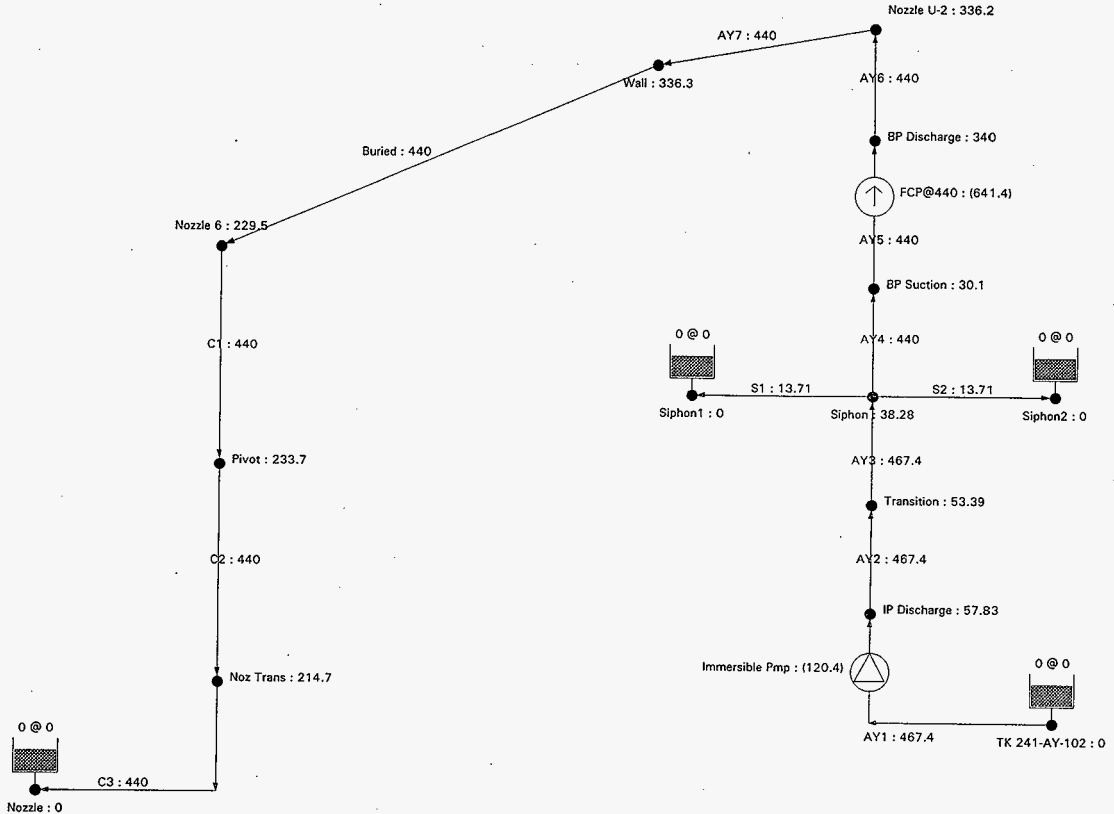
Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01

10/27/97 1:23 pm
LineList: SN-10
Lineup: SN-10
flow rate: gpm
pressure: psig
level & grade: ft

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Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SN-10	
Lineilst: SN-10	
10/27/97 1:23 pm	
level & grade: ft	
flow rate: gpm	
pressure: psig	

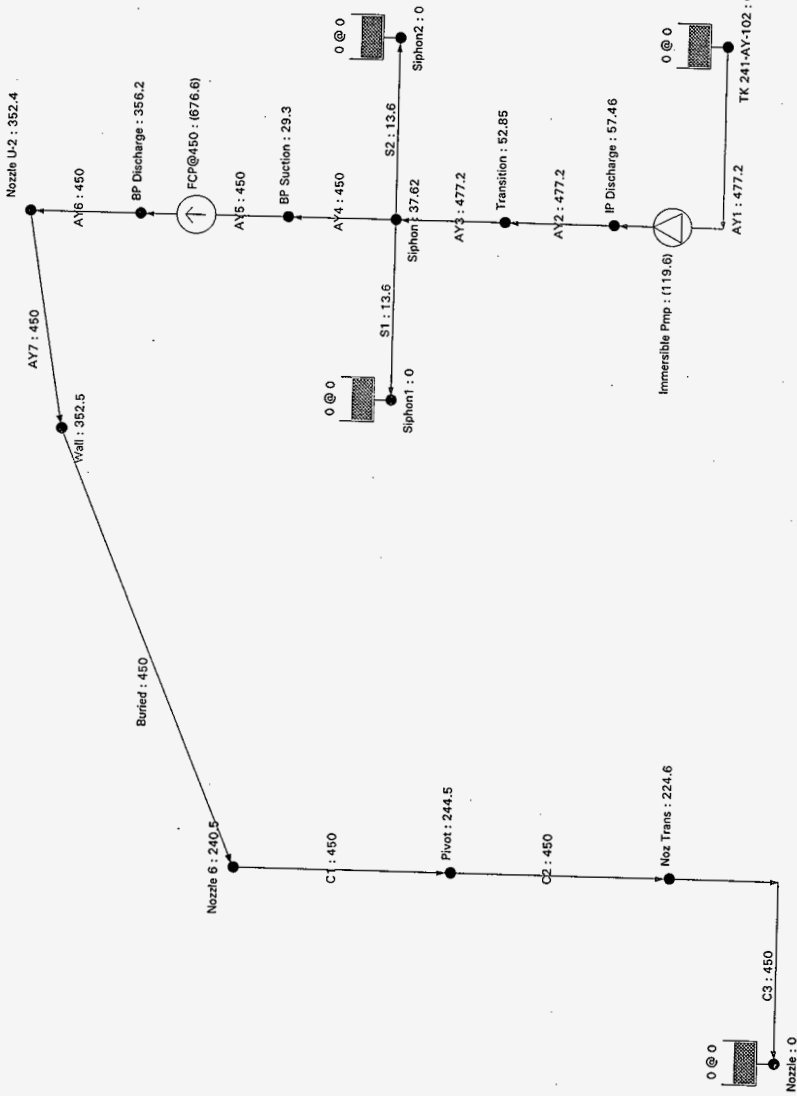




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Company: Fluor Daniel Northwest	10/27/97 1:23 pm
Project: W-320	Linelist: SN-10
by: K Hayase	Lineup: SN-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:24 pm Linelist: SN-10 Lineup: SN-10 flow rate: gpm pressure: psig level & grade: ft</p>
---	---

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date:

By: Kelly Hayase

Checked: 3/5/98 By: *Ken Wood*

Location: 241-C/241-AY

Revised:

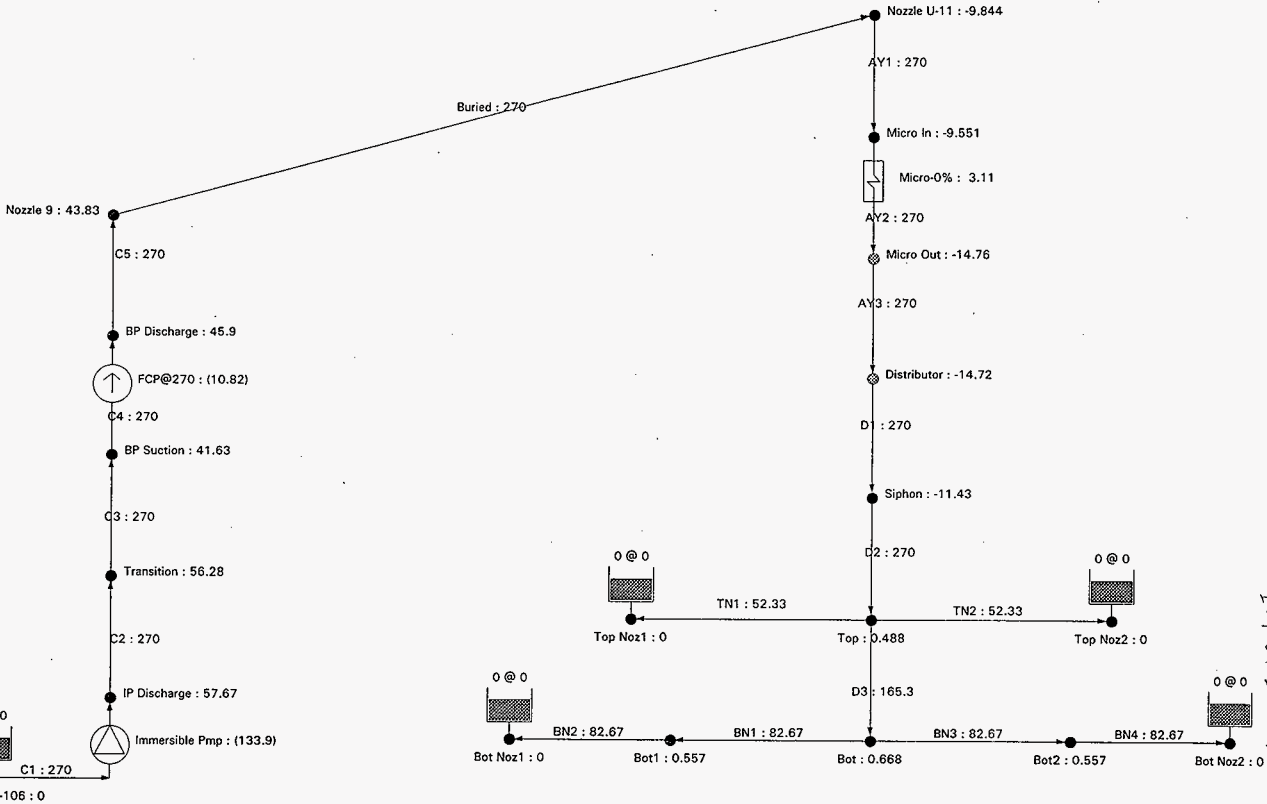
By:

APPENDIX E

Pipe-Flo Results (for system curves) SL-00
Pipe-Flo Results (for system curves) SL-10
Pipe-Flo Results (for system curves) SL-20
Pipe-Flo Results (for system curves) SL-30

Page E-1
Page E-25
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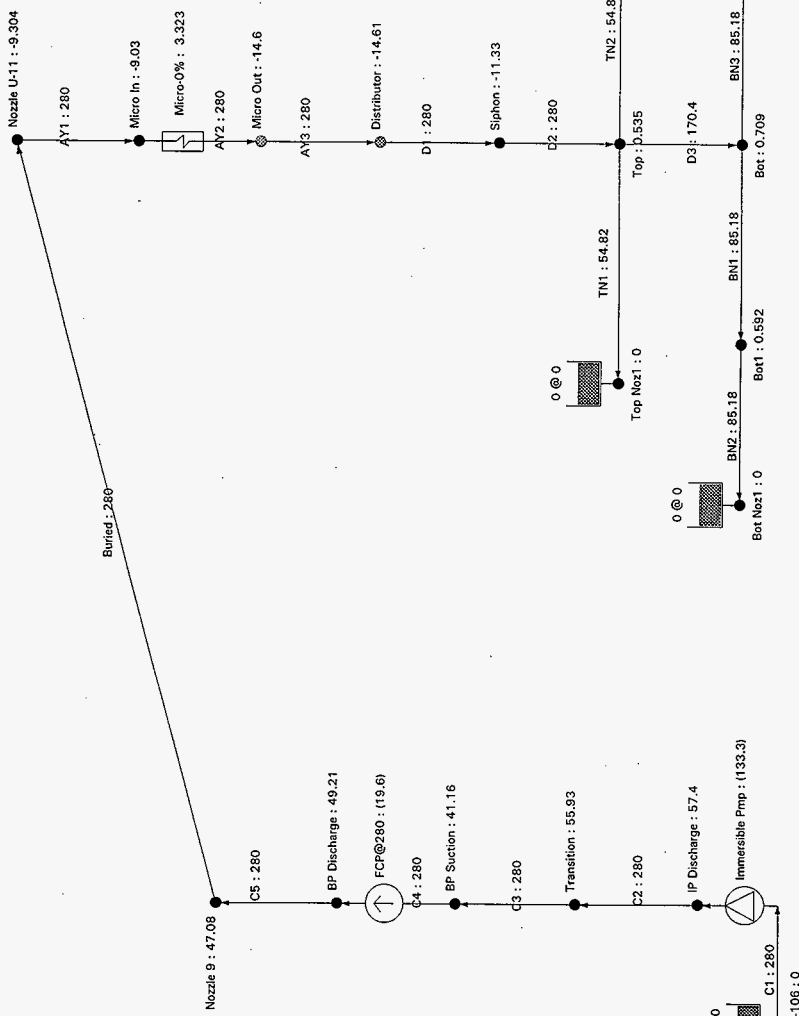
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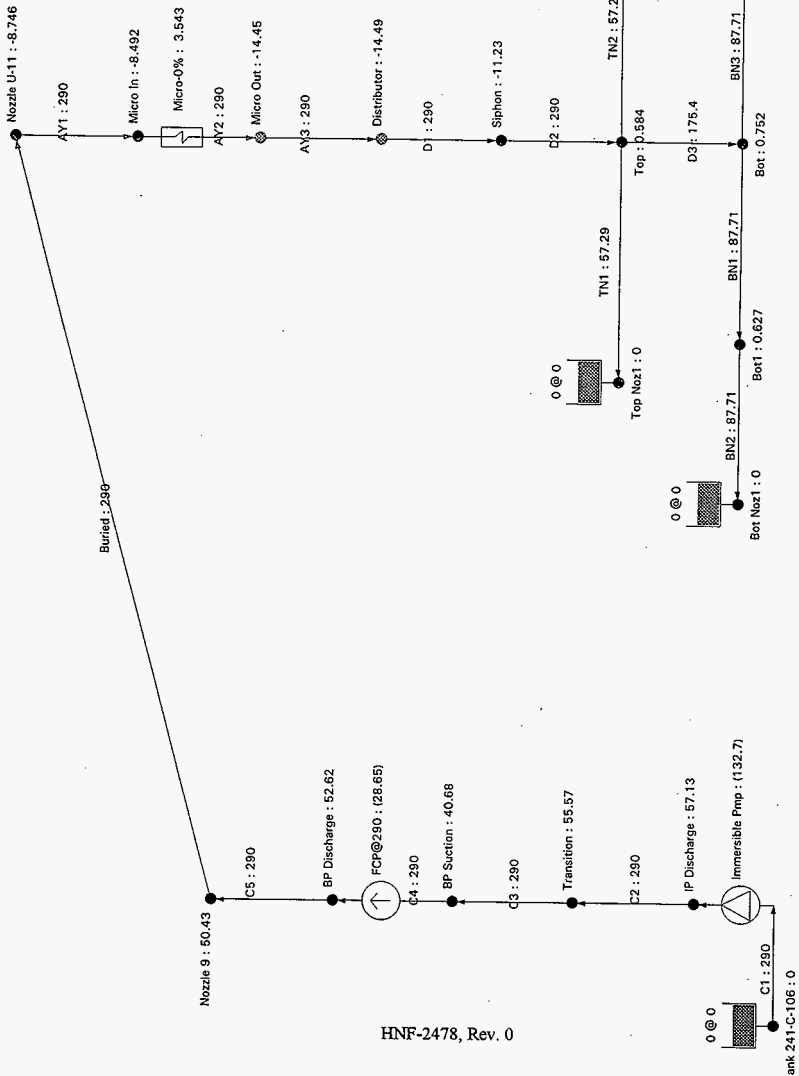
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ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 1:46 pm
Project: W-320	Linelist: SL-00
by: K Hayase	Lineup: SL-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



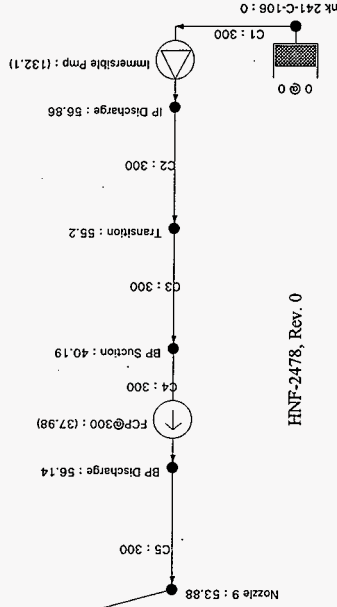
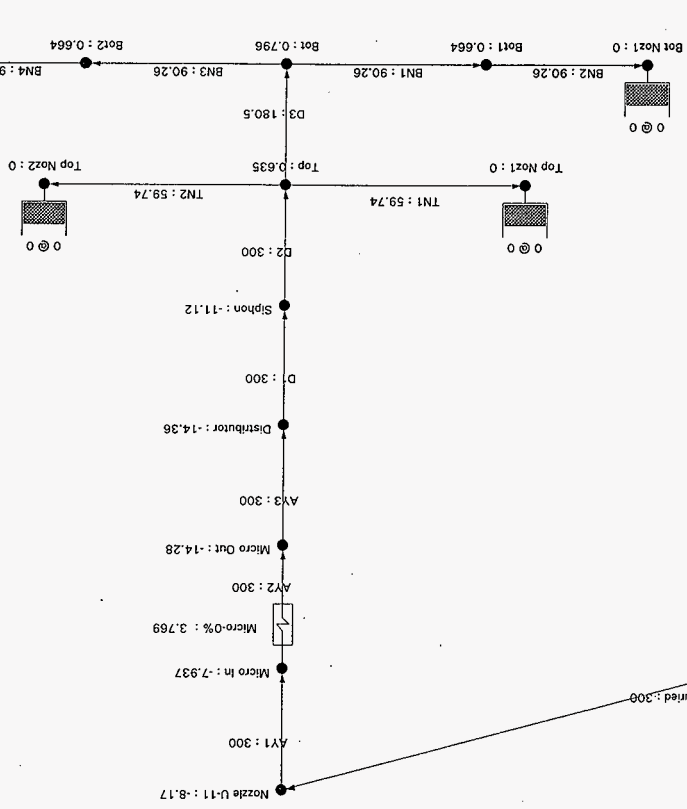
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:47 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:47 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
--	---

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Company: Fluor Daniel Northwest	Version: PIPE-FLO Ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-00	
Lineist: SL-00	
10/27/97 1:47 pm	level & grade: ft
	flow rate: gpm
	pressure: psia

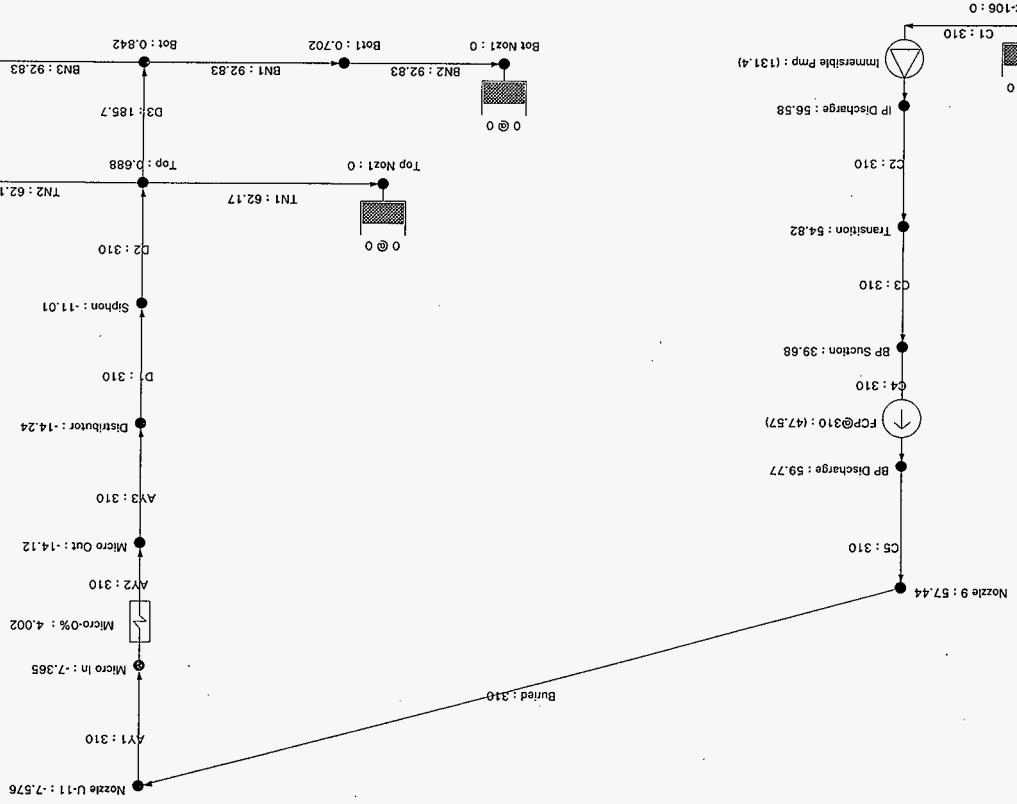


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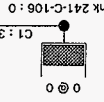
Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01

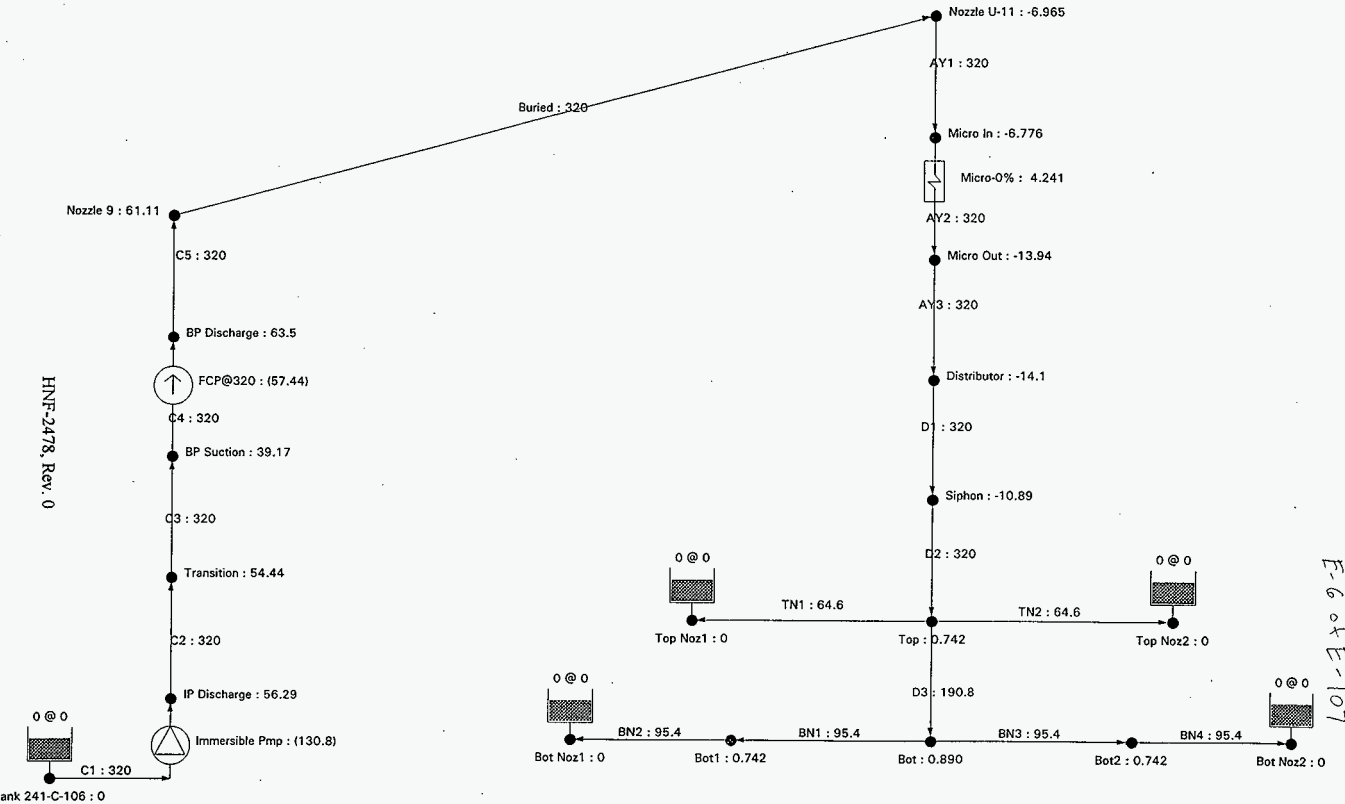
10/27/97 1:47 pm
Lineists: SL-00
Lineup: SL-00
flow rate: gpm
pressure: psi
level & grade: ft

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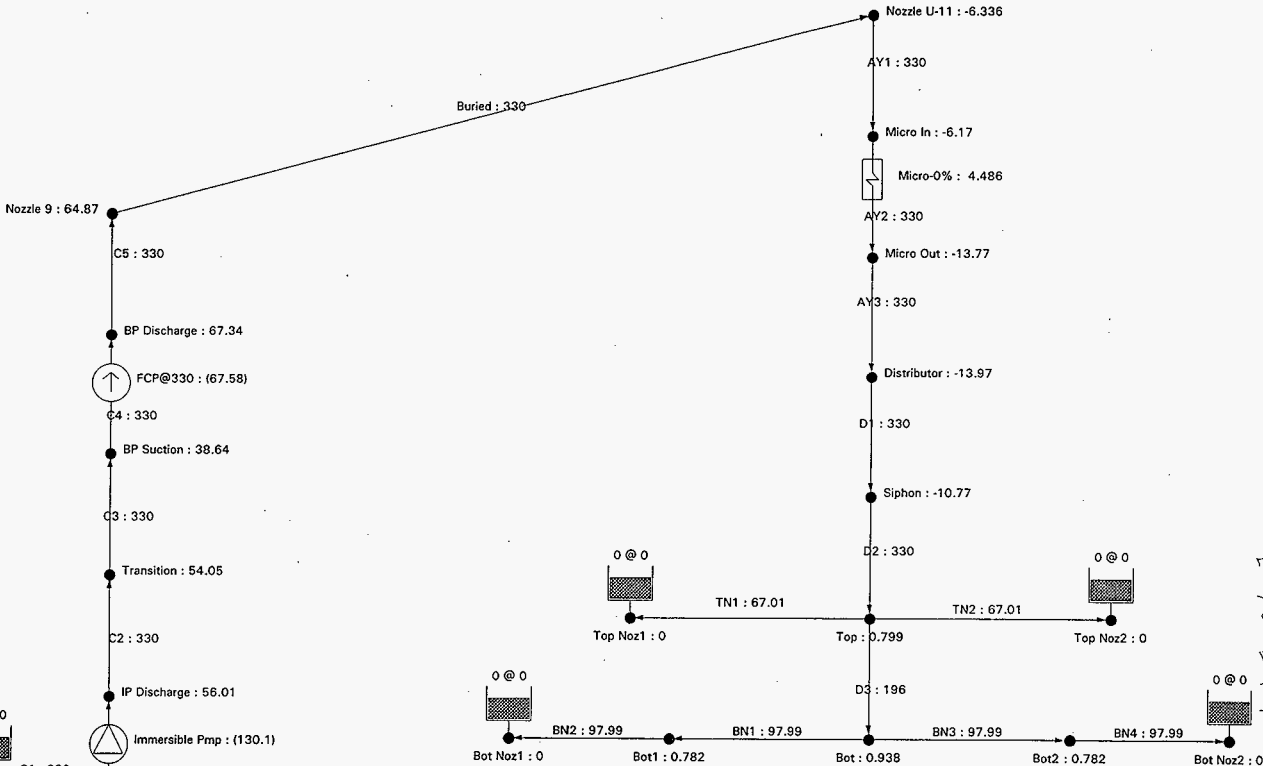
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ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 1:47 pm
Project: W-320	Linelist: SL-00
by: K Hayase	Lineup: SL-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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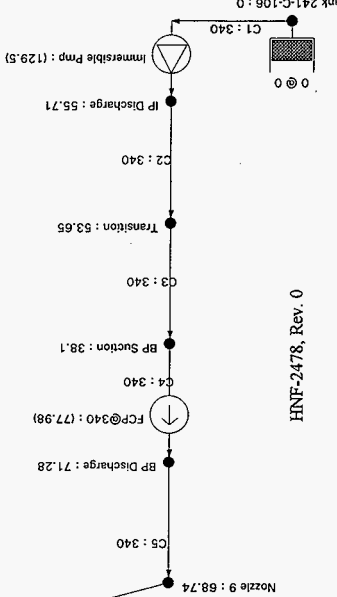
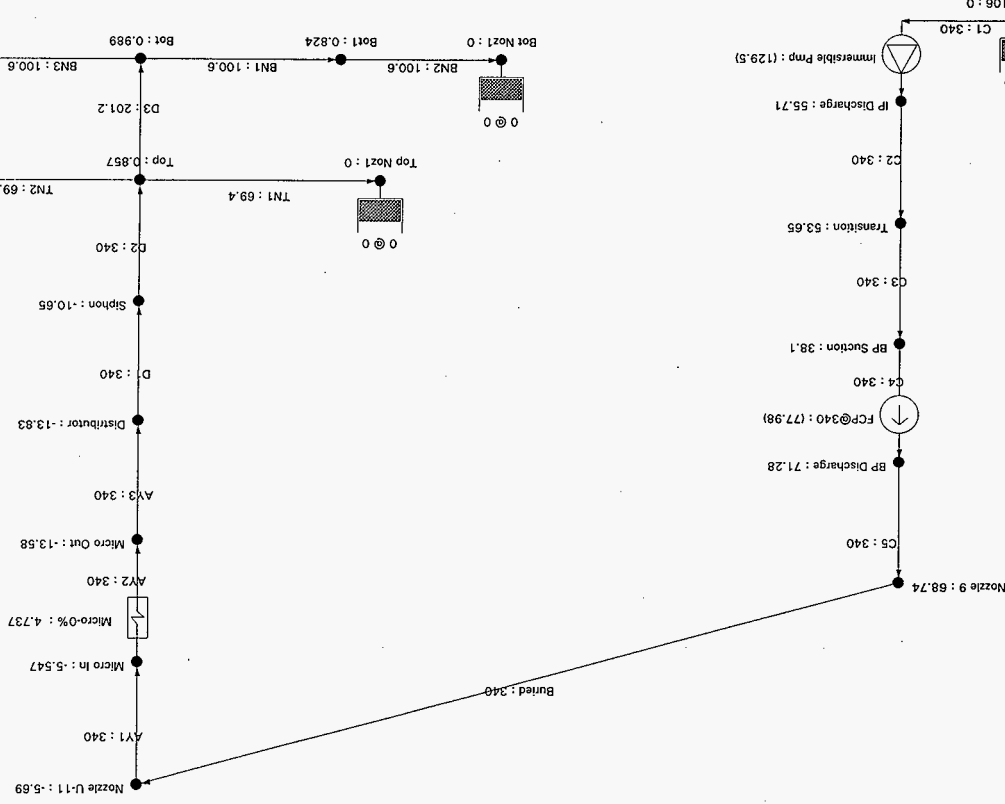


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Company: Fluor Daniel Northwest	10/27/97 1:47 pm
Project: W-320	Linelist: SL-00
by: K Hayase	Lineup: SL-00
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

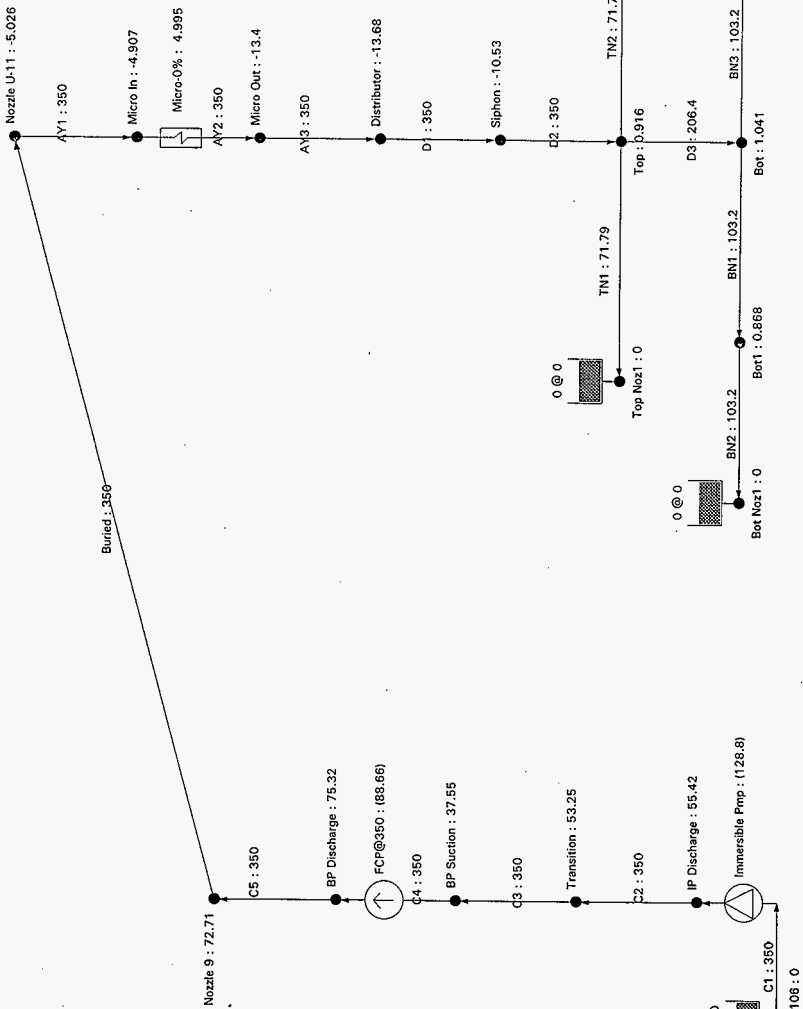
E-8 of E-107

Company: Fluor Daniel Northwest	Project: W-320	by: K Hayase	Comments: Calculation W320-27-048	Version: PIPE-FLO ver 5.01
10/27/97 1:48 pm	Lineup: SL-00	flow rate: gpm	pressure: psig	level & grade: ft
	Lineist: SL-00			



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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:48 pm LineList: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	

Version: PIPE-FLO ver 5.01

Comments: Calculation W320-27-048

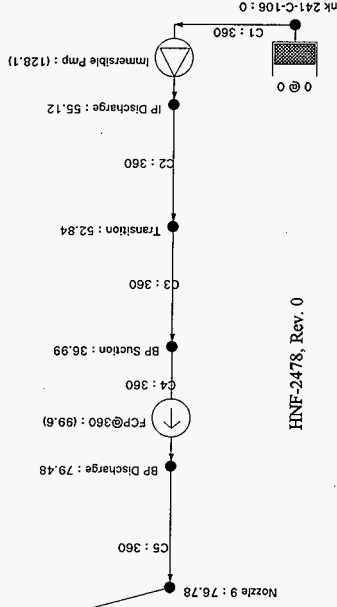
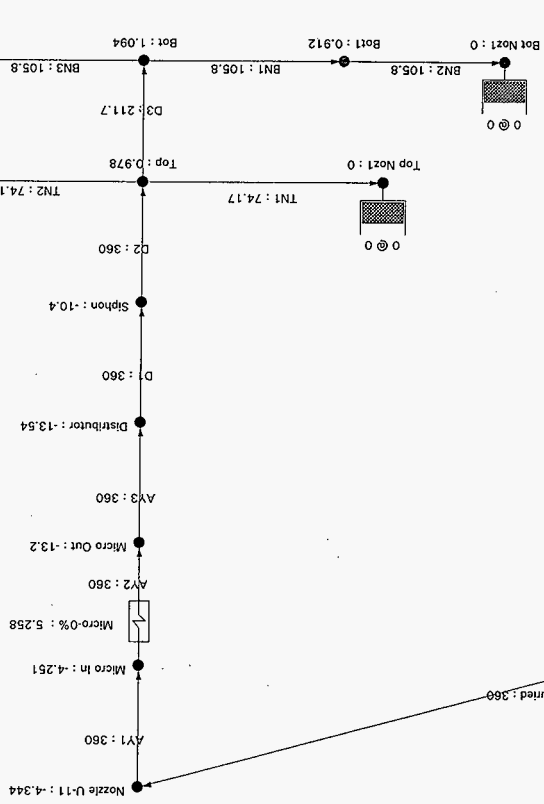
by: K Hayase

Project: W-320

Company: Fluor Daniel Northwest

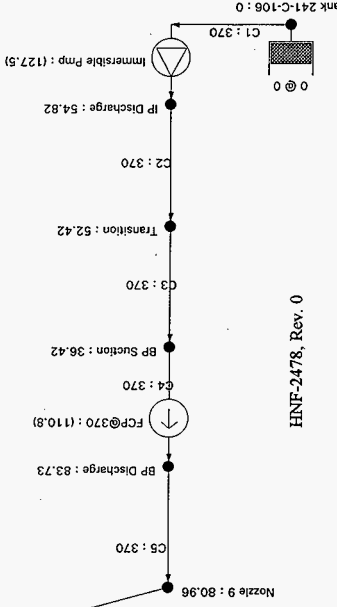
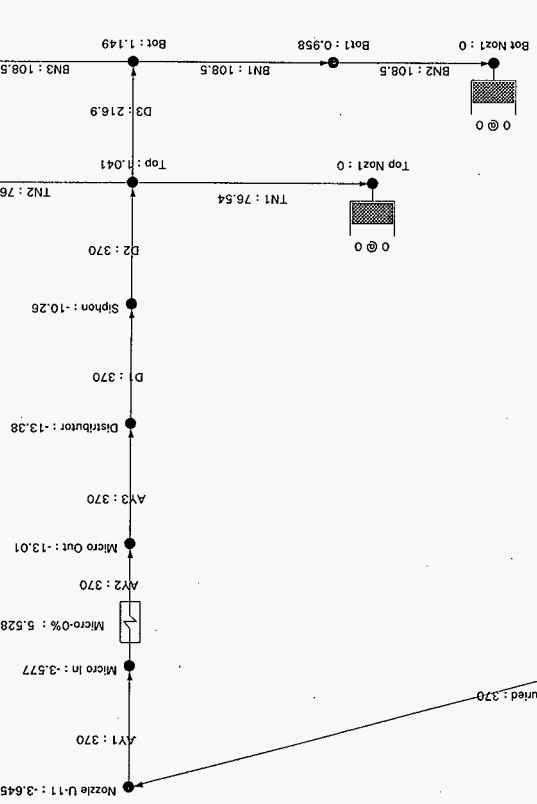
10/27/97 1:48 pm
 Line1st: SL-00
 Lineup: SL-00
 flow rate: gpm
 pressure: psig
 level & grade: ft

E-10 of E-107

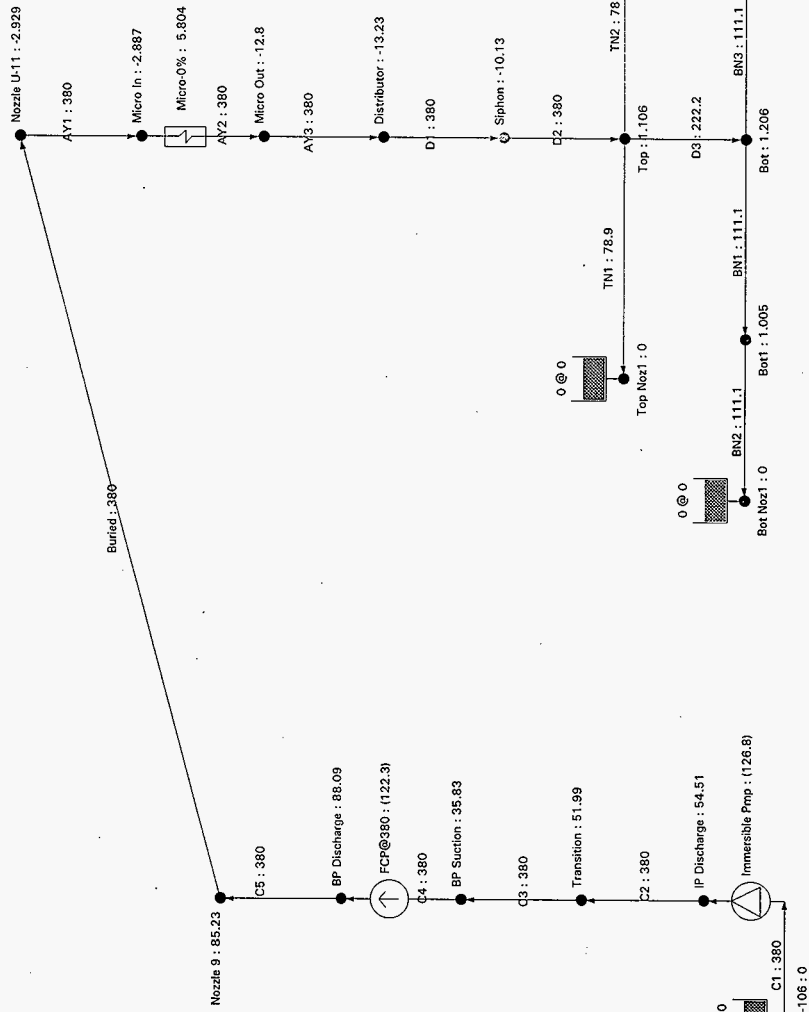


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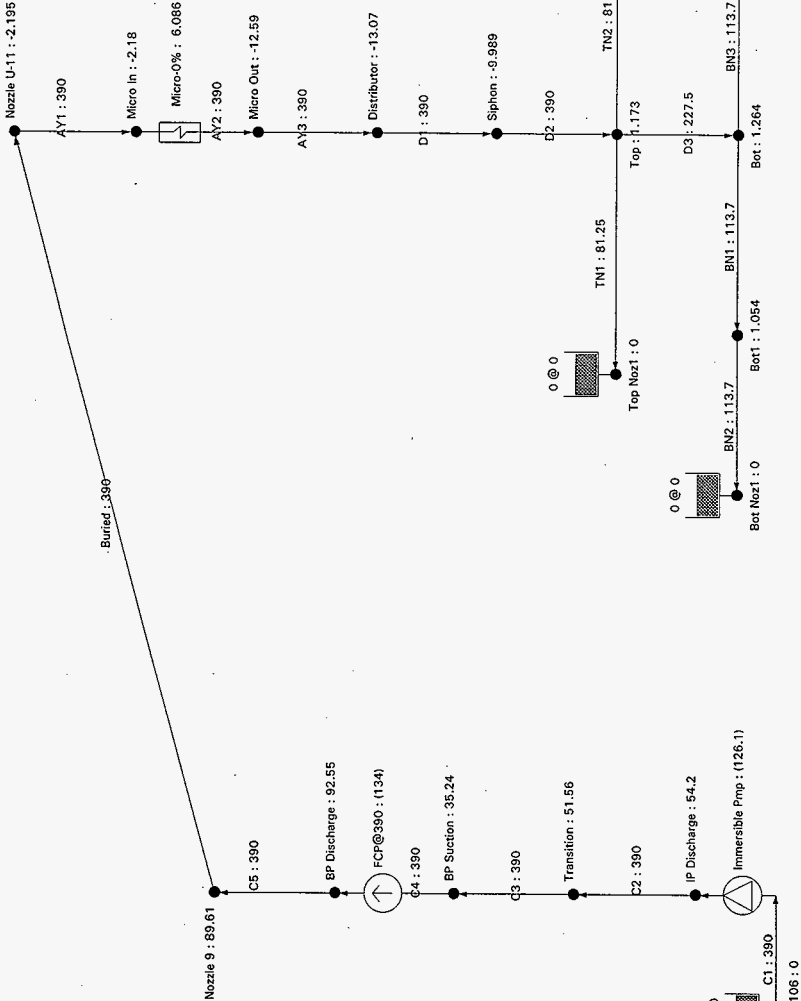
E-11 of E-107



Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-00	
LineList: SL-00	
10/27/97 - 1:48 pm	
level & grade: ft	
flow rate: gpm	
pressure: psig	



<p>Company: Fluor Daniel Northwest</p> <p>Project: W-320</p> <p>by: K Hayase</p> <p>Comments: Calculation W320-27-048</p> <p>Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:48 pm</p> <p>LineList: SL-00</p> <p>Lineup: SL-00</p> <p>flow rate: gpm</p> <p>pressure: psig</p> <p>level & grade: ft</p>
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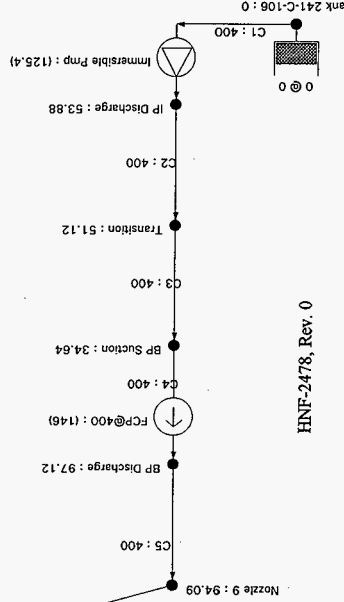
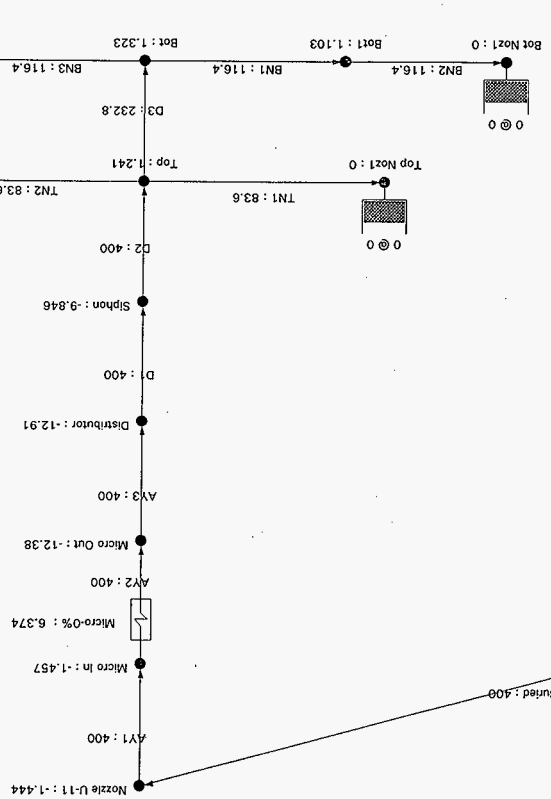


Company: Filcor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048

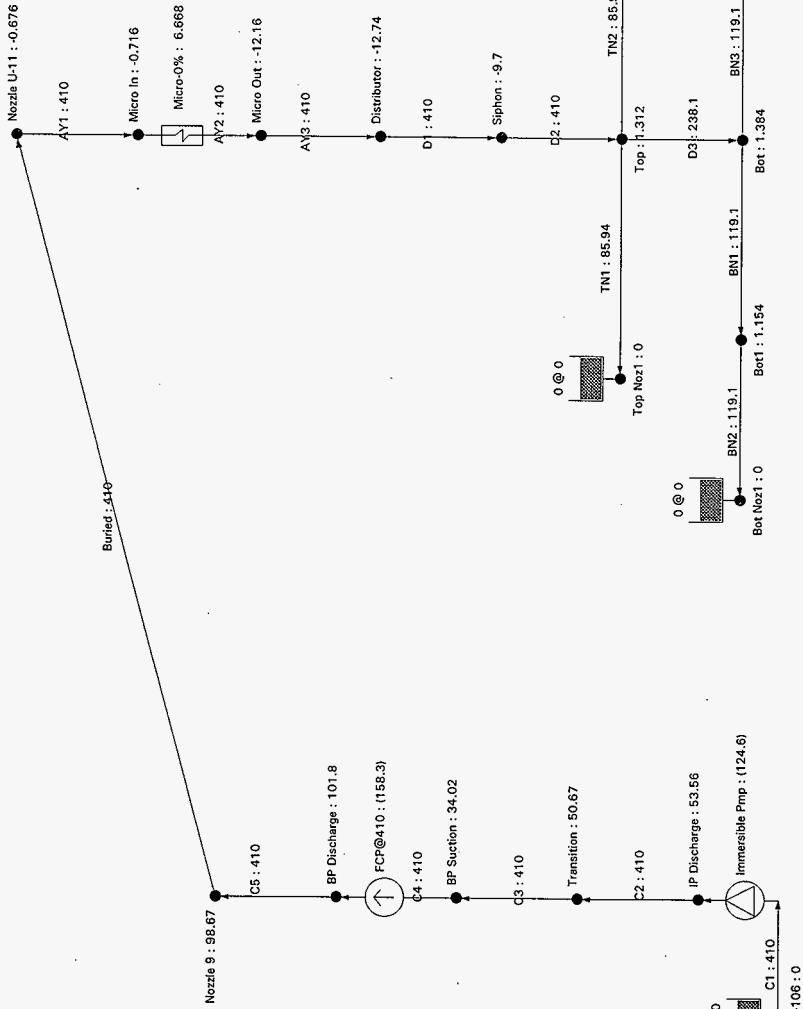
10/27/97 1.48 pm
LineList: SL-00
Lineup: SL-00
flow rate: gpm
pressure: psig
level & grade: ft

E-14 of E-107

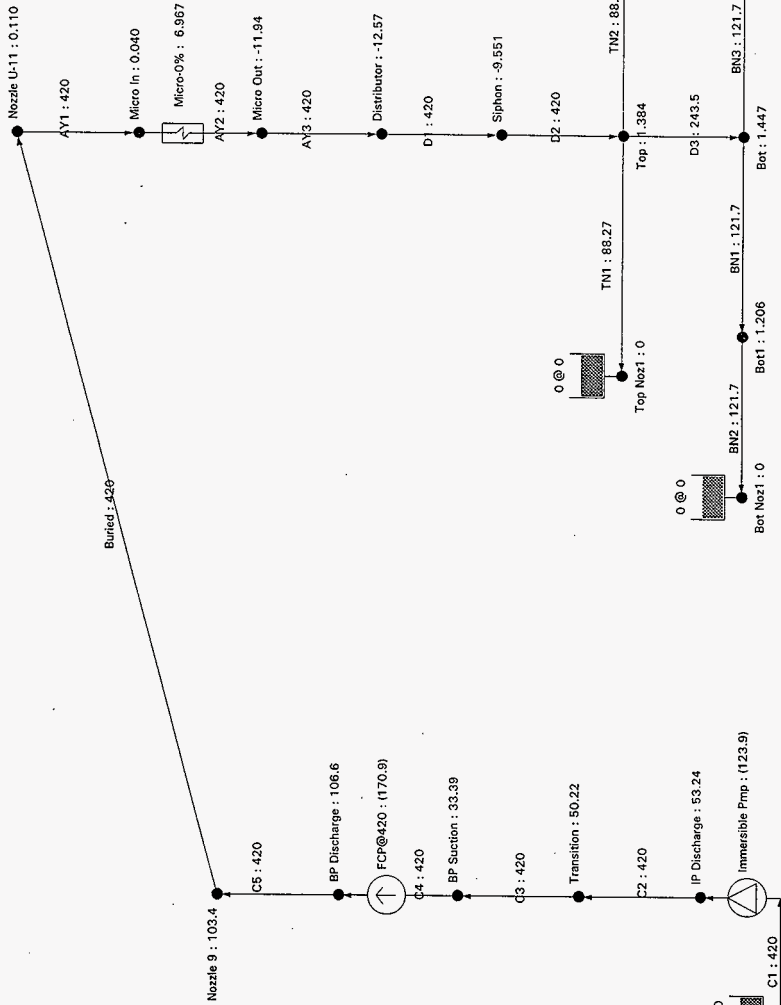
Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-00	
LineList: SL-00	
10/27/97 1:49 pm	
level & grade: ft	
flow rate: gpm	
pressure: psig	



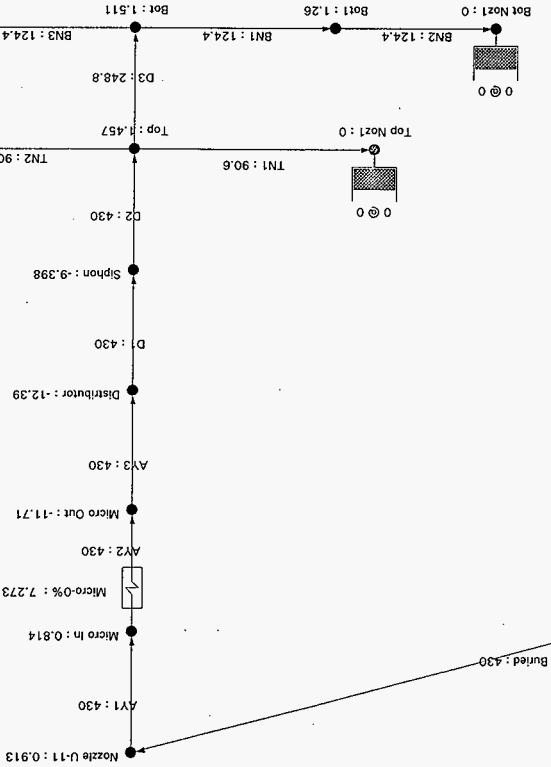
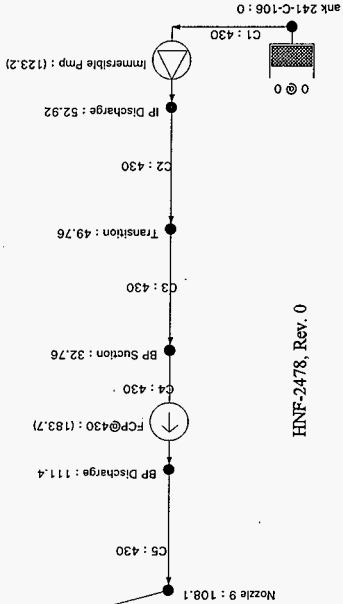
E-15 of E-107



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:49 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
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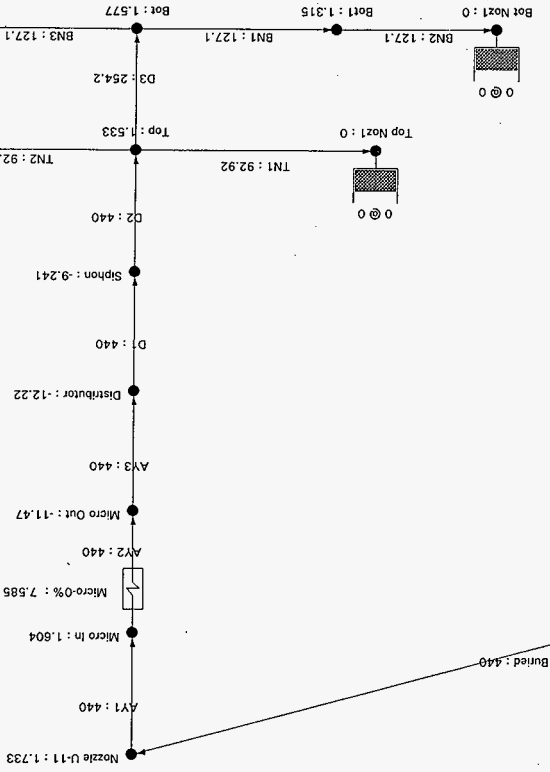
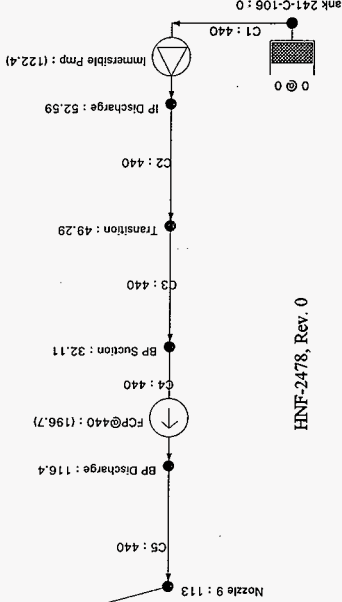


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>Version: PIPE-FLO ver 5.01</p>
<p>10/27/97 1:49 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>	



E-17 of E-107

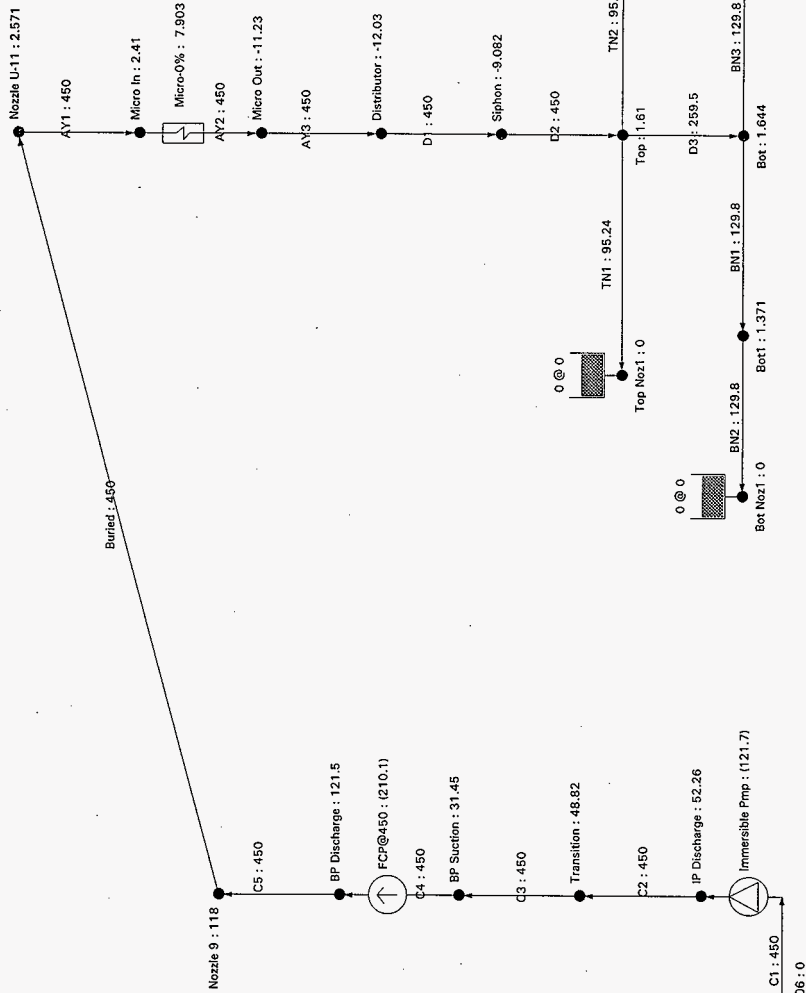
Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-00	
Linehist: SL-00	
10/27/97 1:49 pm	level & grade: ft
	flow rate: gpm
	pressure: psig



E-18 of E-107

Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Level & grade: ft	
Lineists: SL-00	
Lineup: SL-00	
flow rate: gpm	
pressure: psig	
10/27/97 1:49 pm	

E-19 of E-107

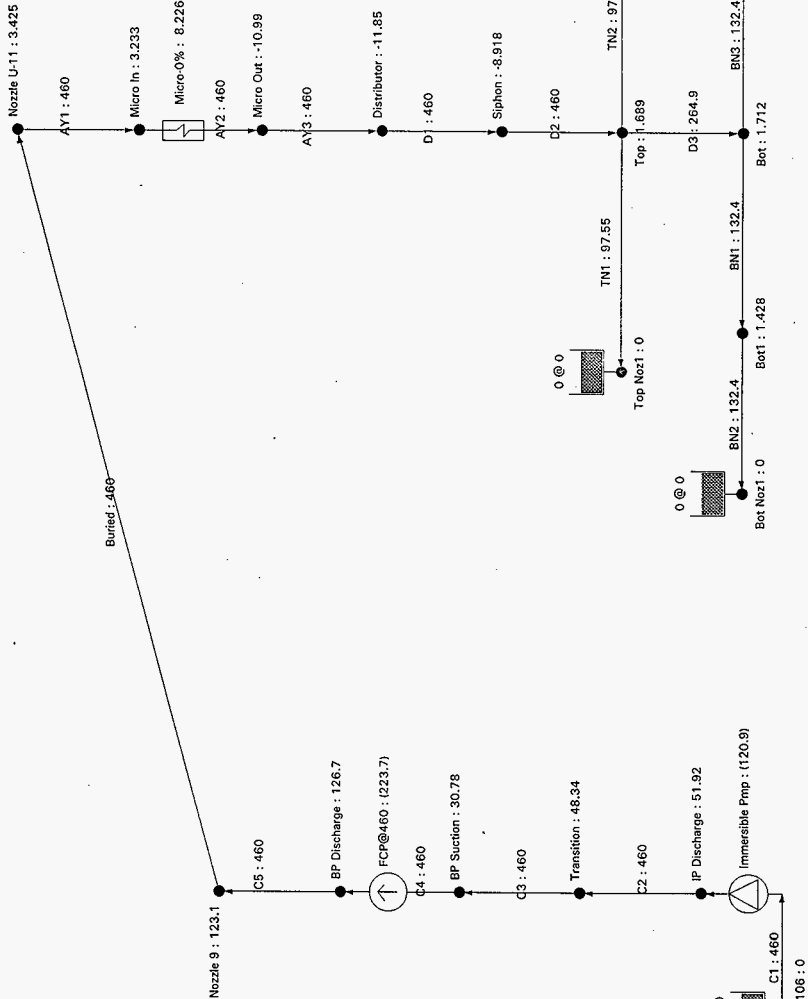


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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:49 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
---	---

Version: PIPE-FLO ver 5.01

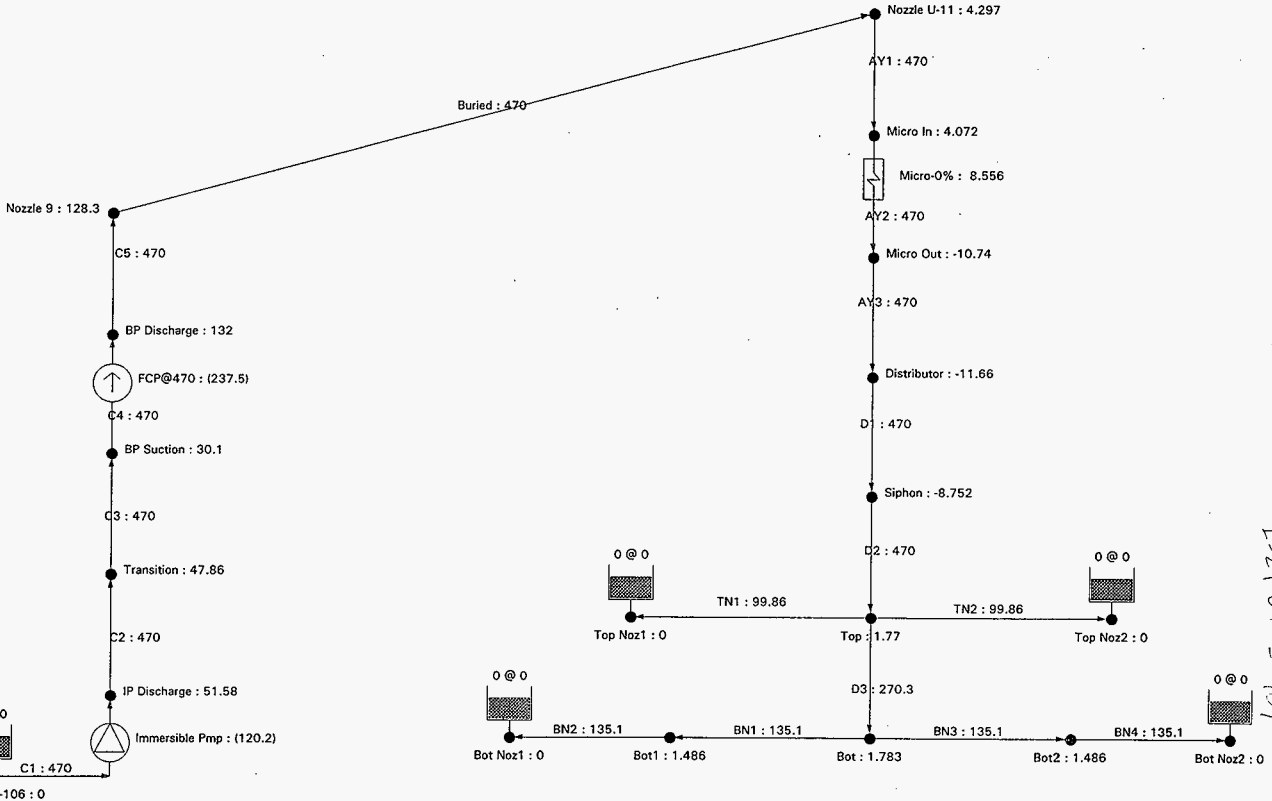
ank-241-C-106: 0



Buried: 466

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:50 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
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HNF-2478, Rev: 0

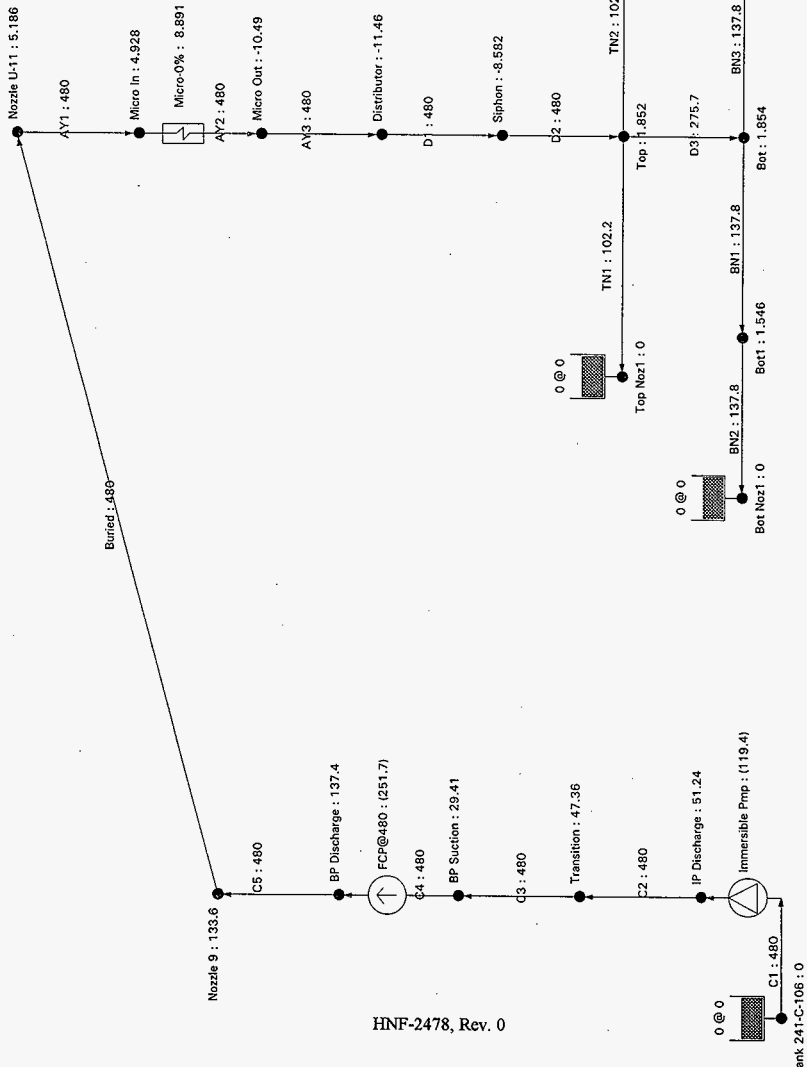


ank 241-C-106 : 0

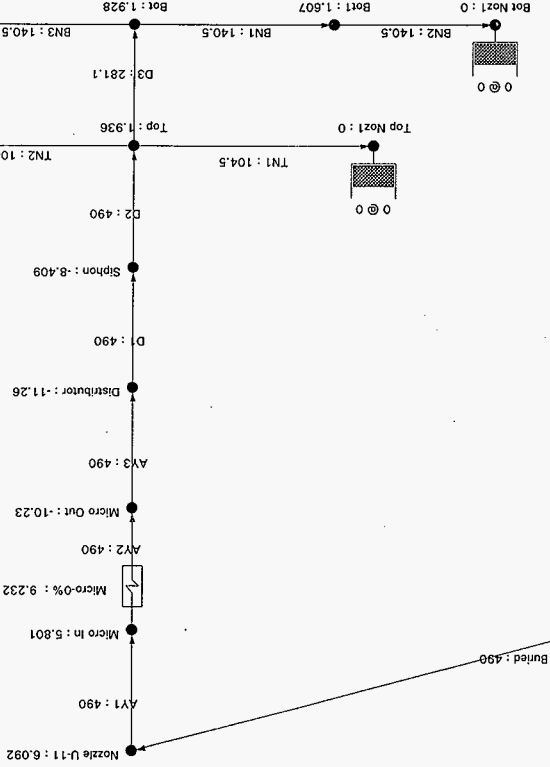
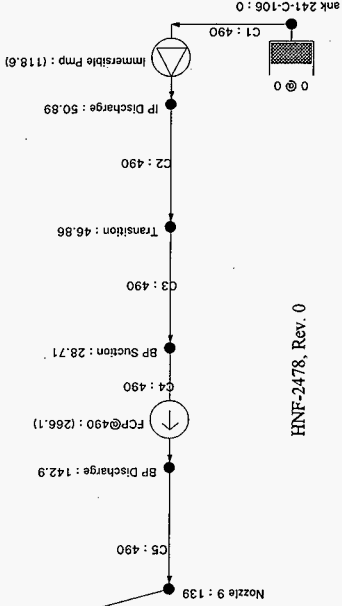
E-21 of E-107

Company: Fluor Daniel Northwest	10/27/97 1:50 pm
Project: W-320	Linelist: SL-00
by: K Hayase	Lineup: SL-00
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

E-22 of E-107

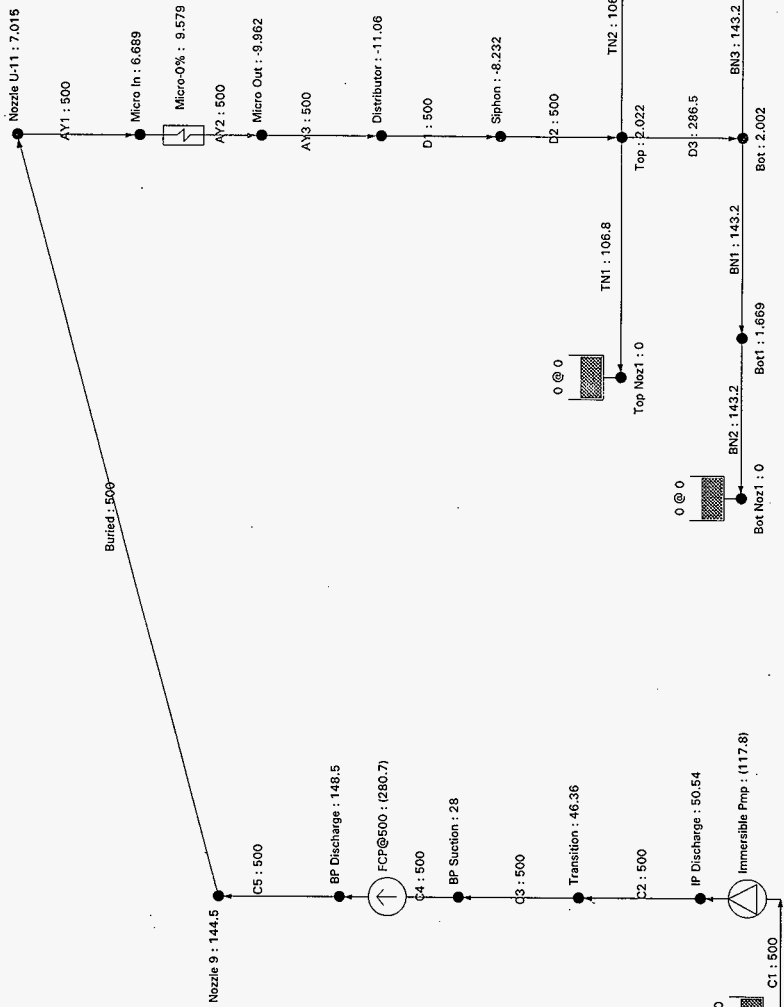


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:50 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
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E-25 of E-107

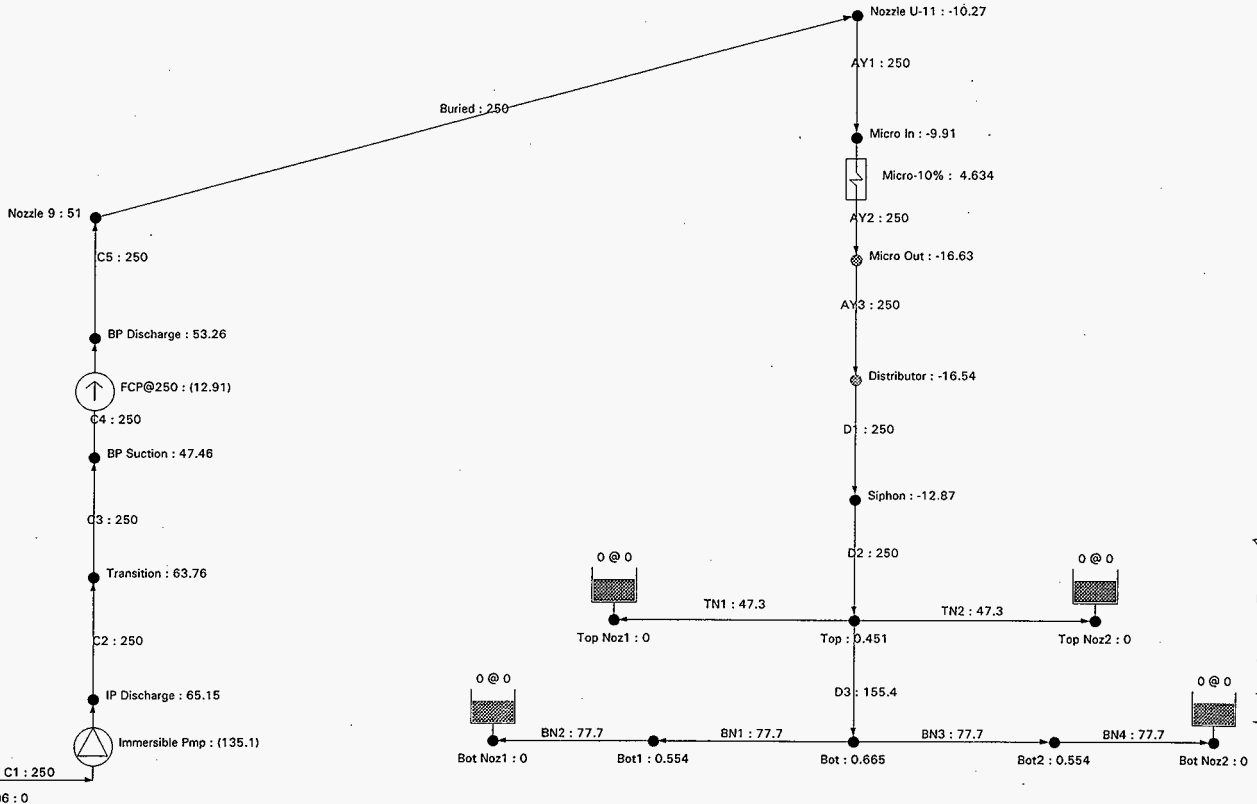
Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-00	
LineList: SL-00	
flow rate: gpm	
pressure: psig	
level & grade: ft	
10/27/97 1:50 pm	



Buried: 508

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:51 pm Linelist: SL-00 Lineup: SL-00 flow rate: gpm pressure: psig level & grade: ft</p>
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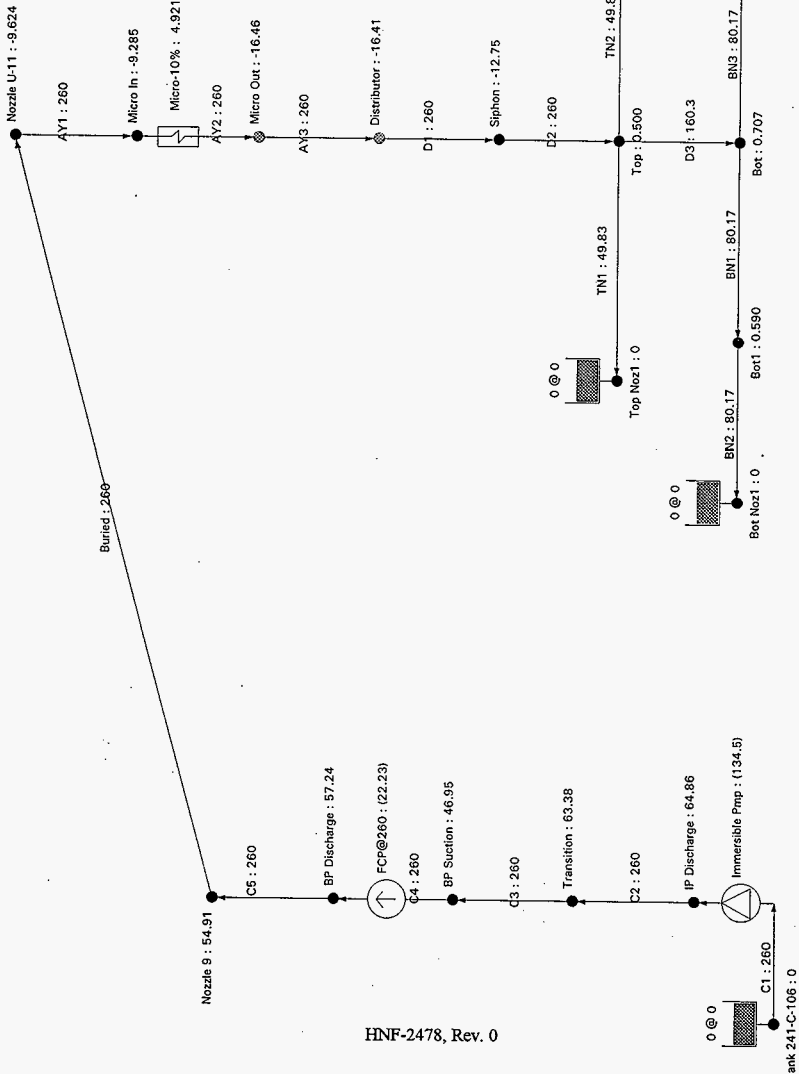
HNF-2478, Rev. 0



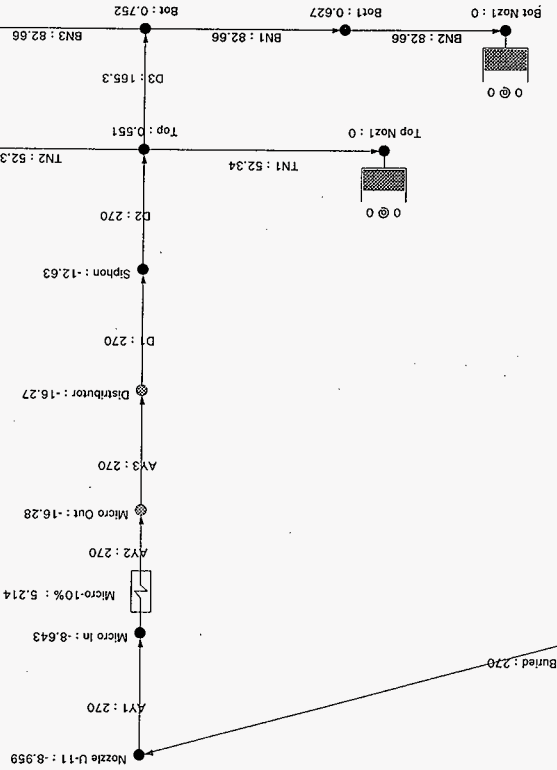
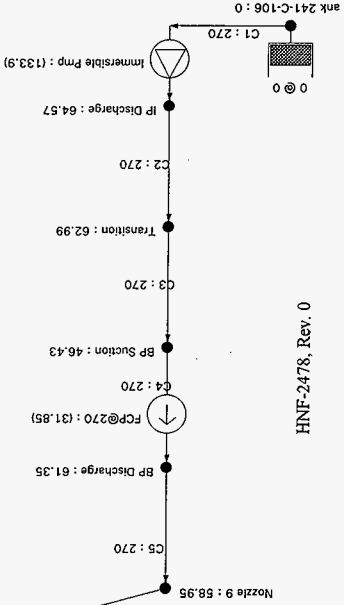
E-25 of E-107

ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 1:51 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



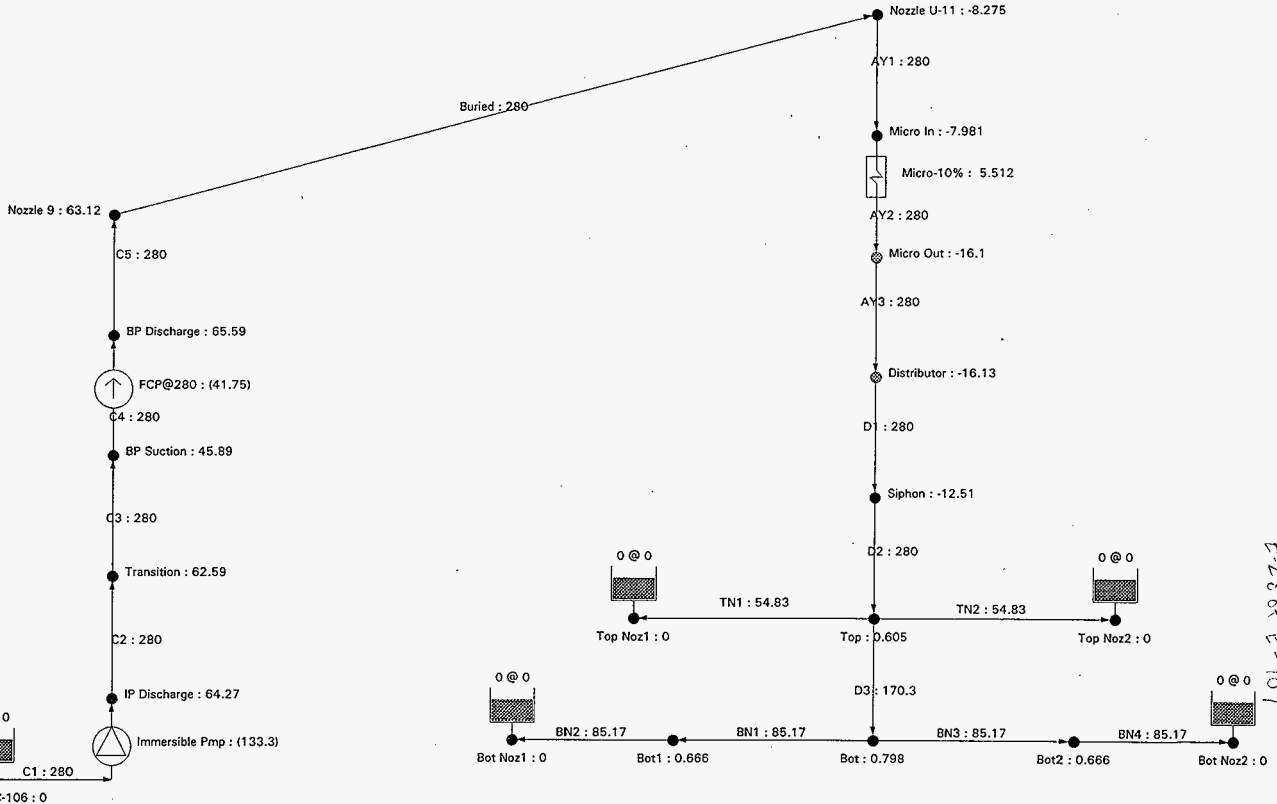
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:51 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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Company: Fluor Daniel Northwest
Project: W-320
by: K Hayase
Comments: Calculation W320-27-048
Version: PIPE-FLO ver 5.01
level & grade: ft
pressure: psig
flow rate: gpm
Lineup: SL-10
Linefile: SL-10
10/27/97 1:51 pm

101-3-E-107

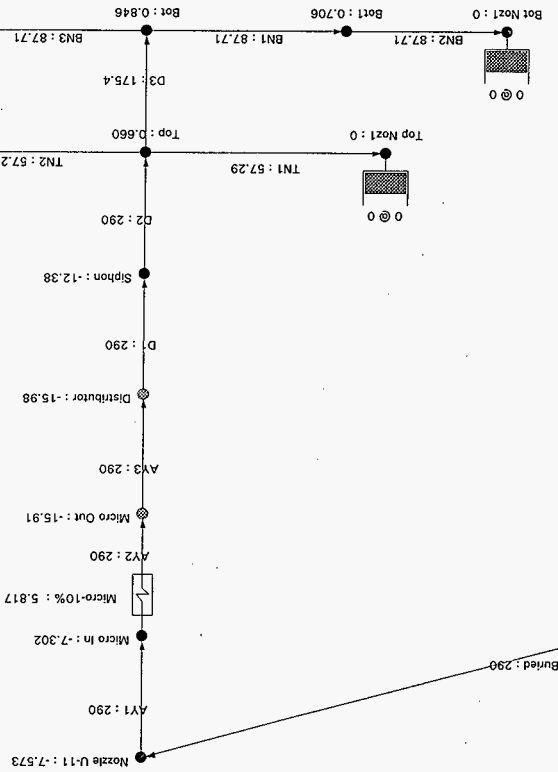
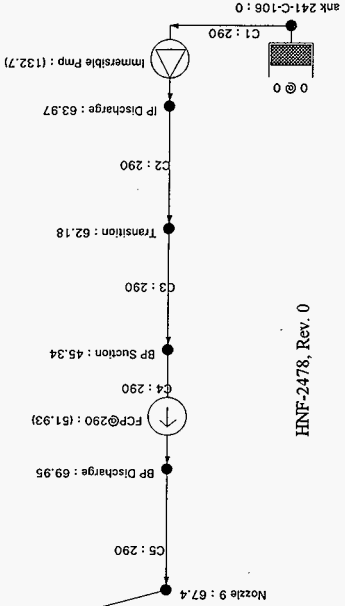
HNF-2478, Rev. 0



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ank 241-C-106 : 0

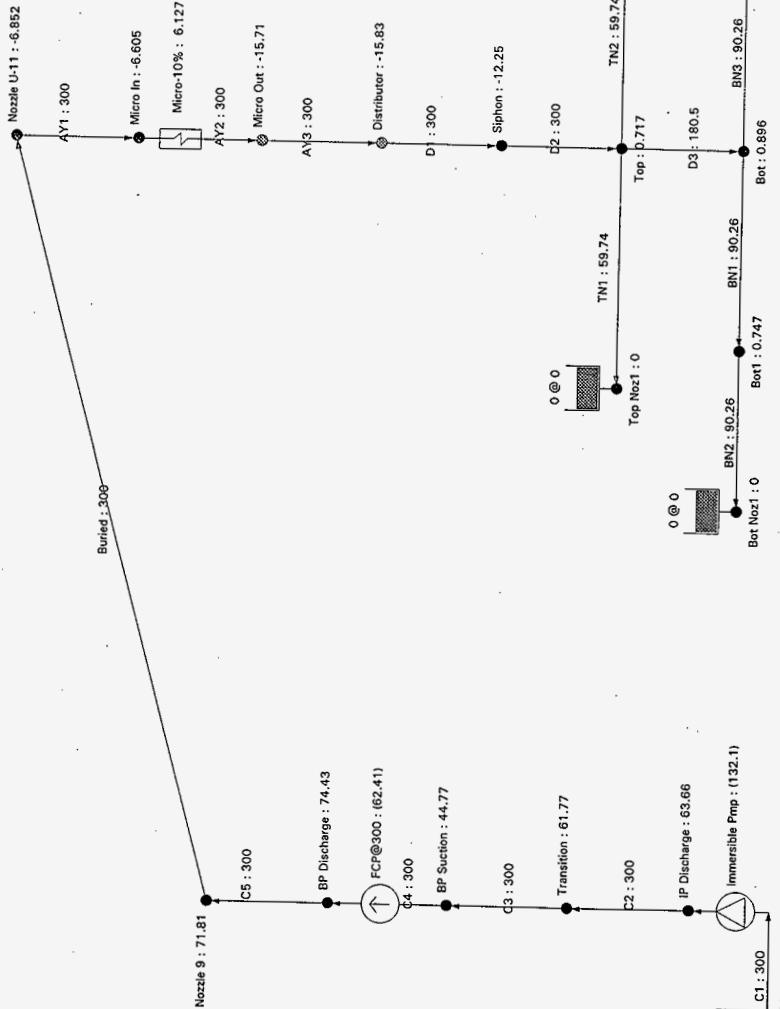
Company: Fluor Daniel Northwest	10/27/97 1:52 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft



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Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-Z7-048
by: K Hayase	
Linelist: SL-10	
Lineup: SL-10	
flow rate: gpm	
pressure: psig	
level & grade: ft	

10/27/97 1:52 pm



Buried : 300

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Company: Fluor Daniel Northwest
 Project: W-320

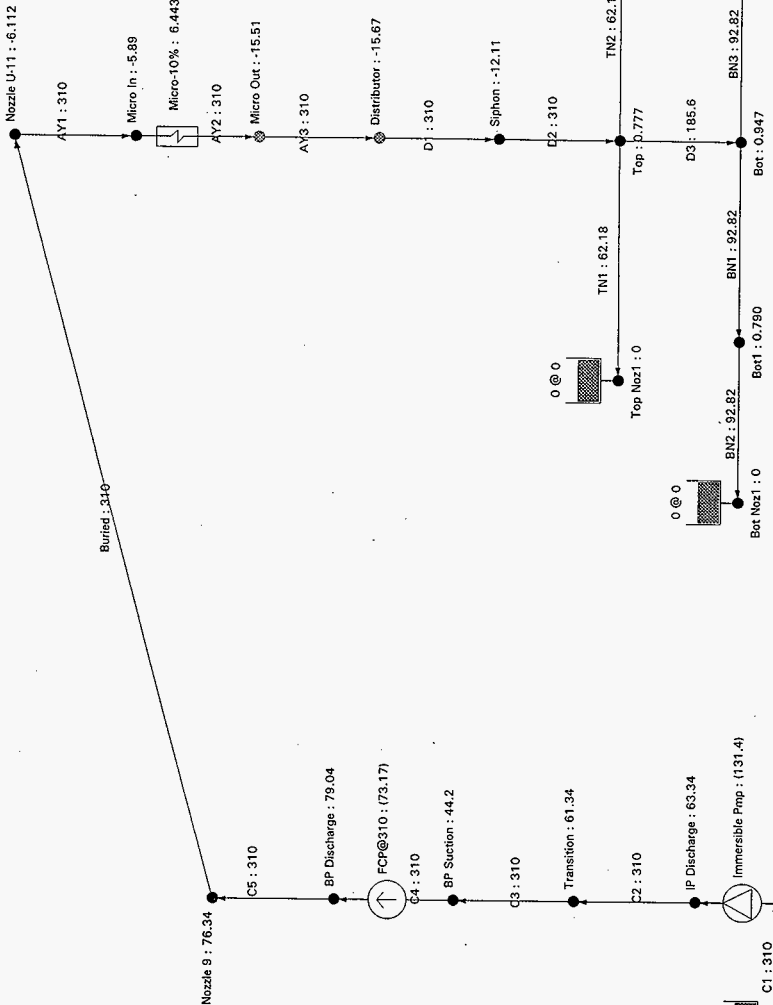
by: K Hayase

Comments: Calculation W320-27-048

Version: PIPE-FLO ver 5.01

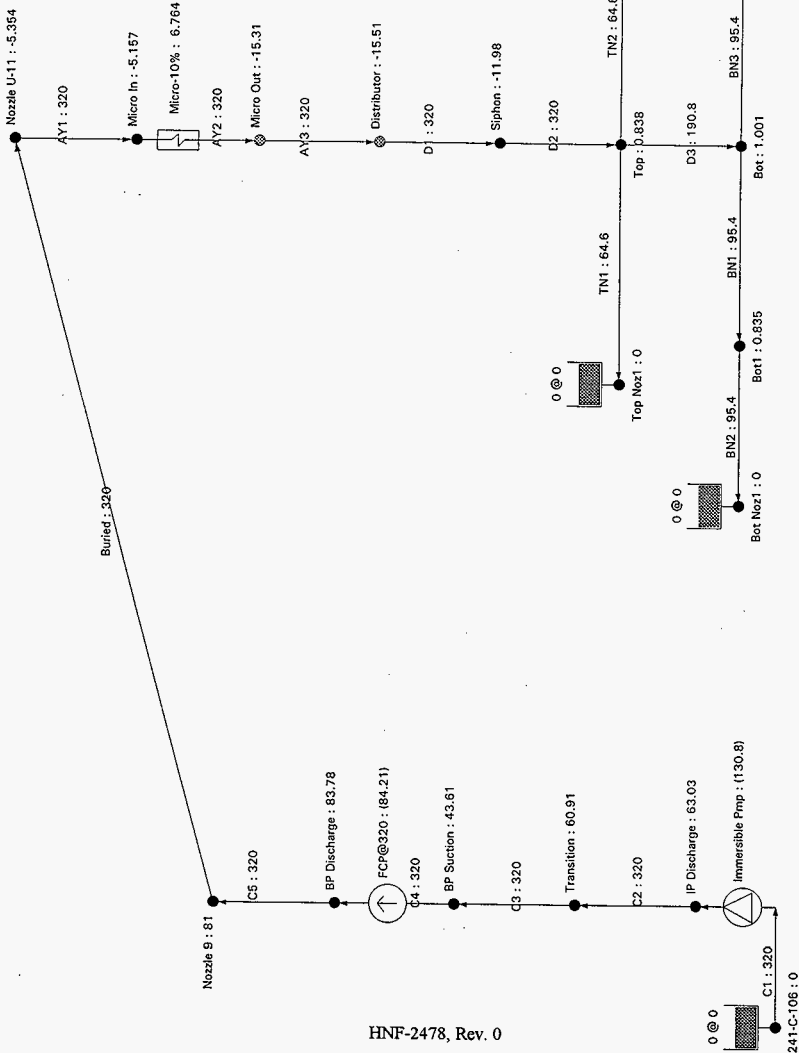
10/27/97 1:52 pm
 Linelist: SL-10
 Lineup: SL-10
 flow rate: gpm
 pressure: psig
 level & grade: ft

ank 241-C-106 : 0

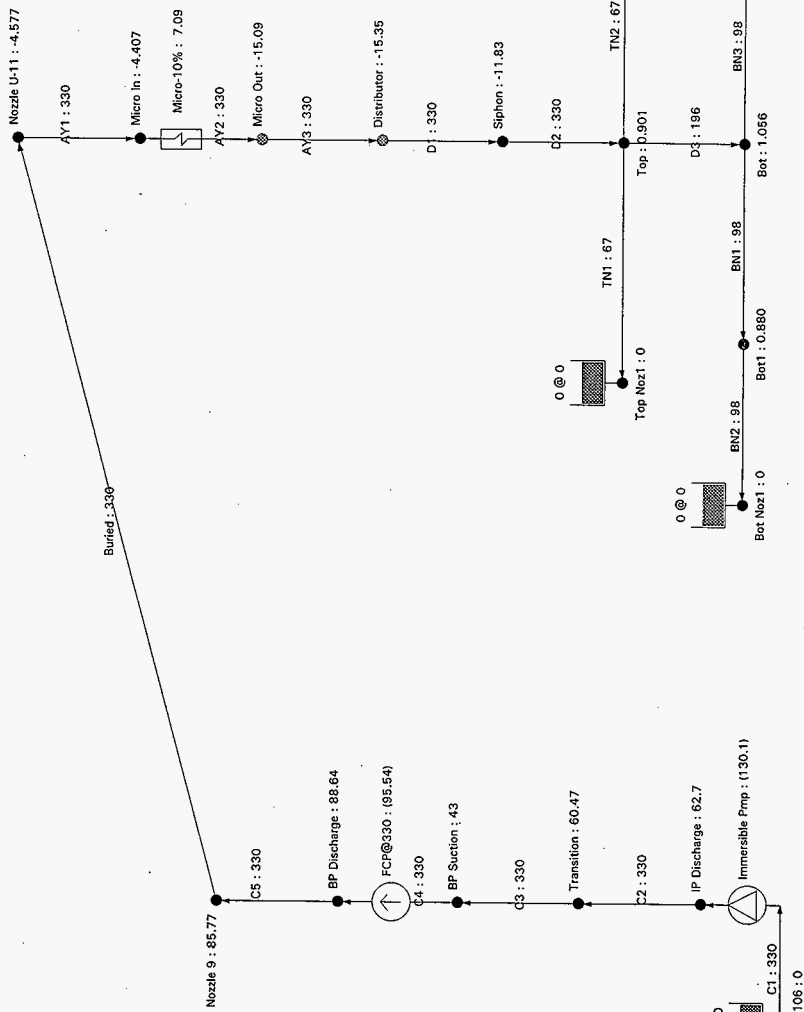


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>Version: PIPE-FLO ver 5.01</p>
<p>10/27/97 1:52 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>	

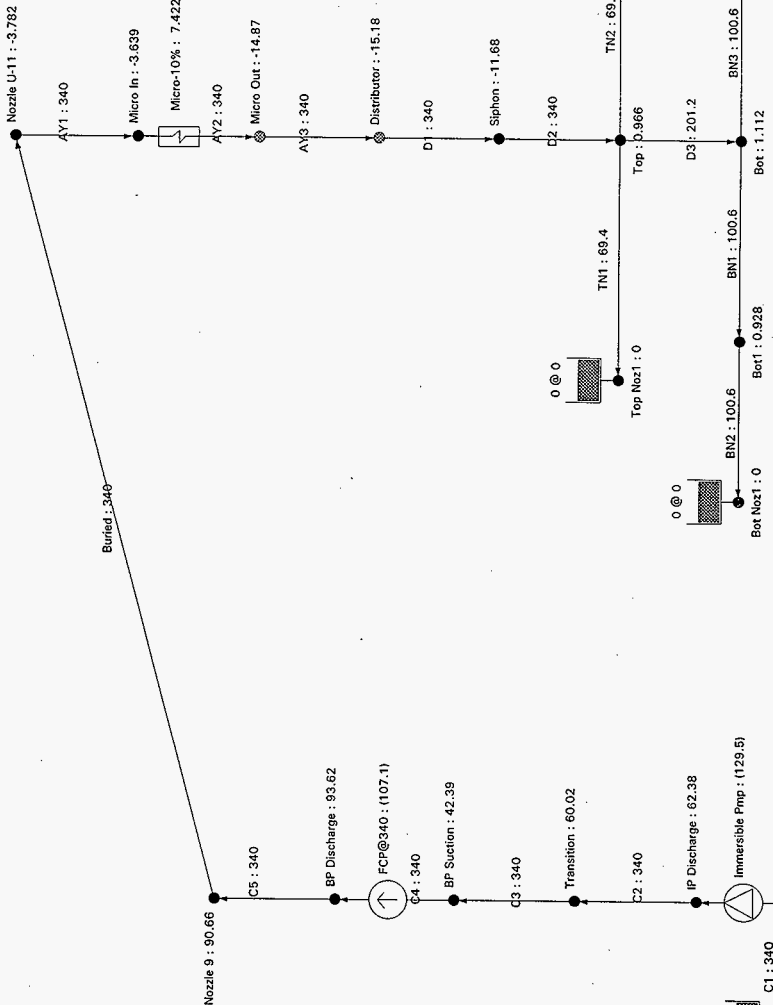
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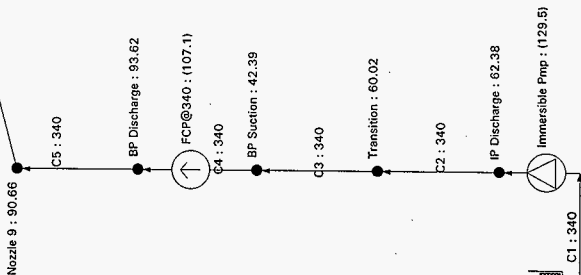
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:52 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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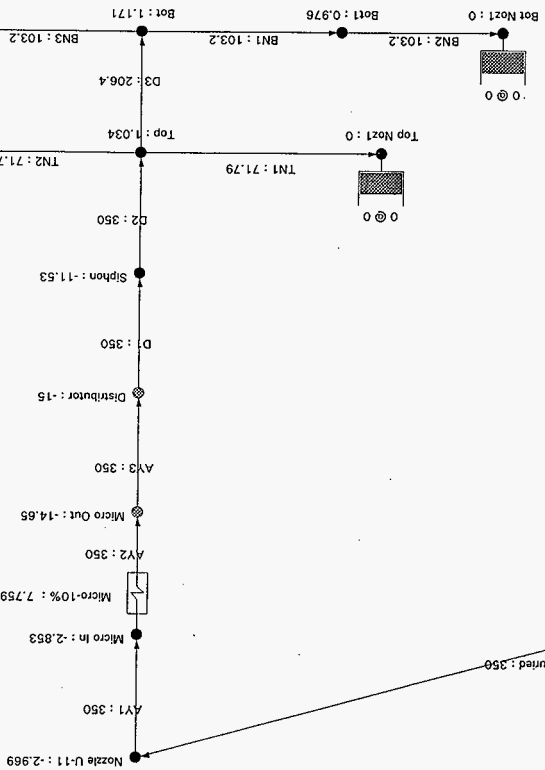
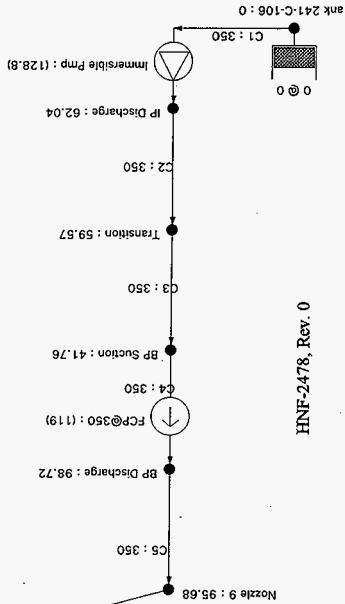
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:52 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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Buried : 340



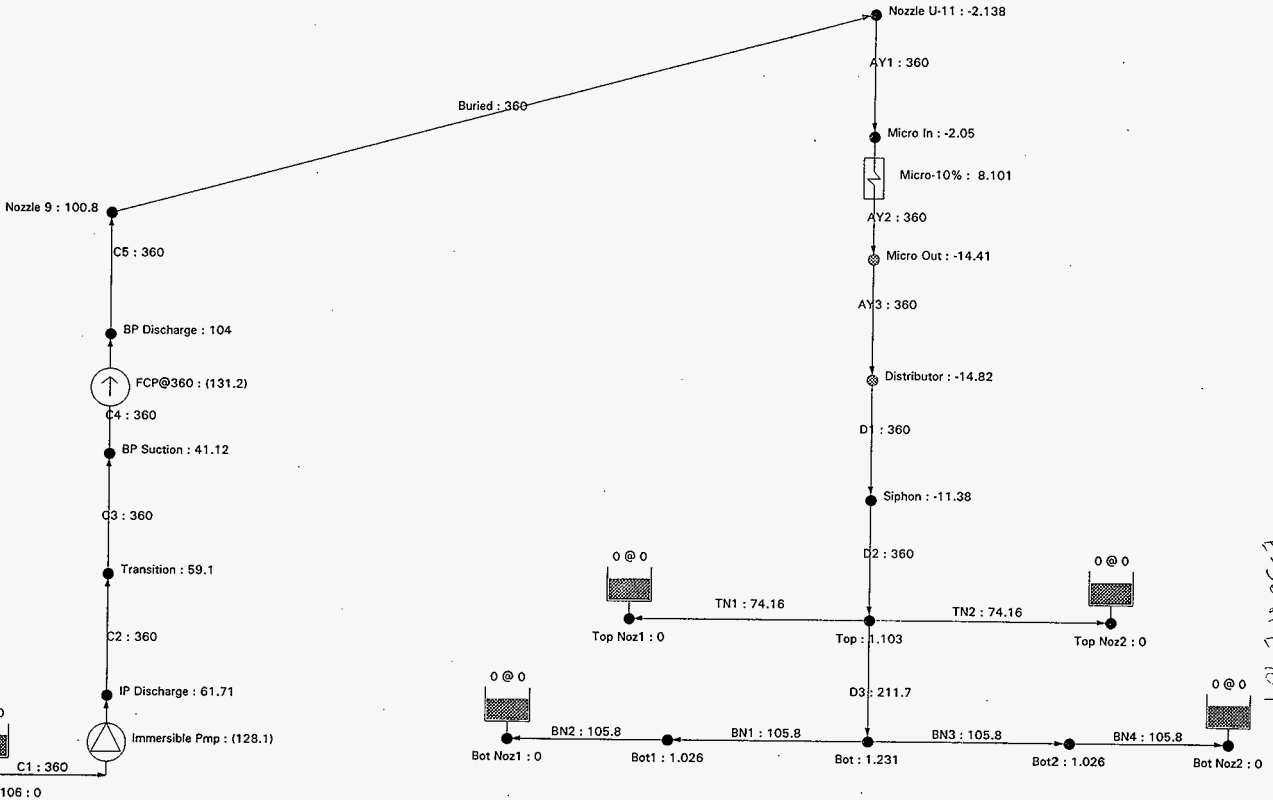
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:53 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Linelist: SL-10	
Lineup: SL-10	
flow rate: gpm	
pressure: psig	
level & grade: ft	

E-35 of E-107

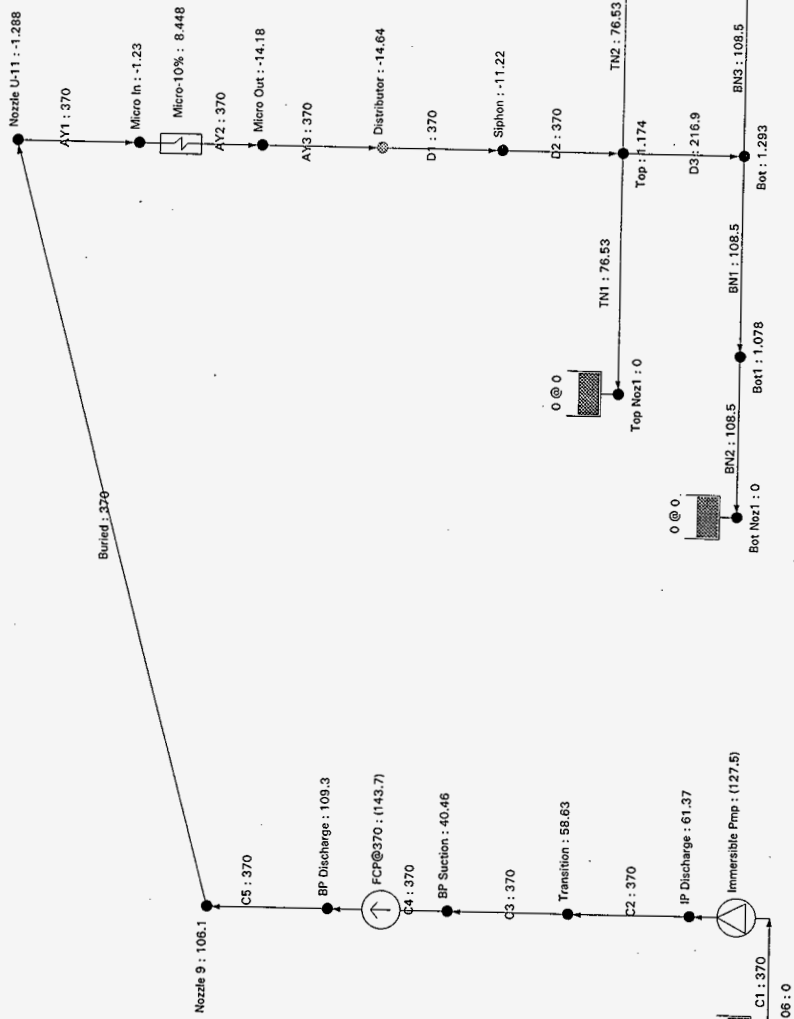
HNF-2478, Rev. 0



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Company: Fluor Daniel Northwest	10/27/97 1:53 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

ank 241-C-106 : 0

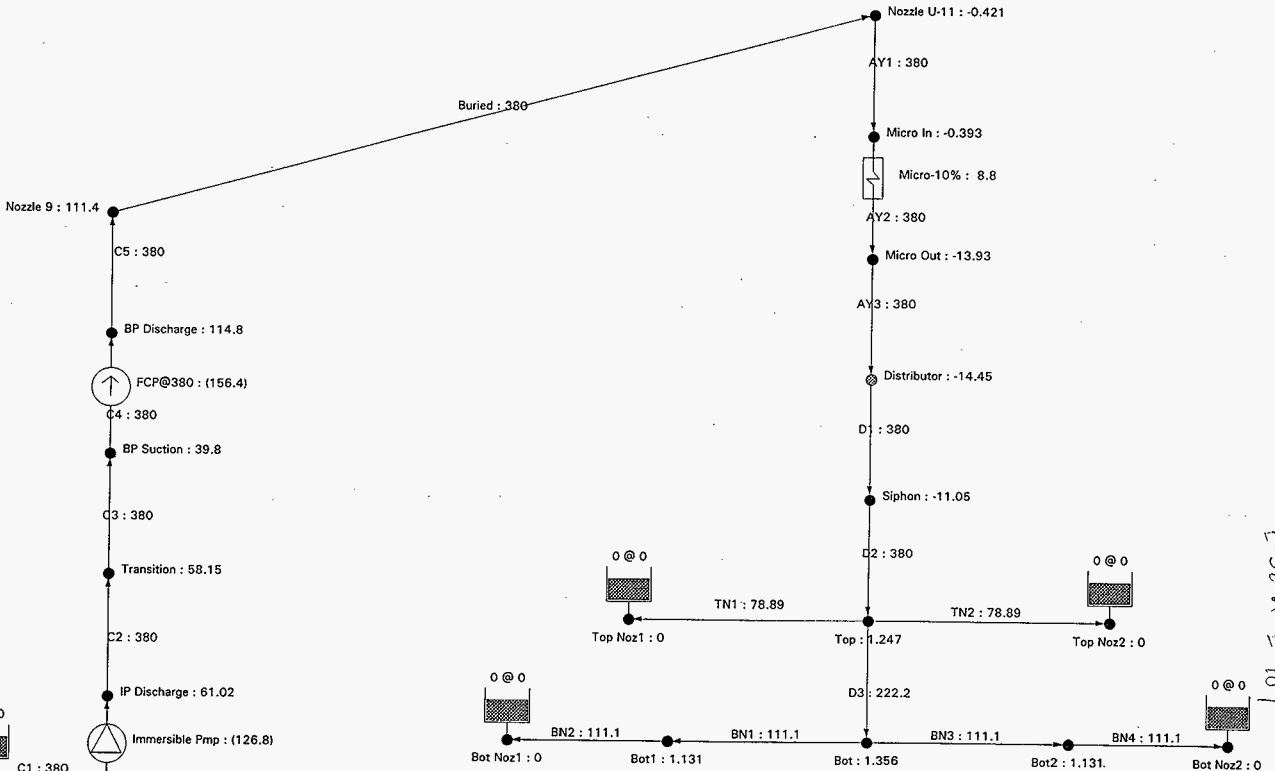


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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:53 pm LineList: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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Version: PIPE-FLO ver 5.01

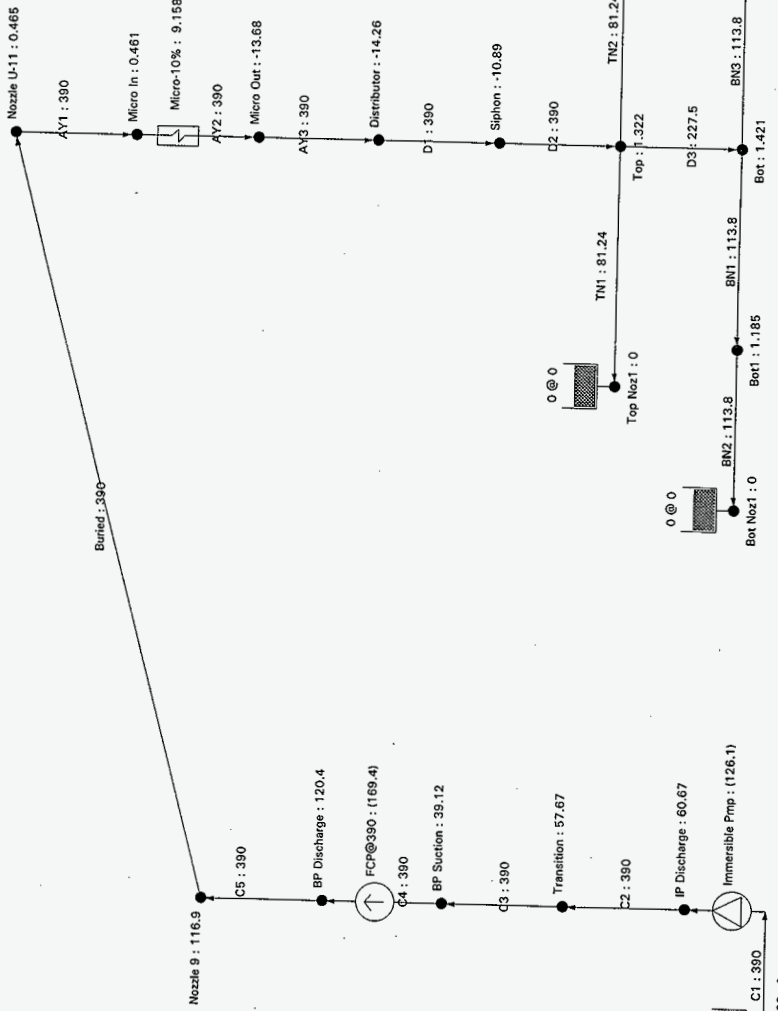
HNF-2478, Rev. 0



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ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 1:53 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



11 69 17
107

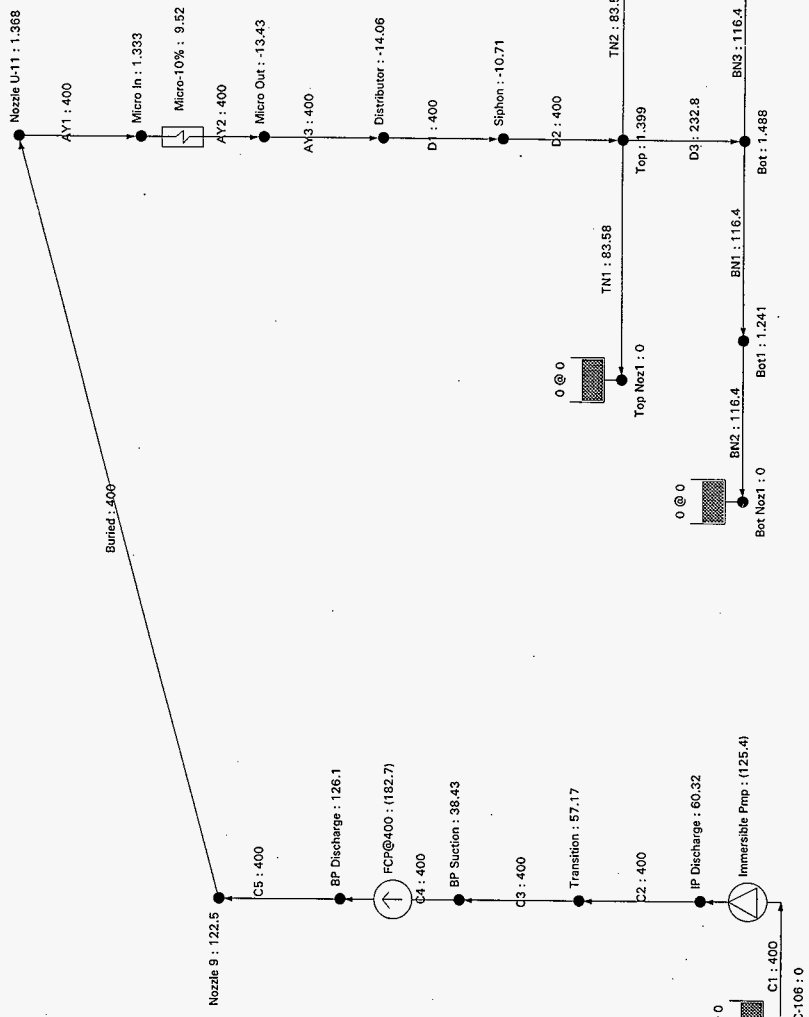
HNF-2478, Rev. 0

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:53 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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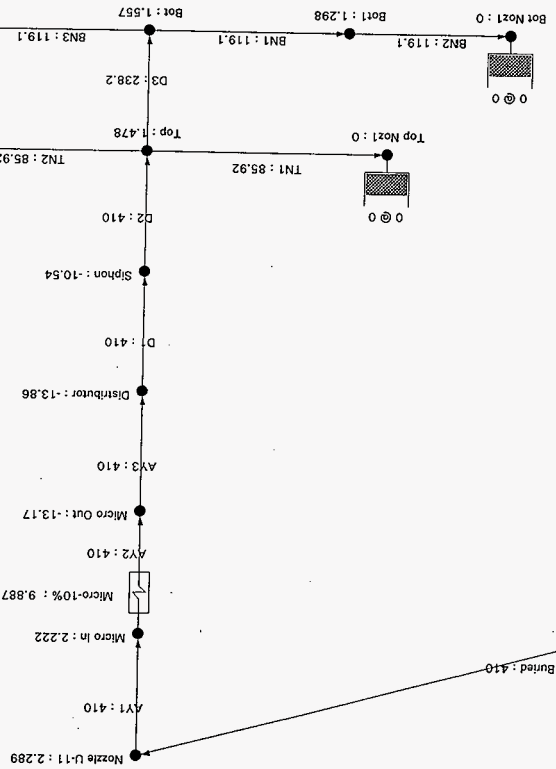
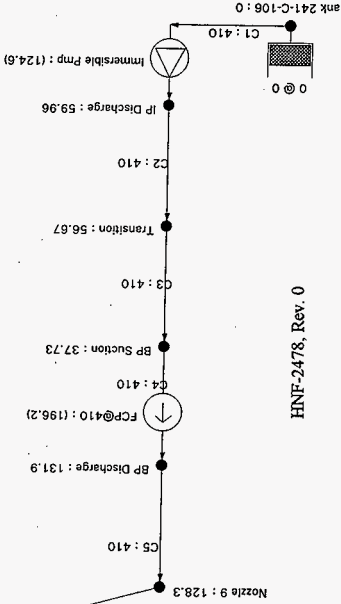
Version: PIPE-FLO ver 5.01

ank 241-C-106 : 0

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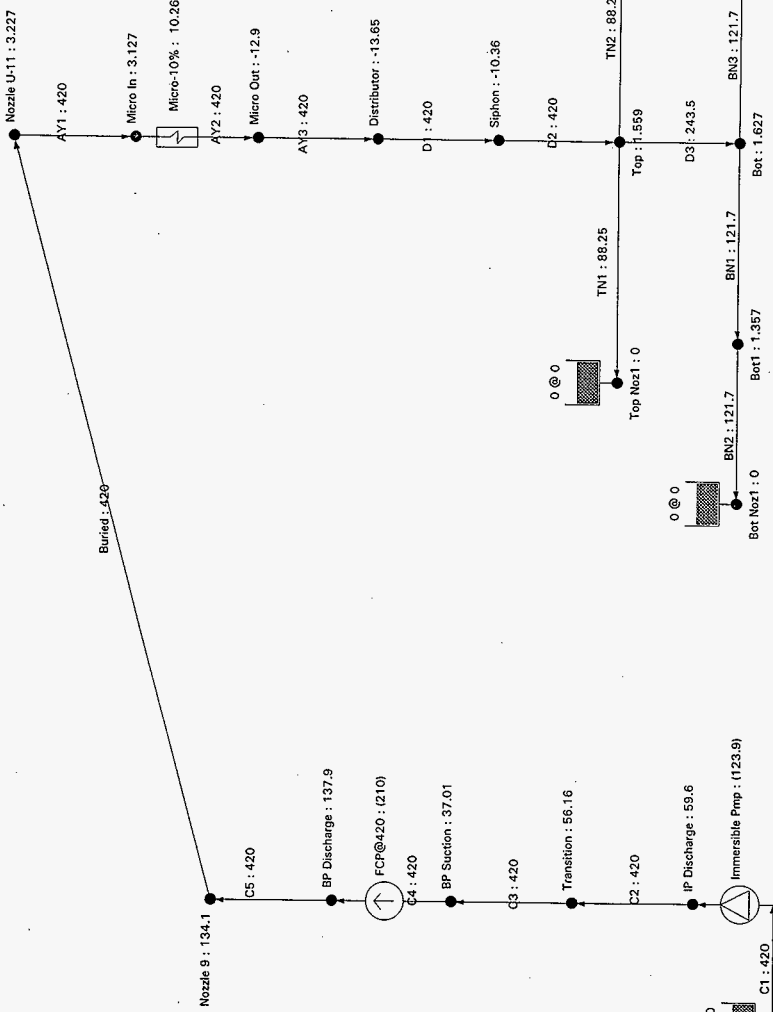


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:54 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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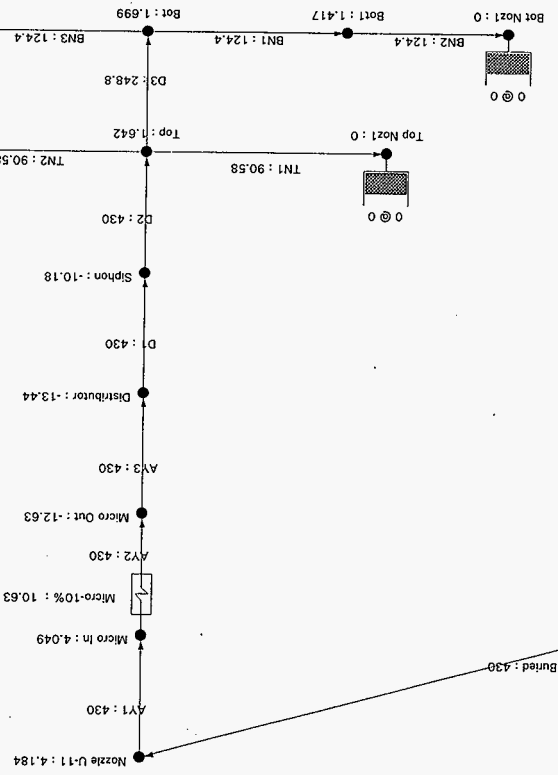
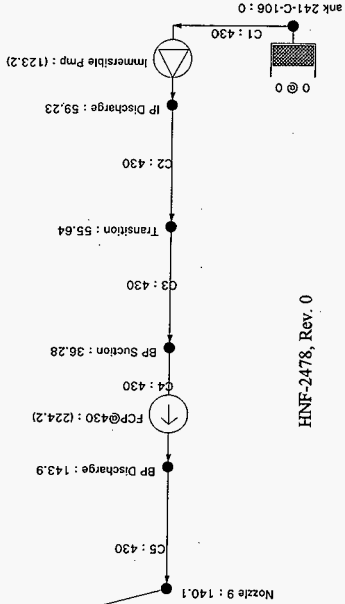


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Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Linefst: SL-10	
Lineup: SL-10	
flow rate: gpm	
pressure: psig	
level & grade: ft	
10/27/97 1:54 pm	



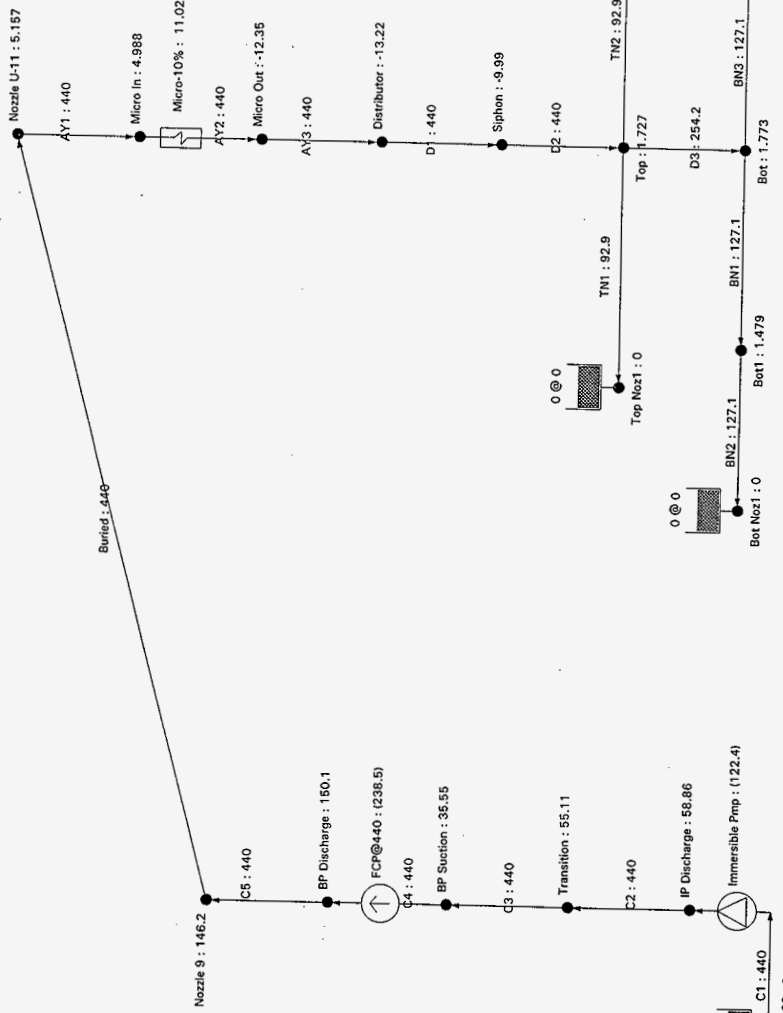
<p>Company: Fluor Daniel Northwest</p> <p>Project: W-320</p> <p>by: K Hayase</p> <p>Comments: Calculation W320-27-048</p> <p>Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:54 pm</p> <p>LineList: SL-10</p> <p>Lineup: SL-10</p> <p>flow rate: gpm</p> <p>pressure: psig</p> <p>level & grade: ft</p>
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E-43 of E-107

Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
By: K Hayase	
Lineist: SL-10	
Lineup: SL-10	
10/27/97 1:54 pm	
Level & grade: ft	
Pressure: psig	
Flow rate: gpm	

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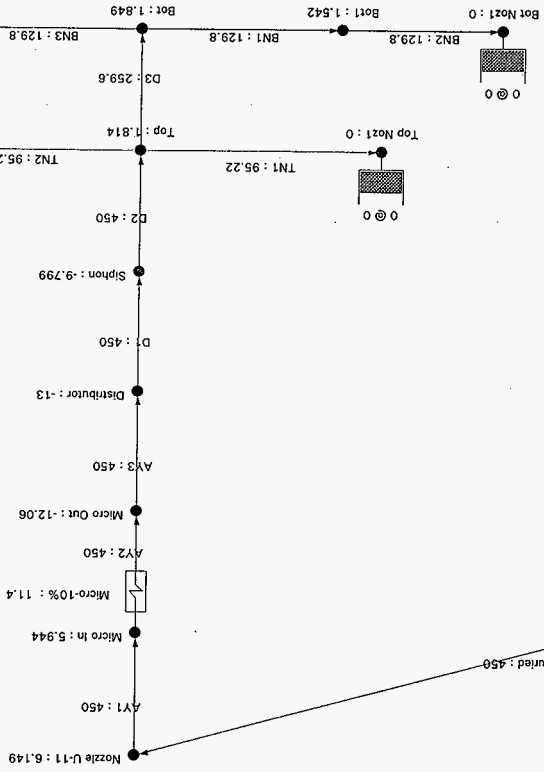
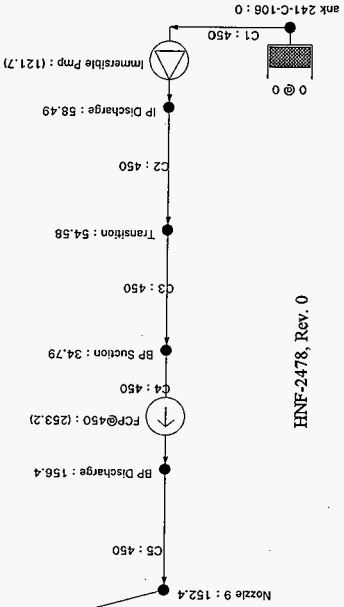


Buried : 440

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K.Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:54 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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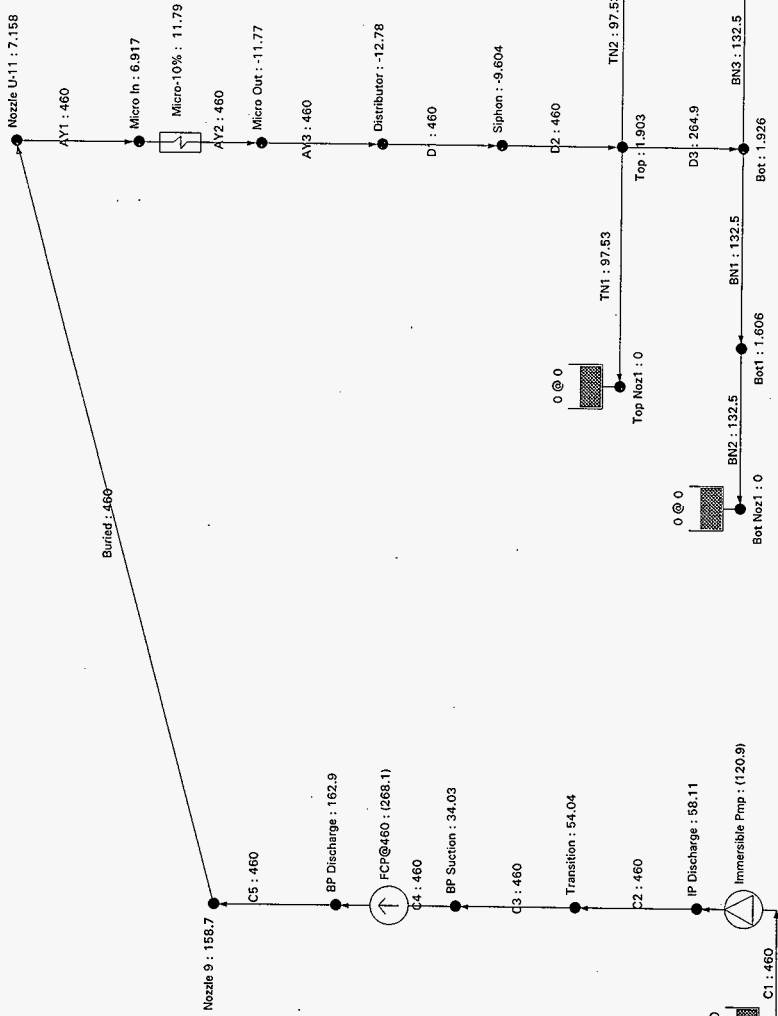
Version: PIPE-FLO ver 5.01



Elev of E-107

Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
By: K Hayase	
Lineists: SL-10	
Lineup: SL-10	
flow rate: gpm	
pressure: psig	
level & grade: ft	
10/27/97 1:54 pm	

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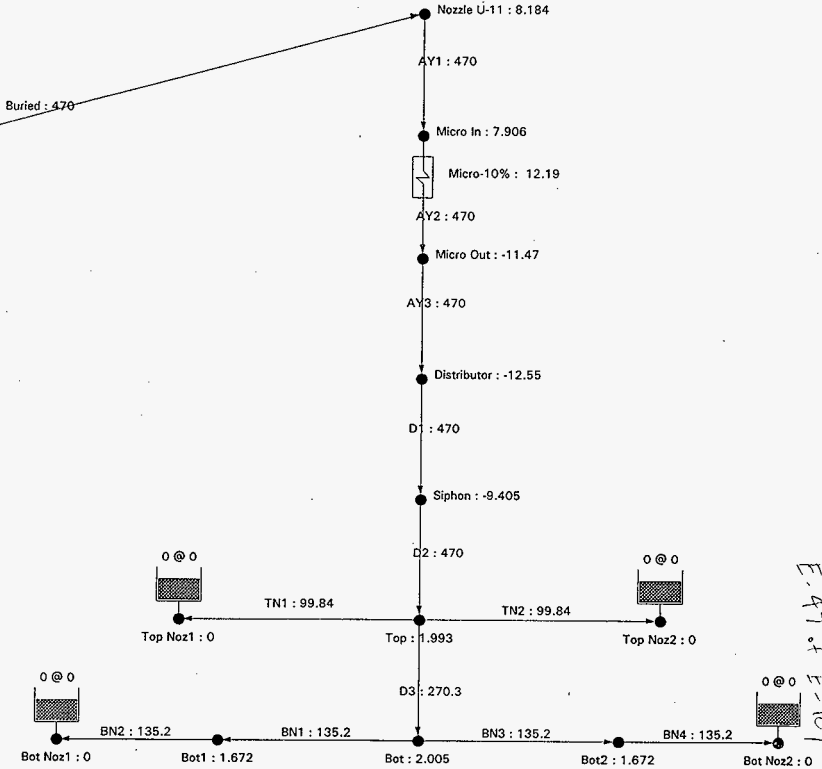
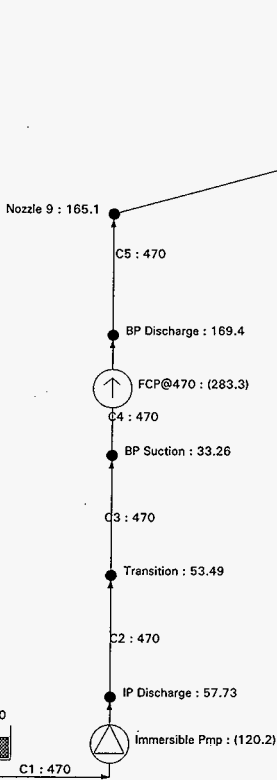


Buried : 460

Nozzle 9 : 158.7
 C5 : 460
 BP Discharge : 162.9
 FCP@460 : (268.1)
 C4 : 460
 BP Suction : 34.03
 C3 : 460
 Transition : 54.04
 C2 : 460
 IP Discharge : 58.11
 Immersible Pmp : (120.9)
 C1 : 460

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:55 pm Linelist: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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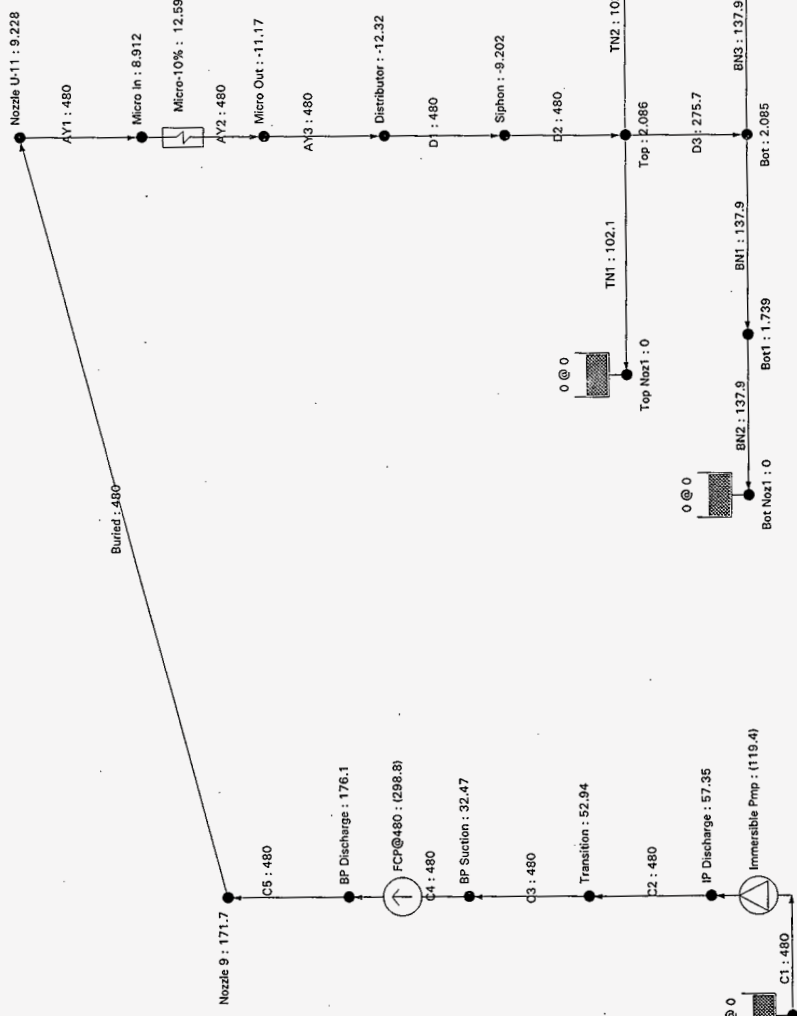
HNF-2478, Rev. 0



ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 1:55 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

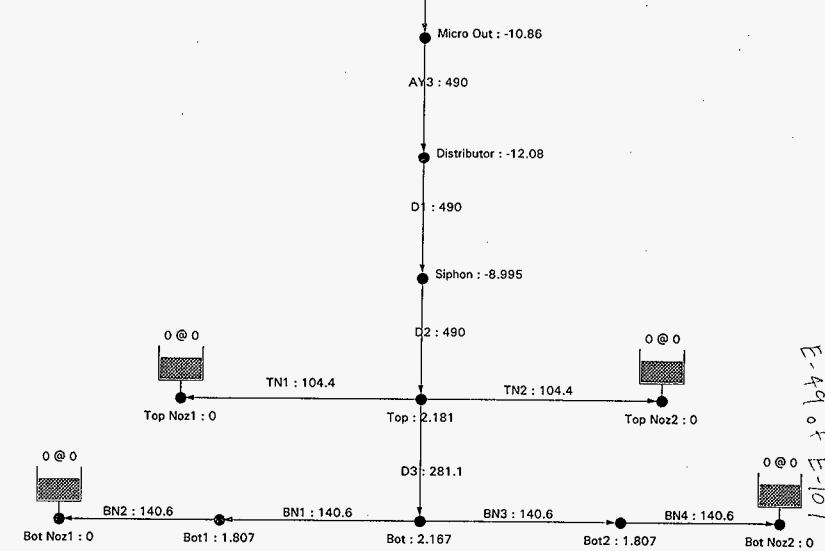
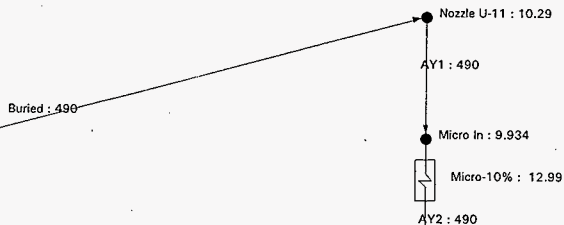
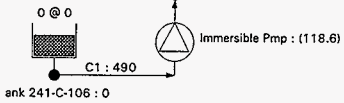
E-48 of E-107



Buried: 480

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:55 pm Lineup: SL-10 Lineup: SL-10 flow rate: gpm pressure: psig level & grade: ft</p>
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HNF-2478, Rev. 3



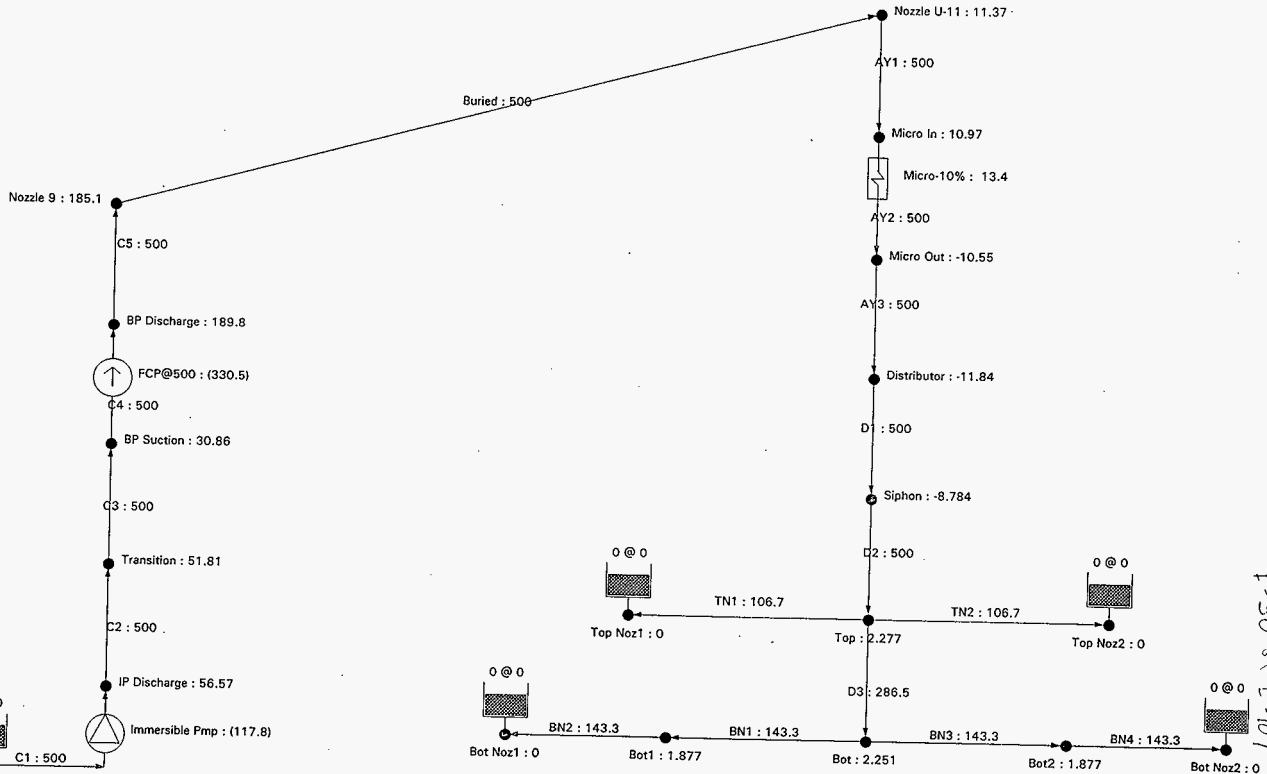
E-49 of E-107

Company: Fluor Daniel Northwest	10/27/97 1:55 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

ank 241-C-106 : 0

H:INF-2478, Rev: 0

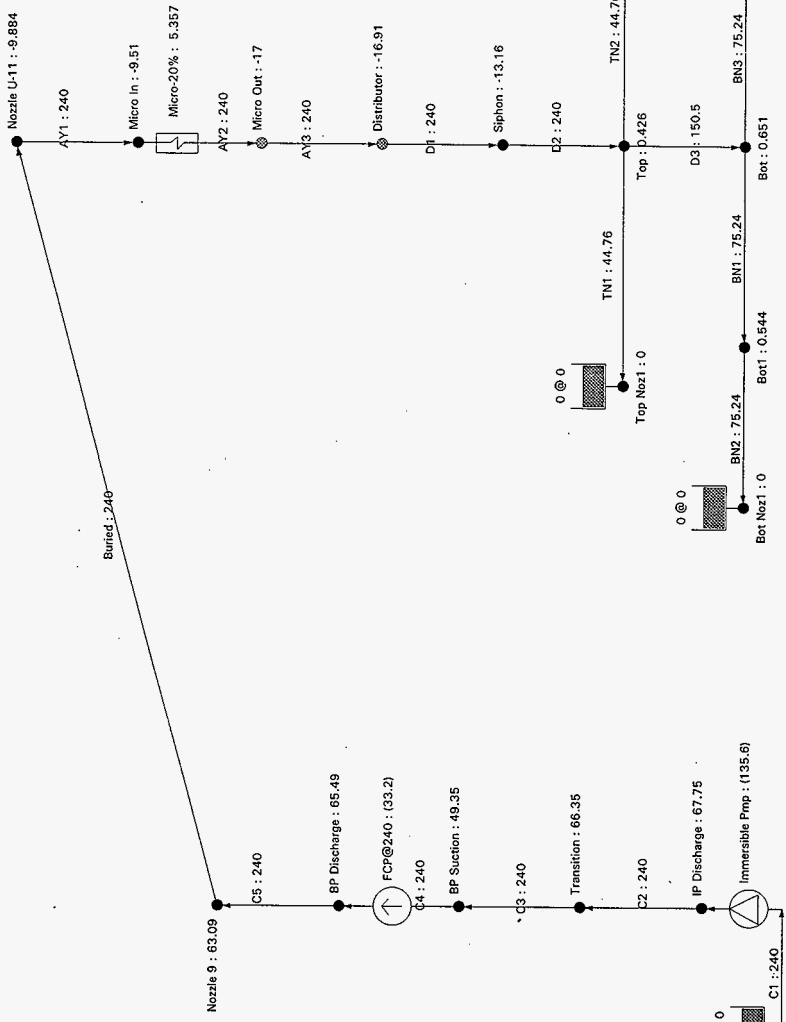
ank 241-C-106 : 0



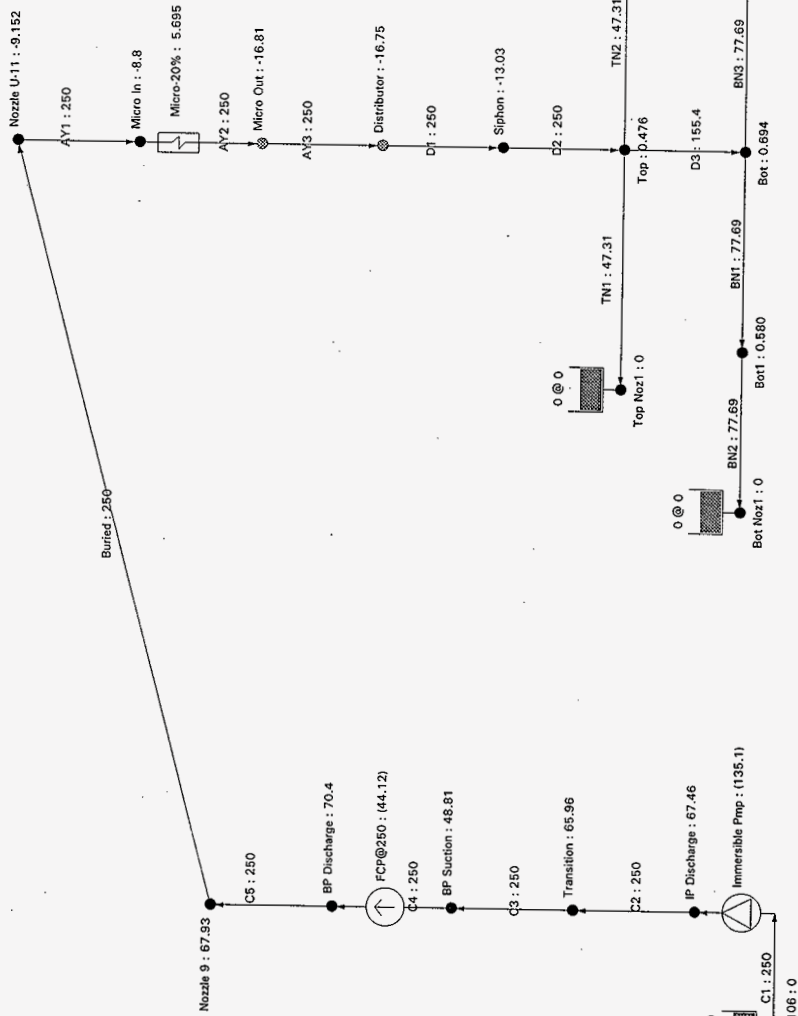
F-50 sF E-107

Company: Fluor Daniel Northwest	10/27/97 1:56 pm
Project: W-320	Linelist: SL-10
by: K Hayase	Lineup: SL-10
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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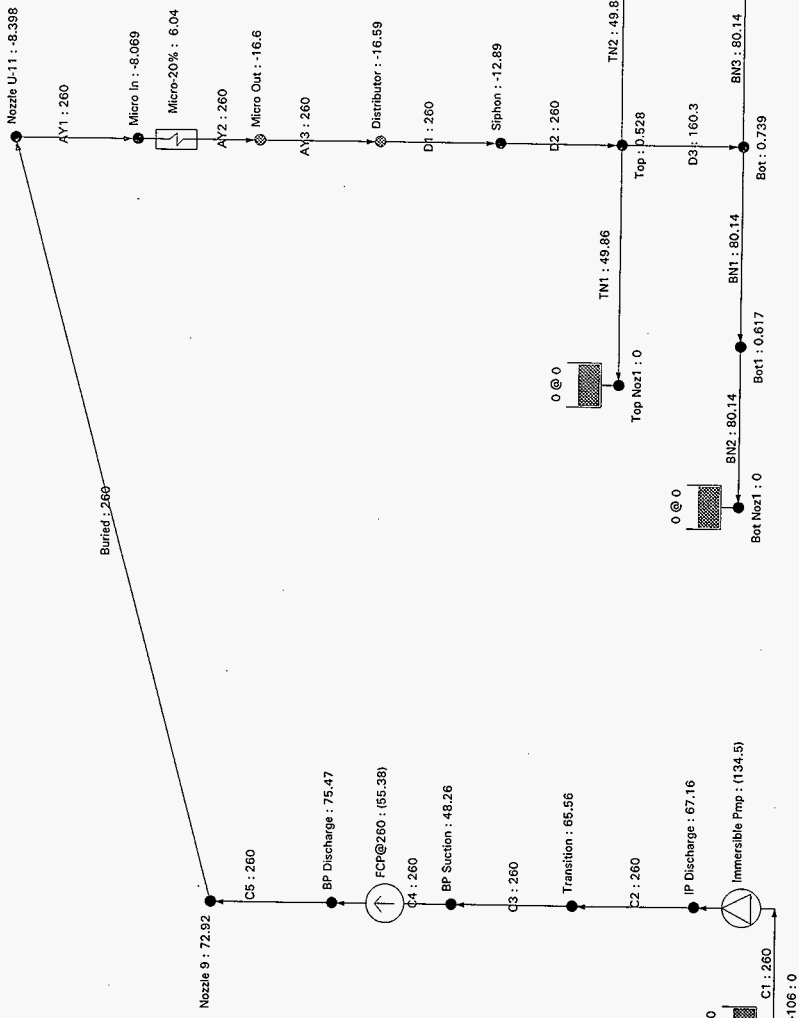


<p>10/27/97 1:56 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>	<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>
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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:57 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
--	---

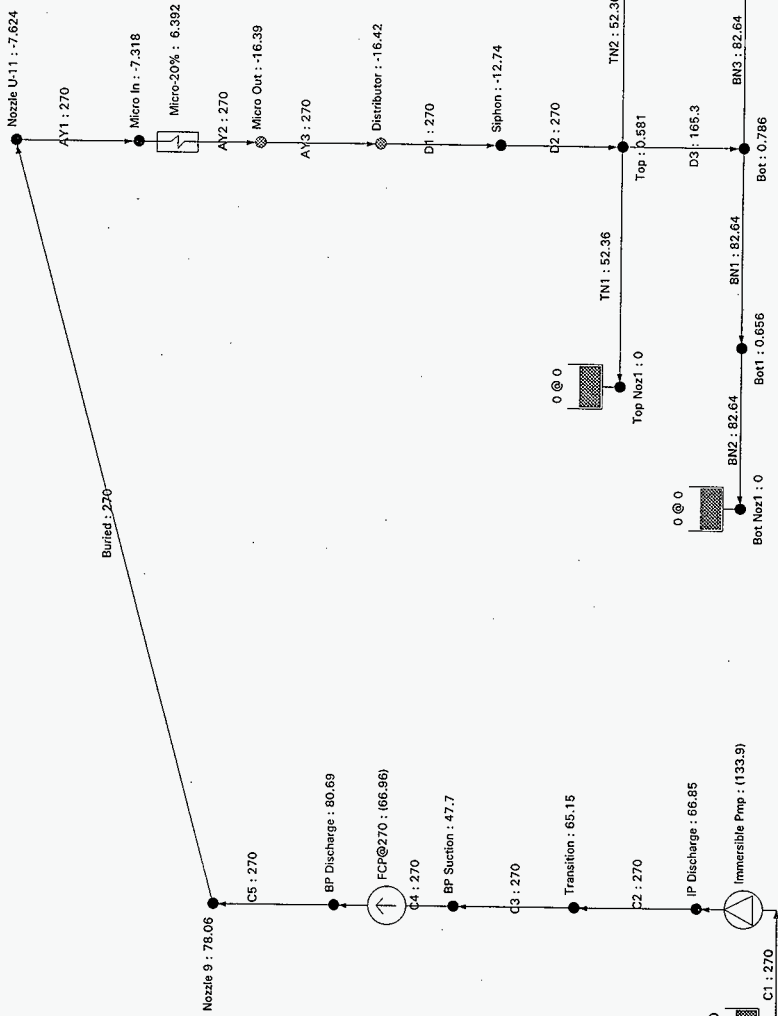
E.S.A. of E-107



Buried : 260

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 1:57 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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F-55 0.7 F-107

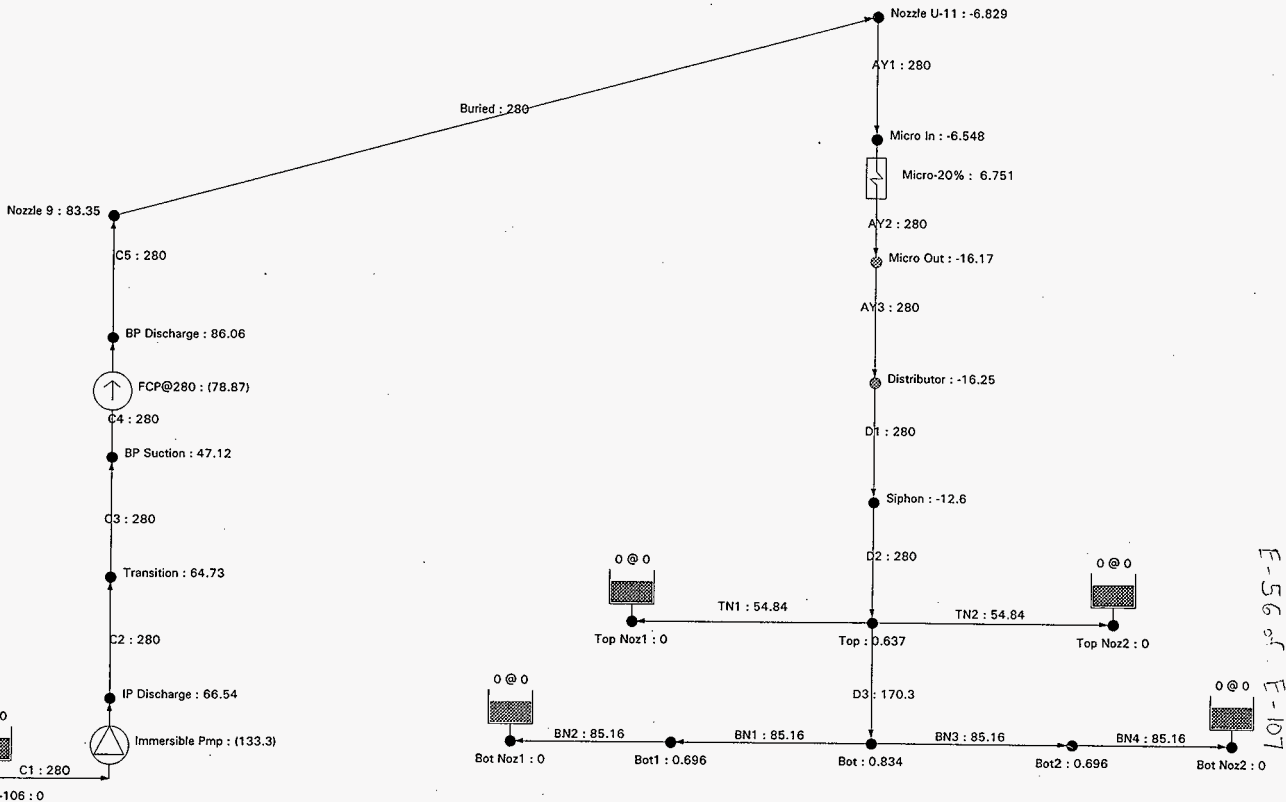


Buried : 270

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:57 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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Version: PIPE-FLO ver 5.01

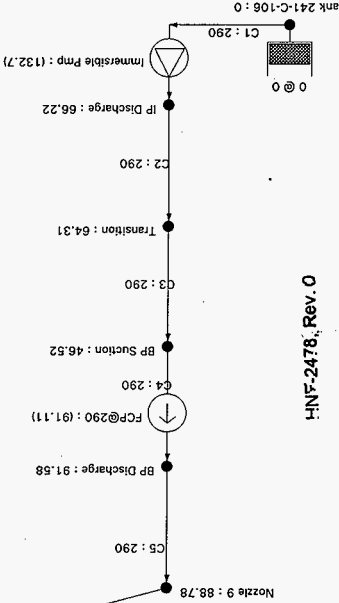
HNF-2478, Rev. 0



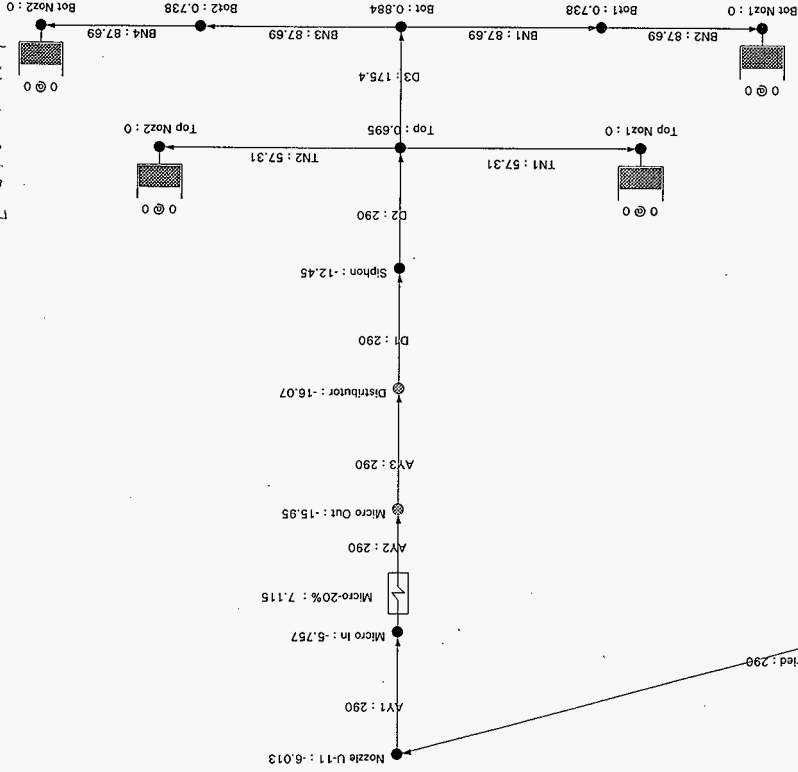
E-56 of E-107

Company: Fluor Daniel Northwest	10/27/97 1:57 pm
Project: W-320	Lineist: SL-20
by: K Hayase	Lineup: SL-20
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

ank 241-C-106 : 0

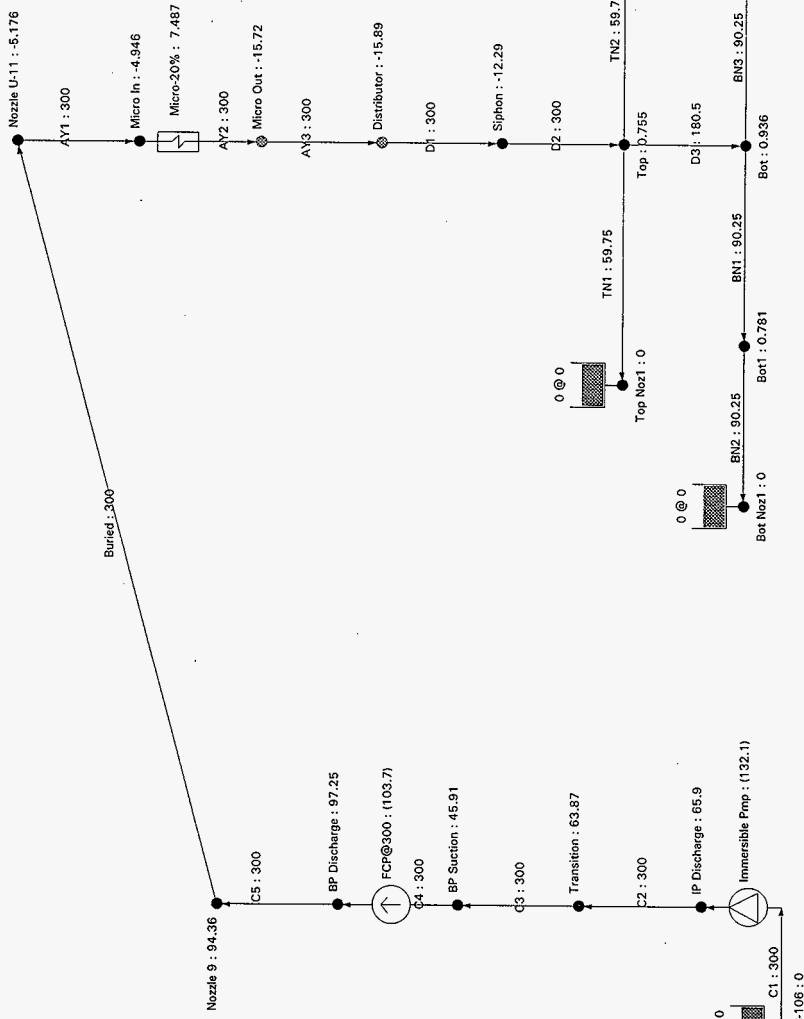


Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-20	
Lineilst: SL-20	
10/27/97 1:57 pm	
level & grade: ft	
flow rate: gpm	
pressure: psfa	



17-57.6 E-107

77-5805 77-107



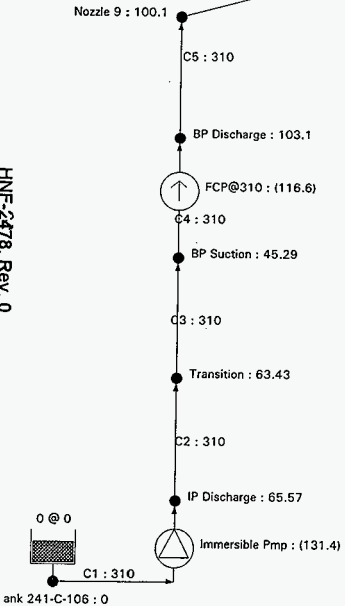
HNF-2478, Rev. 0

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:57 pm LineList: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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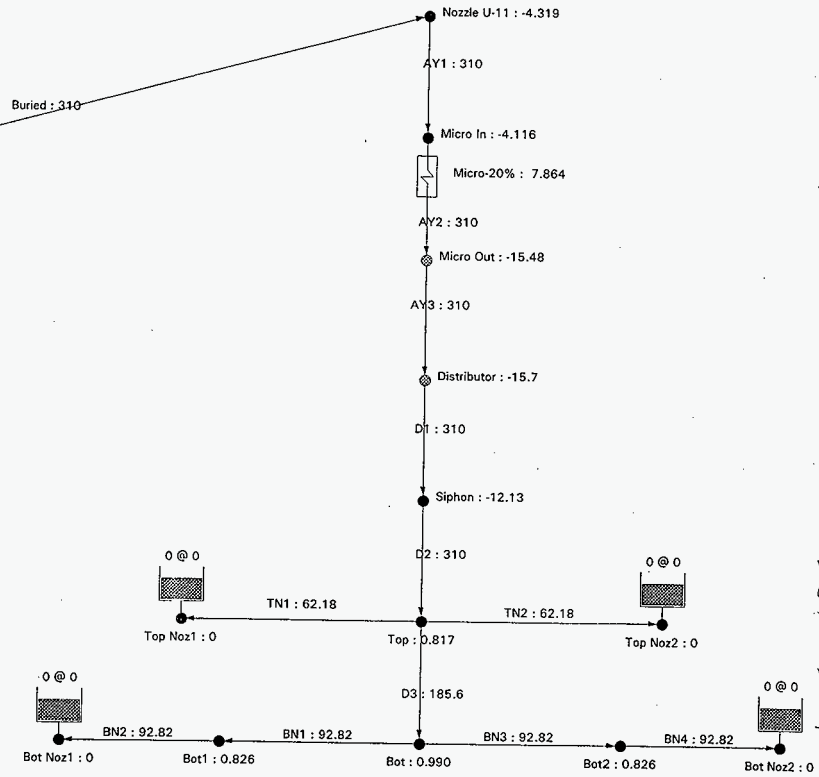
Version: PIPE-FLO ver 5.01

ank 241-C-106 : 0

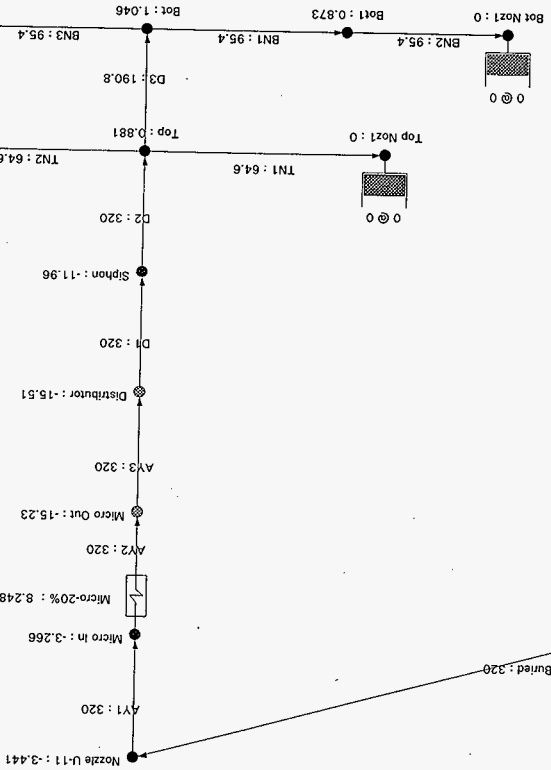
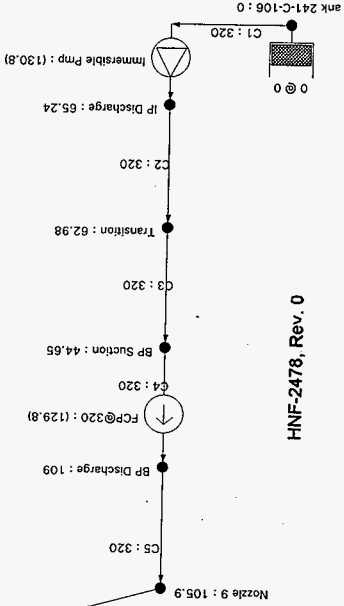
HNF-2478, Rev. 0



ank 241-C-106 : 0



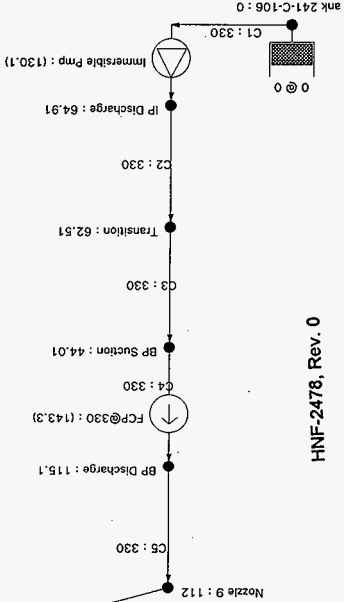
Company: Fluor Daniel Northwest	10/27/97 1:58 pm
Project: W-320	Linelist: SL-20
by: K Hayase	Lineup: SL-20
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft



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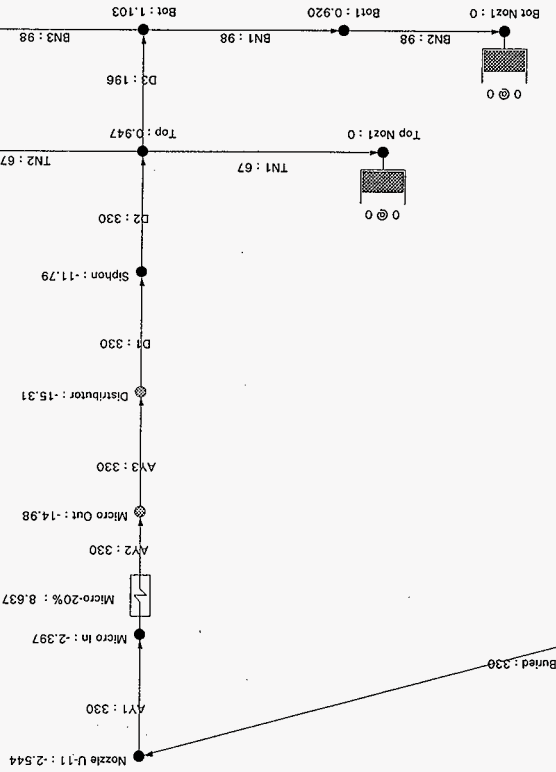
Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-20	
Linefst: SL-20	
10/27/97 1:58 pm	
level & grade: ft	
flow rate: gpm	
pressure: psig	

Company: Fluor Daniel Northwest	Version: PPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-20	flow rate: gpm
Lineist: SL-20	pressure: psig
10/27/97 1:58 pm	level & grade: ft

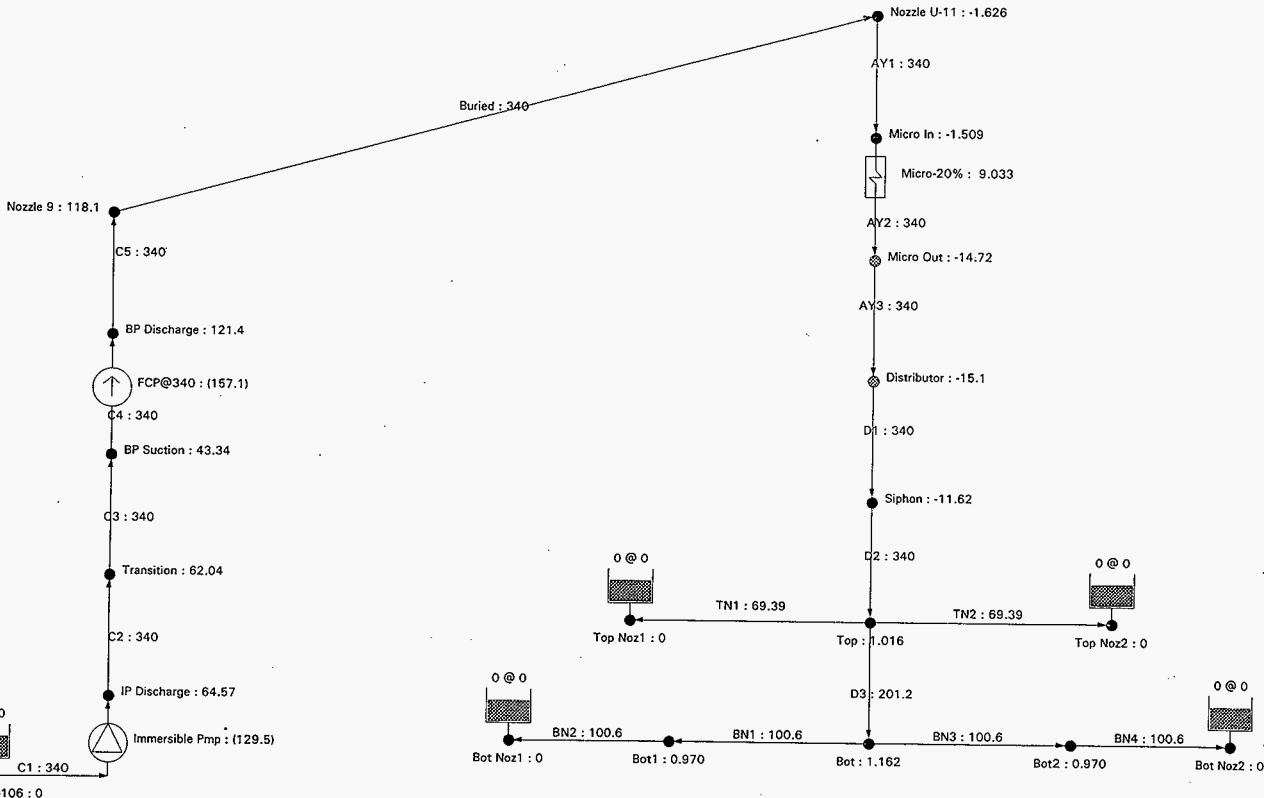


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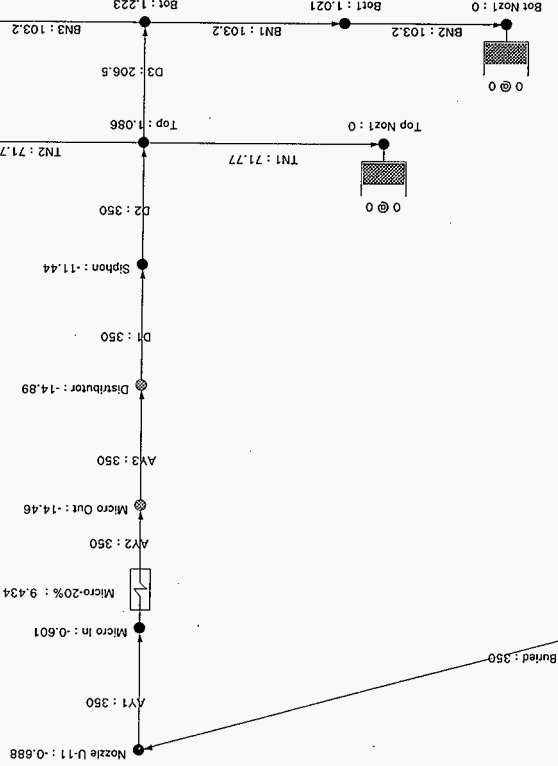
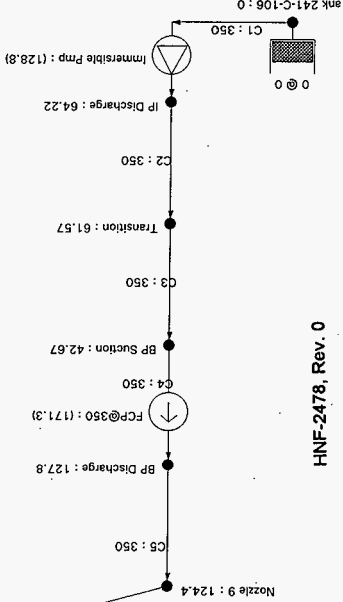


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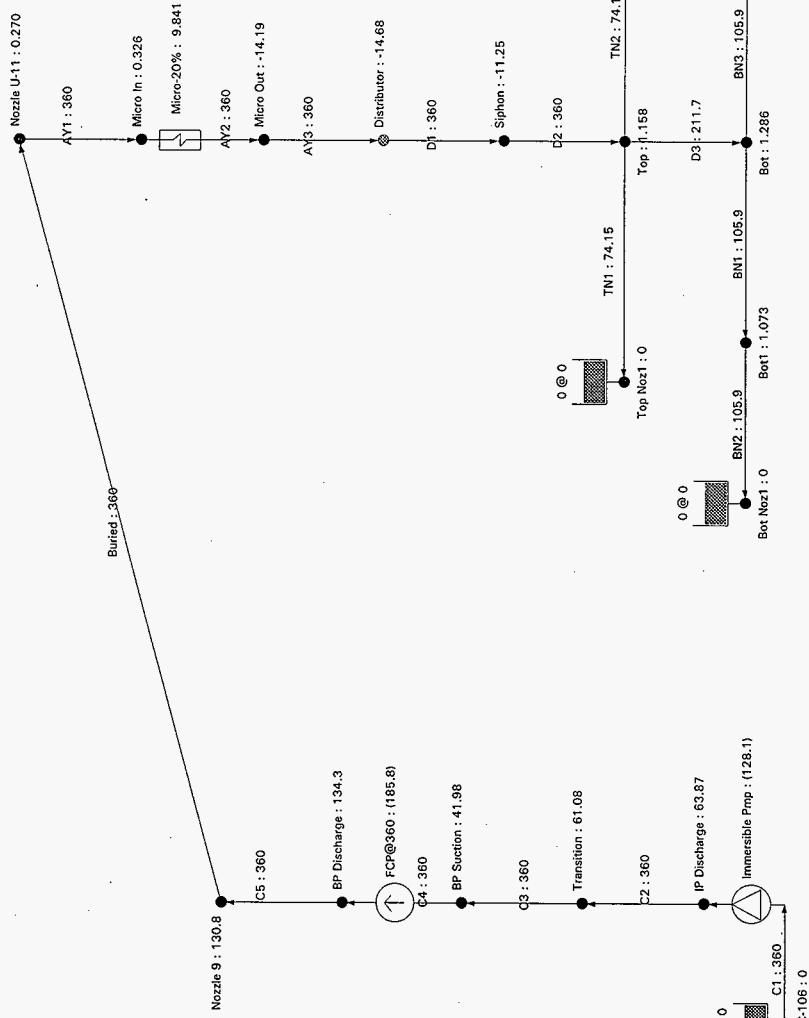
Company: Fluor Daniel Northwest	10/27/97 1:58 pm
Project: W-320	Linelist: SL-20
by: K Hayase	Lineup: SL-20
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



Lot 13 E-107

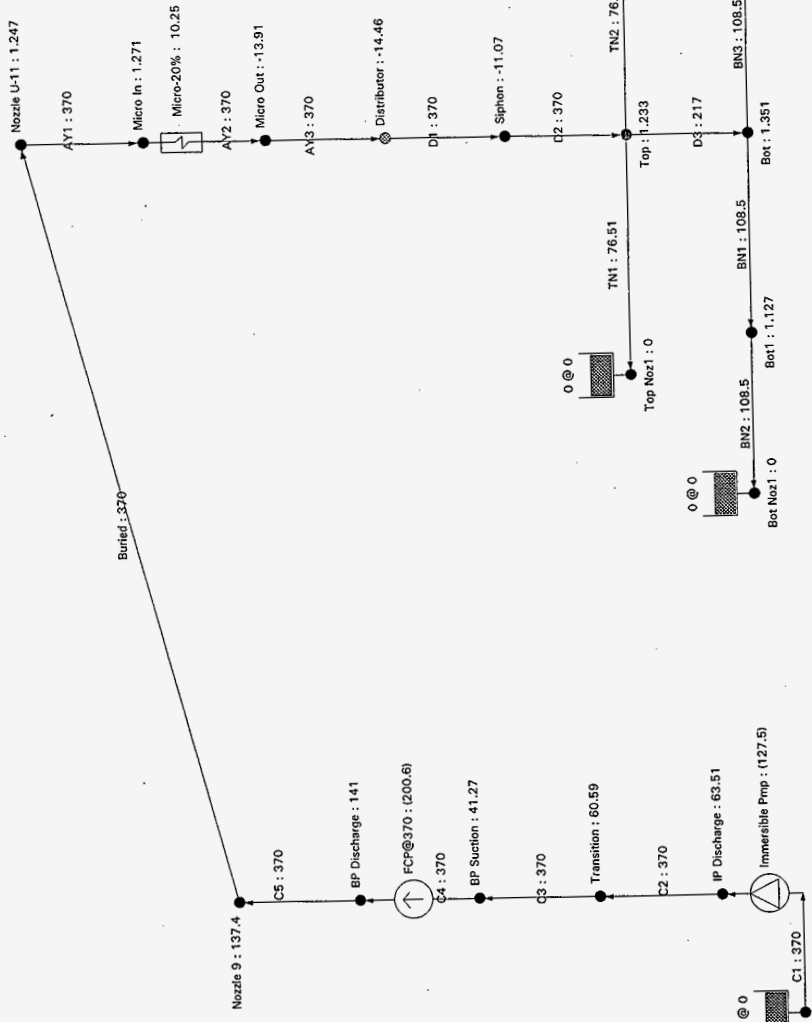
Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-ZT-048
by: K Hayase	
Lineist: SL-20	
flow rate: gpm	
pressure: psig	
level & grade: ft	

10/27/97 1:58 pm



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:58 pm LineList: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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W-63 of W-107

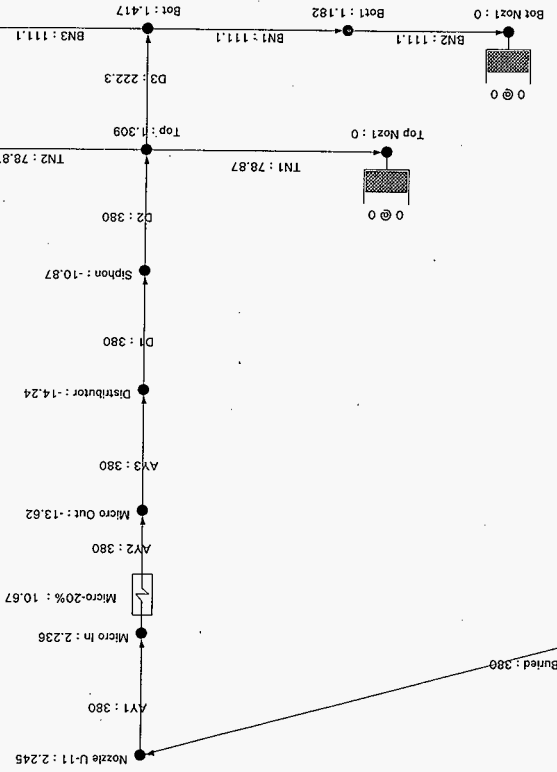
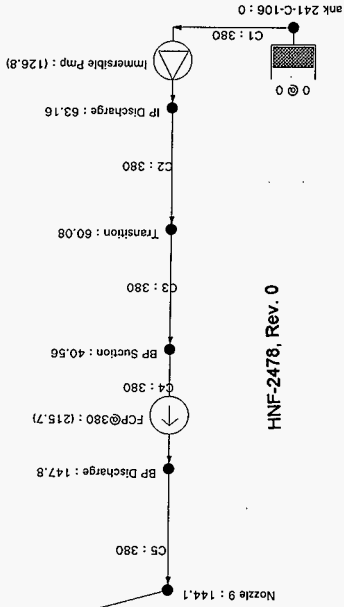


Buried : 370

HNF-2478, Rev. 0

ank 241-C-106 : 0

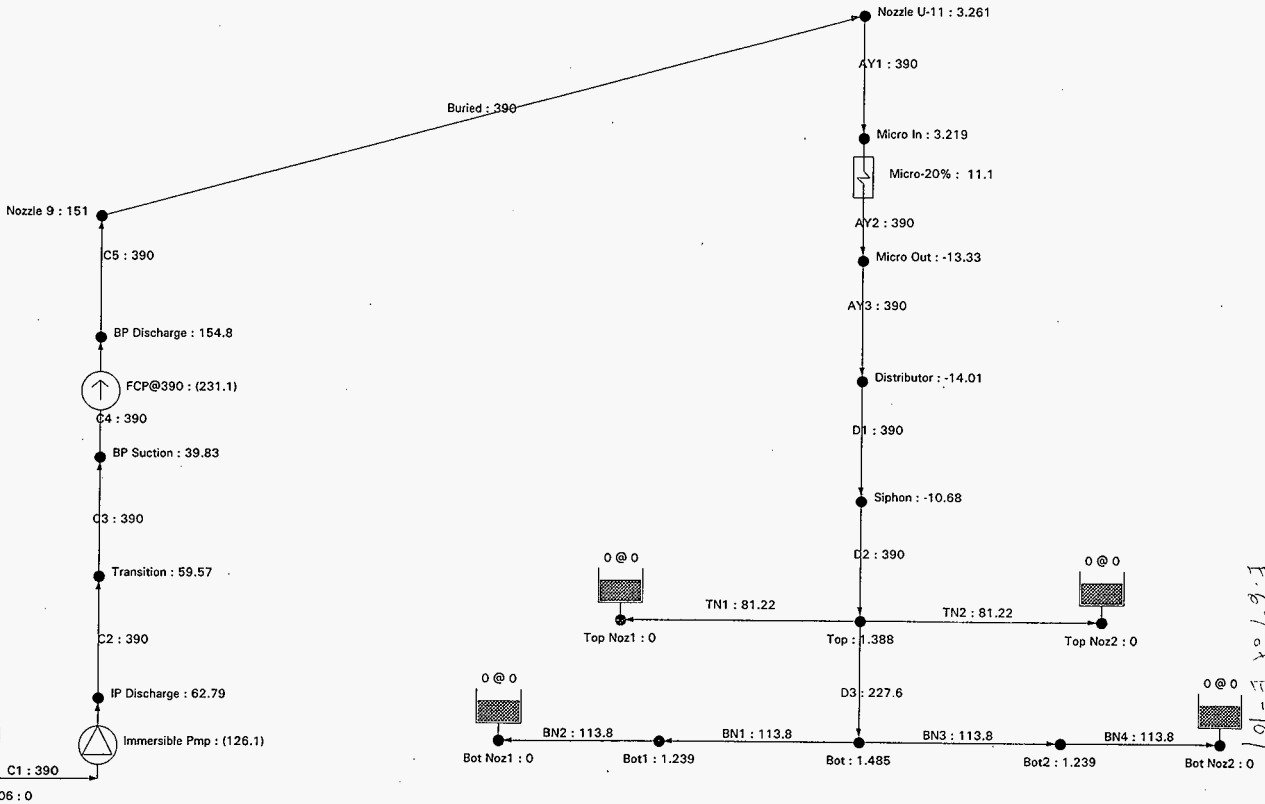
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:59 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	



Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
By: K Hayase	
Lineist: SL-20	
Lineup: SL-20	
Flow rate: gpm	
pressure: psig	
level & grade: ft	
10/27/97 1:59 pm	

101-330 99-3

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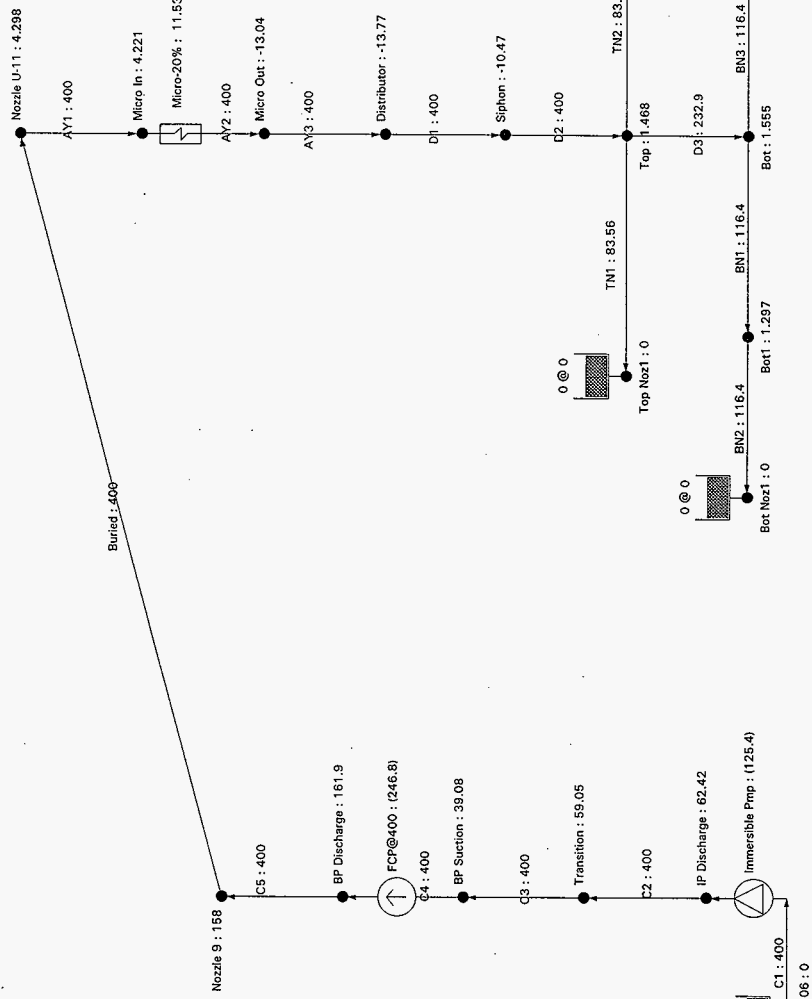


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Company: Fluor Daniel Northwest	10/27/97 1:59 pm
Project: W-320	Linelist: SL-20
by: K Hayase	Lineup: SL-20
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

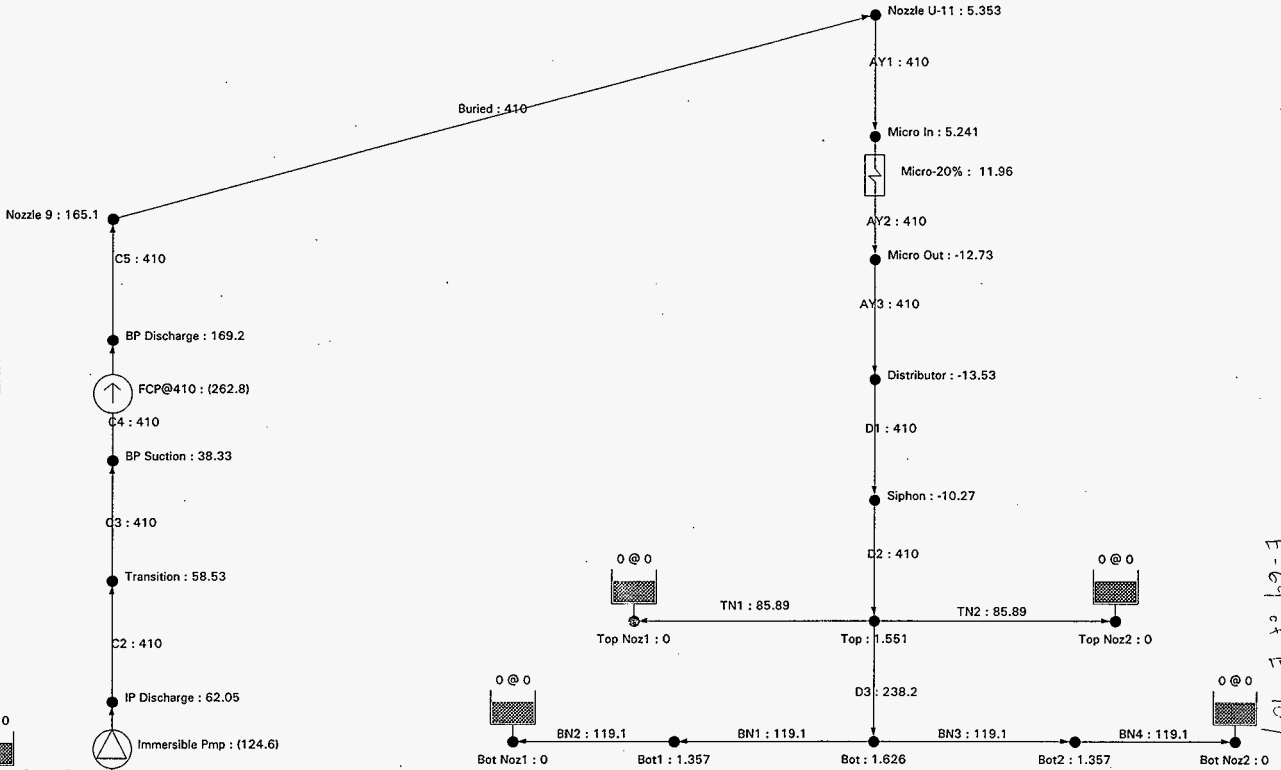
ank 241-C-106 : 0

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:59 pm Line1st: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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HNF-2478, Rev. 0

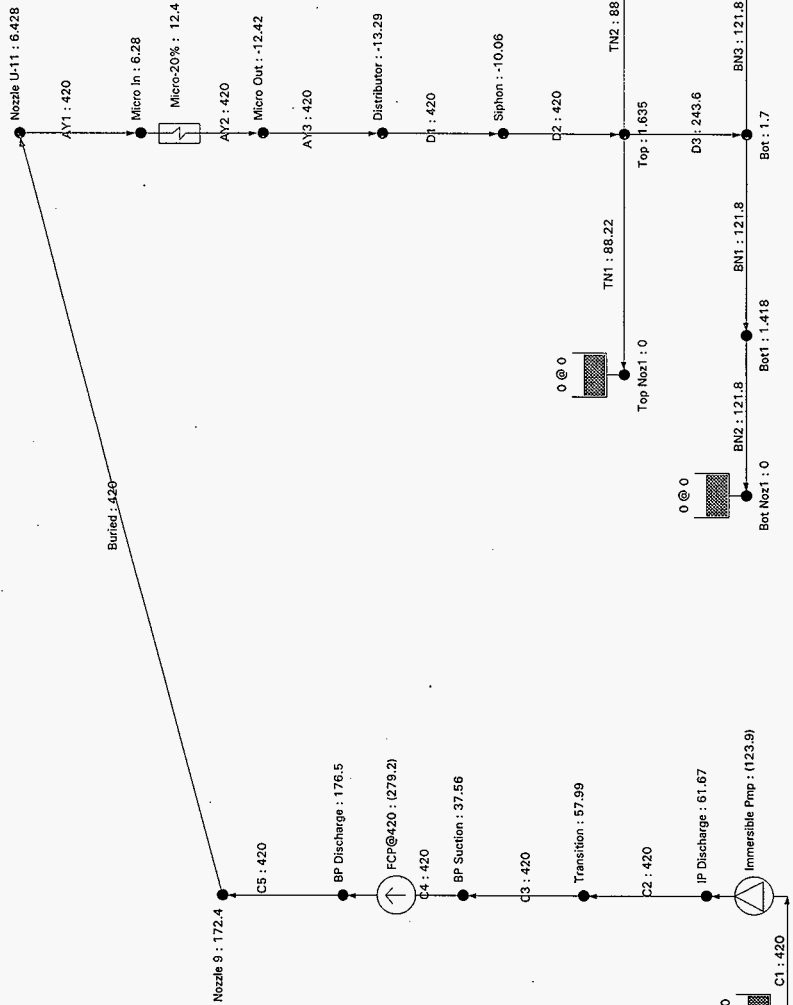


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ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 1:59 pm
Project: W-320	Linelist: SL-20
by: K Hayase	Lineup: SL-20
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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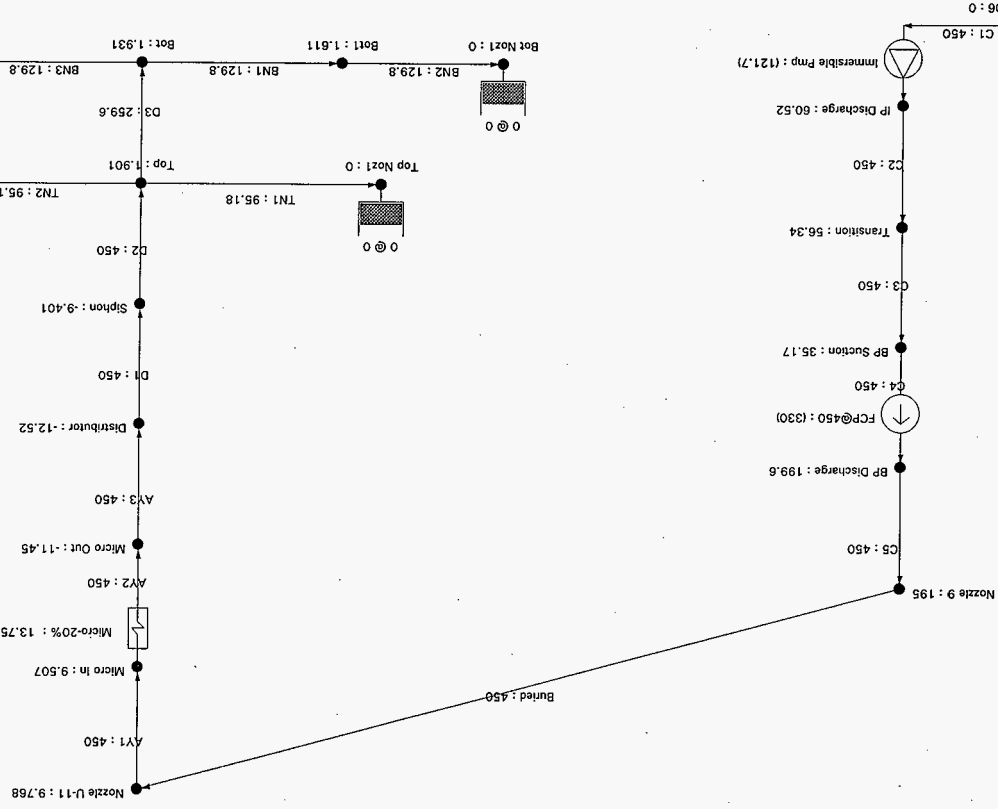


Buried : 426

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 1:59 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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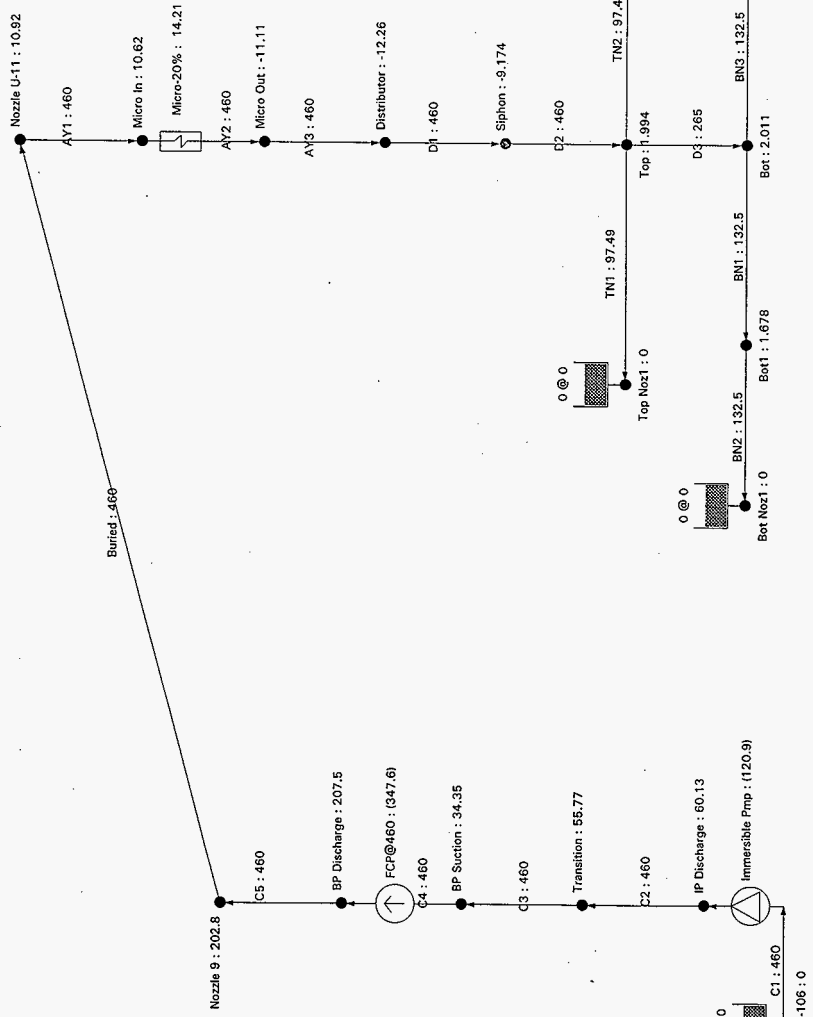
Version: PIPE-FLO ver 5.01

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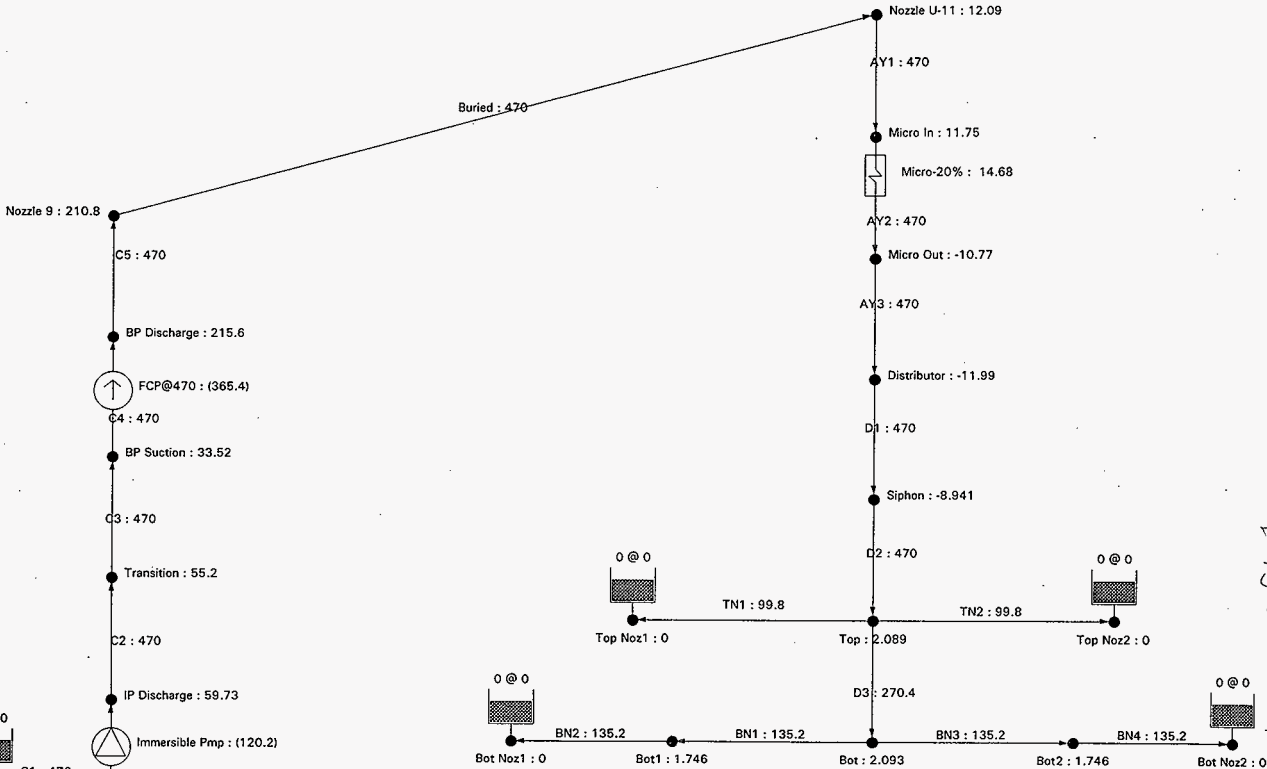
HNF-2478, Rev. 0

Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	flow rate: gpm
Lineist: SL-20	pressure: psig
10/27/97 2:00 pm	level & grade: ft



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:00 pm LineList: SL-20 Lineup: SL-20 flow rate: gpm pressure: psia level & grade: ft</p>
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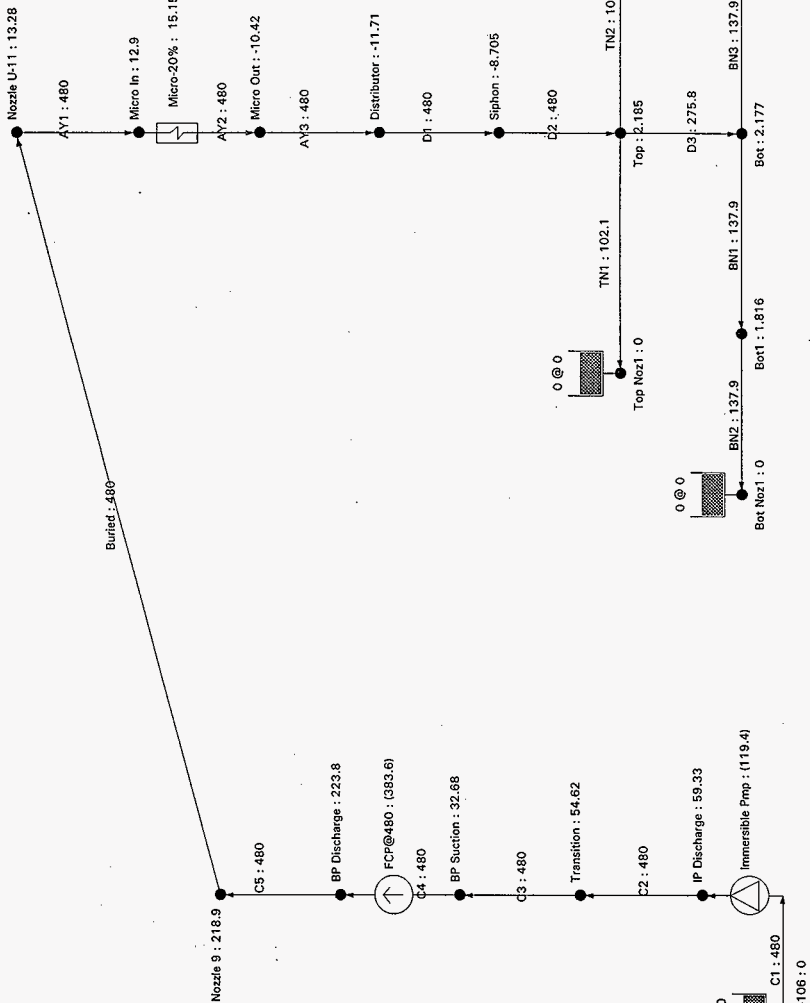
HNF-2478, Rev: 0



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ank 241-C-106 : 0

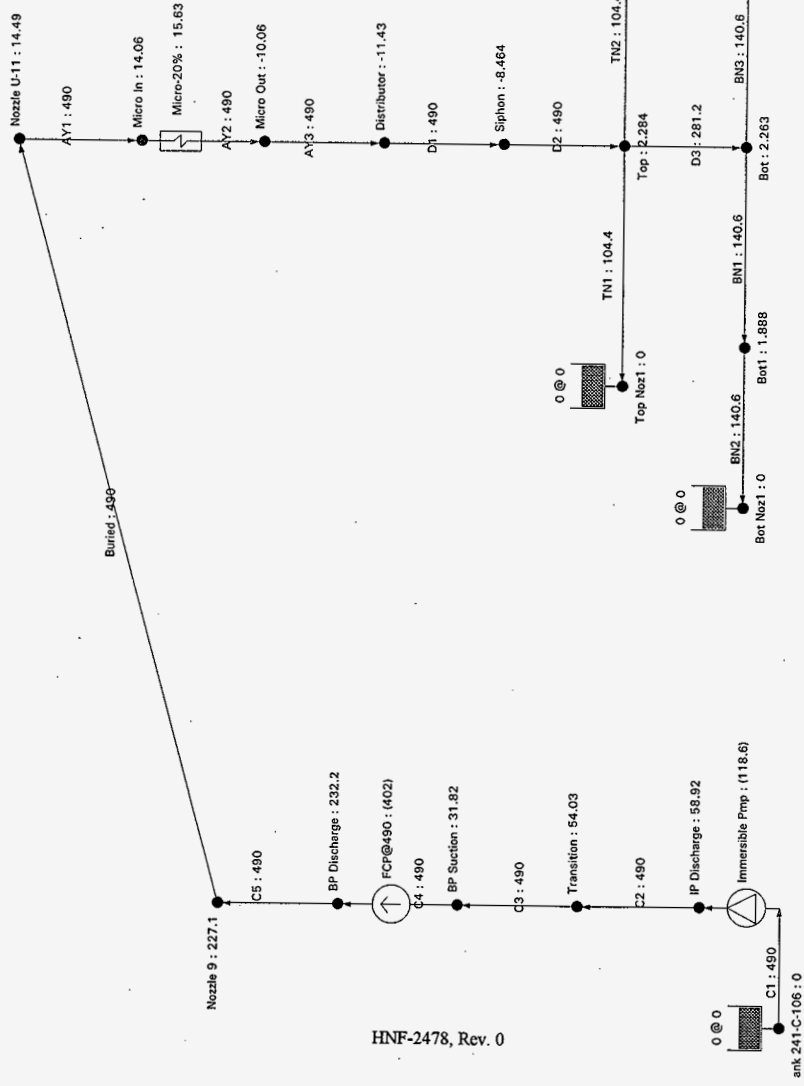
Company: Fluor Daniel Northwest	10/27/97 2:00 pm
Project: W-320	Linelist: SL-20
by: K Hayase	Lineup: SL-20
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



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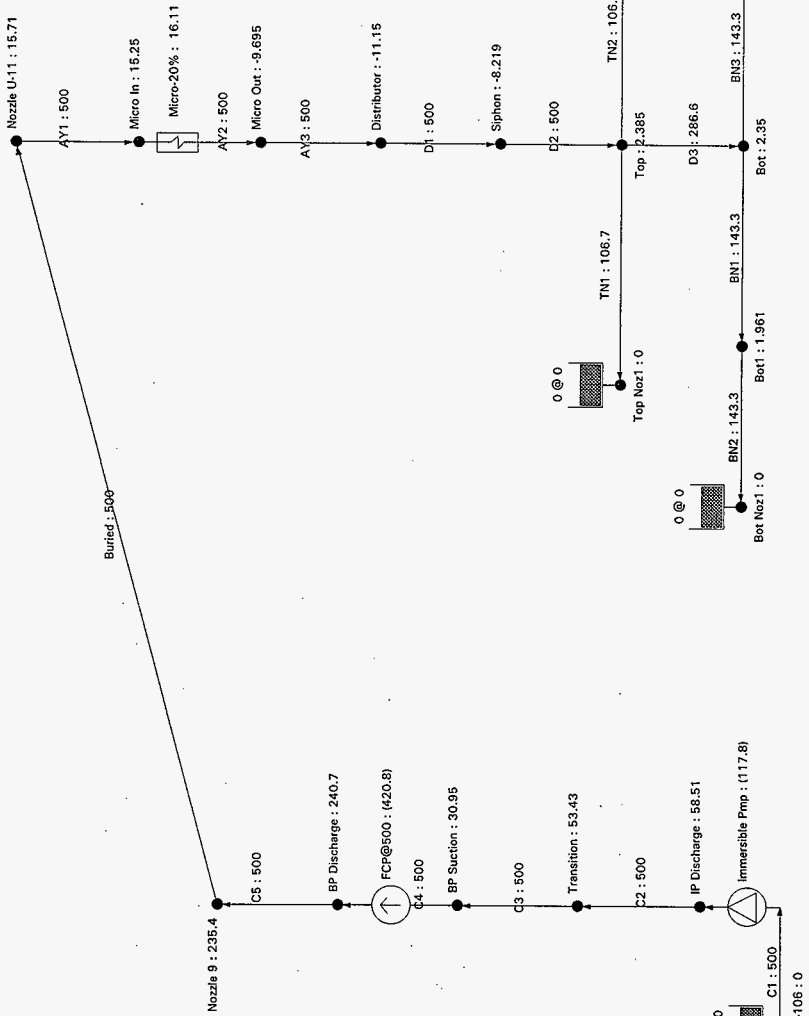
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:00 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
<p>Version: PIPE-FLO ver 5.01</p>	

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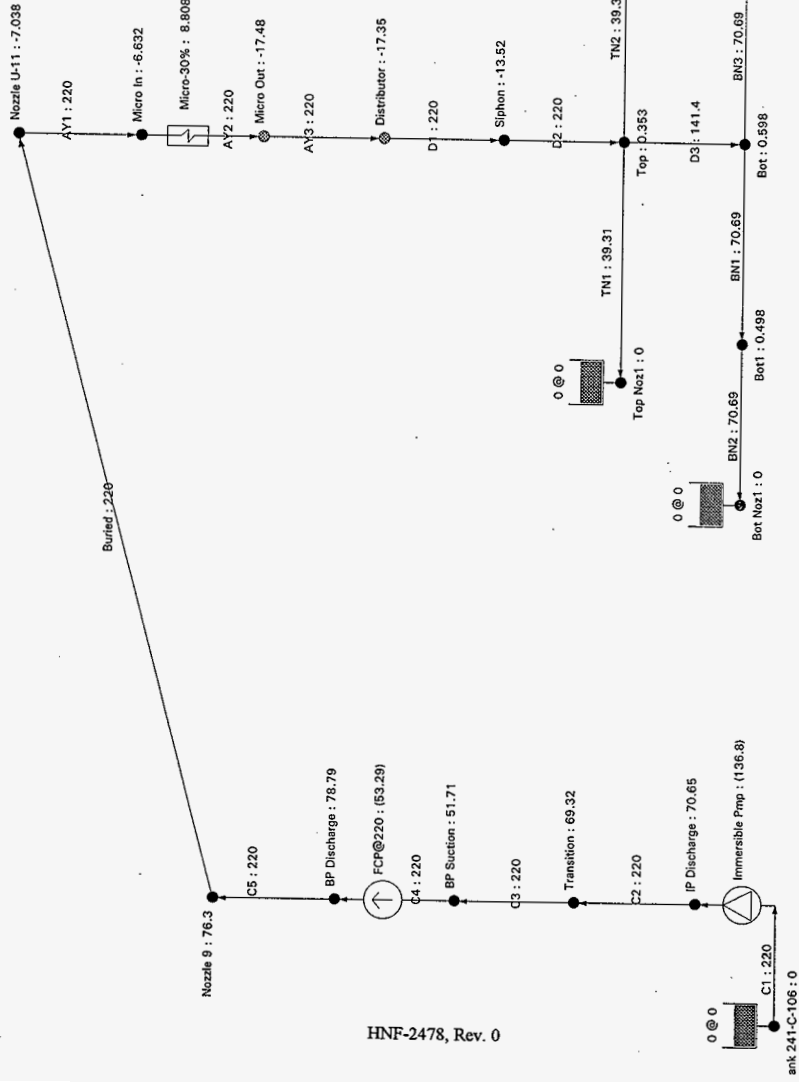
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:01 pm Linelist: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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E-78 of E-107



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:01 pm LineList: SL-20 Lineup: SL-20 flow rate: gpm pressure: psig level & grade: ft</p>
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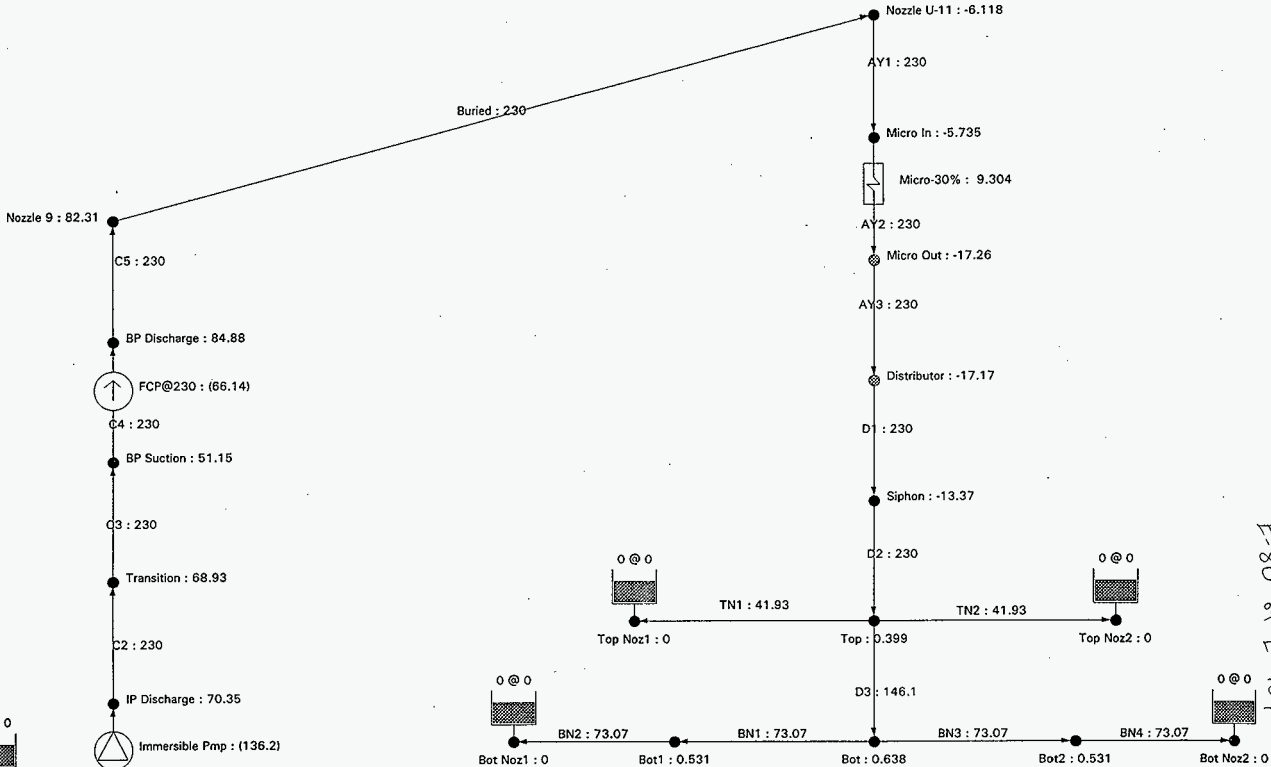
E-79 of E-107



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:01 pm LineList: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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HNF-2478, Rev. 0

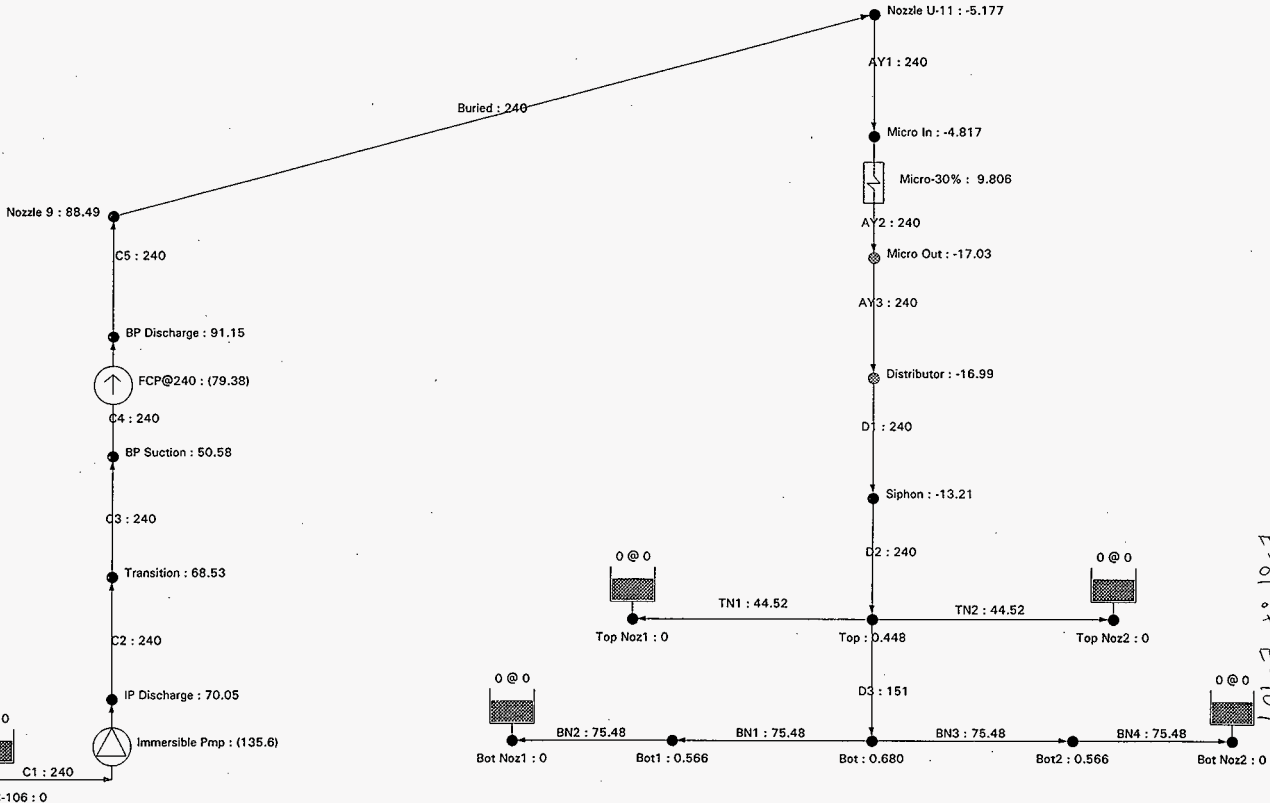
ank 241-C-106 :0



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Company: Fluor Daniel Northwest	10/27/97 2:01 pm
Project: W-320	Lineist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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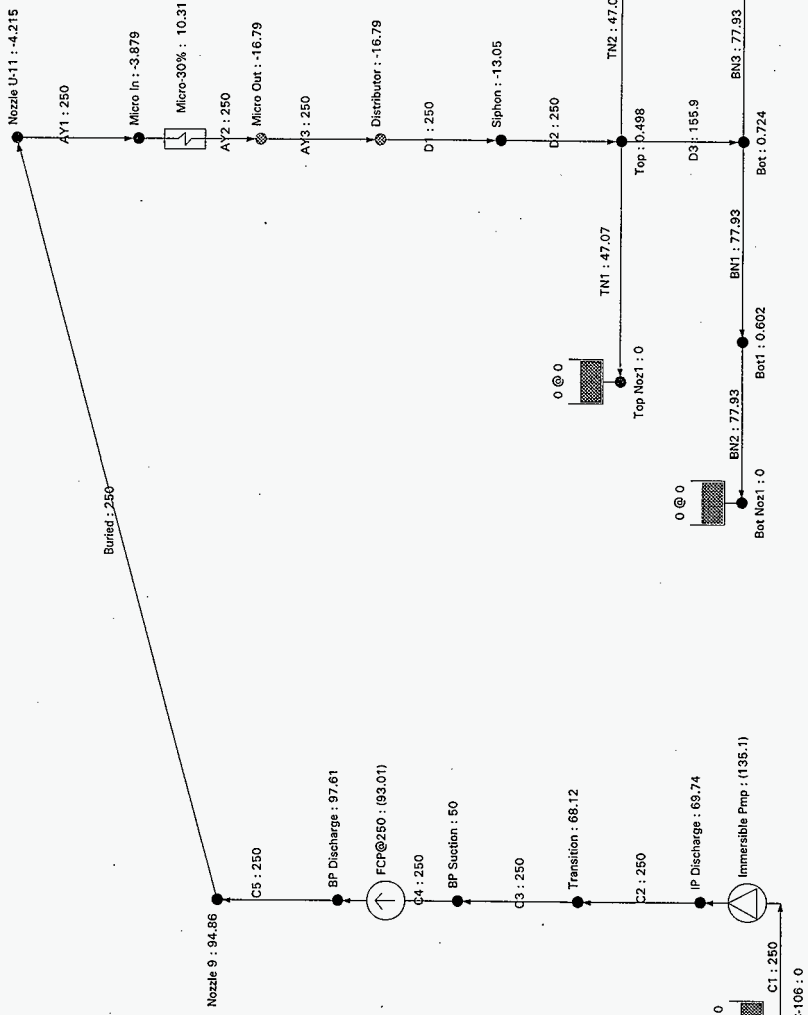


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ank 241-C-106 : 0

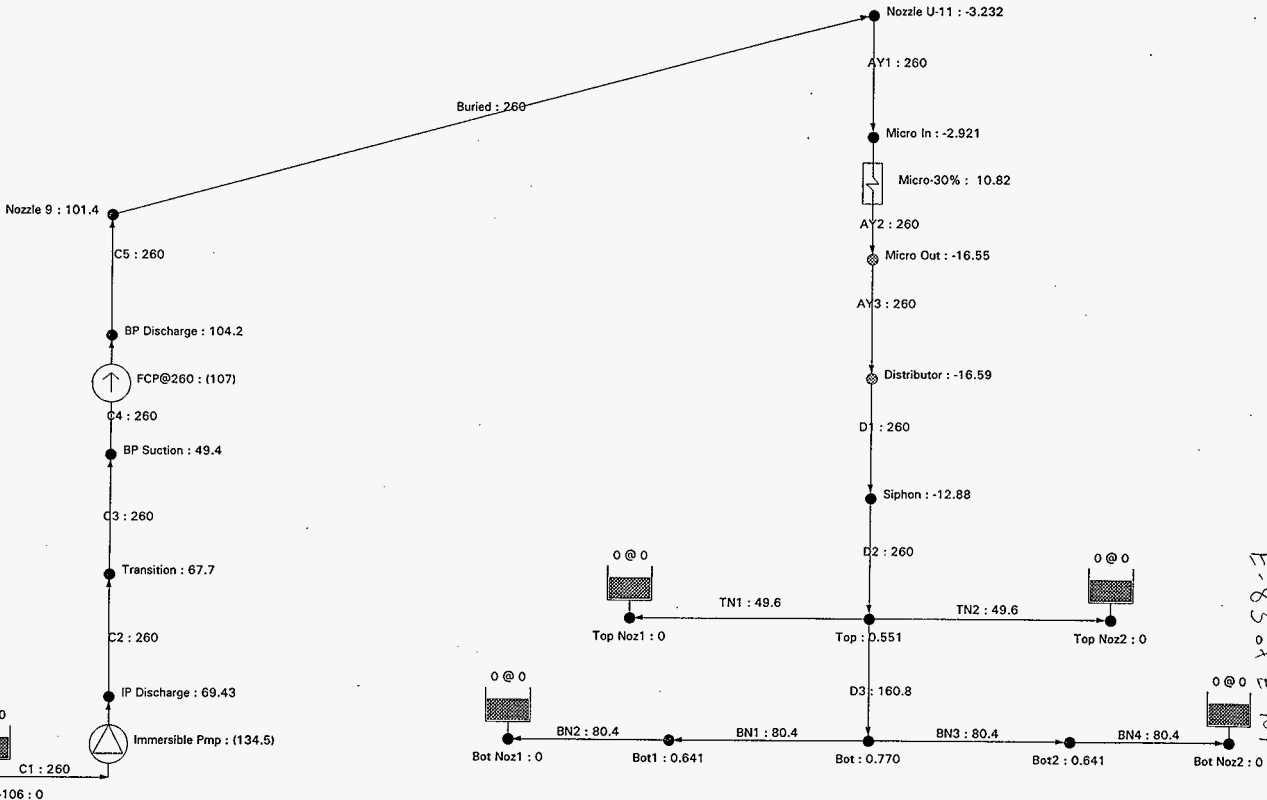
Company: Fluor Daniel Northwest	10/27/97 2:01 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:02 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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HNF-2478, Rev. 0



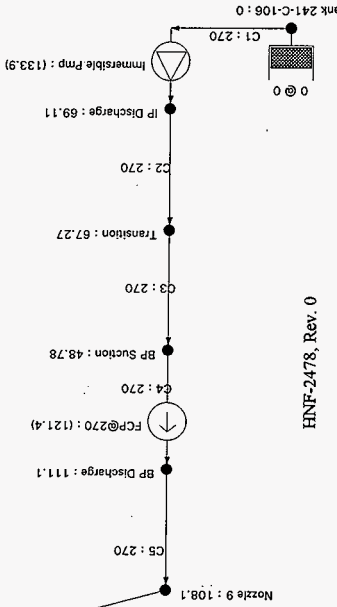
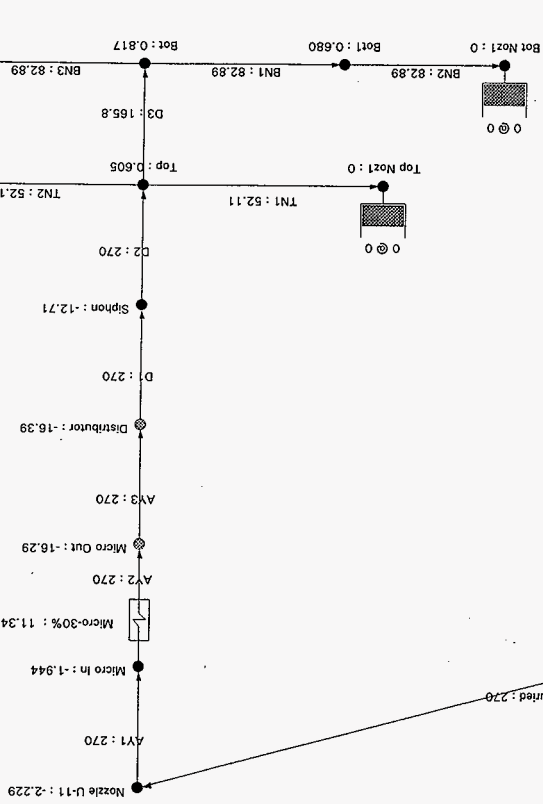
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ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 2:02 pm
Project: W-320	Lineist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

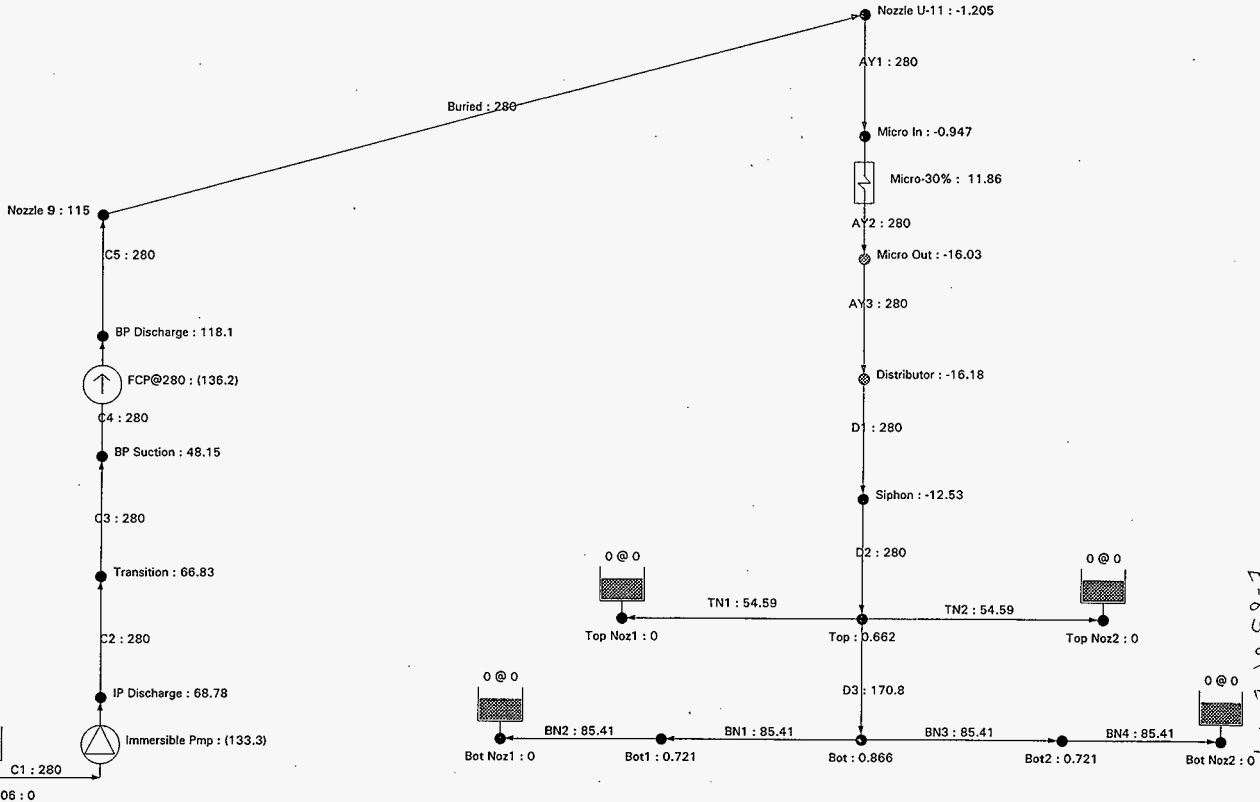
Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-30	
Lineist: SL-30	
10/27/97 2:02 pm	
level & grade: ft	
flow rate: gpm	
pressure: psig	

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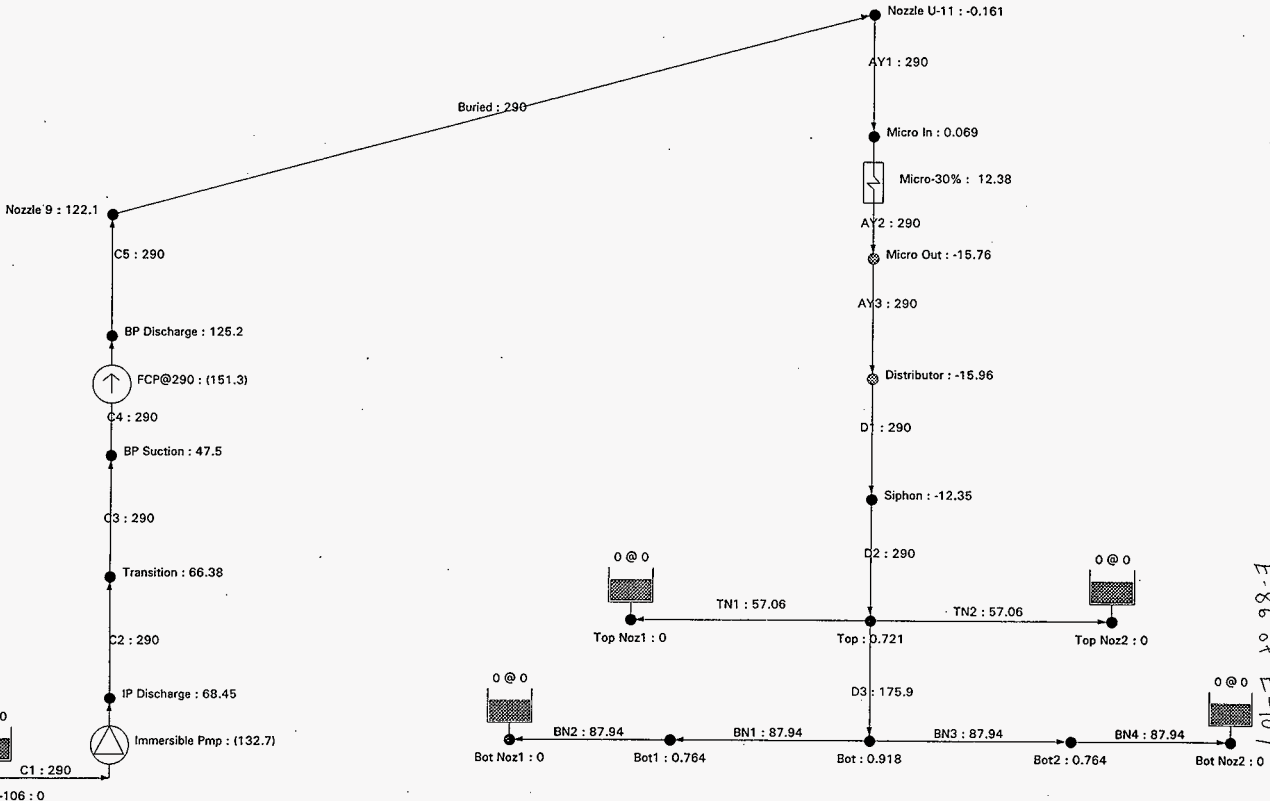


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ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 2:02 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psi _g
	level & grade: ft

HNF-2478, Rev. 0

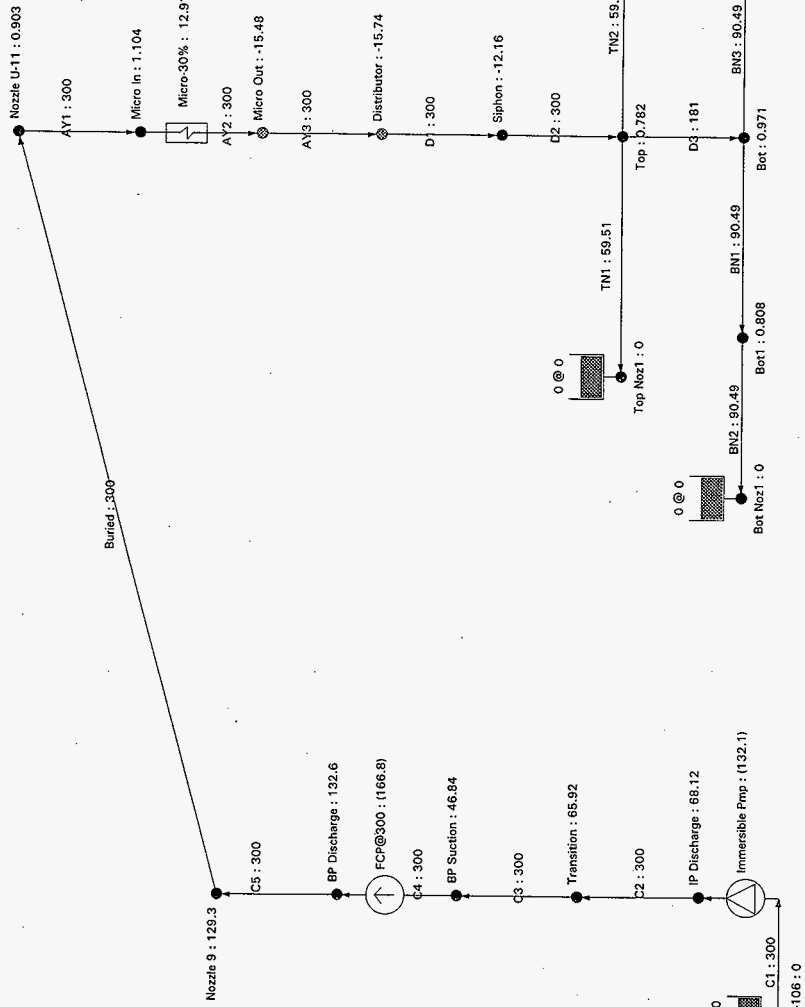


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ank 241-C-106 : 0

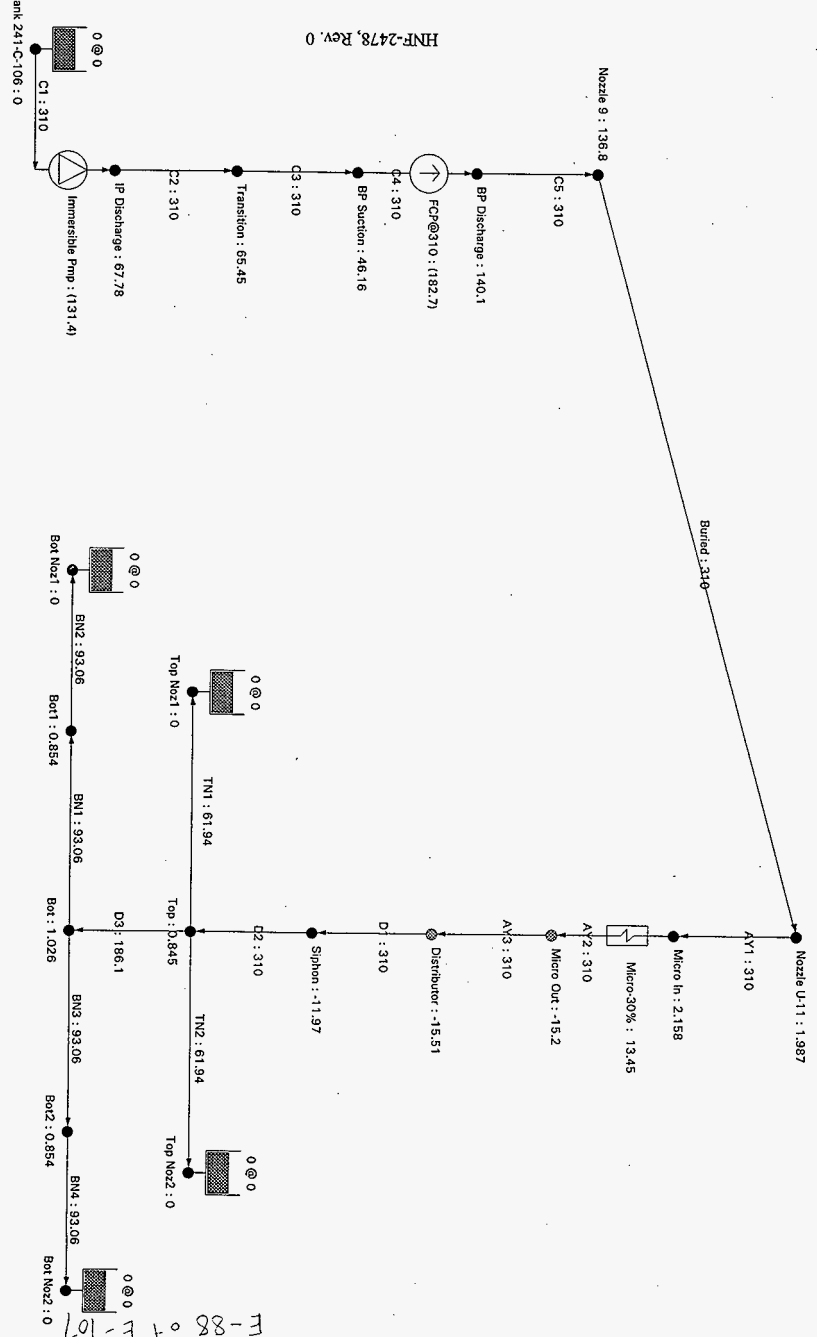
Company: Fluor Daniel Northwest	10/27/97 2:02 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

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Buried : 300

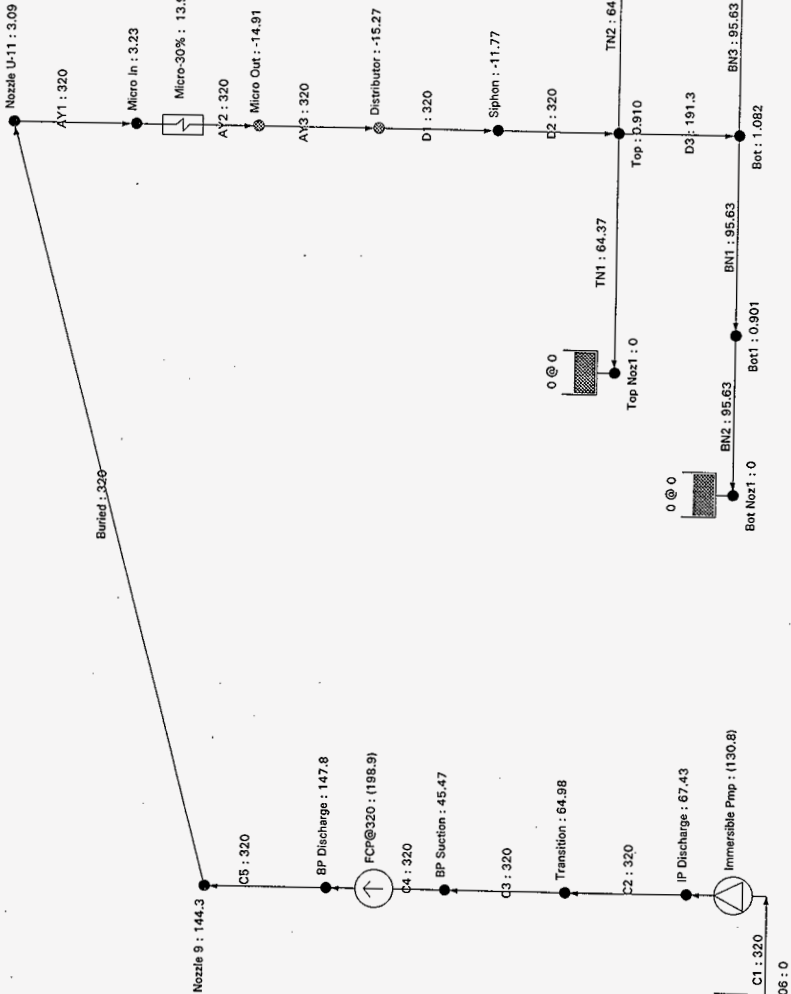
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:02 pm LineList: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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F-88
F-107

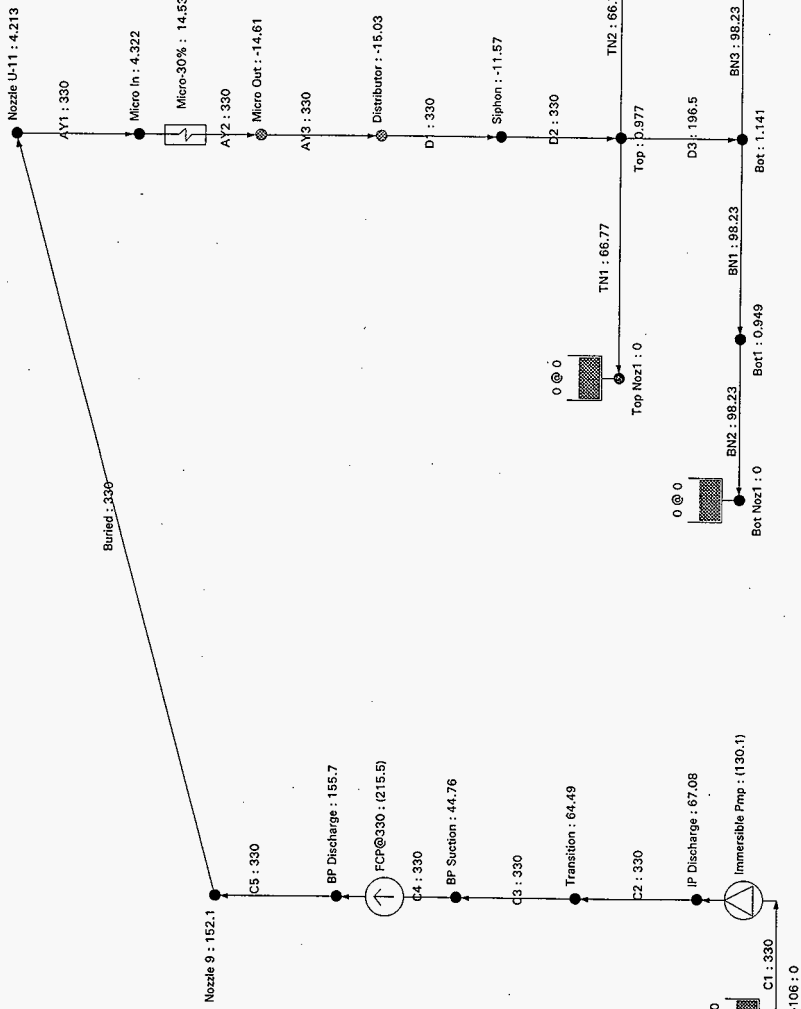
Company: Fluor Daniel Northwest	10/27/97 2:03 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psia
	level & grade: ft

E-89 of E-107



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:03 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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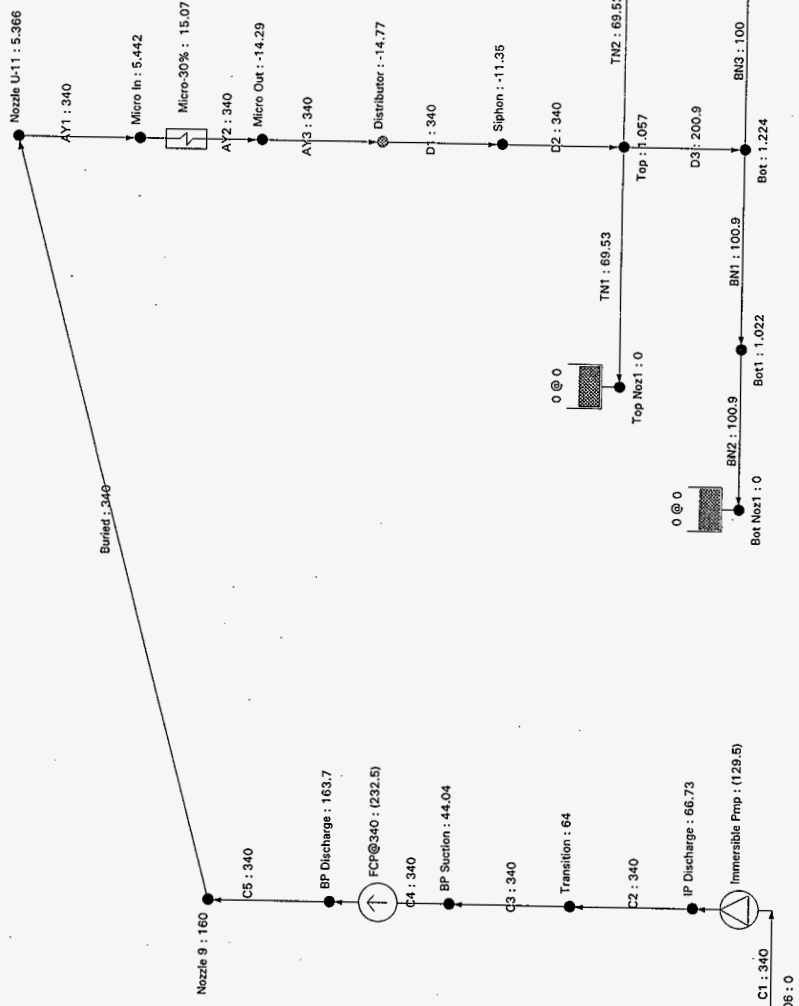
E-90 of E-107



Buried 1.330

<p>10/27/97 2:03 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>	<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>
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E-91 of E-107



Buried : 340

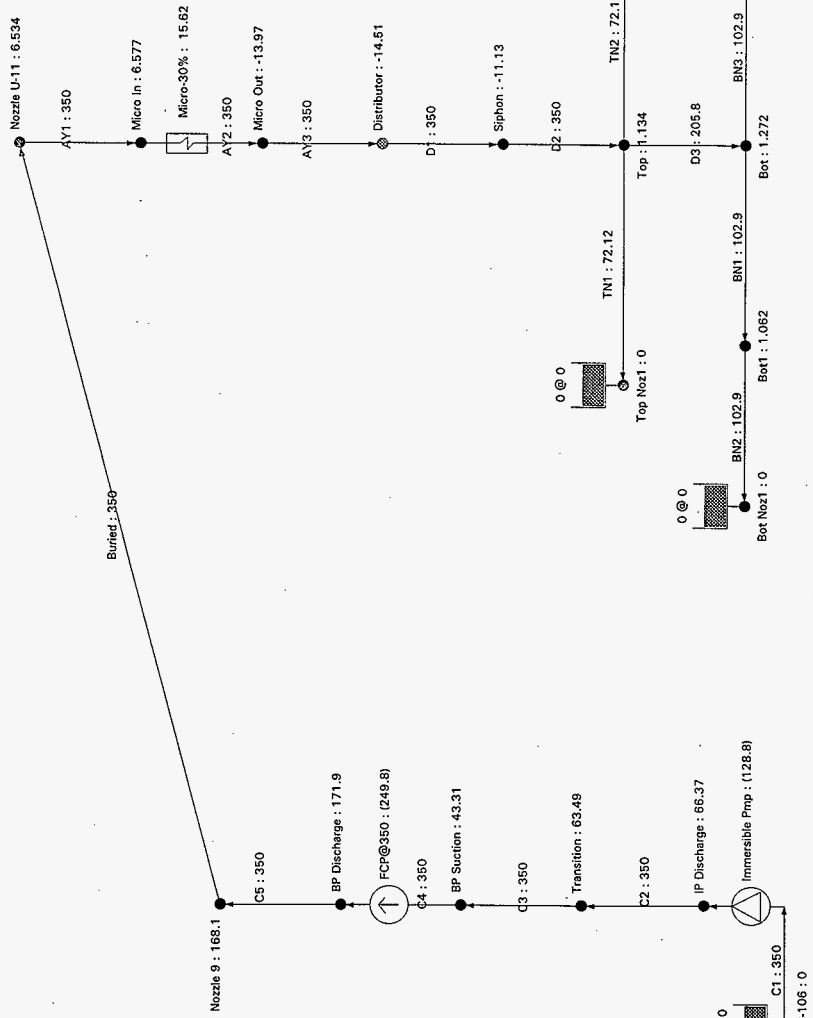
HNF-2478, Rev. 0

<p>Company: Fitor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:03 pm LineList: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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Version: PIPE-FLO ver 5.01

ank 241-C-106 : 0

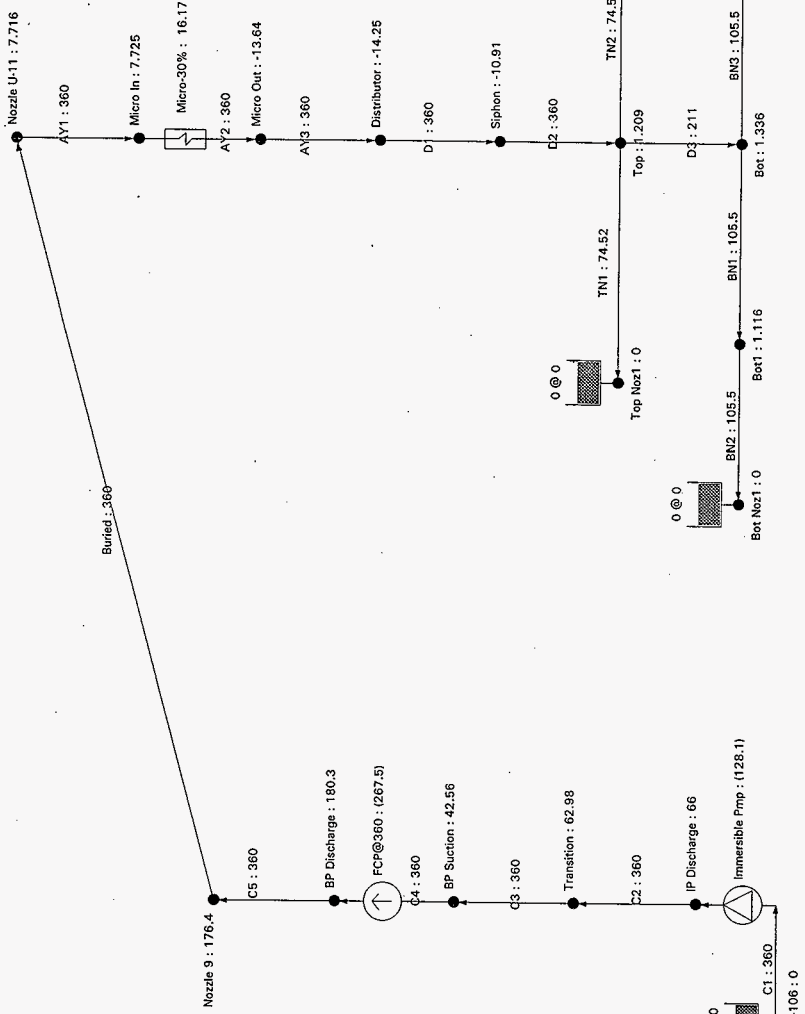
F-92 of F-107



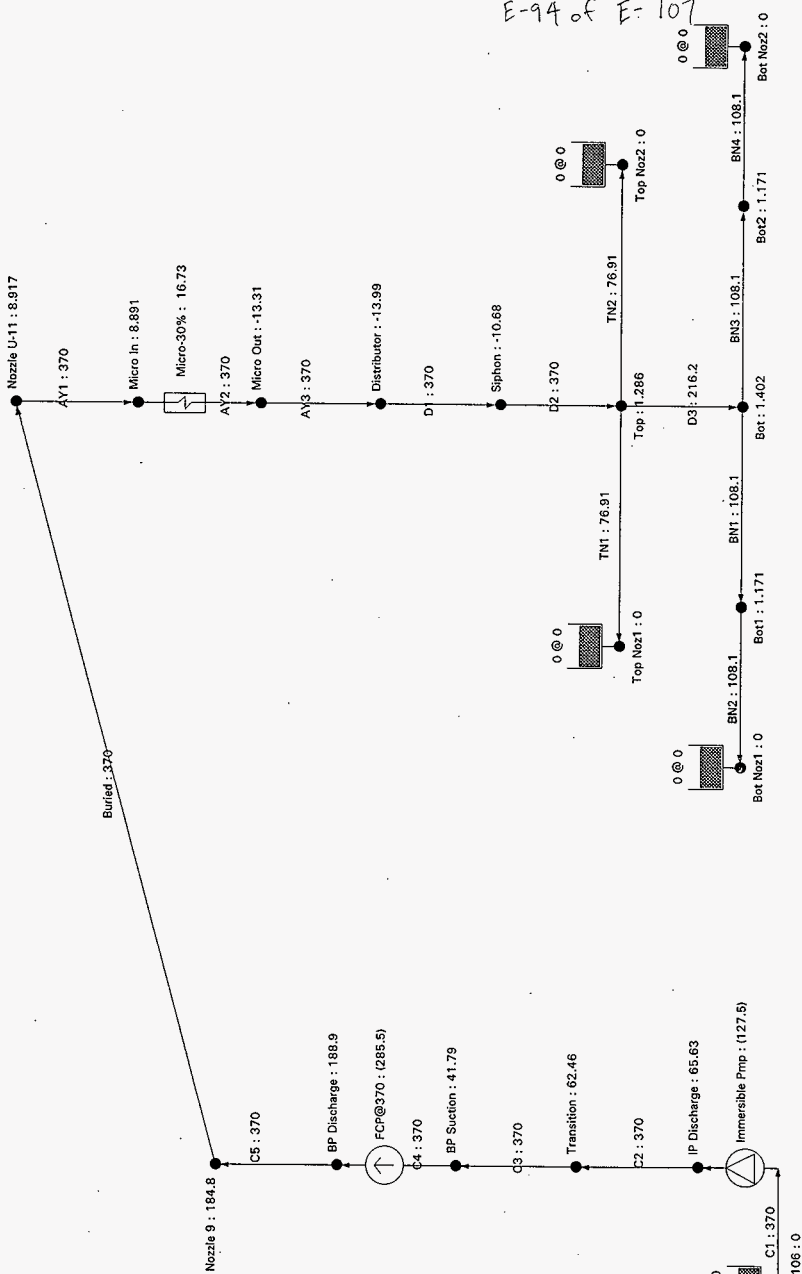
HNF-2478, Rev. 0

<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:03 pm Lineist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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Version: PIPE-FLO ver 5.01

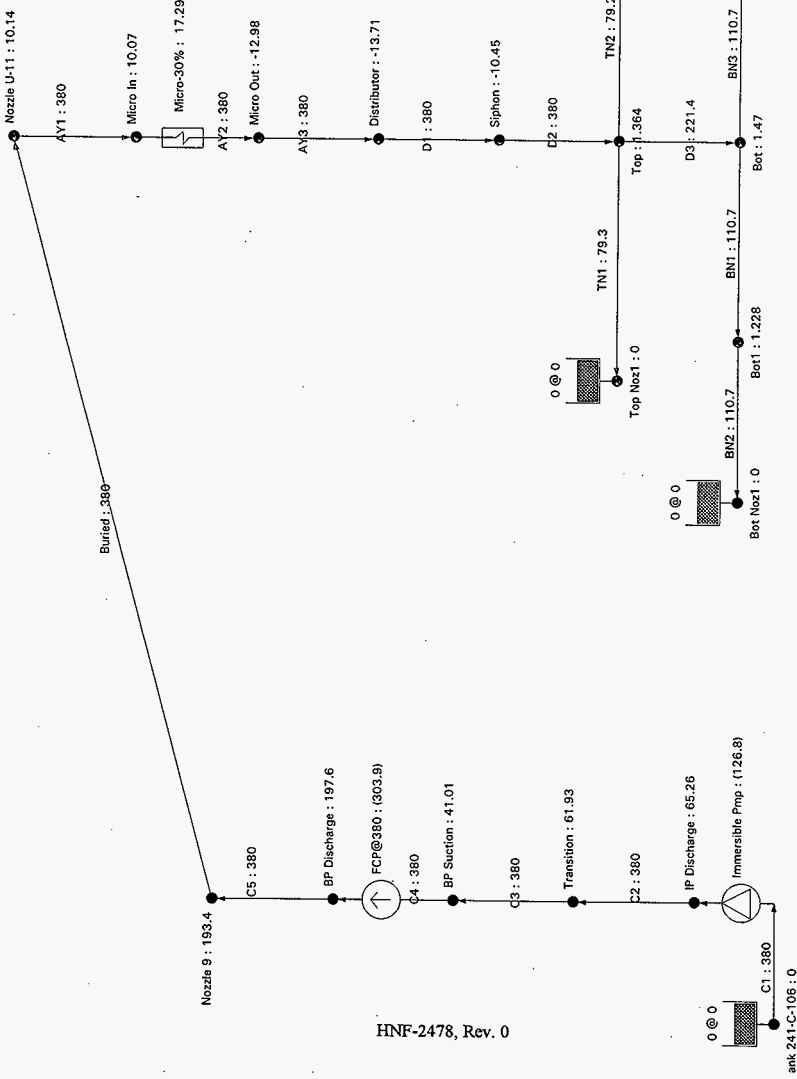


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:04 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:04 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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E-95 of E-107



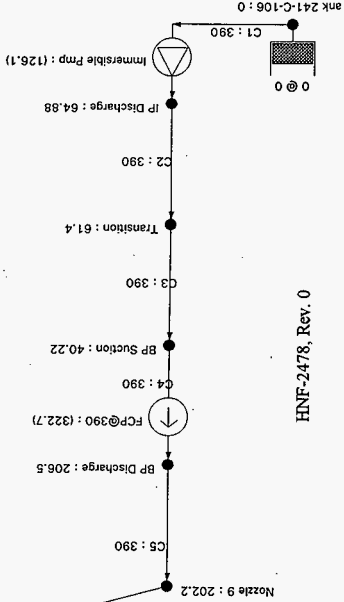
Buried : 380

HNF-2478, Rev. 0

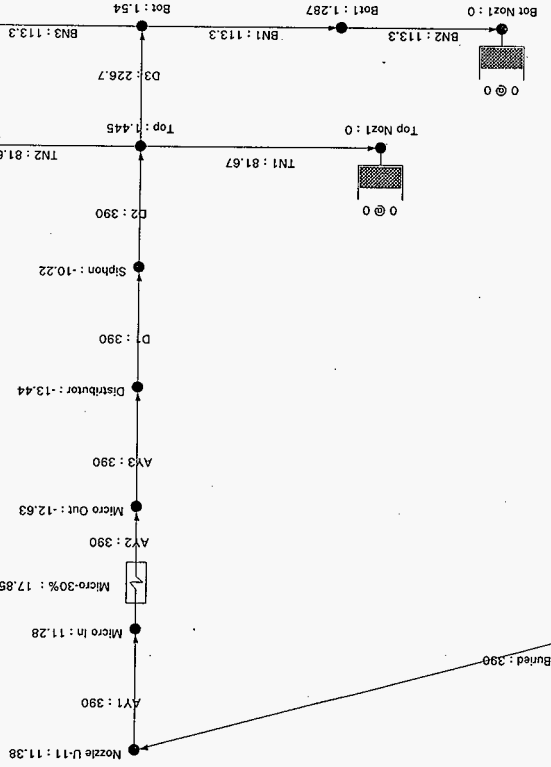
<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:04 pm Linelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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Version: PIPE-FLO ver 5.01

ank 241-C-106 : 0



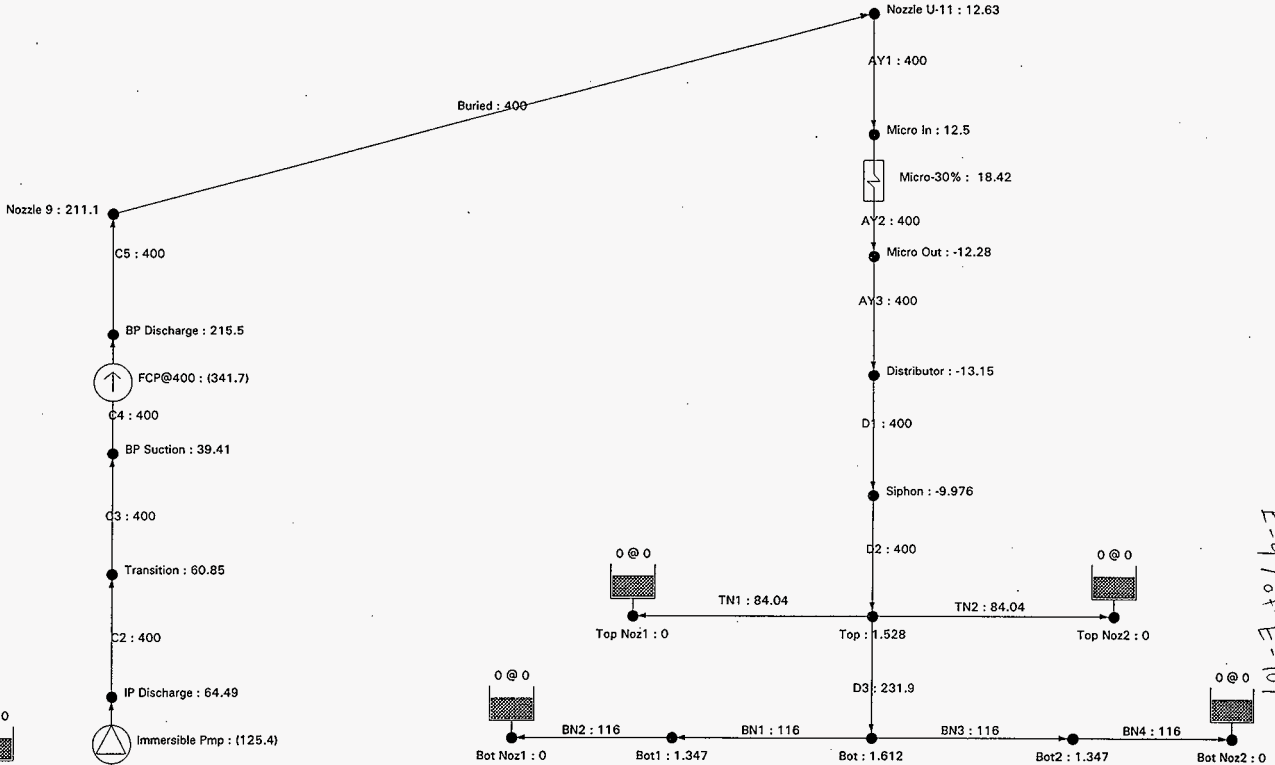
E-96 of E-107



Company: Fluor Daniel Northwest	Version: PIPE-FLOW ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Linefist: SL-30	
Lineup: SL-30	
flow rate: gpm	
pressure: psig	
level & grade: ft	

10/27/97 2:04 pm

HNF-2478, Rev. 0

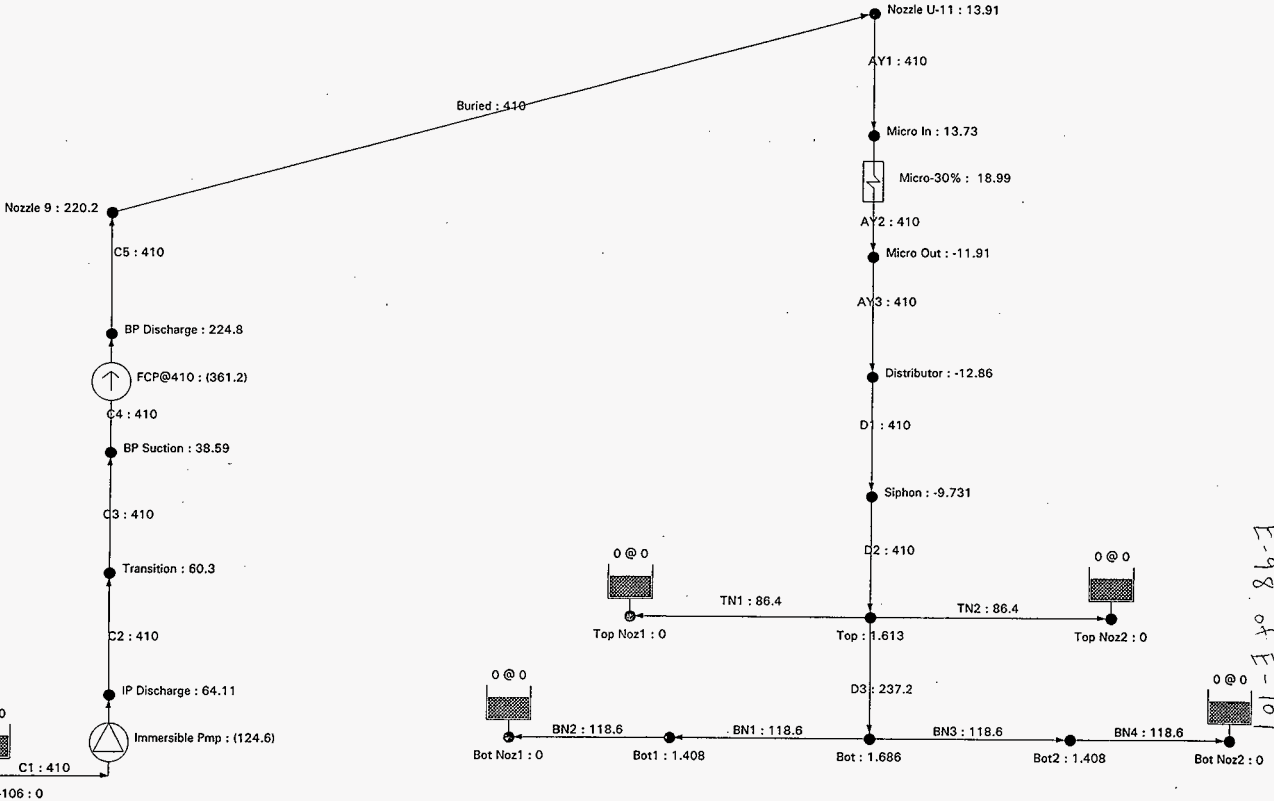


E-97 of E-107

ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 2:04 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft

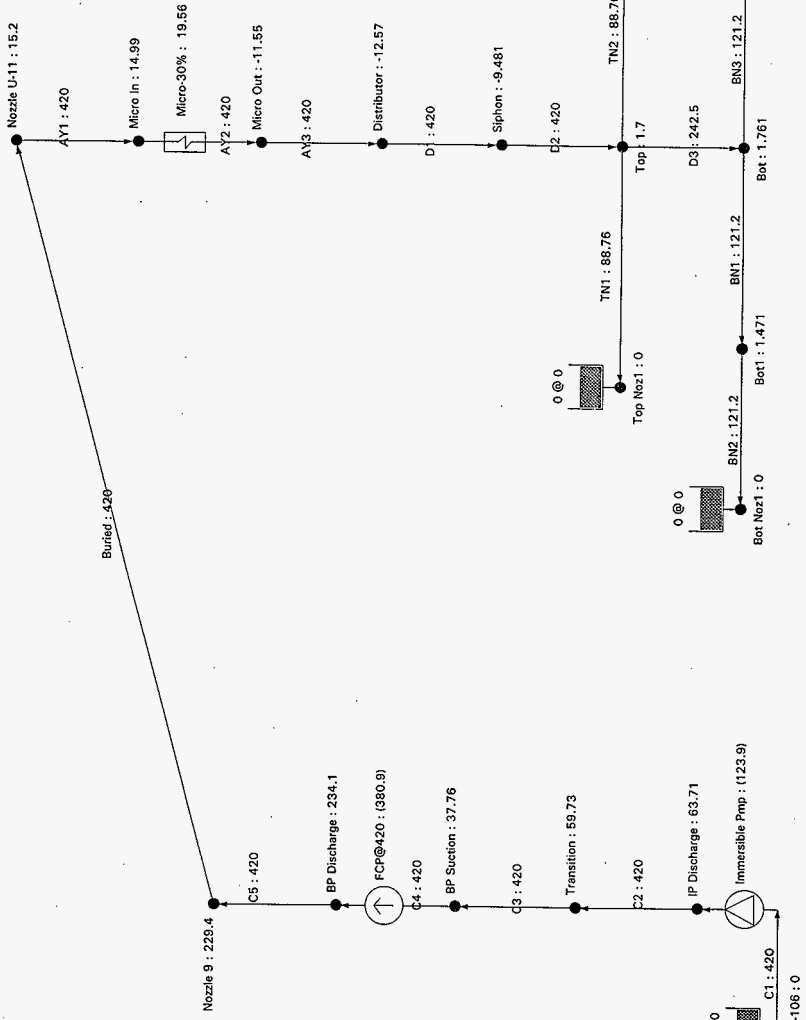
HNF-2478, Rev. 0



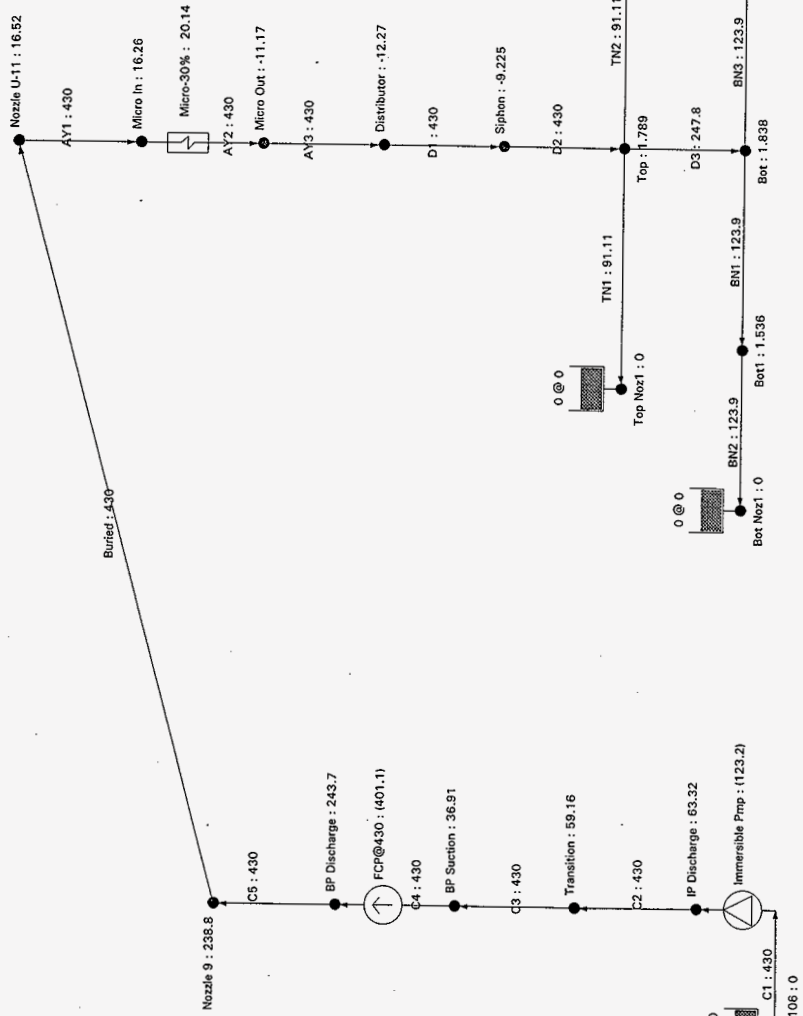
E-98 of E-107

Company: Fluor Daniel Northwest	10/27/97 2:04 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

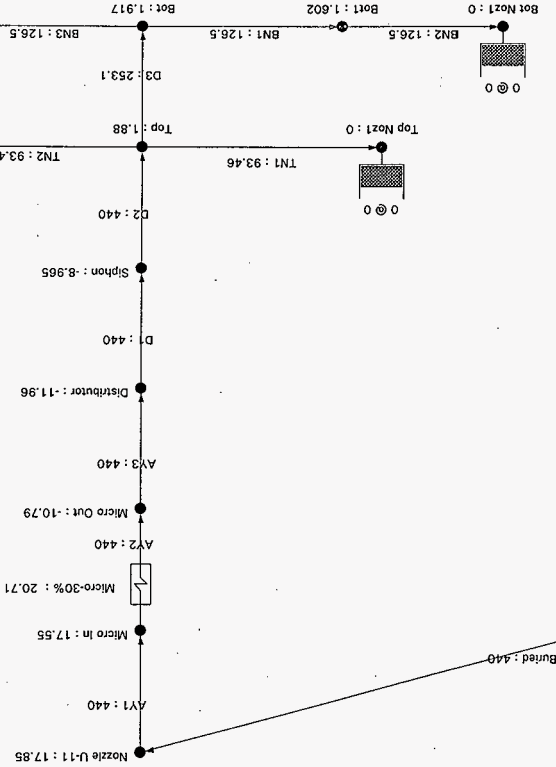
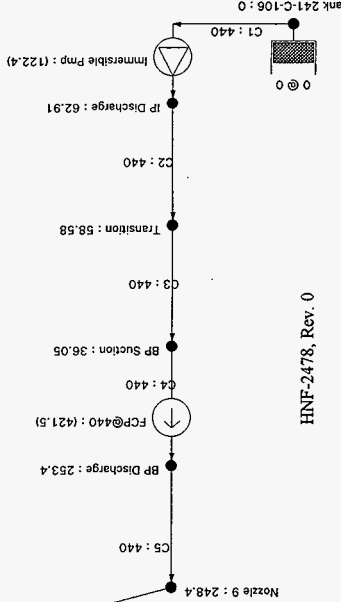
E-99 of E-107



<p>Company: Fluor Daniel Northwest</p> <p>Project: W-320</p> <p>by: K Hayase</p> <p>Comments: Calculation W320-27-048</p> <p>Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:04 pm</p> <p>Linelist: SL-30</p> <p>Lineup: SL-30</p> <p>flow rate: gpm</p> <p>pressure: psig</p> <p>level & grade: ft</p>
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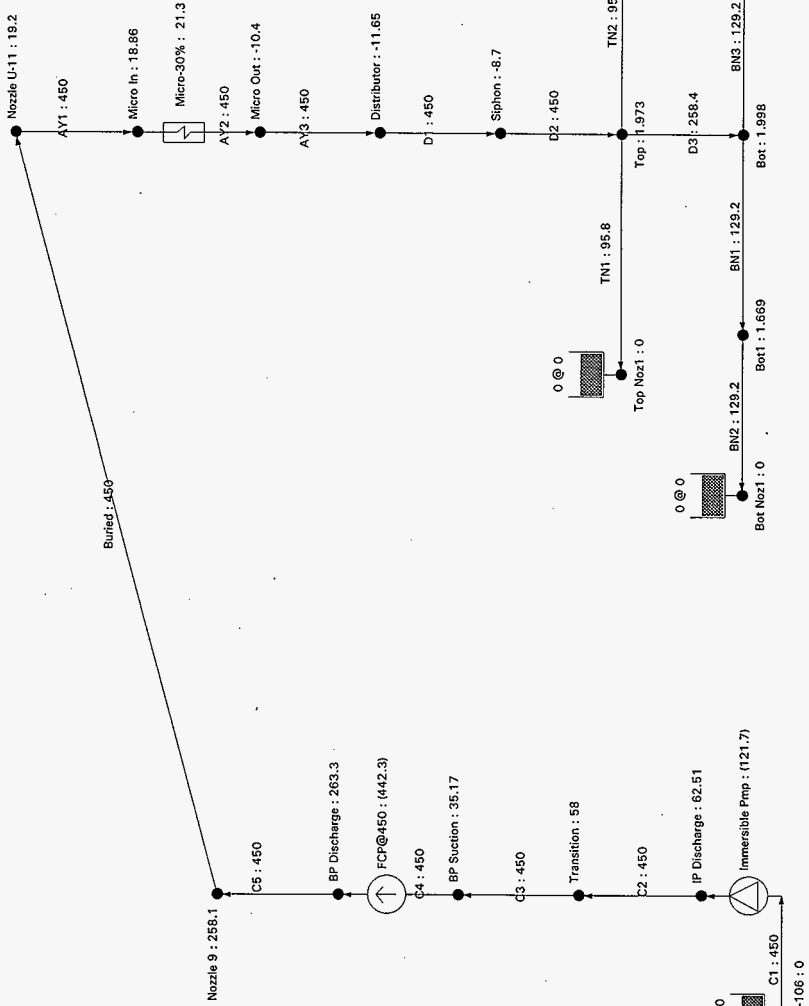


<p>Company: Fluor Daniel Northwest Project: W-320 By: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01</p>	<p>10/27/97 2:05 pm Lineelist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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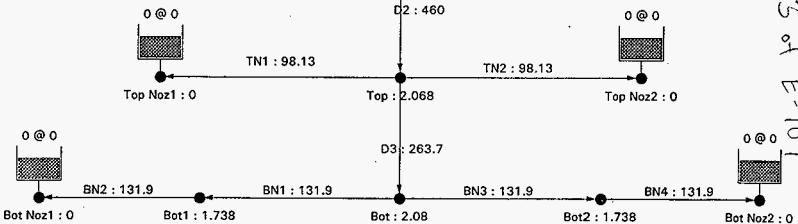
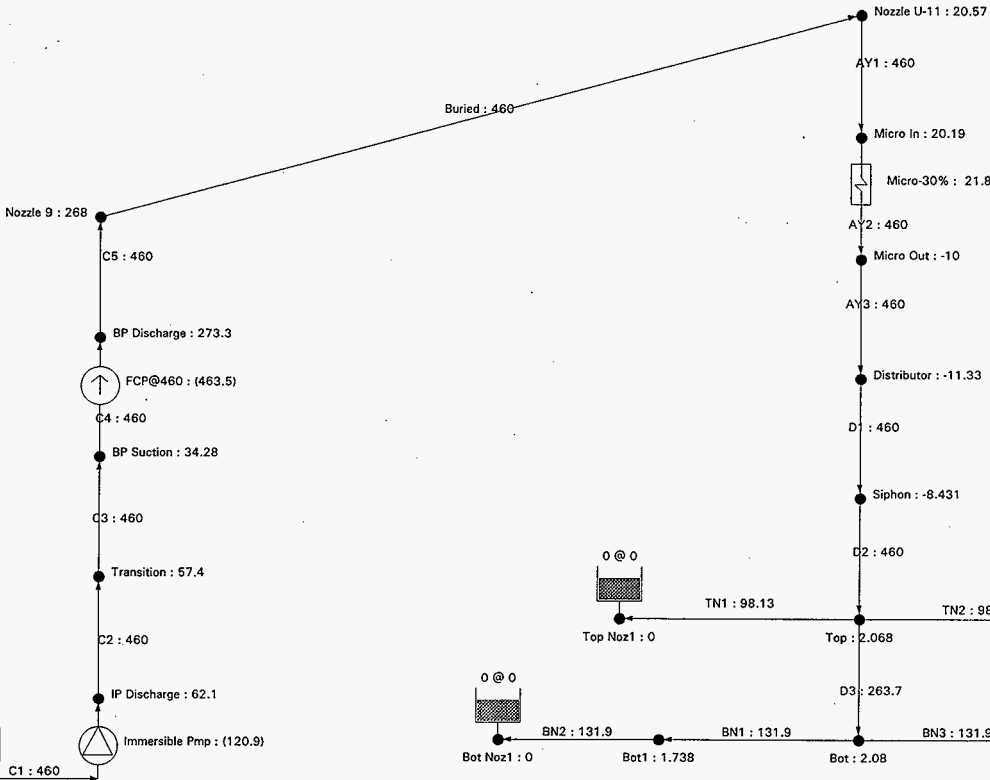
E-101 of E-107

Company: Fluor Daniel Northwest	Version: PIPE-FLO ver 5.01
Project: W-320	Comments: Calculation W320-27-048
by: K Hayase	
Lineup: SL-30	
Line list: SL-30	
10/27/97 2:05 pm	
level & grade: ft	
flow rate: gpm	
pressure: psia	



<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:05 pm LineList: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
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HNF-2478, Rev. 0

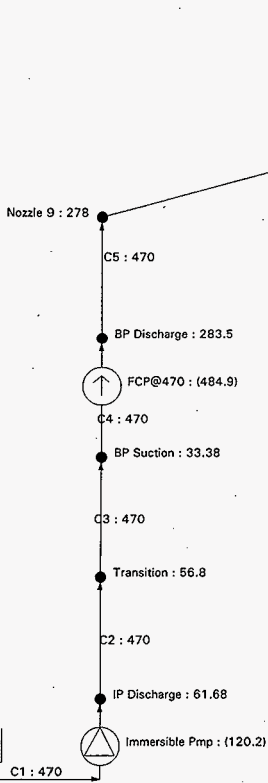


E-103 of E-107

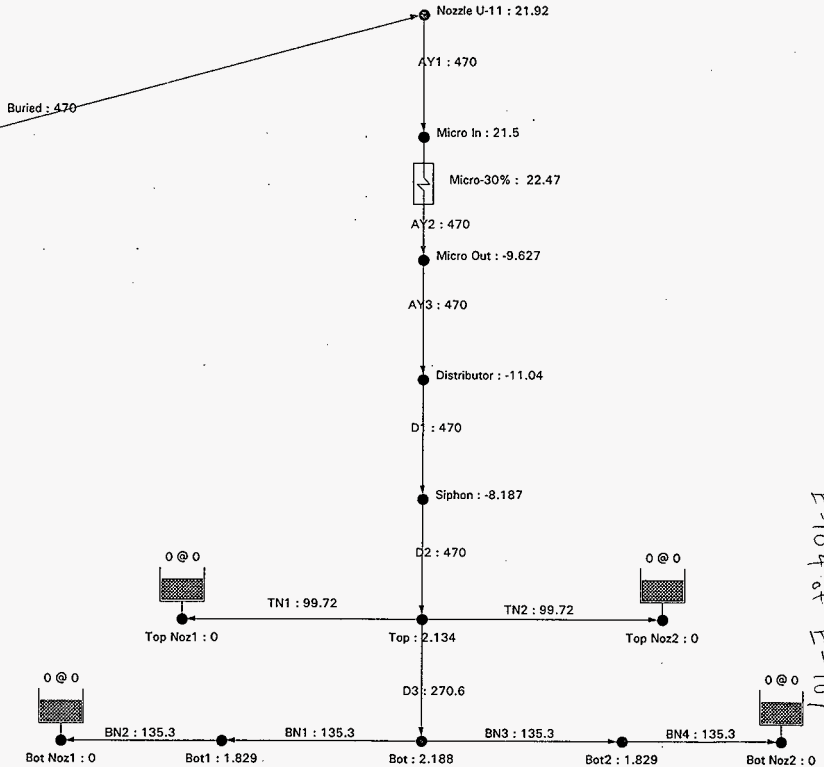
ank 241-C-106 : 0

Company: Fluor Daniel Northwest	10/27/97 2:05 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psi _g
Version: PIPE-FLO ver 5.01	level & grade: ft

HNF-2478, Rev. 0

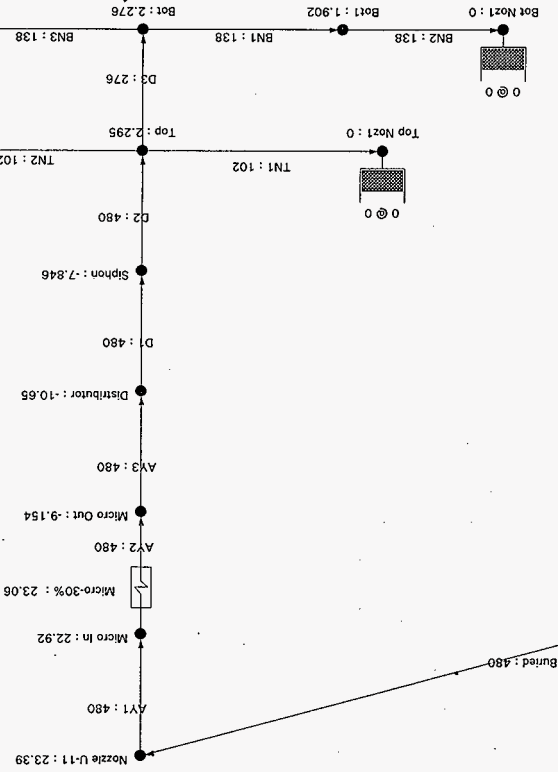
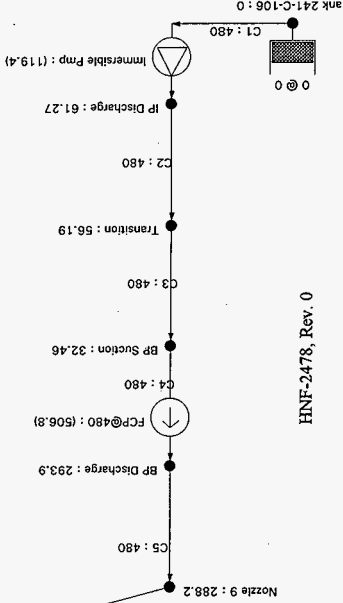


ank 241-C-106 : 0



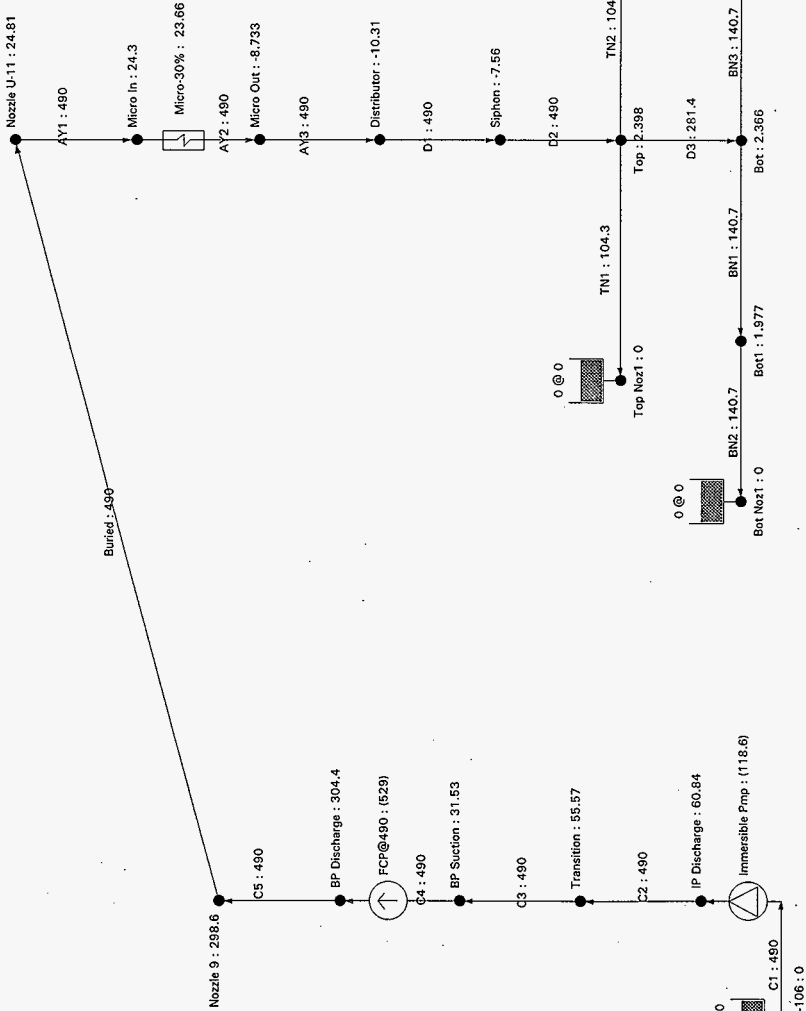
E-104 of E-107

Company: Fluor Daniel Northwest	10/27/97 2:05 pm
Project: W-320	Lineist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
	pressure: psig
Version: PIPE-FLO ver 5.01	level & grade: ft



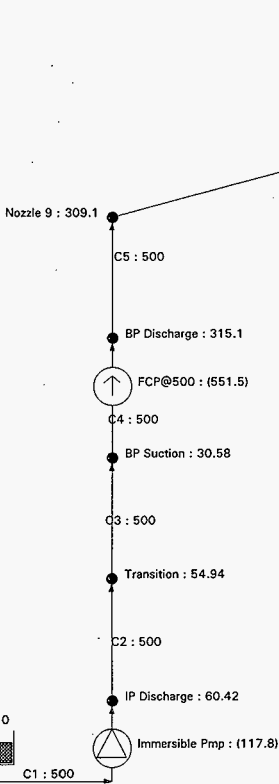
E-105 of E-107

Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048 Version: PIPE-FLO ver 5.01	level & grade: ft pressure: psig flow rate: gpm Lineup: SL-30 Line list: SL-30 10/27/97 2:05 pm
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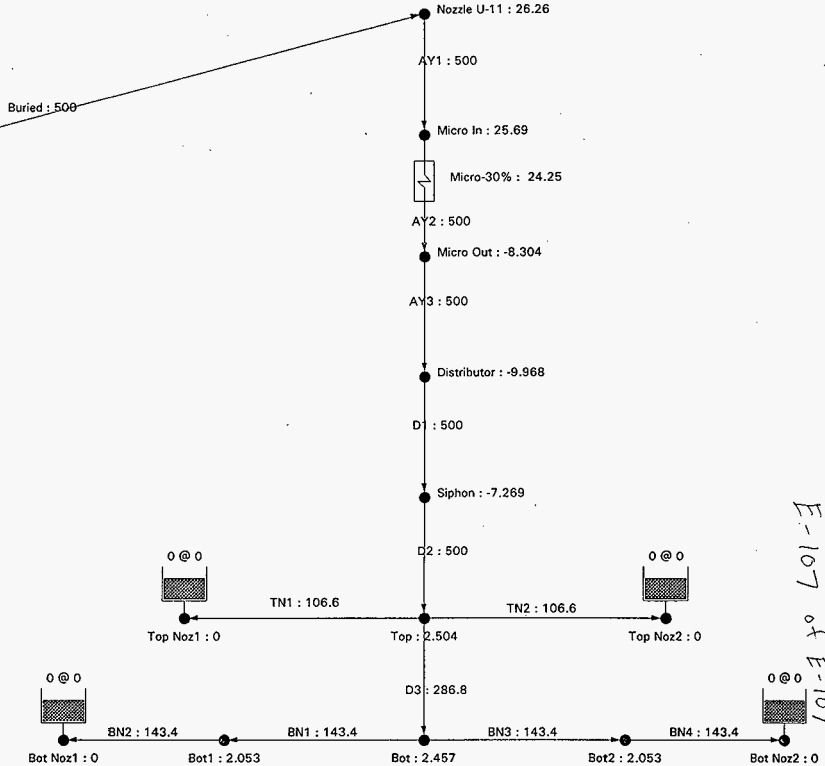


<p>Company: Fluor Daniel Northwest Project: W-320 by: K Hayase Comments: Calculation W320-27-048</p>	<p>10/27/97 2:06 pm Linealist: SL-30 Lineup: SL-30 flow rate: gpm pressure: psig level & grade: ft</p>
---	--

HNF-2478, Rev. 0



ank 241-C-106 : 0



E-107 of E-107

Company: Fluor Daniel Northwest	10/27/97 2:06 pm
Project: W-320	Linelist: SL-30
by: K Hayase	Lineup: SL-30
Comments: Calculation W320-27-048	flow rate: gpm
Version: PIPE-FLO ver 5.01	pressure: psig
	level & grade: ft

DESIGN ANALYSIS

Client: Numatec

WO/Job No.: E09141/W-320

Subject: Slurry/Supernate Hydraulic Analysis

Date:

By: Kelly Hayase

Location: 241-C/241-AY

Checked:

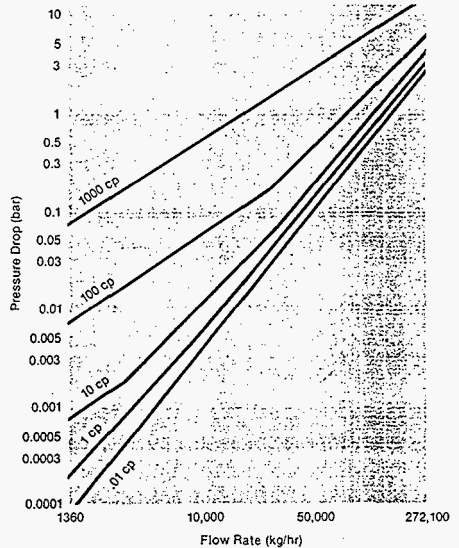
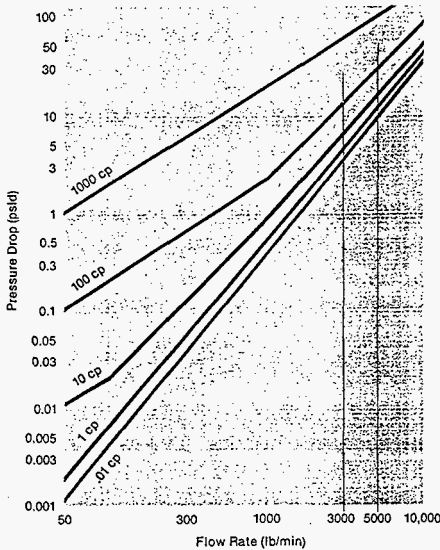
By:

Revised:

By:

APPENDIX F

Flow Rate vs. Pressure Drop



Finding pressure drop of process fluids with a viscosity near 1 centipoise (1 cp)

1. The pressure drop charts shown above have several curves, which represent different viscosity (cp) values. For fluids with a viscosity similar to water, use the curve labeled 1 cp.
2. Locate the point on the English Units or Metric Units graph where the vertical line representing the desired flow rate intersects the curve labeled 1 cp.
3. From that point, locate the nearest horizontal line, then refer to the left side of the graph, which indicates pressure drop (in psi or bar) at the desired flow rate.
4. Divide the pressure drop indicated on the graph by the specific gravity (S) of the process fluid relative to water:

$$\Delta P_{\text{actual}} = \Delta P_{\text{plotted}} / S_{\text{relative to water}}$$

Micro Motion Model CMF300

Finding pressure drop of process fluids with a viscosity above 1 centipoise (1 cp)

1. The pressure drop charts shown above have several curves, which represent different viscosity (cp) values. Use method a or b, below, to find the process fluid viscosity ($f_{\text{viscosity}}$).
 - a. For fluids with a viscosity between any two values plotted on the English Units or Metric Units graph, interpolate the approximate $f_{\text{viscosity}}$ location.
 - b. For fluids with a viscosity above the highest value plotted on the graph, find the ratio of actual viscosity to plotted viscosity:

$$f_{\text{viscosity}} = \text{cp}_{\text{actual}} / \text{cp}_{\text{plotted}}$$

2. Multiply the pressure drop indicated on the left side of the graph by the $f_{\text{viscosity}}$ value from step 1:

$$\Delta P = \Delta P_{\text{plotted}} \times f_{\text{viscosity}}$$

3. To find the actual pressure drop, divide the ΔP from step 2 by the specific gravity (S) of the process fluid relative to water:

$$\Delta P_{\text{actual}} = \Delta P / S_{\text{relative to water}}$$

C_v FACTORS FOR SP-SERIES VALVES

C_v is defined as the number of U.S. gallons of water per minute, of ambient temperature water that will flow through a valve at 1 psi pressure drop.

C _v FACTORS		
Pipe Size	Port Size	SP Series
1/2"	5/8"	20
3/4"	13/16"	36
1"	1"	58
1-1/4"	1-1/4"	100
1-1/2"	1-1/2"	160
2"	1-13/16"	300
2-1/2"	2-1/2"	540
3"	2-3/4"	625
4"	3-1/2"	675
6"	5-1/4"	1950
8"	6-1/4"	2150



PBM TEST INFORMATION

Vacuum Performance

PBM valves excel under vacuum conditions as well as under pressure conditions. An independent laboratory routinely tests selected PBM valves using Helium at an absolute test pressure of 10×10^{-5} Torr and measuring leakage using a helium mass spectrometer.

Vacuum Test Results			
Valve Size	PBM Code	Body Leakage (cc/sec.)	Seat Leakage (cc/sec.)
1"	SPH-34-TT2	7×10^{-8}	6×10^{-8}
2"	SPH-37-F152	3×10^{-7}	1×10^{-7}
4"	SPH-40-F152	2×10^{-6}	8×10^{-8}

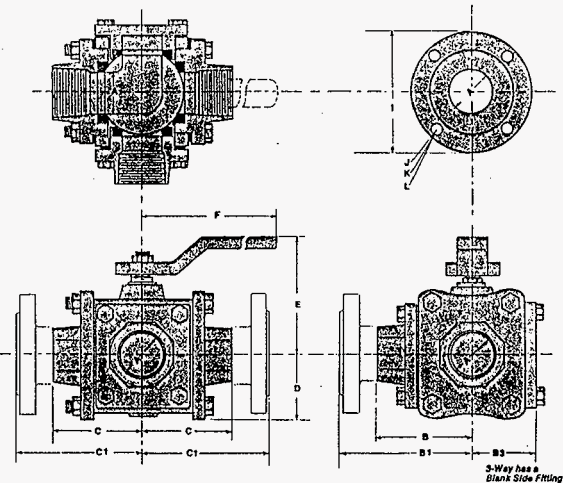
Cycle Testing

The lifetime of a ball valve is dependent on the service conditions, and therefore impossible to predict. However, PBM cycle tests valves at about 300 times per hour using 100 psid of ambient temperature water pressure across the seats when the valve is in the closed position — this simulates a force on the seats which causes wear.

The lifetime of small valves (under 2") is about 50,000 cycles. This lifetime allows for adjustment of the seat preload using the Adjust-O-Seal feature. Generally, the seats will last 10,000 to 20,000 cycles without adjustment. Larger valves (2-1/2" and greater) have about half the wear lifetimes (about 25,000 cycles) due to the greater weights and forces on the seats and packings.

Replacement of gaskets or O-rings is recommended at each disassembly. Replacement of other non-moving parts of the valve would only be dictated by the corrosion caused by the flow media — in most applications, your PBM will operate trouble-free for many years.

DRAWINGS ARE FOR ILLUSTRATION PURPOSES ONLY...
PLEASE CONSULT FACTORY PRIOR TO
ANY FABRICATION OR INSTALLATION WORK



Female NPT

PIPE SIZE (Inch)	A Port Dia.	B Center to Side	B3 Center to Blank Side	C Center to End	D Center to Bottom	E Height	F Handle	3-Way Wt. (Lbs.)** Bronze
1"	1.06"	2.94"	1.75"	2.75"	1.78"	3.80"	6.12"	13
1 1/4"	1.06"	2.94"	1.75"	2.75"	1.78"	3.80"	6.12"	16
1 1/2"	1.62"	3.95"	2.84"	3.67"	2.69"	4.75"	12.00"	30
2"	1.62"	3.83"	2.84"	3.53"	2.69"	4.75"	12.00"	35

150# RF Flange (F15)

PORT SIZE (Inch)	B1 Center to Side	C1 Center to End	I Fig. O.D.	J Dia. S.C.	K No. Bolt Holes	L Bolt Dia.	3-Way Wt. (Lbs.)** Bronze
1 1/2"	4.95"	5.70"	5.00"	3.88"	4	.50"	46
2"	5.02"	5.77"	6.00"	4.75"	4	.62"	59

*1-Port shown. See Flow Charts, pages 5 & 6, for other possibilities.
**Weights for Aluminum and for 4-Way supplied upon request.

Cv Factors for MP and BT Series Ball Valves

Cv is defined as the number of U.S. gallons of water per minute, at standard conditions (60°F @ 14.7 PSIA) that will flow through a valve at a 1 PSIG pressure drop across the Valve.

Pipe Size	PBM Code	Straight Thru Cv	Side Cv	LL Port Cv
1/2"	12	16	10	8
3/4"	13	16	10	8
1"	14	45	25	22
1 1/4"	15	45	25	22
1 1/2"	16	100	56	46
2"	17	180	100	78
3"	19	228	127	90
4"	20	405	225	175

Nomenclature

- GPM — U.S. Gallons per Minute
- W — Pound per hour*
- Q — Cubic feet per hour @ 60°F and 14.7 PSIA
- G — Specific Gravity
- V — Specific volume of inlet steam
- °F — Inlet gas temperature
- P1 — Inlet pressure in PSIA
- P2 — Outlet Pressure in PSIA
- ΔP — Pressure drop across the valve in PSI. Must not be greater than half the absolute inlet pressure
- PSIA = PSIG + 14.7

*Pounds per hour may be converted to standard cubic feet per hour by the following formula:

$$Q = \frac{W}{0.0754 G}$$

The Sizing Formulas

(1). LIQUID:

$$C_v = GPM \sqrt{\frac{P}{\Delta P}}$$

$$GPM = C_v \sqrt{\frac{P}{\Delta P}}$$

(2). SATURATED STEAM

$$C_v = W \sqrt{\frac{1}{P_1(P_1 + P_2)}}$$

$$W = 2.1 C_v \sqrt{P_1 + P_2}$$

(3). GAS:

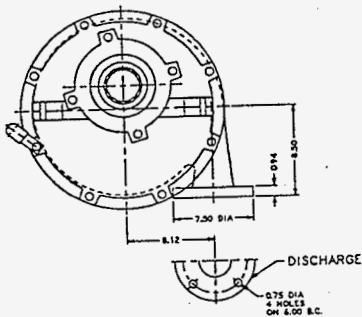
$$C_v = Q \sqrt{\frac{G(460 + \theta) P}{1360}} \sqrt{\frac{2}{P_1 + P_2}}$$

$$Q = (1360) C_v \sqrt{\frac{P}{G(460 + \theta) P_1 + P_2}}$$

$$P = \left[\frac{GPM}{C_v} \right]^2 (G)$$

$$P = \left[\frac{C_v}{.0155 W} \right]^2 \text{HNF-2478, Rev. 0}$$

$$P = \left[\frac{Q}{(1360) C_v} \right]^2 \left[\frac{(460 + \theta) G}{P_1} \right]$$



CONNECTIONS

- MAIN MOTOR POWER LEADS (40 FOOT LENGTH)

WEIGHTS:

- PUMP 300 LBS.
- MOTOR 1800 LBS.
- TOTAL 2300 LBS. APPROXIMATE

NOTES:

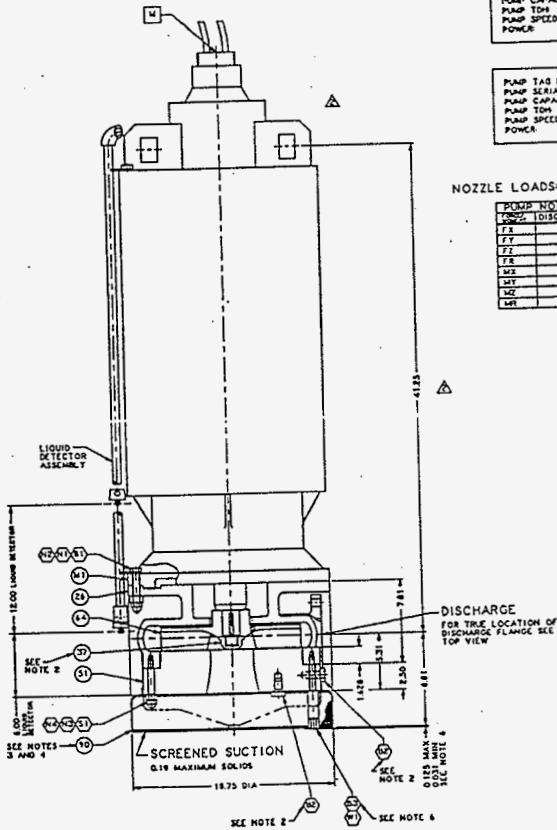
- FOR LIST OF PARTS SEE PUMP PARTS LIST PL3447.
- TACK WELD PART NO.3 37 AND B2 AT ASSEMBLY.
- 0.12 FILLLET WELD PART NO. 90 TO PART NO. 81 AT ASSEMBLY.
- ALL WELDS TO BE GRIND TO 125 RMS MINIMUM.
- PUMP MANIFOLD SHALL BE MADE OF STAINLESS STEEL.
- PUMP SHALL ALSO BE STAMPED USING LOW IMPACT STAMP.
- 0.91 STD HANGPLATE AND IS TO BE WIRED TO THE PUMP.
- LEG SUPPORT #8 TO BE FIT AT ASSEMBLY. HOLES ON SUCTION SCREEN FOR LEG SUPPORTS TO BE FIT AT ASSEMBLY.
- WELD WASHER #9 TO LEG SUPPORT AND ALSO TO SUCTION SCREEN AT ASSEMBLY. LEG SUPPORTS TO BE LOCATED APPROX. 40" AWAY FROM SUCTION SCREEN SUPPORT RIBS. LEG SUPPORTS ARE TO EXTEND BEYOND THE LOWEST POINT ON THE SUCTION SCREEN BY A MIN. OF 0.031 TO A MAX. OF 0.125.

PUMP TAG NO. P-1341
 PUMP SERIAL NO. 91231-1
 PUMP CAPACITY: 318-350 USGPM
 PUMP TDH: 120-123 FT
 PUMP SPEED: 1740 RPM
 POWER: 31-38 HP

PUMP TAG NO. P-0621
 PUMP SERIAL NO. 91231-2
 PUMP CAPACITY: 350 USGPM
 PUMP TDH: 128 FT
 PUMP SPEED: 1740 RPM
 POWER: 25 HP

NOZZLE LOADS:

NOZZLE	DISCHARGE FLANGE
FS	320 LBS
FT	400 LBS
FT	210 LBS
FR	570 LBS
MS	180 FT-LBS
MT	140 FT-LBS
MS	500 FT-LBS
MT	1300 FT-LBS



LEGEND

- PUMP PART
- FABRICATION
- FUNCTION

91231-2	M2-4-VV-78259	P-0621
91231-1		P-1341
PUMP SERIAL NO.	ORDER NO.	PUMP ITEM NO.
CUSTOMER WESTINGHOUSE HANFORD CO.		
SITE RICHLAND, WASHINGTON		

DATE	BY	REVISIONS	DESCRIPTION
07/15/53	W.B.S.	1	ASSEMBLY 2 ELEVATION OF 42.5x13 VERTICAL SUBMERSIBLE PUMP

ASSEMBLY 2 ELEVATION OF 42.5x13 VERTICAL SUBMERSIBLE PUMP

Lawrence Pumps Inc. 1000 W. 10th St. Lawrence, Kansas

568 BALANCE

D 55687 1-1

Calculation W320-27-748

F-5 of F-18

NORMAL

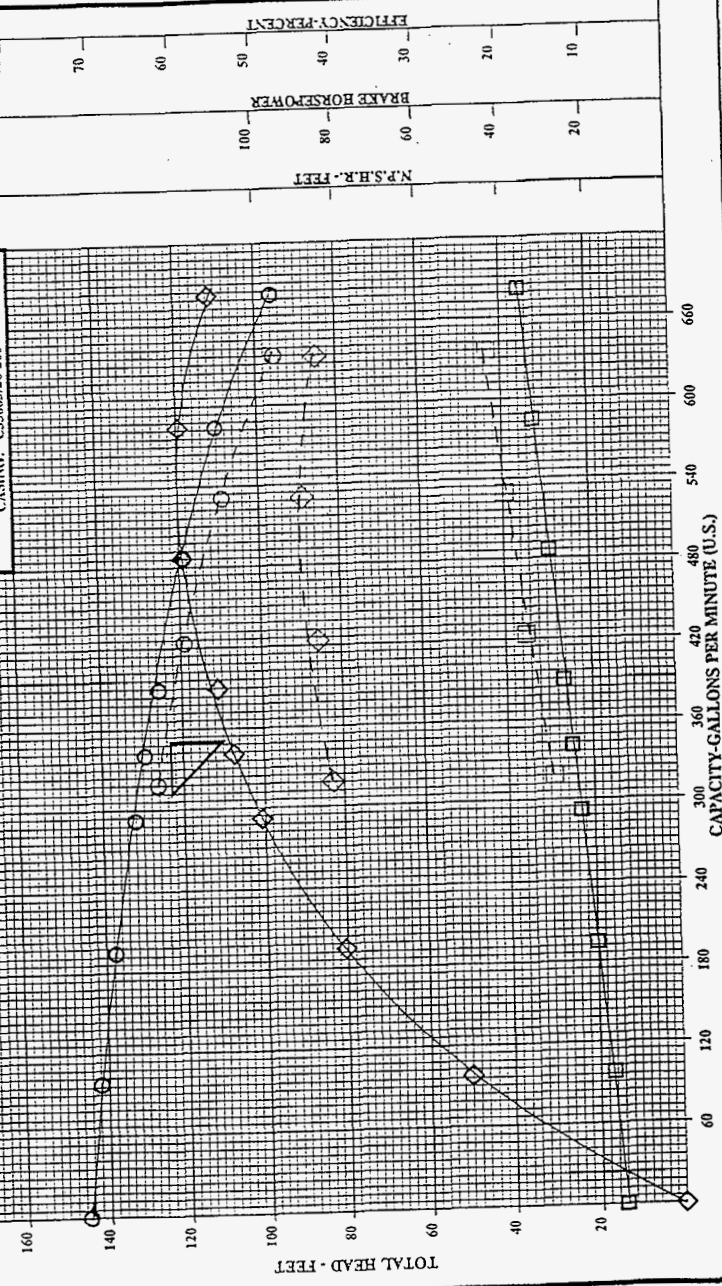
LAWRENCE PUMPS INC.

371 MARKET STREET, LAWRENCE, MA 01843-9966



TEST NO.: T3553
TEST DATE: 04-25-96
TESTED BY: JDA
ACCEPTED BY: SV 4/23/96

○ TOTAL DYNAMIC HEAD
◇ EFFICIENCY
□ BHP AT 1.2 SP.GR.
Viscosity: 008.2 cps ---
IMPELLER: C55662
CASING: C55663/26-200



SPEED (RPM): 1760
IMP DIA. MIN (IN): 7.50
IMP DIA. MAX (IN): 13.00
IMP EYE AREA (IN²):

IMPELLER TESTED (IN): 11.25
IMPELLER PLOTTED (IN): 11.25
RATED FLOW (GPM): 350
RATED HEAD (FT): 123

SERIAL NUMBER: 91231-1
PUMP TYPE: SUBMERSIBLE/SLURRY
PUMP SIZE: 3XAX13
SERVICE: RADIOACTIVE SLURRY

CUSTOMER: WESTINGHOUSE HANFORD
USER NAME: WESTINGHOUSE HANFORD
P.O. NUMBER: MZA-XXV-78259
ITEM NUMBER: P-1361

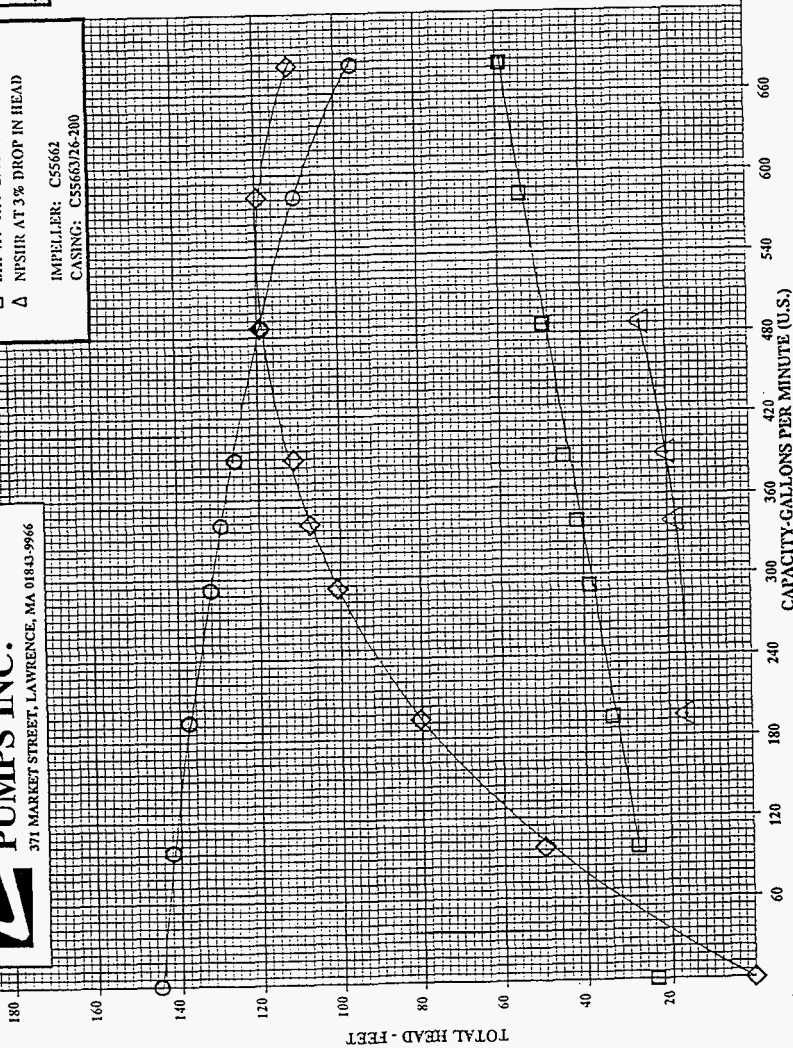
LAWRENCE PUMPS INC.

371 MARKET STREET, LAWRENCE, MA 01843-9966

- TOTAL DYNAMIC HEAD
- ◇ EFFICIENCY
- BHP AT 1.00 SP.-GR.
- △ NPSHR AT 3% DROP IN HEAD

IMPELLER: C55662
CASING: C55663/26-200

TEST NO.: T3553
TEST DATE: 04-25-96
TESTED BY: JDA
ACCEPTED BY:
SV 4/30/96



CUSTOMER: WESTINGHOUSE HANFORD
 USER NAME: WESTINGHOUSE HANFORD
 P.O. NUMBER: MZ4-XVV-78259
 ITEM NUMBER: P-1361

SERIAL NUMBER: 91231-1
 PUMP TYPE: SUBMERSIBLE/SLURRY
 PUMP SIZE: 3X4X13
 SERVICE: RADIOACTIVE SLURRY

IMPELLER TESTED (IN): 11.25
 IMPELLER PLOTTED (IN): 11.25
 RATED FLOW (GPM): 350
 RATED HEAD (FT):

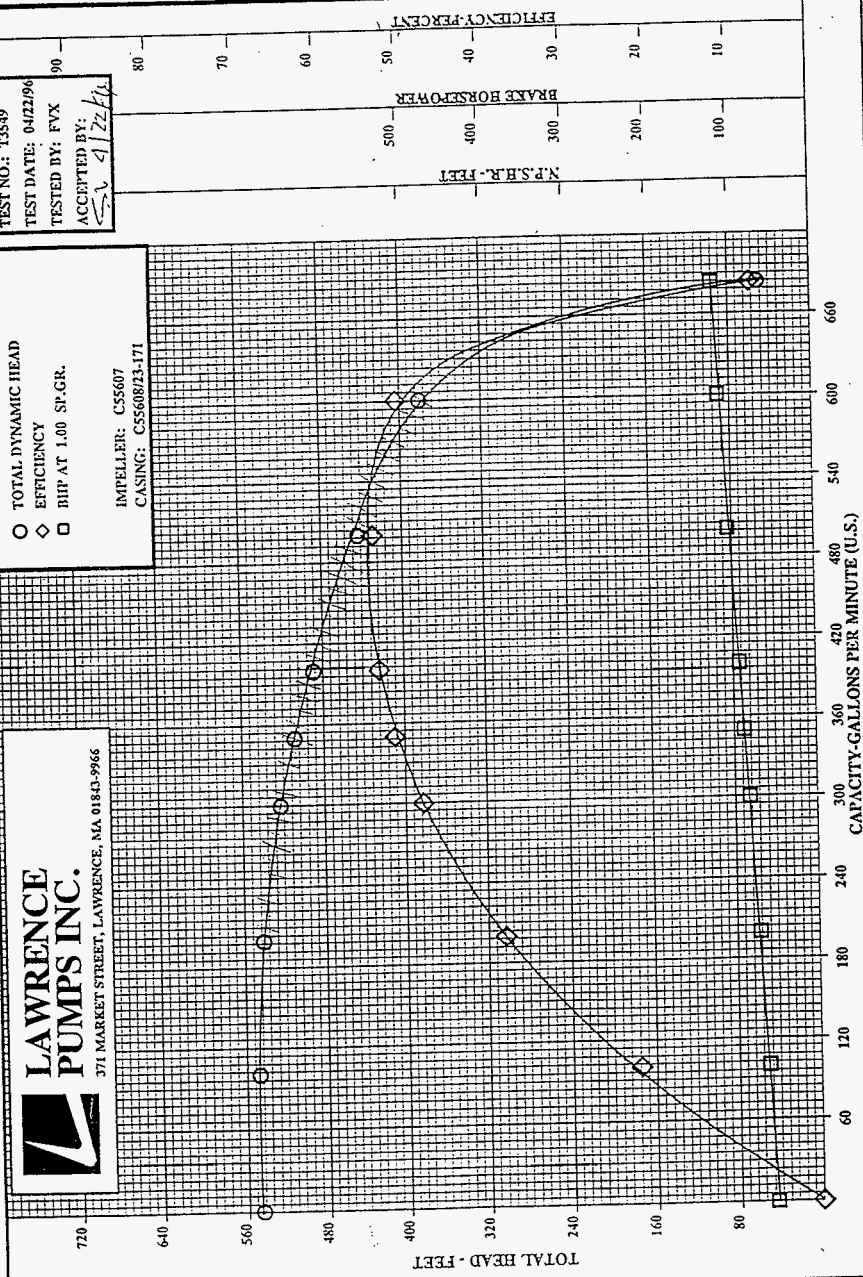
SPEED (RPM): 1760
 IMP DIA. MIN (IN): 7.50
 IMP DIA. MAX (IN): 13.00
 IMP EYE AREA (IN²):



371 MARKET STREET, LAWRENCE, MA 01843-9966

- TOTAL DYNAMIC HEAD
 - EFFICIENCY
 - BHP AT 1.00 SP. GR.
- IMPELLER: C55607
CASING: C55608723-171

TEST NO.: T3549
TEST DATE: 04/22/96
TESTED BY: FXV
ACCEPTED BY: *[Signature]*



CUSTOMER: WESTINGHOUSE HANFORD
USER NAME: WESTINGHOUSE HANFORD
P.O. NUMBER: MZA-XVY-78259
ITEM NUMBER: P-1362

SERIAL NUMBER: 91232-1
PUMP TYPE: VERTICAL INLINE
PUMP SIZE: 3X3X13
SERVICE: RADIOACTIVE SLURRY

IMPELLER TESTED (IN): 13.00
IMPELLER PLOTTED (IN): 13.00
RATED FLOW (GPM): 350
RATED HEAD (FT):

SPEED (RPM): 3056
IMP DIA. MIN (IN): 9.00
IMP DIA. MAX (IN): 13.00
IMP EYE AREA (IN²):

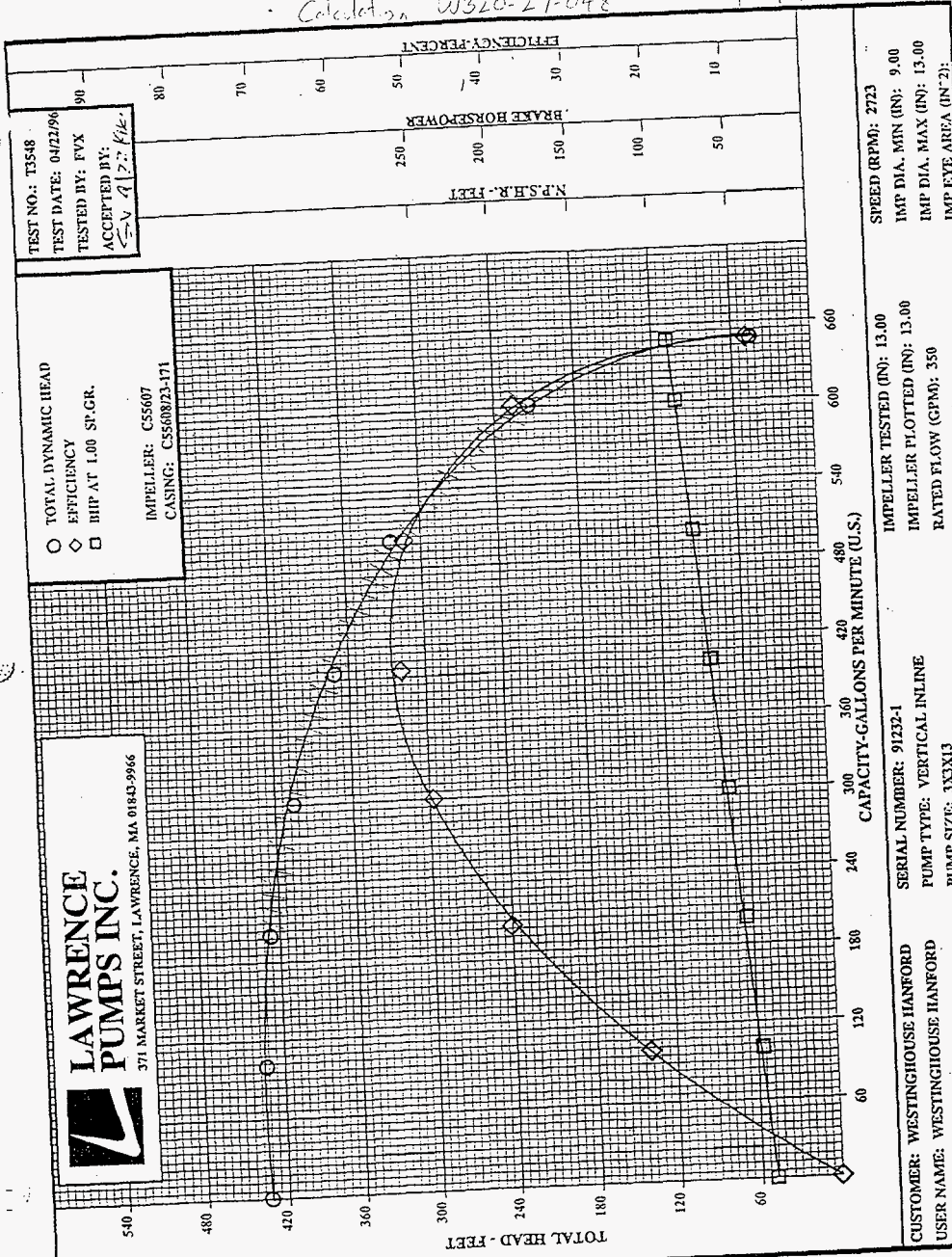


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- TOTAL DYNAMIC HEAD
- ◇ EFFICIENCY
- BHP AT 1.00 SP. GR.

IMPELLER: C55607
CASING: C55608723-171

TEST NO.: T3548
TEST DATE: 04/22/96
TESTED BY: FVX
ACCEPTED BY: *SAV 9/27/96*



CUSTOMER: WESTINGHOUSE HANFORD SERIAL NUMBER: 91232-1
 USER NAME: WESTINGHOUSE HANFORD PUMP TYPE: VERTICAL INLINE
 P.O. NUMBER: MZ4-XVV-78259 PUMP SIZE: 3X3X13
 ITEM NUMBER: P-1562 SERVICE: RADIOACTIVE SLURRY
 IMPELLER TESTED (IN): 13.00 IMPELLER PILOTED (IN): 13.00
 RATED FLOW (GPM): 350 RATED HEAD (FT):
 SPEED (RPM): 2723
 IMP DIA. MIN (IN): 9.00
 IMP DIA. MAX (IN): 13.00
 IMP EYE AREA (IN²):

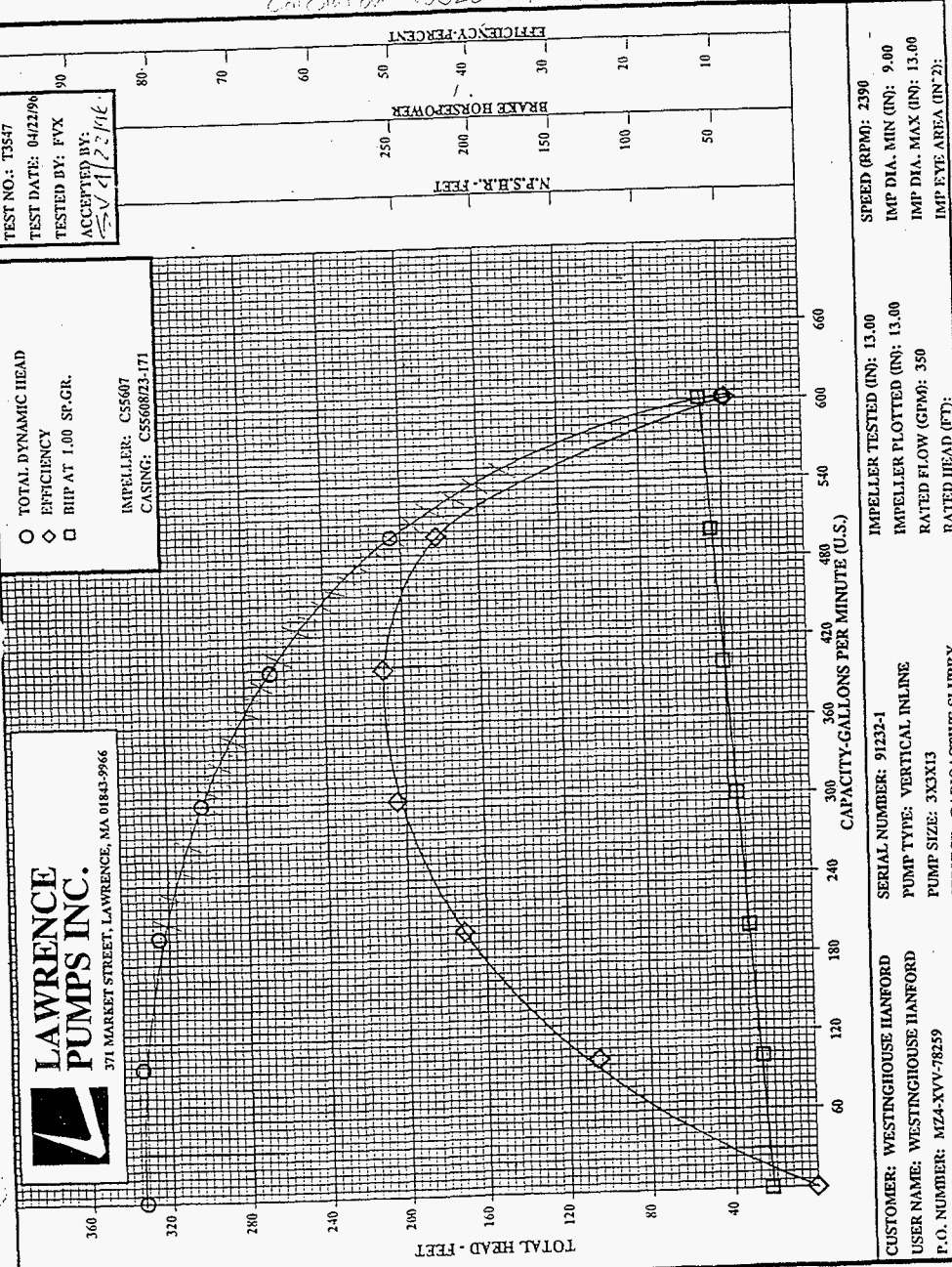
Calculation WS20-27-048

F-10 of F-12

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○ TOTAL DYNAMIC HEAD
 ◇ EFFICIENCY
 ◊ BHP AT 1.00 SP. GR.
 IMPELLER: CS5607
 CASING: CS5608/23-171

TEST NO.: T3547
 TEST DATE: 04/27/96
 TESTED BY: FYK
 ACCEPTED BY: *[Signature]*



CUSTOMER: WESTINGHOUSE HANFORD
 SERIAL NUMBER: 91232-1
 USER NAME: WESTINGHOUSE HANFORD
 PUMP TYPE: VERTICAL INLINE
 P.O. NUMBER: MZA-XVV-7829
 PUMP SIZE: 3X3X13
 SERVICE: RADIOACTIVE SLURRY
 ITEM NUMBER: P-1362

IMPELLER TESTED (IN): 13.00
 IMPELLER PLOTTED (IN): 13.00
 RATED FLOW (GPM): 350
 RATED HEAD (FT):

SPEED (RPM): 2390
 IMP DIA. MIN (IN): 9.00
 IMP DIA. MAX (IN): 13.00
 IMP EYE AREA (IN²):

Calculation: V1320-27-048

F-11 of F-12

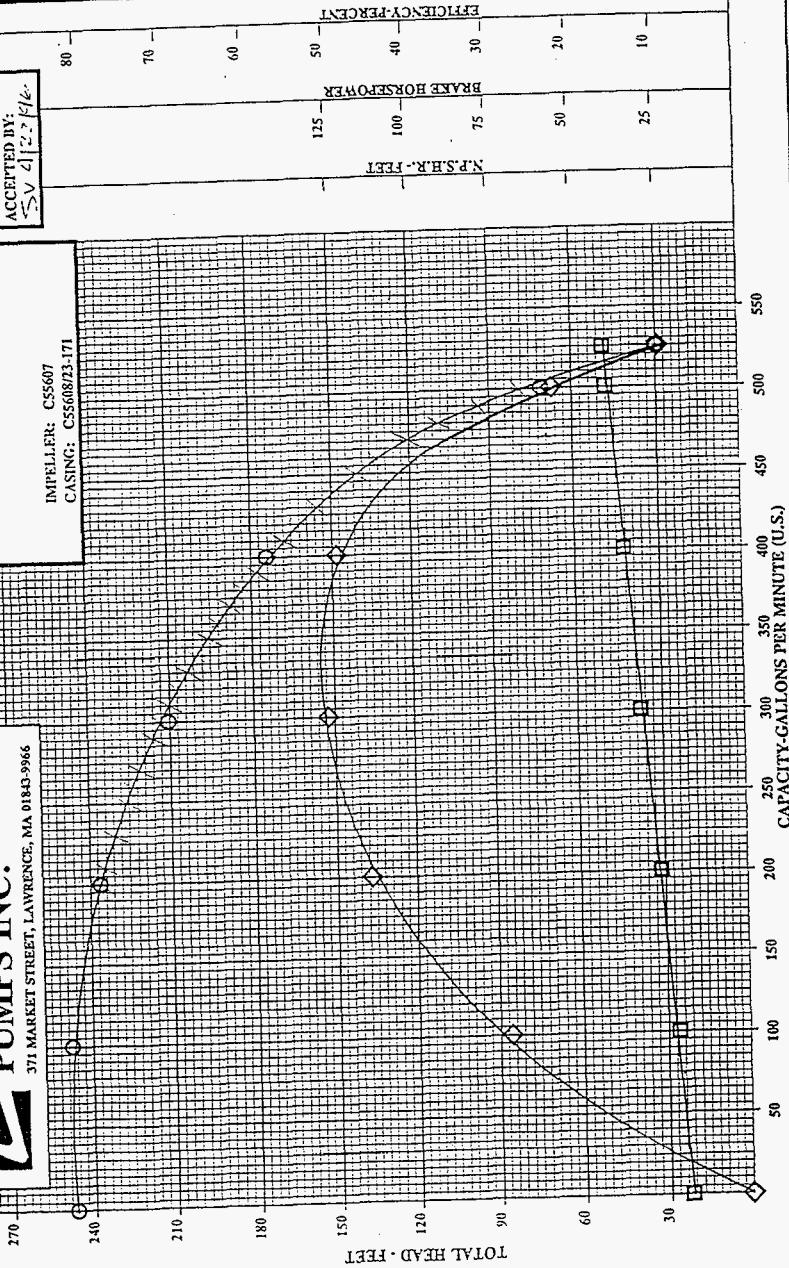
LAWRENCE PUMPS INC.

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- TOTAL DYNAMIC HEAD
- ◇ EFFICIENCY
- BHP AT 1.00 SF.GR.

IMPELLER: C55607
CASING: C55608/23-171

TEST NO.: T3546
TEST DATE: 04/22/96
TESTED BY: FVX
ACCEPTED BY: SV 4/22/96



CUSTOMER: WESTINGHOUSE HANFORD
 USER NAME: WESTINGHOUSE HANFORD
 P.O. NUMBER: MZA-XVY-78259
 ITEM NUMBER: P-1362

SERIAL NUMBER: 91232-1
 PUMP TYPE: VERTICAL INLINE
 PUMP SIZE: 3X3X13
 SERVICE: RADIOACTIVE SLURRY

IMPELLER TESTED (IN): 13.00
 IMPELLER PLOTTED (IN): 13.00
 RATED FLOW (GPM): 350
 RATED HEAD (FT):

SPEED (RPM): 2057
 IMP DIA. MIN (IN): 9.00
 IMP DIA. MAX (IN): 13.00
 IMP EYE AREA (IN²):

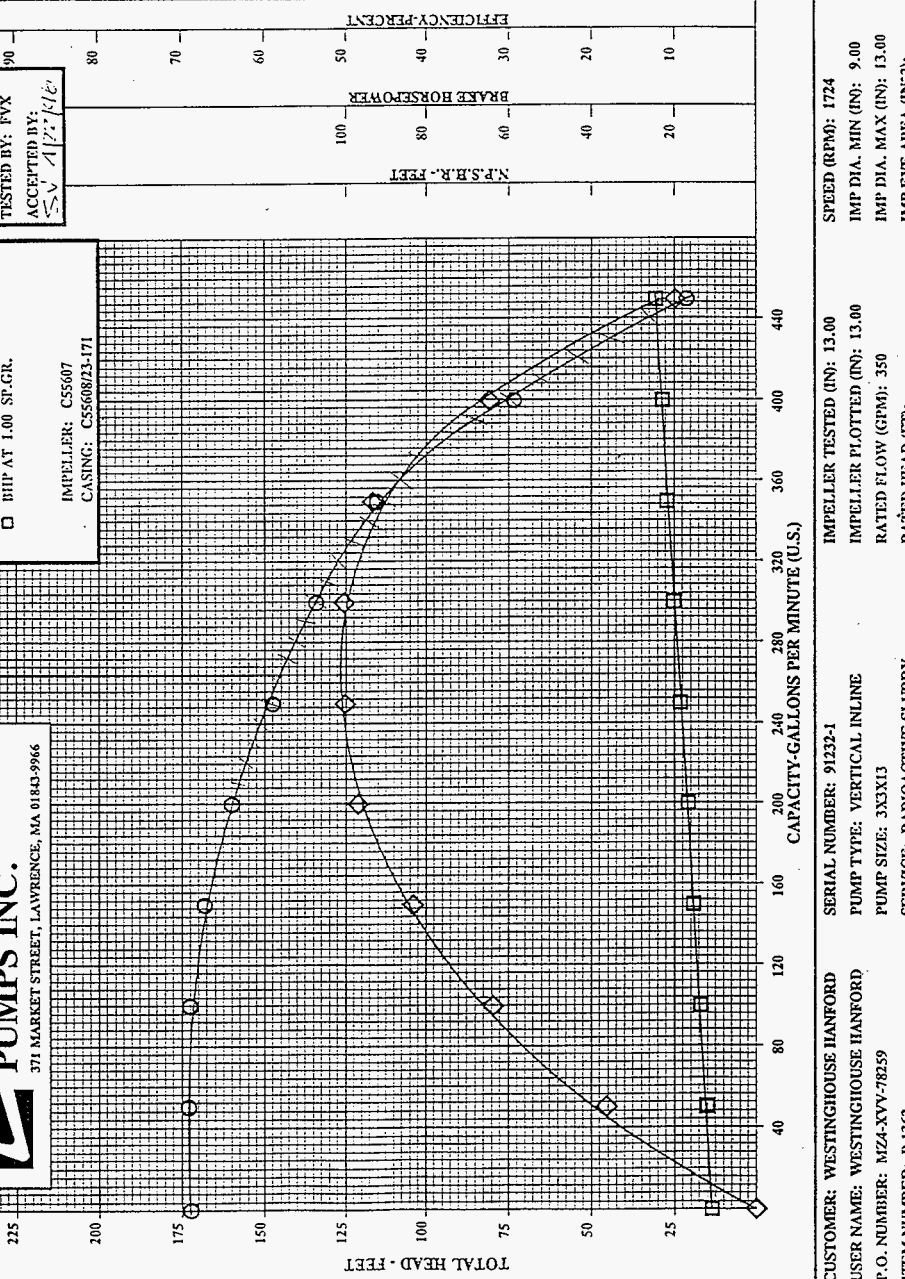
LAWRENCE PUMPS INC.

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- TOTAL DYNAMIC HEAD
- ◇ EFFICIENCY
- BHP AT 1.00 SP. GR.

IMPELLER: C55607
 CASING: C55608/23-171

TEST NO.: T3545
 TEST DATE: 04/22/96
 TESTED BY: FXV
 ACCEPTED BY: *[Signature]*



N.P.S.R.-FEET
 BRAKE HORSEPOWER
 EFFICIENCY PERCENT

CUSTOMER: WESTINGHOUSE HANFORD
 USER NAME: WESTINGHOUSE HANFORD
 P.O. NUMBER: MZA-KVV-78259
 ITEM NUMBER: P-1362

SERIAL NUMBER: 91232-1
 PUMP TYPE: VERTICAL INLINE
 PUMP SIZE: 3X3X13
 SERVICE: RADIOACTIVE SLURRY

IMPELLER TESTED (IN): 13.00
 IMPELLER PLOTTED (IN): 13.00
 RATED FLOW (GPM): 350
 RATED HEAD (FT):

SPEED (RPM): 1724
 IMP DIA. MIN (IN): 9.00
 IMP DIA. MAX (IN): 13.00
 IMP EYE AREA (IN²):



**LAWRENCE
PUMPS INC.**

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- TOTAL DYNAMIC HEAD
- EFFICIENCY
- BHP AT 1.00 SP.GR.

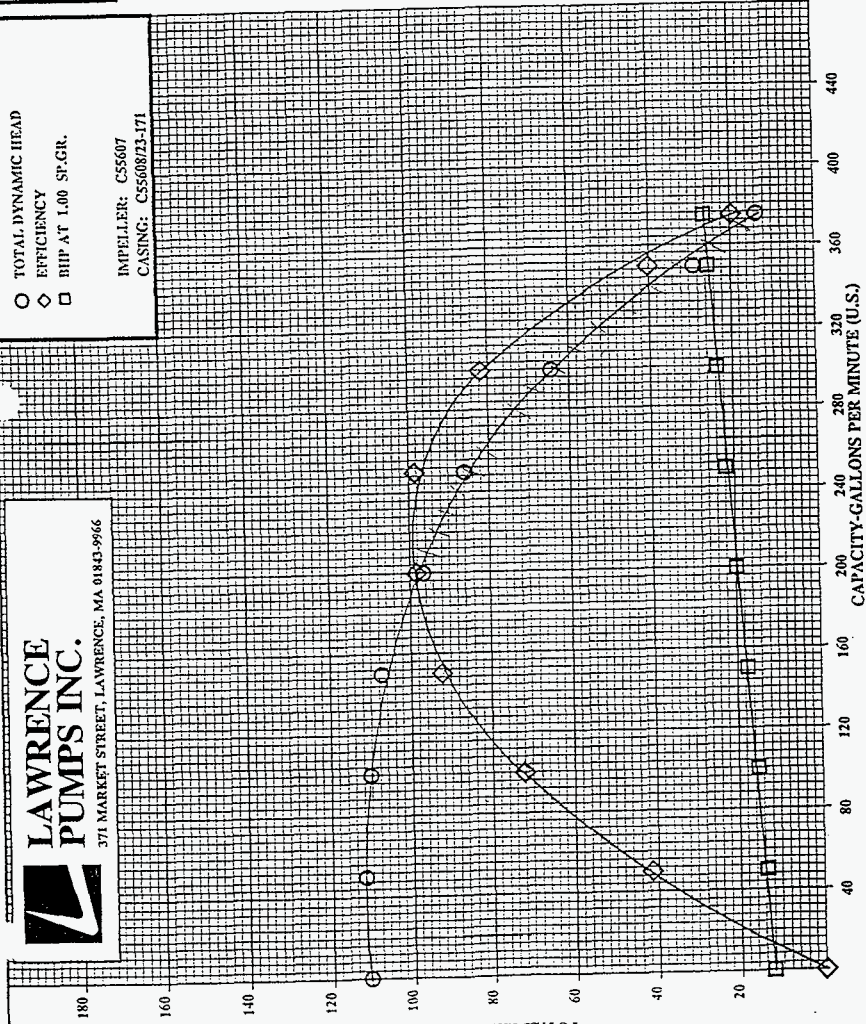
IMPELLER: C55607
CASING: C55608/23-171

TEST NO.: T544
TEST DATE: 04/22/96
TESTED BY: FVX
ACCEPTED BY:
SV 4/22/96

TOTAL HEAD - FEET

N.P.S.H.R.-FEET
BRAKE HORSEPOWER
EFFICIENCY-PERCENT

CAPACITY-GALLONS PER MINUTE (U.S.)



Calculation W320-27-042

F-13 of F-18

SPEED (RPM): 1391
IMP DIA. MIN (IN): 9.00
IMP DIA. MAX (IN): 13.00
IMP EYE AREA (IN²):

IMPELLER TESTED (IN): 13.00
IMPELLER PLOTTED (IN): 13.00
RATED FLOW (GPM): 350
RATED HEAD (FT):

SERIAL NUMBER: 91232-1
PUMP TYPE: VERTICAL INLINE
PUMP SIZE: 3X3X13
SERVICE: RADIOACTIVE SLURRY

CUSTOMER: WESTINGHOUSE HANFORD
USER NAME: WESTINGHOUSE HANFORD
P.O. NUMBER: MZA-XVV-78259
ITEM NUMBER: P-1362



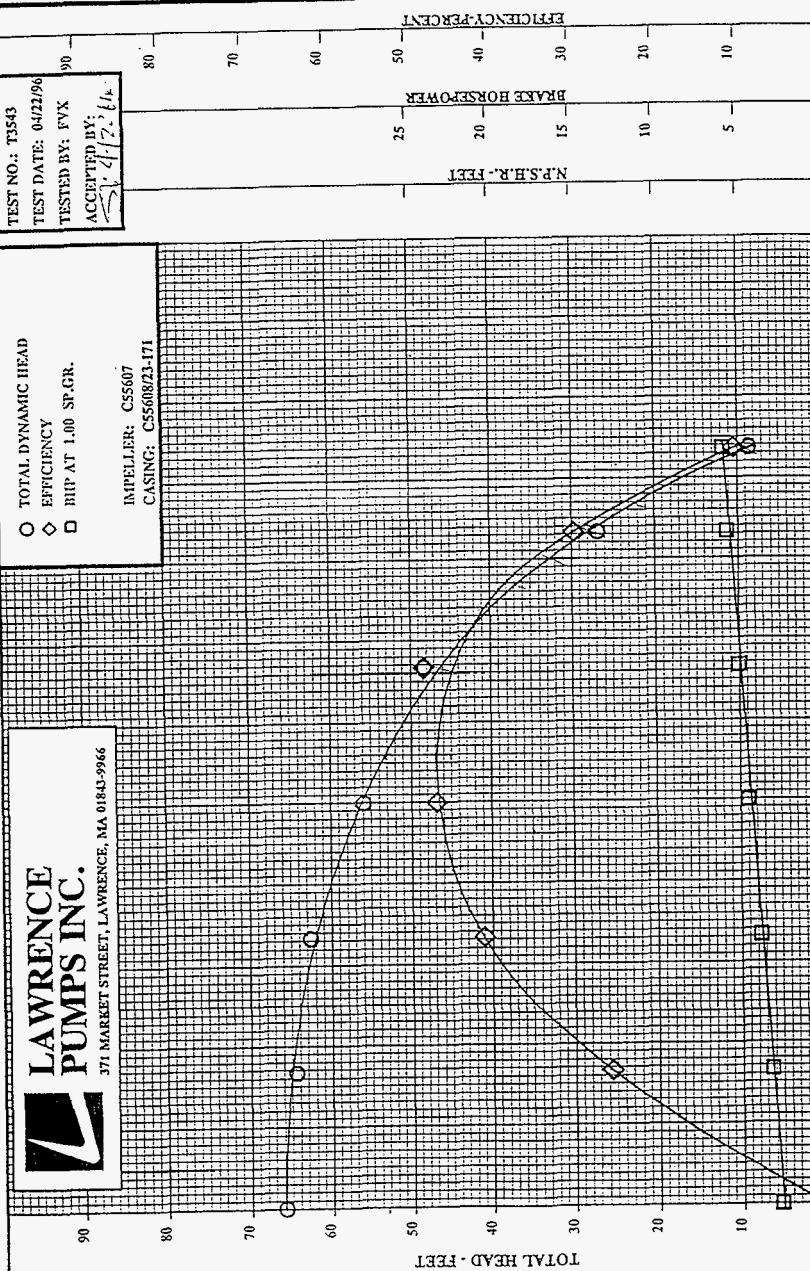
**LAWRENCE
PUMPS INC.**

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- TOTAL DYNAMIC HEAD
- ◇ EFFICIENCY
- BHP AT 1.00 SP.GR.

IMPELLER: C55607
CASING: C55608/23-171

TEST NO.: T3543
TEST DATE: 04/22/96
TESTED BY: FVX
ACCEPTED BY:
S. J. P. L.



Calculation W320-27-048

HNF-2478, Rev. 0

F-14 of F-18

SPEED (RPM): 1058
IMP DIA. MIN (IN): 9.00
IMP DIA. MAX (IN): 13.00
IMP EYE AREA (IN²):

IMPELLER TESTED (IN): 13.00
IMPELLER PLOTTED (IN): 13.00
RATED FLOW (GPM): 350
RATED HEAD (FT):

SERIAL NUMBER: 91232-1
PUMP TYPE: VERTICAL INLINE
PUMP SIZE: 3X3X13
SERVICE: RADIOACTIVE SLURRY

CUSTOMER: WESTINGHOUSE HANFORD
USER NAME: WESTINGHOUSE HANFORD
P.O. NUMBER: MZ4-XVY-78259
ITEM NUMBER: P-1362

Calculation

W320-27-048

F-15 of F-18

HI Centrifugal Pump Design and Application — 1994

1391 RPM

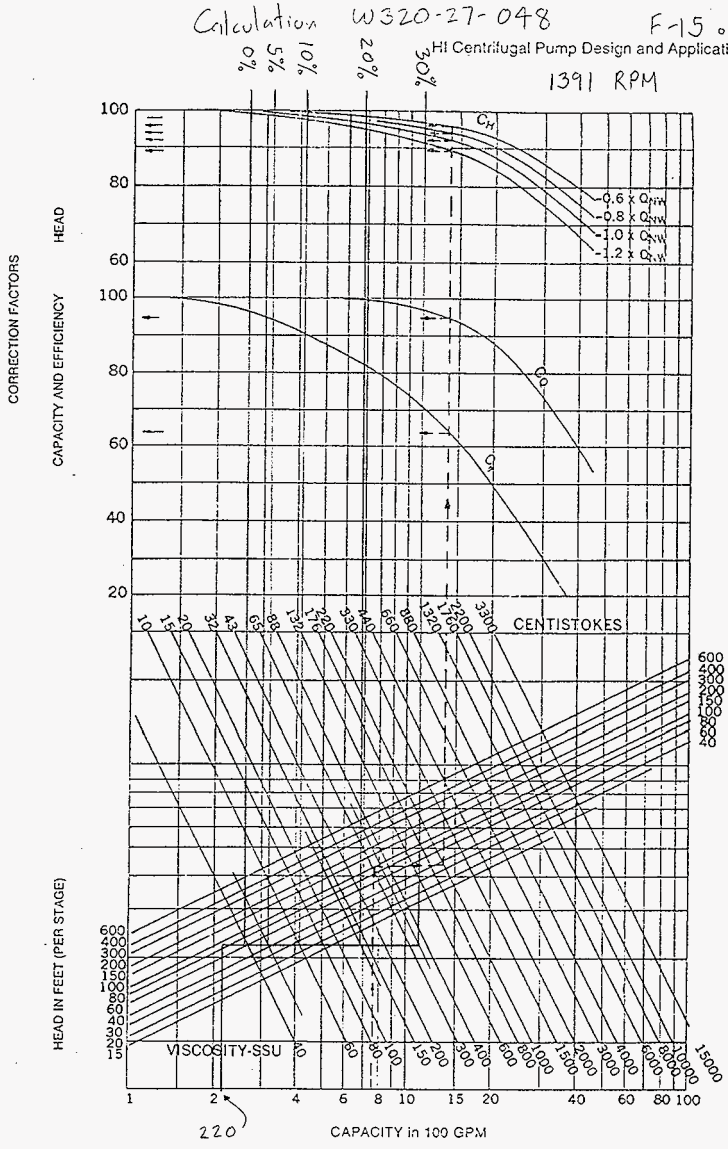


Figure 1.53 — Performance correction chart for viscous liquids

Calculation
 %0
 %5
 %10
 %20
 %30

W320-27-048

F-16 of F-18

HI Centrifugal Pump Design and Application — 1994

1724 RPM

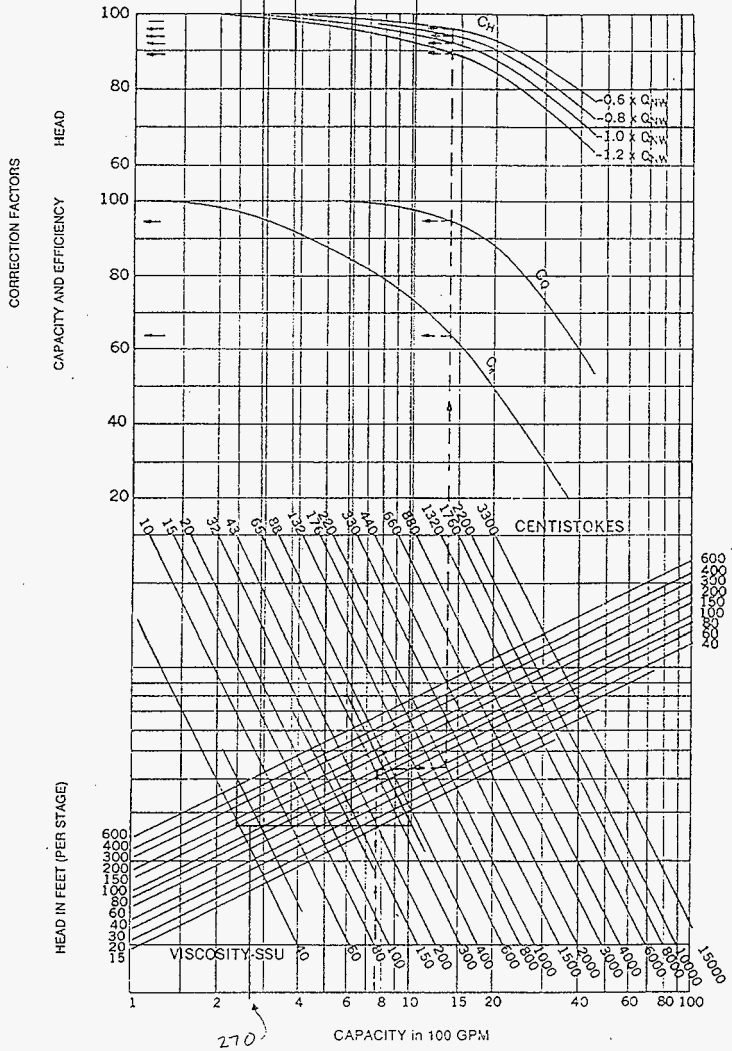


Figure 1.53 — Performance correction chart for viscous liquids

2057 RPM

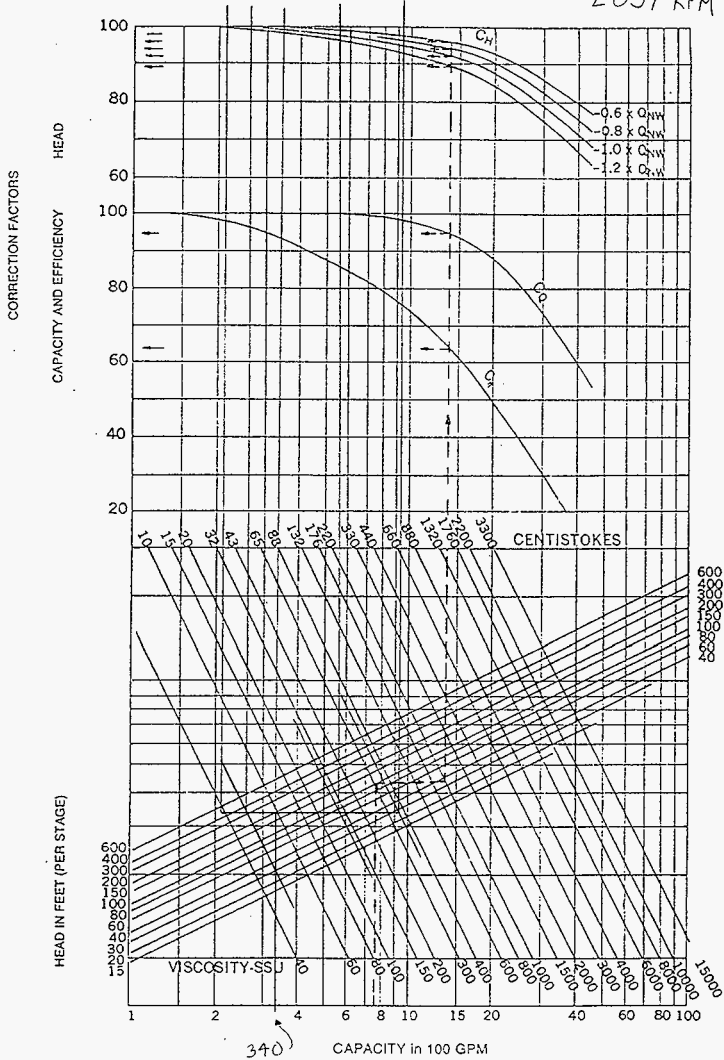


Figure 1.53 — Performance correction chart for viscous liquids

Calculation W320-27-048
 HI Centrifugal Pump Design and Application — 1894
 2390 RPM
 F-18 of F-18

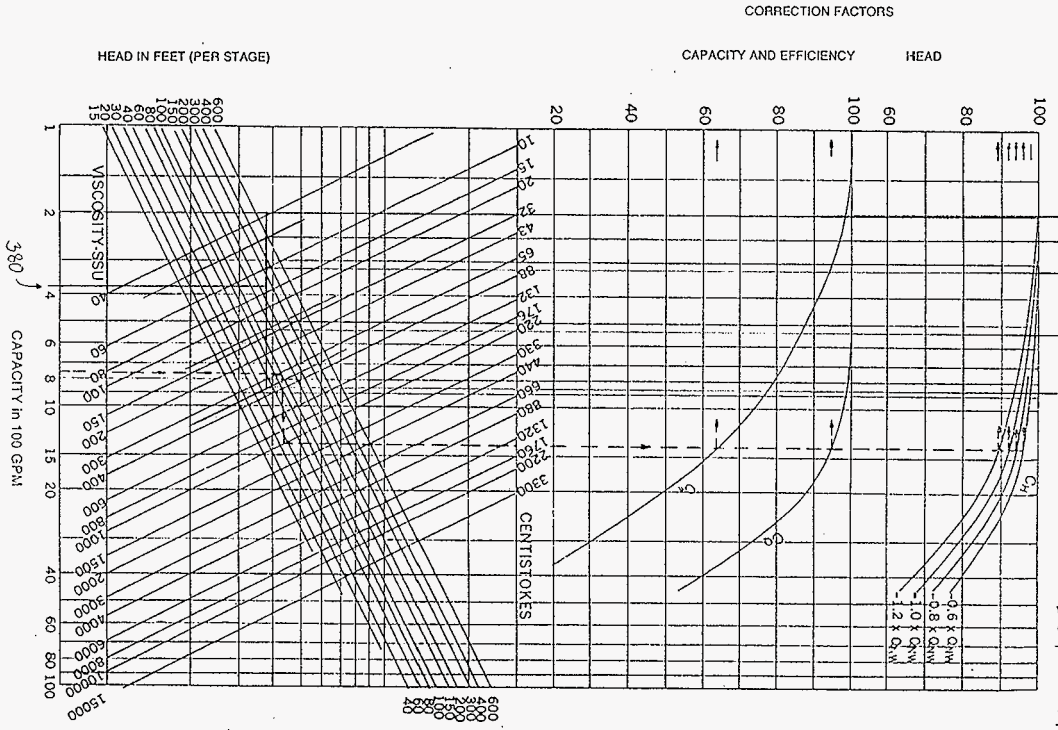


Figure 1.53 — Performance correction chart for viscous liquids

DISTRIBUTION SHEET

To Distribution	From JW Bailey	Page 1 of 1			
		Date 23 July 1998			
Project Title/Work Order Project W-320 Tank 106-C, HNF-2478, Piping Calculations, Vol. 8		EDT No. 622236			
		ECN No. n/a			
Name	MSIN	Text With All Attach.	Text Only	Attach./ Appendix Only	EDT/ECN Only
JW Bailey W-320 Project Files		S2-48 R1-29			