

0	17/12/15	N.I.S.	D.A.N.	A.P.V.	PARA LICITACION
REV.	FECHA	DIBUJADO POR:	REVISADO POR:	APROBADO POR:	DESCRIPCION DE LA REVISION
				CLIENTE:  Refinación S.A.	
PLANOS DE REFERENCIA:					
PROYECTO: NUEVA RED DE AGUA CONTRA INCENDIOS (NURACI)					
TITULO: ESFERA 2939 (Ø10,744 m) CALCULO HIDRAULICO					
ESCALA:	S/E	HOJA:	5 DE 5	CODIGO:	ING-101-4C-225
					REVISION: 0

DATOS ABASTECIMIENTO DE AGUA

FUENTE ETI DEL TAG	PRESION ESTATICA (BAR)	PRESION RESIDUAL @ (BAR)	CAUDAL (LPM)	PRESION DISPONIBLE (BAR)	DEMANDA TOTAL (LPM)	PRESION NECESARIA (BAR)
A	(N/A)	7.00	(N/A)	7.000	5628.3	4.817

ANALISIS DE CAUDALES AGREGADOS:

CAUDAL TOTAL EN LA FUENTE 5628.3 LPM
 CAUDAL TOTAL EN FUENTE PARA MED. MANUALES 0.0 LPM
 PREVISION PARA OTROS MEDIOS MANUALES 0.0 LPM
 DESCARGA TOTAL DE LOS ROCIADORES EN OPER. 5628.3 LPM

ANALISIS DATOS DE NODOS

ETI DEL NODO	ELEVACION (M)	TIPO DE NODO	PRESION (BAR)	DESCARGA (L/MIN)
A1	13.63	- - - -	2.414	- - -
A2	12.15	- - - -	3.019	- - -
A3	9.43	- - - -	3.160	- - -
A4	6.29	- - - -	3.521	- - -
A5	3.56	- - - -	3.826	- - -
A6	1.99	- - - -	3.619	- - -
AA2	11.80	- - - -	3.447	- - -
AA3	9.30	- - - -	3.791	- - -
AA4	6.29	- - - -	4.169	- - -
AA5	3.56	- - - -	4.586	- - -
AA6	2.53	- - - -	4.700	- - -
A	2.20	FUENTE	4.817	5628.3
1-1	13.63	K=17.22	2.213	25.6
2-1	13.63	K=33.10	2.179	48.9
3-1	13.63	K=17.22	2.156	25.3
4-1	13.63	K=33.10	2.137	48.4
5-1	13.63	K=17.22	2.126	25.1
6-1	13.63	K=33.10	2.119	48.2
7-1	13.63	K=17.22	2.116	25.0
8-1	13.63	K=33.10	2.115	48.1
9-1	13.63	K=17.22	2.115	25.0
10-1	13.63	K=33.10	2.116	48.1
11-1	13.63	K=17.22	2.119	25.1
12-1	13.63	K=33.10	2.125	48.3
13-1	13.63	K=17.22	2.138	25.2
14-1	13.63	K=33.10	2.154	48.6
15-1	13.63	K=17.22	2.179	25.4
16-1	13.63	K=33.10	2.211	49.2
1-2	12.15	K=33.10	2.690	54.3
2-2	12.15	K=33.10	2.578	53.1
3-2	12.15	K=33.10	2.491	52.2
4-2	12.15	K=33.10	2.427	51.6
5-2	12.15	K=33.10	2.381	51.1
6-2	12.15	K=33.10	2.350	50.7

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TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ANALISIS DATOS DE NODOS

ETI DEL NODO	ELEVACION (M)	TIPO DE NODO	PRESION (BAR)	DESCARGA (L/MIN)
7-2	12.15	K=33.10	2.333	50.6
8-2	12.15	K=33.10	2.324	50.5
9-2	12.15	K=33.10	2.322	50.4
10-2	12.15	K=33.10	2.322	50.4
11-2	12.15	K=33.10	2.324	50.5
12-2	12.15	K=33.10	2.333	50.6
13-2	12.15	K=33.10	2.350	50.7
14-2	12.15	K=33.10	2.381	51.1
15-2	12.15	K=33.10	2.427	51.6
16-2	12.15	K=33.10	2.491	52.2
17-2	12.15	K=33.10	2.578	53.1
18-2	12.15	K=33.10	2.690	54.3
1-3	9.43	K=33.10	2.691	54.3
2-3	9.43	K=33.10	2.521	52.6
3-3	9.43	K=33.10	2.383	51.1
4-3	9.43	K=33.10	2.271	49.9
5-3	9.43	K=33.10	2.184	48.9
6-3	9.43	K=33.10	2.118	48.2
7-3	9.43	K=33.10	2.069	47.6
8-3	9.43	K=33.10	2.036	47.2
9-3	9.43	K=33.10	2.016	47.0
10-3	9.43	K=33.10	2.005	46.9
11-3	9.43	K=33.10	2.000	46.8
12-3	9.43	K=33.10	2.000	46.8
13-3	9.43	K=33.10	2.001	46.8
14-3	9.43	K=33.10	2.005	46.9
15-3	9.43	K=33.10	2.017	47.0
16-3	9.43	K=33.10	2.038	47.3
17-3	9.43	K=33.10	2.072	47.6
18-3	9.43	K=33.10	2.122	48.2
19-3	9.43	K=33.10	2.189	49.0
20-3	9.43	K=33.10	2.278	50.0
21-3	9.43	K=33.10	2.392	51.2
22-3	9.43	K=33.10	2.533	52.7
23-3	9.43	K=33.10	2.705	54.4
24-3	9.43	K=33.10	2.913	56.5
1-4	6.29	K=33.10	3.002	57.3
2-4	6.29	K=33.10	2.813	55.5
3-4	6.29	K=33.10	2.660	54.0
4-4	6.29	K=33.10	2.536	52.7
5-4	6.29	K=33.10	2.439	51.7
6-4	6.29	K=33.10	2.366	50.9
7-4	6.29	K=33.10	2.312	50.3
8-4	6.29	K=33.10	2.276	49.9
9-4	6.29	K=33.10	2.253	49.7
10-4	6.29	K=33.10	2.241	49.5
11-4	6.29	K=33.10	2.236	49.5
12-4	6.29	K=33.10	2.236	49.5
13-4	6.29	K=33.10	2.236	49.5
14-4	6.29	K=33.10	2.241	49.6
15-4	6.29	K=33.10	2.254	49.7
16-4	6.29	K=33.10	2.278	50.0

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ANALISIS DATOS DE NODOS

ETI DEL NODO	ELEVACION (M)	TIPO DE NODO	PRESION (BAR)	DESCARGA (L/MIN)
17-4	6.29	K=33.10	2.316	50.4
18-4	6.29	K=33.10	2.371	51.0
19-4	6.29	K=33.10	2.446	51.8
20-4	6.29	K=33.10	2.544	52.8
21-4	6.29	K=33.10	2.670	54.1
22-4	6.29	K=33.10	2.826	55.6
23-4	6.29	K=33.10	3.017	57.5
24-4	6.29	K=33.10	3.247	59.6
1-5	3.56	K=33.10	3.300	60.1
2-5	3.56	K=33.10	3.152	58.8
3-5	3.56	K=33.10	3.019	57.5
4-5	3.56	K=33.10	2.916	56.5
5-5	3.56	K=33.10	2.839	55.8
6-5	3.56	K=33.10	2.796	55.4
7-5	3.56	K=33.10	2.768	55.1
8-5	3.56	K=33.10	2.753	54.9
9-5	3.56	K=33.10	2.749	54.9
10-5	3.56	K=33.10	2.749	54.9
11-5	3.56	K=33.10	2.752	54.9
12-5	3.56	K=33.10	2.766	55.1
13-5	3.56	K=33.10	2.794	55.3
14-5	3.56	K=33.10	2.834	55.7
15-5	3.56	K=33.10	2.909	56.5
16-5	3.56	K=33.10	3.010	57.4
17-5	3.56	K=33.10	3.125	58.5
18-5	3.56	K=33.10	3.307	60.2
P1-5	3.56	K=17.25	3.207	30.9
P2-5	3.56	K=17.25	2.812	28.9
P3-5	3.56	K=17.25	2.750	28.6
P4-5	3.56	K=17.25	2.750	28.6
P5-5	3.56	K=17.25	2.816	28.9
P6-5	3.56	K=17.25	3.076	30.3
1-6	1.99	K=43.20	3.452	80.3
2-6	1.99	K=43.20	3.407	79.7
3-6	1.99	K=43.20	3.394	79.6
4-6	1.99	K=43.20	3.394	79.6
5-6	1.99	K=43.20	3.407	79.7
6-6	1.99	K=43.20	3.452	80.3

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TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

DATOS DE TUBERIA

ETI DE TUB	Q (LPM)	DIA (MM)	LONG.	RESUM.
END ELEV. FAC. PT DESC. VEL (MPS) HW (C) (M) PRES.				
EXTREMOS (M) (K) (BAR) (LPM) FL/M (BAR)				
Tuberia: 1	-589.5	41.80	PL	PF 0.855
A1 13.63 0.0 2.414 0.0 7.16 120 Acc 2E				PE 0.179
AA2 11.80 0.0 3.447 0.0 0.1464 TL				PV
Tuberia: 2	-929.0	53.00	PL	PF 0.394
A2 12.15 0.0 3.019 0.0 7.02 120 Acc T				PE 0.034
AA2 11.80 0.0 3.447 0.0 0.1068 TL				PV
Tuberia: 3	-1184.8	53.00	PL	PF 0.618
A3 9.43 0.0 3.160 0.0 8.95 120 Acc T				PE 0.013
AA3 9.30 0.0 3.791 0.0 0.1675 TL				PV
Tuberia: 4	-1252.1	53.00	PL	PF 0.648
A4 6.29 0.0 3.521 0.0 9.46 120 Acc T				PE 0.000
AA4 6.29 0.0 4.169 0.0 0.1856 TL				PV
Tuberia: 5	-1193.6	53.00	PL	PF 0.759
A5 3.56 0.0 3.826 0.0 9.02 120 Acc T				PE 0.000
AA5 3.56 0.0 4.586 0.0 0.1698 TL				PV
Tuberia: 6	-479.2	41.80	PL	PF 1.134
A6 1.99 0.0 3.619 0.0 5.82 120 Acc E2T				PE-0.053
AA6 2.53 0.0 4.700 0.0 0.0997 TL				PV
Tuberia: 8	-1518.5	80.80	PL	PF 0.099
AA2 11.80 0.0 3.447 0.0 4.94 120 Acc ----				PE 0.245
AA3 9.30 0.0 3.791 0.0 0.0340 TL				PV
Tuberia: 9	-2703.3	105.30	PL	PF 0.082
AA3 9.30 0.0 3.791 0.0 5.17 120 Acc ----				PE 0.295
AA4 6.29 0.0 4.169 0.0 0.0272 TL				PV
Tuberia: 10	-3955.4	105.30	PL	PF 0.150
AA4 6.29 0.0 4.169 0.0 7.57 120 Acc ----				PE 0.267
AA5 3.56 0.0 4.586 0.0 0.0550 TL				PV
Tuberia: 11	-5149.0	155.40	PL	PF 0.014
AA5 3.56 0.0 4.586 0.0 4.52 120 Acc ----				PE 0.101
AA6 2.53 0.0 4.700 0.0 0.0135 TL				PV
Tuberia: 12	-5628.3	155.40	PL	PF 0.084
AA6 2.53 0.0 4.700 0.0 4.95 120 Acc E				PE 0.032
A 2.20 SRCE 4.817 (N/A) 0.0159 TL				PV
Tuberia: 1-1	289.5	35.90	PL	PF 0.200
A1 13.63 0.0 2.414 0.0 4.77 120 Acc T				PE 0.000
1-1 13.63 17.2 2.213 25.6 0.0824 TL				PV

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ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 2-1					263.9	35.90	PL	PF 0.034
1-1	13.63	17.2	2.213	25.6	4.34	150	Acc	PE 0.000
2-1	13.63	33.1	2.179	48.9		0.0459	TL	PV
Tuberia: 3-1					215.0	35.90	PL	PF 0.023
2-1	13.63	33.1	2.179	48.9	3.54	150	Acc	PE 0.000
3-1	13.63	17.2	2.156	25.3		0.0314	TL	PV
Tuberia: 4-1					189.7	35.90	PL	PF 0.019
3-1	13.63	17.2	2.156	25.3	3.12	150	Acc	PE 0.000
4-1	13.63	33.1	2.137	48.4		0.0249	TL	PV
Tuberia: 5-1					141.3	35.90	PL	PF 0.011
4-1	13.63	33.1	2.137	48.4	2.33	150	Acc	PE 0.000
5-1	13.63	17.2	2.126	25.1		0.0145	TL	PV
Tuberia: 6-1					116.2	35.90	PL	PF 0.008
5-1	13.63	17.2	2.126	25.1	1.91	150	Acc	PE 0.000
6-1	13.63	33.1	2.119	48.2		0.0101	TL	PV
Tuberia: 7-1					68.0	35.90	PL	PF 0.003
6-1	13.63	33.1	2.119	48.2	1.12	150	Acc	PE 0.000
7-1	13.63	17.2	2.116	25.0		0.0037	TL	PV
Tuberia: 8-1					43.0	35.90	PL	PF 0.001
7-1	13.63	17.2	2.116	25.0	0.71	150	Acc	PE 0.000
8-1	13.63	33.1	2.115	48.1		0.0016	TL	PV
Tuberia: 9-1					-5.1	35.90	PL	PF 0.000
8-1	13.63	33.1	2.115	48.1	0.08	150	Acc	PE 0.000
9-1	13.63	17.2	2.115	25.0		0.0000	TL	PV
Tuberia: 10-1					-30.2	35.90	PL	PF 0.001
9-1	13.63	17.2	2.115	25.0	0.50	150	Acc	PE 0.000
10-1	13.63	33.1	2.116	48.1		0.0008	TL	PV
Tuberia: 11-1					-78.3	35.90	PL	PF 0.004
10-1	13.63	33.1	2.116	48.1	1.29	150	Acc	PE 0.000
11-1	13.63	17.2	2.119	25.1		0.0049	TL	PV
Tuberia: 12-1					-103.4	35.90	PL	PF 0.006
11-1	13.63	17.2	2.119	25.1	1.70	150	Acc	PE 0.000
12-1	13.63	33.1	2.125	48.3		0.0081	TL	PV
Tuberia: 13-1					-151.7	35.90	PL	PF 0.012
12-1	13.63	33.1	2.125	48.3	2.50	150	Acc	PE 0.000
13-1	13.63	17.2	2.138	25.2		0.0165	TL	PV
Tuberia: 14-1					-176.8	35.90	PL	PF 0.016
13-1	13.63	17.2	2.138	25.2	2.91	150	Acc	PE 0.000
14-1	13.63	33.1	2.154	48.6		0.0219	TL	PV

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TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 15-1					-225.4	35.90	PL	PF 0.026
14-1	13.63	33.1	2.154	48.6	3.71	150	Acc	PE 0.000
15-1	13.63	17.2	2.179	25.4		0.0343	TL	PV
Tuberia: 16-1					-250.8	35.90	PL	PF 0.031
15-1	13.63	17.2	2.179	25.4	4.13	150	Acc	PE 0.000
16-1	13.63	33.1	2.211	49.2		0.0418	TL	PV
Tuberia: 17-1					-300.0	35.90	PL	PF 0.203
16-1	13.63	33.1	2.211	49.2	4.94	150	Acc	PE 0.000
A1	13.63	0.0	2.414	0.0		0.0582	TL	PV
Tuberia: 1-2					464.5	41.80	PL	PF 0.329
A2	12.15	0.0	3.019	0.0	5.64	120	Acc	PE 0.000
1-2	12.15	33.1	2.690	54.3		0.0942	TL	PV
Tuberia: 2-2					410.2	41.80	PL	PF 0.112
1-2	12.15	33.1	2.690	54.3	4.98	120	Acc	PE 0.000
2-2	12.15	33.1	2.578	53.1		0.0748	TL	PV
Tuberia: 3-2					357.1	41.80	PL	PF 0.087
2-2	12.15	33.1	2.578	53.1	4.34	120	Acc	PE 0.000
3-2	12.15	33.1	2.491	52.2		0.0579	TL	PV
Tuberia: 4-2					304.8	41.80	PL	PF 0.065
3-2	12.15	33.1	2.491	52.2	3.70	120	Acc	PE 0.000
4-2	12.15	33.1	2.427	51.6		0.0432	TL	PV
Tuberia: 5-2					253.3	41.80	PL	PF 0.046
4-2	12.15	33.1	2.427	51.6	3.08	120	Acc	PE 0.000
5-2	12.15	33.1	2.381	51.1		0.0307	TL	PV
Tuberia: 6-2					202.2	41.80	PL	PF 0.030
5-2	12.15	33.1	2.381	51.1	2.46	120	Acc	PE 0.000
6-2	12.15	33.1	2.350	50.7		0.0202	TL	PV
Tuberia: 7-2					151.5	41.80	PL	PF 0.018
6-2	12.15	33.1	2.350	50.7	1.84	120	Acc	PE 0.000
7-2	12.15	33.1	2.333	50.6		0.0118	TL	PV
Tuberia: 8-2					100.9	41.80	PL	PF 0.008
7-2	12.15	33.1	2.333	50.6	1.23	120	Acc	PE 0.000
8-2	12.15	33.1	2.324	50.5		0.0056	TL	PV
Tuberia: 9-2					50.4	41.80	PL	PF 0.002
8-2	12.15	33.1	2.324	50.5	0.61	120	Acc	PE 0.000
9-2	12.15	33.1	2.322	50.4		0.0015	TL	PV
Tuberia: 10-2					0.0	41.80	PL	PF 0.000
9-2	12.15	33.1	2.322	50.4	0.00	120	Acc	PE 0.000
10-2	12.15	33.1	2.322	50.4		0.0000	TL	PV

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ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 11-2					-50.4	41.80 PL	1.50	PF 0.002
10-2	12.15	33.1	2.322	50.4	0.61	120 Acc	----	PE 0.000
11-2	12.15	33.1	2.324	50.5		0.0015 TL	1.50	PV
Tuberia: 12-2					-100.9	41.80 PL	1.50	PF 0.008
11-2	12.15	33.1	2.324	50.5	1.23	120 Acc	----	PE 0.000
12-2	12.15	33.1	2.333	50.6		0.0056 TL	1.50	PV
Tuberia: 13-2					-151.5	41.80 PL	1.50	PF 0.018
12-2	12.15	33.1	2.333	50.6	1.84	120 Acc	----	PE 0.000
13-2	12.15	33.1	2.350	50.7		0.0118 TL	1.50	PV
Tuberia: 14-2					-202.2	41.80 PL	1.50	PF 0.030
13-2	12.15	33.1	2.350	50.7	2.46	120 Acc	----	PE 0.000
14-2	12.15	33.1	2.381	51.1		0.0202 TL	1.50	PV
Tuberia: 15-2					-253.3	41.80 PL	1.50	PF 0.046
14-2	12.15	33.1	2.381	51.1	3.08	120 Acc	----	PE 0.000
15-2	12.15	33.1	2.427	51.6		0.0307 TL	1.50	PV
Tuberia: 16-2					-304.8	41.80 PL	1.50	PF 0.065
15-2	12.15	33.1	2.427	51.6	3.70	120 Acc	----	PE 0.000
16-2	12.15	33.1	2.491	52.2		0.0432 TL	1.50	PV
Tuberia: 17-2					-357.1	41.80 PL	1.50	PF 0.087
16-2	12.15	33.1	2.491	52.2	4.34	120 Acc	----	PE 0.000
17-2	12.15	33.1	2.578	53.1		0.0579 TL	1.50	PV
Tuberia: 18-2					-410.2	41.80 PL	1.50	PF 0.112
17-2	12.15	33.1	2.578	53.1	4.98	120 Acc	----	PE 0.000
18-2	12.15	33.1	2.690	54.3		0.0748 TL	1.50	PV
Tuberia: 19-2					-464.5	41.80 PL	0.75	PF 0.329
18-2	12.15	33.1	2.690	54.3	5.64	120 Acc	T	PE 0.000
A2	12.15	0.0	3.019	0.0		0.0942 TL	3.49	PV
Tuberia: 1-3					562.2	41.80 PL	0.76	PF 0.469
A3	9.43	0.0	3.160	0.0	6.83	120 Acc	T	PE 0.000
1-3	9.43	33.1	2.691	54.3		0.1340 TL	3.50	PV
Tuberia: 2-3					507.9	41.80 PL	1.53	PF 0.170
1-3	9.43	33.1	2.691	54.3	6.17	120 Acc	----	PE 0.000
2-3	9.43	33.1	2.521	52.6		0.1111 TL	1.53	PV
Tuberia: 3-3					455.3	41.80 PL	1.53	PF 0.139
2-3	9.43	33.1	2.521	52.6	5.53	120 Acc	----	PE 0.000
3-3	9.43	33.1	2.383	51.1		0.0907 TL	1.53	PV
Tuberia: 4-3					404.2	41.80 PL	1.53	PF 0.111
3-3	9.43	33.1	2.383	51.1	4.91	120 Acc	----	PE 0.000
4-3	9.43	33.1	2.271	49.9		0.0728 TL	1.53	PV

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PROTECFIRE\ESFERAS BOLIVIA\YPFB-PCI-E-03.SDF

TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 5-3					354.3	41.80 PL	1.53	PF 0.087
4-3	9.43	33.1	2.271	49.9	4.30	120 Acc	----	PE 0.000
5-3	9.43	33.1	2.184	48.9		0.0571 TL	1.53	PV
Tuberia: 6-3					305.4	41.80 PL	1.53	PF 0.066
5-3	9.43	33.1	2.184	48.9	3.71	120 Acc	----	PE 0.000
6-3	9.43	33.1	2.118	48.2		0.0433 TL	1.53	PV
Tuberia: 7-3					257.2	41.80 PL	1.53	PF 0.048
6-3	9.43	33.1	2.118	48.2	3.12	120 Acc	----	PE 0.000
7-3	9.43	33.1	2.069	47.6		0.0316 TL	1.53	PV
Tuberia: 8-3					209.6	41.80 PL	1.53	PF 0.033
7-3	9.43	33.1	2.069	47.6	2.55	120 Acc	----	PE 0.000
8-3	9.43	33.1	2.036	47.2		0.0216 TL	1.53	PV
Tuberia: 9-3					162.4	41.80 PL	1.53	PF 0.021
8-3	9.43	33.1	2.036	47.2	1.97	120 Acc	----	PE 0.000
9-3	9.43	33.1	2.016	47.0		0.0135 TL	1.53	PV
Tuberia: 10-3					115.4	41.80 PL	1.53	PF 0.011
9-3	9.43	33.1	2.016	47.0	1.40	120 Acc	----	PE 0.000
10-3	9.43	33.1	2.005	46.9		0.0072 TL	1.53	PV
Tuberia: 11-3					68.5	41.80 PL	1.53	PF 0.004
10-3	9.43	33.1	2.005	46.9	0.83	120 Acc	----	PE 0.000
11-3	9.43	33.1	2.000	46.8		0.0027 TL	1.53	PV
Tuberia: 12-3					21.7	41.80 PL	1.53	PF 0.000
11-3	9.43	33.1	2.000	46.8	0.26	120 Acc	----	PE 0.000
12-3	9.43	33.1	2.000	46.8		0.0003 TL	1.53	PV
Tuberia: 13-3					-25.1	41.80 PL	1.53	PF 0.001
12-3	9.43	33.1	2.000	46.8	0.30	120 Acc	----	PE 0.000
13-3	9.43	33.1	2.001	46.8		0.0004 TL	1.53	PV
Tuberia: 14-3					-71.9	41.80 PL	1.53	PF 0.005
13-3	9.43	33.1	2.001	46.8	0.87	120 Acc	----	PE 0.000
14-3	9.43	33.1	2.005	46.9		0.0030 TL	1.53	PV
Tuberia: 15-3					-118.8	41.80 PL	1.53	PF 0.012
14-3	9.43	33.1	2.005	46.9	1.44	120 Acc	----	PE 0.000
15-3	9.43	33.1	2.017	47.0		0.0076 TL	1.53	PV
Tuberia: 16-3					-165.8	41.80 PL	1.53	PF 0.021
15-3	9.43	33.1	2.017	47.0	2.01	120 Acc	----	PE 0.000
16-3	9.43	33.1	2.038	47.3		0.0140 TL	1.53	PV
Tuberia: 17-3					-213.0	41.80 PL	1.53	PF 0.034
16-3	9.43	33.1	2.038	47.3	2.59	120 Acc	----	PE 0.000
17-3	9.43	33.1	2.072	47.6		0.0223 TL	1.53	PV

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PROTECFIRE\ESFERAS BOLIVIA\YPFB-PCI-E-03.SDF

TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 18-3					-260.7	41.80	PL	PF 0.049
17-3	9.43	33.1	2.072	47.6	3.17	120	Acc	PE 0.000
18-3	9.43	33.1	2.122	48.2		0.0323	TL	PV
Tuberia: 19-3					-308.9	41.80	PL	PF 0.068
18-3	9.43	33.1	2.122	48.2	3.75	120	Acc	PE 0.000
19-3	9.43	33.1	2.189	49.0		0.0443	TL	PV
Tuberia: 20-3					-357.9	41.80	PL	PF 0.089
19-3	9.43	33.1	2.189	49.0	4.35	120	Acc	PE 0.000
20-3	9.43	33.1	2.278	50.0		0.0581	TL	PV
Tuberia: 21-3					-407.8	41.80	PL	PF 0.113
20-3	9.43	33.1	2.278	50.0	4.95	120	Acc	PE 0.000
21-3	9.43	33.1	2.392	51.2		0.0740	TL	PV
Tuberia: 22-3					-459.0	41.80	PL	PF 0.141
21-3	9.43	33.1	2.392	51.2	5.57	120	Acc	PE 0.000
22-3	9.43	33.1	2.533	52.7		0.0921	TL	PV
Tuberia: 23-3					-511.7	41.80	PL	PF 0.172
22-3	9.43	33.1	2.533	52.7	6.21	120	Acc	PE 0.000
23-3	9.43	33.1	2.705	54.4		0.1126	TL	PV
Tuberia: 24-3					-566.1	41.80	PL	PF 0.208
23-3	9.43	33.1	2.705	54.4	6.88	120	Acc	PE 0.000
24-3	9.43	33.1	2.913	56.5		0.1358	TL	PV
Tuberia: 25-3					-622.6	41.80	PL	PF 0.248
24-3	9.43	33.1	2.913	56.5	7.56	120	Acc	PE 0.000
A3	9.43	0.0	3.160	0.0		0.1619	TL	PV
Tuberia: 1-4					594.1	41.80	PL	PF 0.520
A4	6.29	0.0	3.521	0.0	7.22	120	Acc	PE 0.000
1-4	6.29	33.1	3.002	57.3		0.1485	TL	PV
Tuberia: 2-4					536.8	41.80	PL	PF 0.188
1-4	6.29	33.1	3.002	57.3	6.52	120	Acc	PE 0.000
2-4	6.29	33.1	2.813	55.5		0.1230	TL	PV
Tuberia: 3-4					481.3	41.80	PL	PF 0.154
2-4	6.29	33.1	2.813	55.5	5.84	120	Acc	PE 0.000
3-4	6.29	33.1	2.660	54.0		0.1005	TL	PV
Tuberia: 4-4					427.3	41.80	PL	PF 0.123
3-4	6.29	33.1	2.660	54.0	5.19	120	Acc	PE 0.000
4-4	6.29	33.1	2.536	52.7		0.0807	TL	PV
Tuberia: 5-4					374.6	41.80	PL	PF 0.097
4-4	6.29	33.1	2.536	52.7	4.55	120	Acc	PE 0.000
5-4	6.29	33.1	2.439	51.7		0.0632	TL	PV

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TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 6-4					322.9	41.80 PL	1.53	PF 0.074
5-4	6.29	33.1	2.439	51.7	3.92	120 Acc	----	PE 0.000
6-4	6.29	33.1	2.366	50.9		0.0480 TL	1.53	PV
Tuberia: 7-4					271.9	41.80 PL	1.53	PF 0.054
6-4	6.29	33.1	2.366	50.9	3.30	120 Acc	----	PE 0.000
7-4	6.29	33.1	2.312	50.3		0.0350 TL	1.53	PV
Tuberia: 8-4					221.6	41.80 PL	1.53	PF 0.037
7-4	6.29	33.1	2.312	50.3	2.69	120 Acc	----	PE 0.000
8-4	6.29	33.1	2.276	49.9		0.0239 TL	1.53	PV
Tuberia: 9-4					171.7	41.80 PL	1.53	PF 0.023
8-4	6.29	33.1	2.276	49.9	2.09	120 Acc	----	PE 0.000
9-4	6.29	33.1	2.253	49.7		0.0149 TL	1.53	PV
Tuberia: 10-4					122.0	41.80 PL	1.53	PF 0.012
9-4	6.29	33.1	2.253	49.7	1.48	120 Acc	----	PE 0.000
10-4	6.29	33.1	2.241	49.5		0.0079 TL	1.53	PV
Tuberia: 11-4					72.5	41.80 PL	1.53	PF 0.005
10-4	6.29	33.1	2.241	49.5	0.88	120 Acc	----	PE 0.000
11-4	6.29	33.1	2.236	49.5		0.0030 TL	1.53	PV
Tuberia: 12-4					23.0	41.80 PL	1.53	PF 0.001
11-4	6.29	33.1	2.236	49.5	0.28	120 Acc	----	PE 0.000
12-4	6.29	33.1	2.236	49.5		0.0004 TL	1.53	PV
Tuberia: 13-4					-26.5	41.80 PL	1.53	PF 0.001
12-4	6.29	33.1	2.236	49.5	0.32	120 Acc	----	PE 0.000
13-4	6.29	33.1	2.236	49.5		0.0005 TL	1.53	PV
Tuberia: 14-4					-76.0	41.80 PL	1.53	PF 0.005
13-4	6.29	33.1	2.236	49.5	0.92	120 Acc	----	PE 0.000
14-4	6.29	33.1	2.241	49.6		0.0033 TL	1.53	PV
Tuberia: 15-4					-125.6	41.80 PL	1.53	PF 0.013
14-4	6.29	33.1	2.241	49.6	1.53	120 Acc	----	PE 0.000
15-4	6.29	33.1	2.254	49.7		0.0084 TL	1.53	PV
Tuberia: 16-4					-175.3	41.80 PL	1.53	PF 0.024
15-4	6.29	33.1	2.254	49.7	2.13	120 Acc	----	PE 0.000
16-4	6.29	33.1	2.278	50.0		0.0155 TL	1.53	PV
Tuberia: 17-4					-225.2	41.80 PL	1.53	PF 0.038
16-4	6.29	33.1	2.278	50.0	2.74	120 Acc	----	PE 0.000
17-4	6.29	33.1	2.316	50.4		0.0247 TL	1.53	PV
Tuberia: 18-4					-275.6	41.80 PL	1.53	PF 0.055
17-4	6.29	33.1	2.316	50.4	3.35	120 Acc	----	PE 0.000
18-4	6.29	33.1	2.371	51.0		0.0358 TL	1.53	PV

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PROTECFIRE\ESFERAS BOLIVIA\YPFB-PCI-E-03.SDF

TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 19-4					-326.6	41.80	PL	PF 0.075
18-4	6.29	33.1	2.371	51.0	3.97	120	Acc	PE 0.000
19-4	6.29	33.1	2.446	51.8		0.0491	TL	PV
Tuberia: 20-4					-378.3	41.80	PL	PF 0.099
19-4	6.29	33.1	2.446	51.8	4.59	120	Acc	PE 0.000
20-4	6.29	33.1	2.544	52.8		0.0644	TL	PV
Tuberia: 21-4					-431.1	41.80	PL	PF 0.126
20-4	6.29	33.1	2.544	52.8	5.24	120	Acc	PE 0.000
21-4	6.29	33.1	2.670	54.1		0.0820	TL	PV
Tuberia: 22-4					-485.2	41.80	PL	PF 0.156
21-4	6.29	33.1	2.670	54.1	5.89	120	Acc	PE 0.000
22-4	6.29	33.1	2.826	55.6		0.1021	TL	PV
Tuberia: 23-4					-540.9	41.80	PL	PF 0.191
22-4	6.29	33.1	2.826	55.6	6.57	120	Acc	PE 0.000
23-4	6.29	33.1	3.017	57.5		0.1248	TL	PV
Tuberia: 24-4					-598.3	41.80	PL	PF 0.230
23-4	6.29	33.1	3.017	57.5	7.27	120	Acc	PE 0.000
24-4	6.29	33.1	3.247	59.6		0.1504	TL	PV
Tuberia: 25-4					-658.0	41.80	PL	PF 0.274
24-4	6.29	33.1	3.247	59.6	7.99	120	Acc	PE 0.000
A4	6.29	0.0	3.521	0.0		0.1793	TL	PV
Tuberia: 1-5					599.1	41.80	PL	PF 0.526
A5	3.56	0.0	3.826	0.0	7.28	120	Acc	PE 0.000
1-5	3.56	33.1	3.300	60.1		0.1508	TL	PV
Tuberia: 2-5					539.0	41.80	PL	PF 0.093
1-5	3.56	33.1	3.300	60.1	6.55	120	Acc	PE 0.000
P1-5	3.56	17.2	3.207	30.9		0.1240	TL	PV
Tuberia: 3-5					508.1	41.80	PL	PF 0.055
P1-5	3.56	17.2	3.207	30.9	6.17	150	Acc	PE 0.000
2-5	3.56	33.1	3.152	58.8		0.0736	TL	PV
Tuberia: 4-5					449.3	41.80	PL	PF 0.133
2-5	3.56	33.1	3.152	58.8	5.46	120	Acc	PE 0.000
3-5	3.56	33.1	3.019	57.5		0.0886	TL	PV
Tuberia: 5-5					391.8	41.80	PL	PF 0.103
3-5	3.56	33.1	3.019	57.5	4.76	120	Acc	PE 0.000
4-5	3.56	33.1	2.916	56.5		0.0687	TL	PV
Tuberia: 6-5					335.3	41.80	PL	PF 0.077
4-5	3.56	33.1	2.916	56.5	4.07	120	Acc	PE 0.000
5-5	3.56	33.1	2.839	55.8		0.0515	TL	PV

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TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 7-5					279.5	41.80 PL	0.75	PF 0.028
5-5	3.56	33.1	2.839	55.8	3.39	120 Acc	----	PE 0.000
P2-5	3.56	17.2	2.812	28.9		0.0368 TL	0.75	PV
Tuberia: 8-5					250.6	41.80 PL	0.75	PF 0.015
P2-5	3.56	17.2	2.812	28.9	3.04	150 Acc	----	PE 0.000
6-5	3.56	33.1	2.796	55.4		0.0199 TL	0.75	PV
Tuberia: 9-5					195.3	41.80 PL	1.50	PF 0.028
6-5	3.56	33.1	2.796	55.4	2.37	120 Acc	----	PE 0.000
7-5	3.56	33.1	2.768	55.1		0.0189 TL	1.50	PV
Tuberia: 10-5					140.2	41.80 PL	1.50	PF 0.015
7-5	3.56	33.1	2.768	55.1	1.70	120 Acc	----	PE 0.000
8-5	3.56	33.1	2.753	54.9		0.0103 TL	1.50	PV
Tuberia: 11-5					85.3	41.80 PL	0.75	PF 0.003
8-5	3.56	33.1	2.753	54.9	1.04	120 Acc	----	PE 0.000
P3-5	3.56	17.2	2.750	28.6		0.0041 TL	0.75	PV
Tuberia: 12-5					56.7	41.80 PL	0.75	PF 0.001
P3-5	3.56	17.2	2.750	28.6	0.69	150 Acc	----	PE 0.000
9-5	3.56	33.1	2.749	54.9		0.0013 TL	0.75	PV
Tuberia: 13-5					1.8	41.80 PL	1.50	PF 0.000
9-5	3.56	33.1	2.749	54.9	0.02	120 Acc	----	PE 0.000
10-5	3.56	33.1	2.749	54.9		0.0000 TL	1.50	PV
Tuberia: 14-5					-53.1	41.80 PL	0.75	PF 0.001
10-5	3.56	33.1	2.749	54.9	0.64	120 Acc	----	PE 0.000
P4-5	3.56	17.2	2.750	28.6		0.0017 TL	0.75	PV
Tuberia: 15-5					-81.7	41.80 PL	0.75	PF 0.002
P4-5	3.56	17.2	2.750	28.6	0.99	150 Acc	----	PE 0.000
11-5	3.56	33.1	2.752	54.9		0.0025 TL	0.75	PV
Tuberia: 16-5					-136.6	41.80 PL	1.50	PF 0.015
11-5	3.56	33.1	2.752	54.9	1.66	120 Acc	----	PE 0.000
12-5	3.56	33.1	2.766	55.1		0.0098 TL	1.50	PV
Tuberia: 17-5					-191.6	41.80 PL	1.50	PF 0.027
12-5	3.56	33.1	2.766	55.1	2.33	120 Acc	----	PE 0.000
13-5	3.56	33.1	2.794	55.3		0.0183 TL	1.50	PV
Tuberia: 18-5					-247.0	41.80 PL	0.75	PF 0.022
13-5	3.56	33.1	2.794	55.3	3.00	120 Acc	----	PE 0.000
P5-5	3.56	17.2	2.816	28.9		0.0293 TL	0.75	PV
Tuberia: 19-5					-275.9	41.80 PL	0.75	PF 0.018
P5-5	3.56	17.2	2.816	28.9	3.35	150 Acc	----	PE 0.000
14-5	3.56	33.1	2.834	55.7		0.0238 TL	0.75	PV

FECHA: 5/15/2014

PROTECFIRE\ESFERAS BOLIVIA\YPFB-PCI-E-03.SDF

TITULO PROYECTO: YPFB-BOLIVIA. ESFERAS 2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944

ETI DE TUB					Q (LPM)	DIA (MM)	LONG.	RESUM.
END	ELEV.	FAC.	PT	DESC.	VEL (MPS)	HW (C)	(M)	PRES.
EXTREMOS	(M)	(K)	(BAR)	(LPM)		FL/M		(BAR)
Tuberia: 20-5					-331.6	41.80 PL	1.50	PF 0.076
14-5	3.56	33.1	2.834	55.7	4.03	120 Acc	----	PE 0.000
15-5	3.56	33.1	2.909	56.5		0.0505 TL	1.50	PV
Tuberia: 21-5					-388.1	41.80 PL	1.50	PF 0.101
15-5	3.56	33.1	2.909	56.5	4.71	120 Acc	----	PE 0.000
16-5	3.56	33.1	3.010	57.4		0.0675 TL	1.50	PV
Tuberia: 22-5					-445.5	41.80 PL	0.75	PF 0.065
16-5	3.56	33.1	3.010	57.4	5.41	120 Acc	----	PE 0.000
P6-5	3.56	17.2	3.076	30.3		0.0872 TL	0.75	PV
Tuberia: 23-5					-475.8	41.80 PL	0.75	PF 0.049
P6-5	3.56	17.2	3.076	30.3	5.78	150 Acc	----	PE 0.000
17-5	3.56	33.1	3.125	58.5		0.0651 TL	0.75	PV
Tuberia: 24-5					-534.3	41.80 PL	1.50	PF 0.183
17-5	3.56	33.1	3.125	58.5	6.49	120 Acc	----	PE 0.000
18-5	3.56	33.1	3.307	60.2		0.1220 TL	1.50	PV
Tuberia: 25-5					-594.5	41.80 PL	0.75	PF 0.519
18-5	3.56	33.1	3.307	60.2	7.22	120 Acc	T	PE 0.000
A5	3.56	0.0	3.826	0.0		0.1486 TL	3.49	PV
Tuberia: 1-6					239.6	35.90 PL	0.82	PF 0.167
A6	1.99	0.0	3.619	0.0	3.94	120 Acc	T	PE 0.000
1-6	1.99	43.2	3.452	80.3		0.0580 TL	2.88	PV
Tuberia: 2-6					159.3	35.90 PL	1.65	PF 0.045
1-6	1.99	43.2	3.452	80.3	2.62	120 Acc	----	PE 0.000
2-6	1.99	43.2	3.407	79.7		0.0273 TL	1.65	PV
Tuberia: 3-6					79.6	35.90 PL	1.65	PF 0.012
2-6	1.99	43.2	3.407	79.7	1.31	120 Acc	----	PE 0.000
3-6	1.99	43.2	3.394	79.6		0.0076 TL	1.65	PV
Tuberia: 4-6					0.0	35.90 PL	1.65	PF 0.000
3-6	1.99	43.2	3.394	79.6	0.00	120 Acc	----	PE 0.000
4-6	1.99	43.2	3.394	79.6		0.0000 TL	1.65	PV
Tuberia: 5-6					-79.6	35.90 PL	1.65	PF 0.012
4-6	1.99	43.2	3.394	79.6	1.31	120 Acc	----	PE 0.000
5-6	1.99	43.2	3.407	79.7		0.0076 TL	1.65	PV
Tuberia: 6-6					-159.3	35.90 PL	1.65	PF 0.045
5-6	1.99	43.2	3.407	79.7	2.62	120 Acc	----	PE 0.000
6-6	1.99	43.2	3.452	80.3		0.0273 TL	1.65	PV
Tuberia: 7-6					-239.6	35.90 PL	0.82	PF 0.167
6-6	1.99	43.2	3.452	80.3	3.94	120 Acc	T	PE 0.000
A6	1.99	0.0	3.619	0.0		0.0580 TL	2.88	PV

NOTAS (HASS):

- (1) Los calculos se han realizado mediante el programa de ordenador HASS versi n 8.4
bajo licencia numero 16060884 SUMINISTRADO por
HRS Systems, Inc.
208 Southside Square
Petersburg, TN 37144
(931) 659-9760
- (2) El sistema ha sido equilibrado hasta tener un desequilibrio
medio en los nodos de 0.0032 l/min y un desequilibrio
maximo en cualquier nodo de 0.3911 l/min.
- (3) Se utiliza la presi n total en cada nodo para equilibrar el sistema.
La maxima velocidad del agua es 9.46 m/seg en tuberia 4.
- (4) Art culos listado en letra negrita en la portada
son transferidos autom ticamente del informe de c lculo.
- (5) Presi n disponible al nodo de origen A con las condiciones de flujo completo
es 7.00 bar en comparaci n con la presi n requerida m nima de 0.00 bar.

(6) TABLA DE ACCESORIOS DE TUBERIAS

Nombre de Tabla de Tuberias: IPTUBERIAS.PIP

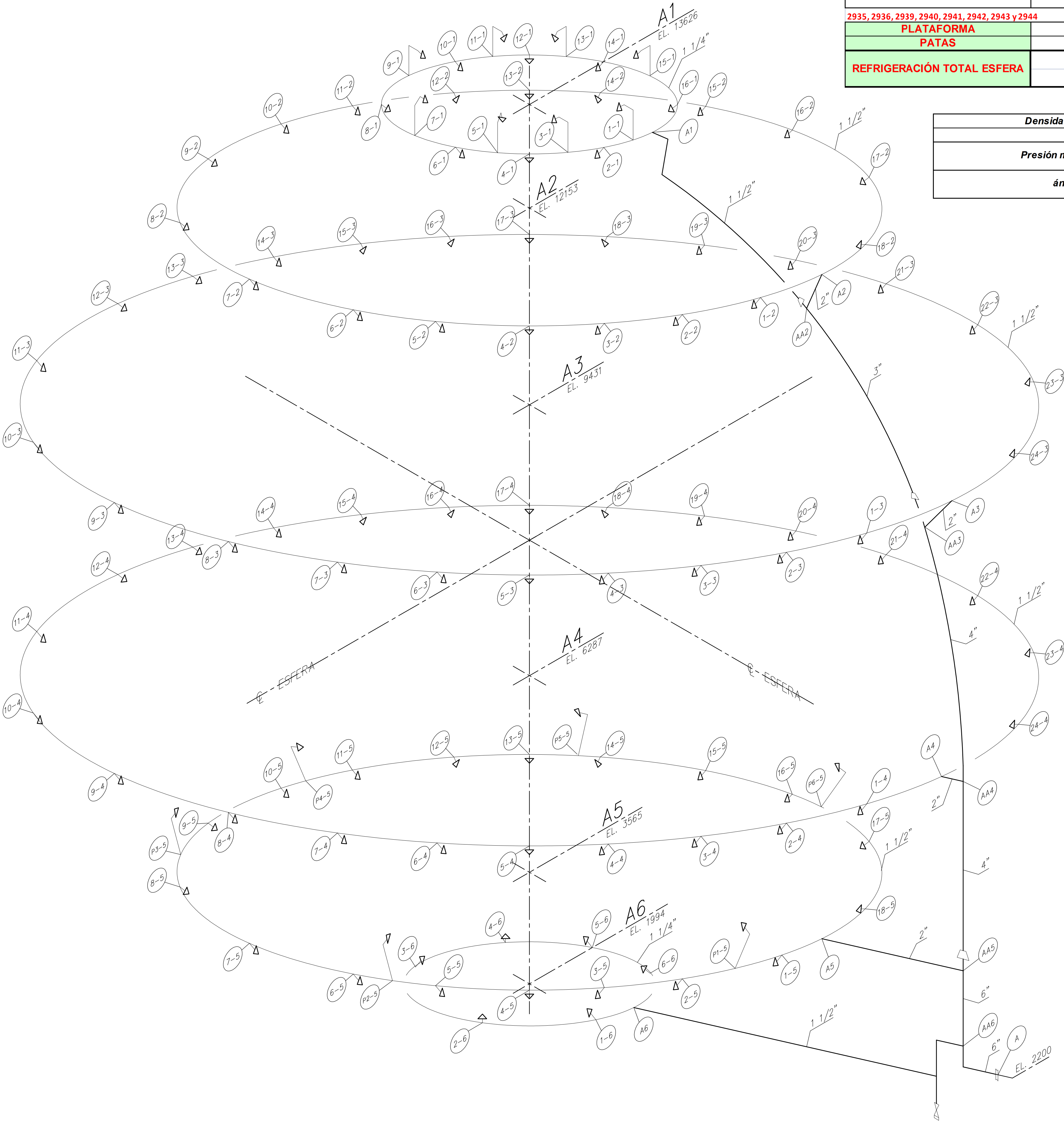
PAGINA: F MATERIAL: 2440 HWC: 120

Diametro (mm)	Longitud Equivalente del Accesorio en Metros							
	E	T	L	C	B	G	A	D
	Ell	Tee	LngEl	VReten	VMarip	VCompu	PcRoci	PcDelu
35.90	1.02	2.06	0.69	2.39	2.06	0.34	3.43	3.43
41.80	1.36	2.74	0.68	3.05	2.04	0.33	3.40	3.40
53.00	1.59	3.19	0.95	3.51	1.92	0.31	3.19	3.19
80.80	2.54	5.54	1.81	5.82	3.64	0.36	4.72	3.64
105.30	3.52	7.04	2.11	7.74	4.22	0.70	7.04	3.52
155.40	4.46	9.54	2.86	10.17	3.18	0.95	8.90	6.04

		DIMENSIONES ESFERA			CAUDAL ESFERA			
	NUMERO DE PATAS	D	V	A	Caudal (área*Dd)	Caudal esfera	n°boq. final	Qboq= Qsist / n°boq
2935, 2936, 2939, 2940, 2941, 2942, 2943 y 2944		10,7440	649,36	362,64	3.626,36	Esfera	3.626,36	98,00
PLATAFORMA		3,0000		6,89	68,90	Plataforma	68,90	8,00
PATAS		6		5,22	52,20	Patas	52,20	6,00
REFRIGERACIÓN TOTAL ESFERA					3.747,46			112,00

Densidad de diseño (l/min*m2)	10					
Anillos	A1	A2	A3	A4	A5	A6
Presión mínima en boquilla (bar)	2	2,00	2,00	2,00	2,00	2,00
	1				1,00	
ángulo de boquilla	125	125	125	125	125	125
	95 (Plat)				125 (Patas)	

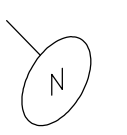
ANILLO	ELEVACIÓN (mm)	DIÁMETRO (mm)	DN TUBERIA (")	Nº BOQUILLAS	FACTOR K	ÁNGULO DESCARGA	MODELO (TYCO)	Deb (mm)
A1	13626	3800,00	1 1/4"	8	33,1	125	D3	1492,26
PLATAFORMA	14424		8 VELAS 1"	8	17,3	95	D3	
A2	12153	8587,00	1 1/2"	18	33,1	125	D3	1498,72
A3	9431	11730,00	1 1/2"	24	33,1	125	D3	1535,46
A4	6287	11730,00	1 1/2"	24	33,1	125	D3	1535,46
A5	3565	8587,00	1 1/2"	18	33,1	125	D3	1498,72
PATAS	4104		6 VELAS 1"	6	17,3	125	D3	4496,15
A6	1994	3143,00	1 1/4"	6	43,2	125	D3	1645,67



NOTAS

1.- TODAS LAS COTAS ESTÁN EN MILÍMETROS.
2.- TODAS LAS ELEVACIONES SON RESPECTO A LA COTA DE SUELO ±0,00 DE LA ESFERA.

SIMBOLOGIA

 IDENTIFICACIÓN DE NODOS HIDRÁULICOS PARA CÁLCULOS
(VER HOJAS DE ANÁLISIS HIDRÁULICO)

TÍTULO:

ESFERA 2939 (Ø10,744 m)
PLANO ISOMÉTRICO DE CÁLCULOS HIDRÁULICOS