 YPFB Corporación <small>La fuerza que transforma Bolivia</small> PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 1 de 11

DOCUMENTO REFERENCIAL:

El presente documento es de carácter referencial para fines exclusivos de preparación de la propuesta durante la etapa de licitación del Proyecto, por lo que la empresa Contratista es responsable de verificar dicha información durante el desarrollo y ejecución del proyecto, sin que esto implique derecho a modificaciones contractuales.

INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS

N° del Contrato : DLG 0304

N° del Proy. de SECL : SC2566

1	30 Mar 2017	AS	Como Construido			
Rev	Fecha	Estado	Descripción del Estado	Preparado por	Verificado por	Aprobado por
Revisión del Documento				Página: Total de 10 hojas (Incl. Carátula)		



 <p>YPFB Corporación La fuerza que transforma Bolivia PLANTAS DE AMONIACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 3 de 11

TABLA DE CONTENIDOS

1. GENERAL	4
1.1 INTRODUCCIÓN	4
1.2 ALCANCE	4
1.3 CÓDIGOS Y ESTÁNDARES	4
2. DATOS Y DEFINICIÓN DE DISEÑO	5
2.1 PROGRAMAS INFORMÁTICOS	5
2.2 DATOS DEL TUBO	6
2.3 VELOCIDAD MÁXIMA DE DISEÑO	6
2.4 PRESIÓN MÍNIMA REQUERIDA EN LA SALIDA	6
2.5 UN SOLO INCENDIO EN UN SOLO ÁREA	7
2.6 CAPACIDAD DE LA BOMBA DE AGUA CONTRA INCENDIOS	7
3. CAUDAL PARA CADA ZONA DE INCENDIO	8
4. CÁLCULO HIDRÁULICO	10
4.1 DESCRIPCIÓN DEL CÁLCULO HIDRÁULICO	10
5. CONCLUSIÓN	11
6. ANEXO	
1. Hoja de Cálculos de la demanda de Agua Contra Incendios.Rev.0	
2. Plano de la Zona de Incendio Rev.0	
3. Análisis del Cálculo Hidráulico y diagrama esquemático para la zona de incendio 03	
4. Análisis del Cálculo Hidráulico para el sistema de rocío de agua	

 <p>PLANTAS DE AMONIACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1 Página 4 de 11

1. GENERAL

1.1 INTRODUCCIÓN

El propósito de este cálculo hidráulico es prever la situación de incendio en la planta y asegurar que las presiones y flujos estén disponibles para proporcionar un rendimiento óptimo de la operación de protección contra incendios. Este cálculo hidráulico ha sido conducido para la red principal de agua contra incendios al caso de la demanda máxima de agua contra incendios para que la presión y el caudal sean suficientes a suministrar para los sistemas de protección contra incendios para poder realizar el caudal de descarga requerido.

1.2 ALCANCE


El sistema de suministro de agua contra incendios será proporcionado por el Proyecto de Amoníaco / Urea de YPFB. El agua principal contra incendios debe ser una red y se debe considerar como un diseño de circuito cerrado. Se ubica a lo largo de las carreteras principales para suministrar agua contra incendios a cada salida. (ej. hidrante de agua, monitor de agua, sistema de rociado de agua, etc.)

Como el resultado de esta hoja de cálculo hidráulico se muestran la presión y el caudal calculado en cada tubería y son determinados como la presión y el caudal de las bombas de agua contra incendios para proveer el agua contra incendios a los sistemas de protección contra incendios (sistemas de rociado de agua, monitores de agua, etc.) mientras el caudal requerido en cada salida es descargado.

1.3 CÓDIGOS Y ESTÁNDARES

El cálculo debe ser calculado generalmente de acuerdo con la última edición de códigos, estándares y especificaciones.

- (1) Código NFPA 13, 15, 24
- (2) Ecuaciones de Hazen y Williams

 <p>PLANTAS DE AMONIACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 5 de 11

2. DATOS Y DEFINICIÓN DE DISEÑO

Los siguientes datos y definición de diseño fueron usados en este cálculo.

2.1 PROGRAMAS INFORMÁTICOS

El cálculo hidráulico ha sido realizado usando el programa informático “PIPENET VISION versión 1.6” desarrollado por SUNRISE SYSTEM LTD (U.K). Este programa está basado en la fórmula de cálculo de pérdida de fricción de Hazen-Williams y el código NFPA.

El Método de Ecuación de Hazen-Williams

La ecuación de Hazen-Williams es una fórmula empírica que da una expresión explícita para la pérdida de la presión por fricción:

donde:

L es la longitud del tubo.


L_e es la longitud equivalente de cualquier accesorio de tubo.

Q es el caudal de fluido (volumétrico).

D es el diámetro del tubo.

C es el constante (O *factor-C*) de Hazen-Williams para el tubo.

$$P_{fric} = \frac{6.05 \times 10^5 (L + L_e) Q^{1.85}}{C^{1.85} D^{4.87}}$$

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small> PLANTAS DE AMONÍACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 6 de 11

2.2 DATOS DEL TUBO

1) Materiales de Tubería

Servicio	Tamaño	Clase	Descripción del Material
AGUA CONTRA INCENDIOS (SUBTERRÁNEO)	1/2" – 24"	A53 GR. B. ERW	CS + EXT. REVESTIDO DE PE
AGUA CONTRA INCENDIOS (SUPERFICIAL)	1/2" – 24"	A106 GR. B. SMLS	CS + GALV
AGUA CONTRA INCENDIOS (SUPERFICIAL)	1/2" – 24"	A106 GR. B. SMLS	CS

2) Valor 'C' de Hazen y Williams (Referirse a la tabla 8.5.3.10 de NFPA 15)

Factor-C = 120


2.3 VELOCIDAD MÁXIMA DE DISEÑO

La velocidad al máximo caudal de diseño en las redes con bucles (looped) no debe exceder 4.5m/seg y la velocidad al máximo caudal de diseño en redes sin bucles (non looped) que alimentan a hidrantes, monitores, y sistemas fijos no debe exceder 6.0 m/seg.

- | | |
|---|-------------|
| (1) Red de agua contra incendios | : 4.5 m/seg |
| (2) Sistema de rociador & rociado de agua | : 6.0 m/seg |

2.4 PRESIÓN MÍNIMA REQUERIDA EN LA SALIDA

Ítem	Mínimo Requerido	Observaciones
	Presión (Barg)	
Hidrante de Agua Contra Incendios	7	La presión calculada debe ser mayor que la presión mínima requerida.
Monitor de Agua Contra Incendios	7	

 PLANTAS DE AMONÍACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 7 de 11

2.5 UN SOLO INCENDIO EN UN SOLO ÁREA


El sistema de protección contra incendios debe ser diseñado en la base de un incendio principal a la vez. No se considerarán unidades de incendios simultáneos, ya sea dentro de un solo área o en múltiples ubicaciones en la planta.

2.6 CAPACIDAD DE LA BOMBA DE AGUA CONTRA INCENDIOS

Tres bombas de agua contra incendios centrífugas principales (dos en función y uno en espera) serán proporcionadas.


Una (1) bomba principal de agua contra incendios accionada a Motor en Función:
caudal de 340 m³/hr en 10.5 barg

Dos (2) bombas principales de agua contra incendios accionadas a Motor Diesel:
caudal de 340 m³/hr en 10.5 barg (Una en función y una en espera)

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small></p> <p>PLANTAS DE AMONIACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 8 de 11


3. CAUDAL PARA CADA ZONA DE INCENDIO

Zona de Incendio	Área Protegida	Sistema de Protección Contra Incendios	Caudal Requerido	Caudal Requerido
		Aplicado	(lpm)	(m3/hr)
Zona-1	Área de Edificios	Hidrante Contra Incendios	2,000	120
		Rociador	1,126	67.5
		Soporte de Manguera (Interior)	758	46
		TOTAL	3,884	234
Zona-2	Área de Sala de Ensacado de Urea	Hidrante Contra Incendios	2,000	120
		Rociador	1,126	67.5
		Soporte de Manguera (Interior)	758	46
		TOTAL	3,884	234
Zona-3	Unidad de Proceso de Amoniaco	Hidrante Contra Incendios	2,000	120
		Monitor Contra Incendios	3,800	228
		Enrollador de Manguera Exterior	758	46
		Sistema de Rociado de Agua	2,430	146
		TOTAL	8,988	540
		(Máxima Demanda de Agua Contra Incendios)		
Zona-4	Unidad de Proceso de Urea	Hidrante Contra Incendios	2,000	120
		Monitor Contra Incendios	3,800	228
		Sistema de Rociado de Agua	1,824	109
		TOTAL	7,624	457
Zona-5	Área de Torre de Enfriamiento	Hidrante Contra Incendios	2,000	120
		Monitor Contra Incendios	3,800	228
		TOTAL	5,800	348
Zona-6	Área de Servicios Auxiliares	Hidrante Contra Incendios	2,000	120
		Sistema de Rociado de Agua	1,465	88
		TOTAL	3,465	208
Zona-7	Área de Almacenamiento a Granel	Hidrante Contra Incendios	2,000	120
		TOTAL	2,000	120

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small></p> <p>PLANTAS DE AMONIACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 9 de 11

Zona de Incendio	Área Protegida	Sistema de Protección Contra Incendios	Caudal Requerido	Caudal Requerido
		Aplicado	(lpm)	(m3/hr)
Zona-8	Área de Quemador Elevado	Hidrante Contra Incendios	2,000	120
		TOTAL	2,000	120
Zona-9	Edificio de Administración	Hidrante Contra Incendios	2,000	120
		Soporte de Manguera (Interior)	758	46
		TOTAL	2,758	166

Nota: Referirse al Anexo #2, "DIBUJO DE LA ZONA DE INCENDIO"

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small> PLANTAS DE AMONÍACO Y UREA, CARRASCO</p>	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 10 de 11

4. CÁLCULO HIDRÁULICO

4.1 DESCRIPCIÓN DEL CÁLCULO HIDRÁULICO

Este cálculo hidráulico es determinado por el tamaño del tubo para que la velocidad del agua no exceda la velocidad máxima de agua de diseño, y se encontraron los requisitos de la presión y el caudal a través de la red principal de agua y la tubería de distribución de rociado de agua para proveer el óptimo rendimiento de cada sistema de rociado de agua e hidrante exterior contra incendios.

4.2 RESULTADOS DEL CÁLCULO HIDRÁULICO PARA LA ZONA DE MÁXIMA DEMANDA DE AGUA CONTRA INCENDIOS

Tabla 1. Caudal Óptimo Mínimo

N° de Nodo	Descripción	Presión	Caudal	Caudal	Hoja de Cálculo
		(kg/cm ²)	(lpm)	(m ³ /hr)	
84	10-DV-9901	-	2,430	146	Anexo #1
22, 56	Hidrante Contra Incendios	7	2,000	120	
26, 55	Monitor Contra Incendios	7	3,800	228	
58, 60	Enrollador de Manguera Exterior	7	758	46	

Tabla 2. Caudal Real (Red)

N° de Nodo	Descripción	Presión	Caudal	Caudal	Hoja de Cálculo
		(kg/cm ²)	(lpm)	(m ³ /hr)	
84	10-DV-9901	10.174	3,750	225	Anexo #3
22, 56	Hidrante Contra Incendios	10.042	2,274	136	
26, 55	Monitor Contra Incendios	10.007	4,783	287	
58, 60	Enrollador de Manguera Exterior	10.047	908	54	




	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1
		Página 11 de 11

Tabla 3. Caudal Real (10-DV-9901)

N° de Nodo	Descripción	Presión	Caudal	Caudal	Hoja de
		(kg/cm ²)	(lpm)	(m ³ /hr)	Cálculos
1	10-DV-9901	4.558	2,111.6	127	Anexo #3

5. CONCLUSIÓN

De acuerdo al resultado del cálculo hidráulico como se muestra, las tuberías para los sistemas de protección contra incendios son suficientes para suministrar la presión y el caudal requerido para proporcionar el caudal de descarga a todas las salidas. Por lo tanto, la presión y el caudal disponible de la red de agua contra incendios es suficiente para proveer la presión óptima de descarga a todas las boquillas de rociado de agua, e hidrantes exteriores contra incendios.

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small> PLANTAS DE AMONÍACO Y UREA, CARRASCO</p>	<p>INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS</p>	 SAMSUNG ENGINEERING
	<p>N° del DOC. PAU-EFF-C-CAL-00001</p>	<p>Rev. 1</p>

ANEXO #1

HOJA DE CÁLCULOS DE LA DEMANDA DE AGUA CONTRA INCENDIOS

ATTACHMENT #1. MAXIMUM FIRE WATER DEMAND

PROJECT : YPFB Ammonia/Urea Project

FIRE RISK AREA - 01. Building Area

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Sprinkler System	AV-003	1,126	67.5	405	139sqm x 8.1lpm/sqm(ordinary hazard group-II occupancy)
Indoor Hose Rack		758	46	276	Max. 2set (Per each 379 lpm)
Total		3,884	234	1,401	

FIRE RISK AREA - 02. Urea Bagging House Area

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Sprinkler System	AV-001	1,126	67.5	405	139sqm x 8.1lpm/sqm(ordinary hazard group-II occupancy)
Indoor Hose Rack		758	46	276	Max. 2set (Per each 379 lpm)
Total		3,884	234	1,401	

FIRE RISK AREA - 03. Ammonia Process Units

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm) - HY021, HY029
Fire Monitor		3,800	228	1,368	Max. 2set (Per each 1900 lpm) - WM005, HM004
Outdoor Hose Reel		758	46	276	Max. 2set (Per each 379 lpm) - HS005, HS006
Water Spray System	10-DV-9901	2,430	146	875	See Data Attachment #2
Total		8,988	540	3,239	Max. Water Demand

FIRE RISK AREA - 04. Urea Process Units

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Fire Monitor		3,800	228	1,368	2set
Water Spray System	20-DV-9901	1,824	109	657	See Data Attachment #2
Total		7,624	457	2,745	

FIRE RISK AREA - 05. Cooling Tower Area

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Fire Monitor		3,800	228	1,368	2set
Total		5,800	348	2,088	

FIRE RISK AREA - 06. Utility Area

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Water Spray System	30-DV-9901	1,465	88	528	See Data Attachment #2, Each T/R yard is considered to be single fire zone.
Total		3,465	208	1,248	

FIRE RISK AREA - 07. Bulk Storage Area


System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Total		2,000	120	720	

FIRE RISK AREA - 08. Flare Stack Area

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Total		2,000	120	720	

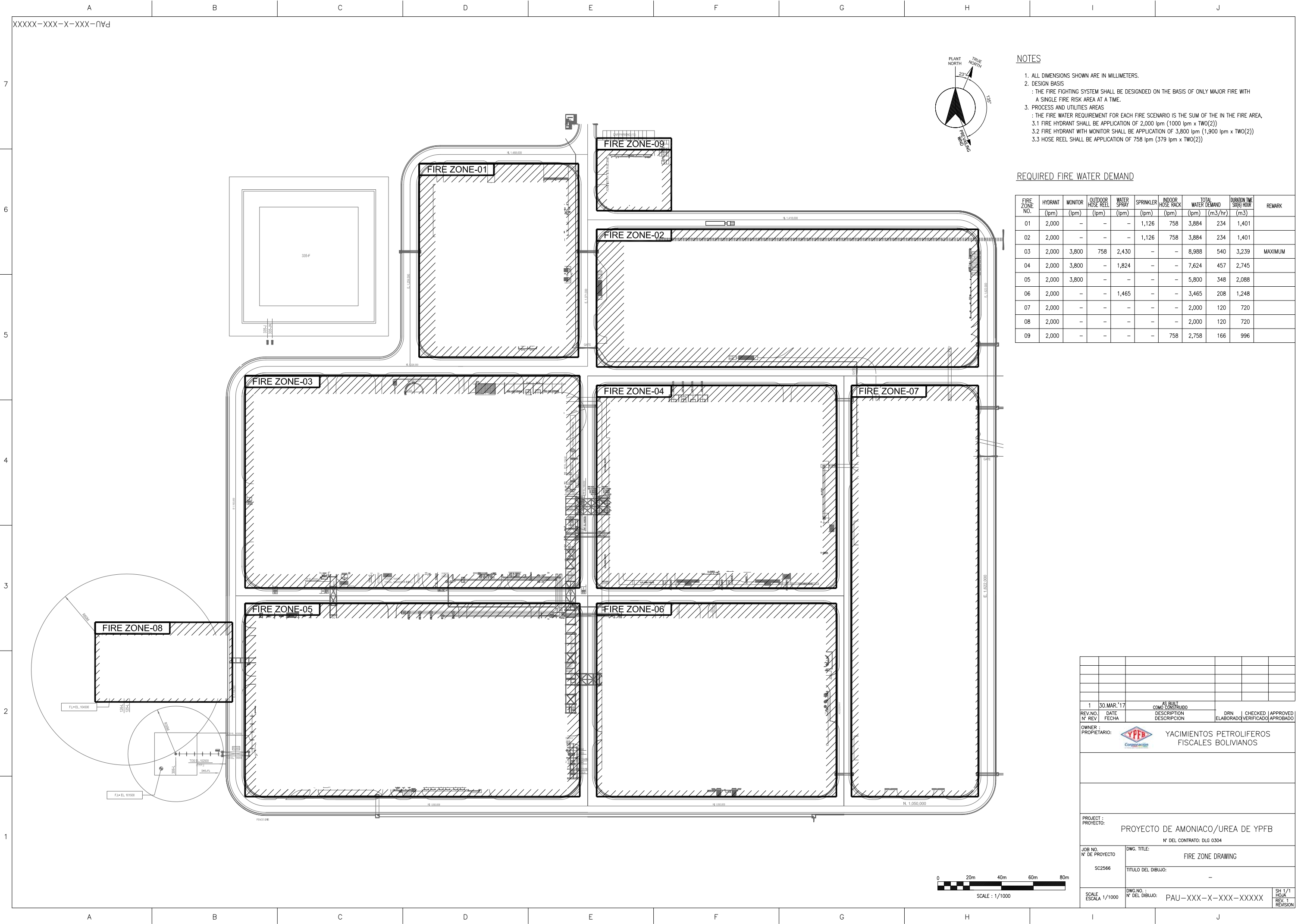
FIRE RISK AREA - 09. Administration Building

System	Valve No.	Firewater Rate		Fire Water Capacity at six(6) hours (m3)	Remarks
		(lpm)	(m3/hr)		
Fire Hydrant		2,000	120	720	Max. 2set (Per each 1000 lpm)
Indoor Hose Rack		758	46	276	Max. 2set (Per each 379 lpm)
Total		2,758	166	996	

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small> PLANTAS DE AMONIACO Y UREA, CARRASCO</p>	<p>INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS</p>	
	<p>N° del DOC. PAU-EFF-C-CAL-00001</p>	<p>Rev. 1</p>

ANEXO #2

DIBUJO DE LA ZONA DE FUEGO




NOTES

1. ALL DIMENSIONS SHOWN ARE IN MILLIMETERS.
2. DESIGN BASIS
: THE FIRE FIGHTING SYSTEM SHALL BE DESIGNED ON THE BASIS OF ONLY MAJOR FIRE WITH A SINGLE FIRE RISK AREA AT A TIME.
3. PROCESS AND UTILITIES AREAS
: THE FIRE WATER REQUIREMENT FOR EACH FIRE SCENARIO IS THE SUM OF THE IN THE FIRE AREA,
3.1 FIRE HYDRANT SHALL BE APPLICATION OF 2,000 lpm (1000 lpm x TWO(2))
3.2 FIRE HYDRANT WITH MONITOR SHALL BE APPLICATION OF 3,800 lpm (1,900 lpm x TWO(2))
3.3 HOSE REEL SHALL BE APPLICATION OF 758 lpm (379 lpm x TWO(2))

REQUIRED FIRE WATER DEMAND

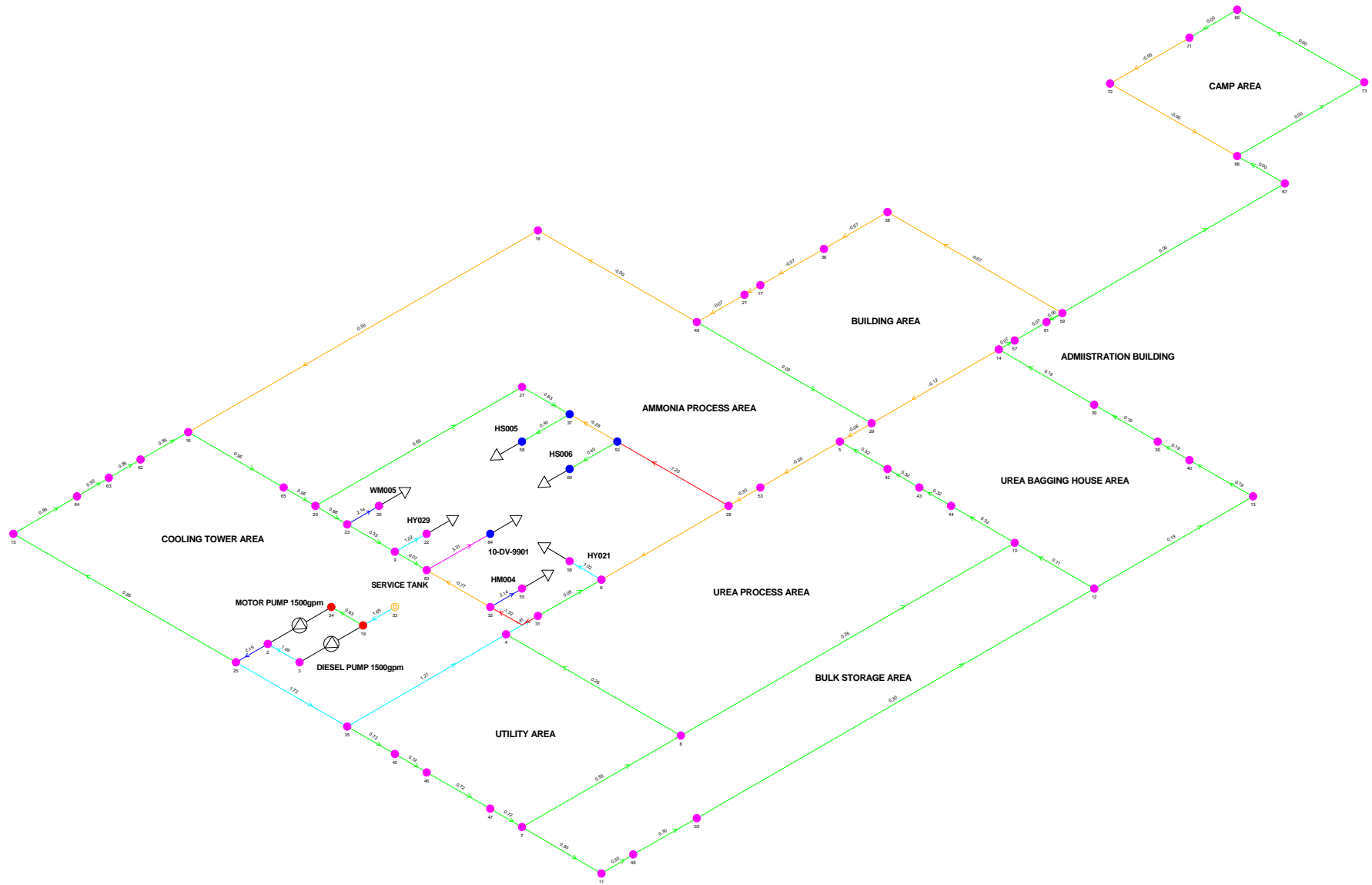
FIRE ZONE NO.	HYDRANT	MONITOR	OUTDOOR HOSE REEL	WATER SPRAY	SPRINKLER	INDOOR HOSE RACK	TOTAL WATER DEMAND		DURATION TIME (6) HOUR	REMARK
	(lpm)	(lpm)	(lpm)	(lpm)	(lpm)	(lpm)	(lpm)	(m3/hr)	(m3)	
01	2,000	–	–	–	1,126	758	3,884	234	1,401	
02	2,000	–	–	–	1,126	758	3,884	234	1,401	
03	2,000	3,800	758	2,430	–	–	8,988	540	3,239	MAXIMUM
04	2,000	3,800	–	1,824	–	–	7,624	457	2,745	
05	2,000	3,800	–	–	–	–	5,800	348	2,088	
06	2,000	–	–	1,465	–	–	3,465	208	1,248	
07	2,000	–	–	–	–	–	2,000	120	720	
08	2,000	–	–	–	–	–	2,000	120	720	
09	2,000	–	–	–	–	758	2,758	166	996	

1	30.MAR.'17	AS BUILT COMO CONSTRUIDO			
REV.NO.	DATE	DESCRIPTION	DRN	CHECKED	APPROVED
Nº REV	FECHA	DESCRIPCION	ELABORADO	VERIFICADO	APROBADO
OWNER : PROPIETARIO:			YACIMIENTOS PETROLIFEROS FISCALES BOLIVIANOS		
PROJECT : PROYECTO:					
PROYECTO DE AMONIACO/UREA DE YPFB					
Nº DEL CONTRATO: DLG 0304					
JOB NO. Nº DE PROYECTO		DWG. TITLE:			
SC2566		FIRE ZONE DRAWING			
		TITULO DEL DIBUJO:			
		-			
SCALE ESCALA 1/1000		DWG.NO : Nº DEL DIBUJO:			SH 1/1 HOJA REV. 1 REVISION
		PAU-XXX-X-XXX-XXXXX			

 La fuerza que transforma Bolivia PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #3

ANÁLISIS DEL CÁLCULO HIDRÁULICO Y DIAGRAMA ESQUEMÁTICO PARA ZONA DE FUEGO 03



MAJOR FIRE_NETWORK

Kunkook Fire Protection Co., Ltd

PIPENET Schematic

Monday, July 28, 2014

Page 1 of 1

Pipe velocity
(m/sec)

< -1.000000
< 2.000000

< 0.000000
< 3.000000

< 1.000000
> 3.000000

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : MAJOR FIRE_NETWORK
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

16:45 on 28-Jul-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	8
Pump Configuration.....	9
Designed Diameters & Flowrates.....	10
Flow in Pipes.....	13
Flow through Nozzles.....	15
Flow through Pumps.....	16
Flow at Inlets.....	17
Important Notice.....	18
Comments.....	19
Warnings.....	20

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
13 -- API5L GR.B PSL2, ERW	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

API5L GR.B PSL2, ERW
Not lined

Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	15.8000	4.5000					
20.0000	20.9300	4.5000					
25.0000	26.6400	4.5000					
40.0000	40.8900	4.5000					
50.0000	52.6800	4.5000					
65.0000	62.7000	4.5000					
80.0000	77.9200	4.5000					
100.0000	102.2600	4.5000					
150.0000	154.0800	4.5000					
200.0000	202.7200	4.5000					
250.0000	254.5100	4.5000					
300.0000	304.7600	4.5000					
350.0000	336.5600	4.5000					
400.0000	387.3600	4.5000					

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	25	15	300.0	200.0	0.000	120.0	3.745
2	25	35	300.0	25.00	0.000	120.0	1.873
3	83	84	150.0	10.00	0.000	120.0	4.267
4	2	25	350.0	10.00	0.000	120.0	29.71
5	35	45	250.0	17.00	0.000	120.0	15.23
6	7	8	250.0	132.0	0.000	120.0	1.523
7	42	5	250.0	18.00	0.000	120.0	23.45
8	31	6	300.0	22.00	0.000	120.0	18.73
9	10	44	250.0	90.00	0.000	120.0	16.75
10	8	10	250.0	130.0	0.000	120.0	16.75
11	7	11	200.0	90.00	0.000	120.0	10.66
12	11	48	200.0	57.00	0.000	120.0	6.702
13	12	10	200.0	90.00	0.000	120.0	1.219
14	12	13	200.0	100.0	0.000	120.0	11.88
15	13	40	200.0	42.00	0.000	120.0	5.484
16	29	14	200.0	92.00	0.000	120.0	11.88
17	6	28	300.0	35.00	0.000	120.0	1.873
18	15	64	300.0	82.00	0.000	120.0	8.427
19	32	31	300.0	42.00	0.000	120.0	0.000
20	16	18	300.0	135.0	0.000	120.0	18.73
21	9	83	300.0	10.00	0.000	120.0	0.000
22	36	38	200.0	15.00	0.000	120.0	10.66
23	49	21	200.0	55.00	0.000	120.0	1.219
24	16	65	300.0	33.00	0.000	120.0	1.873
25	53	5	300.0	45.00	0.000	120.0	1.873
26	20	27	100.0	55.00	0.000	120.0	6.706
27	27	37	100.0	95.00	0.000	120.0	21.95
28	20	23	300.0	45.00	0.000	120.0	0.000
29	23	9	300.0	30.00	0.000	120.0	0.000
30	33	19	400.0	16.00	0.000	120.0	45.59
31	9	22	150.0	5.000	0.000	120.0	4.267
32	23	26	150.0	5.000	0.000	120.0	4.267
33	32	55	150.0	5.000	0.000	120.0	4.267
34	18	49	300.0	115.0	0.000	120.0	30.90
35	30	39	200.0	75.00	0.000	120.0	0.000
36	4	31	300.0	1.000	0.000	120.0	18.73
37	83	32	300.0	45.00	0.000	120.0	1.873
38	19	34	400.0	3.000	0.000	120.0	45.59
39	21	17	200.0	5.000	0.000	120.0	0.000
40	35	4	300.0	132.0	0.000	120.0	20.60
41	5	29	300.0	6.000	0.000	120.0	18.73
42	3	2	350.0	3.000	0.000	120.0	140.2
43	17	36	200.0	70.00	0.000	120.0	0.000

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
44	38	59	200.0	105.0	0.000	120.0	17.37
45	39	14	200.0	112.0	0.000	120.0	11.88
46	40	30	200.0	25.00	0.000	120.0	0.000
47	8	4	250.0	155.0	0.000	120.0	1.523
48	43	42	250.0	12.00	0.000	120.0	0.000
49	44	43	250.0	35.00	0.000	120.0	0.000
50	28	53	300.0	32.00	0.000	120.0	18.73
51	45	46	250.0	5.000	0.000	120.0	15.23
52	46	47	250.0	75.00	0.000	120.0	15.23
53	47	7	250.0	62.00	0.000	120.0	16.75
54	48	50	200.0	75.00	0.000	120.0	0.000
55	14	57	200.0	22.00	0.000	120.0	10.66
56	50	12	200.0	130.0	0.000	120.0	0.000
57	37	52	100.0	30.00	0.000	120.0	6.096
58	52	28	100.0	45.00	0.000	120.0	18.90
59	6	56	150.0	5.000	0.000	120.0	4.267
60	37	58	150.0	5.000	0.000	120.0	4.267
61	52	60	150.0	5.000	0.000	120.0	4.267
62	49	29	300.0	115.0	0.000	120.0	0.000
63	57	59	200.0	6.000	0.000	120.0	0.000
64	59	61	200.0	7.000	0.000	120.0	0.000
66	62	16	300.0	25.00	0.000	120.0	1.873
67	63	62	300.0	14.00	0.000	120.0	0.000
68	64	63	300.0	15.00	0.000	120.0	0.000
69	65	20	300.0	25.00	0.000	120.0	18.73
70	61	67	100.0	1020.	0.000	120.0	19.51
71	67	68	100.0	15.00	0.000	120.0	9.144
72	73	69	100.0	125.0	0.000	120.0	21.34
73	69	71	100.0	25.00	0.000	120.0	6.096
75	68	73	100.0	50.00	0.000	120.0	18.90
76	68	72	100.0	110.0	0.000	120.0	31.09
77	72	71	100.0	30.00	0.000	120.0	9.754

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	2 x 5	1.873
2	1 x 5	1.873
3	1 x 2	4.267

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)			

4	1 x 2	8.305	1 x 4	21.40	
5	1 x 4	15.23			
6	1 x 5	1.523			
7	1 x 2	6.699	1 x 4	15.23	1 x 5 1.523
8	1 x 4	18.73			
9	1 x 4	15.23	1 x 5	1.523	
10	1 x 4	15.23	1 x 5	1.523	
11	1 x 4	10.66			
12	1 x 2	5.484	1 x 5	1.219	
13	1 x 5	1.219			
14	1 x 4	10.66	1 x 5	1.219	
15	1 x 2	5.484			
16	1 x 4	10.66	1 x 5	1.219	
17	1 x 5	1.873			
18	1 x 2	8.427			
20	1 x 4	18.73			
22	1 x 4	10.66			
23	1 x 5	1.219			
24	1 x 5	1.873			
25	1 x 5	1.873			
26	1 x 4	6.096	1 x 5	0.6096	
27	1 x 2	3.048	3 x 4	6.096	1 x 5 0.6096
30	2 x 2	9.912	1 x 4	25.77	
31	1 x 2	4.267			
32	1 x 2	4.267			
33	1 x 2	4.267			
34	1 x 2	8.427	1 x 4	18.73	2 x 5 1.873
36	1 x 4	18.73			
37	1 x 5	1.873			
38	2 x 2	9.912	1 x 4	25.77	
40	1 x 4	18.73	1 x 5	1.873	
41	1 x 4	18.73			
42	4 x 2	8.305	5 x 4	21.40	
44	1 x 2	5.484	1 x 4	10.66	1 x 5 1.219
45	1 x 4	10.66	1 x 5	1.219	
47	1 x 5	1.523			
50	1 x 4	18.73			
51	1 x 4	15.23			
52	1 x 4	15.23			
53	1 x 4	15.23	1 x 5	1.523	
55	1 x 4	10.66			
57	1 x 4	6.096			
58	2 x 2	3.048	2 x 4	6.096	1 x 5 0.6096

PIPE FITTINGS

Pipe Label	Number x	Type	Equivalent Length (metres)			
59	1 x	2	4.267			
60	1 x	2	4.267			
61	1 x	2	4.267			
66	1 x	5	1.873			
69	1 x	4	18.73			
70	6 x	2	3.048	2 x	5	0.6096
71	1 x	2	3.048	1 x	4	6.096
72	1 x	2	3.048	3 x	4	6.096
73	1 x	4	6.096			
75	2 x	2	3.048	2 x	4	6.096
76	2 x	2	3.048	4 x	4	6.096
77	1 x	2	3.048	1 x	4	6.096

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
- 5 -- Gate Valve
- 6 -- Swing Check Valve
- 7 -- Non-Return Valve
- 8 -- Ball Valve
- 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	58	10	143.2500	379.0000	0.70000E+01	0.10000E+02
2	60	10	143.2500	379.0000	0.70000E+01	0.10000E+02
3	26	10	755.9999	1900.0000	0.70000E+01	0.10000E+02
4	22	10	359.0000	1000.0001	0.70000E+01	0.10000E+02
5	84	10	1175.6998	2757.2000	0.55000E+01	0.10500E+02
6	55	10	755.9999	1900.0000	0.70000E+01	0.10000E+02
7	56	10	359.0000	1000.0001	0.70000E+01	0.10000E+02

Nozzle types are :
10 -- User Defined

PUMP CONFIGURATION

Pump	Input	Output	Pump	Coeffs. of Press Drop (bar)				Min flow
Max flow	ON Sensor							
Label	Node	Node	Descriptor	Cubic	Quadratic	Linear	Constant	
(lit/min)	(lit/min)	Type						

1	34	2	FW-P-001 M	N.A.	-8.362E-08	1.696E-04	12.2	1.667E+03
8.500E+03	YES None							
2	19	3	FW-P-002 D-A	N.A.	-8.362E-08	1.696E-04	12.2	1.667E+03
8.500E+03	YES None							

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	25	15	4148.9429	13	304.7600	300.0000	*
2	25	35	7516.1323	13	304.7600	300.0000	*
3	83	84	3703.4685	13	154.0800	150.0000	*
4	2	25	11665.0742	13	336.5600	350.0000	*
5	35	45	2199.6868	13	254.5100	250.0000	*
6	7	8	1623.9690	13	254.5100	250.0000	*
7	42	5	981.2408	13	254.5100	250.0000	*
8	31	6	398.3131	13	304.7600	300.0000	*
9	10	44	981.2408	13	254.5100	250.0000	*
10	8	10	771.1514	13	254.5100	250.0000	*
11	7	11	575.7181	13	202.7200	200.0000	*
12	11	48	575.7181	13	202.7200	200.0000	*
13	12	10	210.0894	13	202.7200	200.0000	*
14	12	13	365.6286	13	202.7200	200.0000	*
15	13	40	365.6286	13	202.7200	200.0000	*
16	29	14	-237.4245	13	202.7200	200.0000	*
17	6	28	-740.3773	13	304.7600	300.0000	*
18	15	64	4148.9429	13	304.7600	300.0000	*
19	32	31	-5770.9502	13	304.7600	300.0000	*
20	16	18	-14.6428	13	304.7600	300.0000	*
21	9	83	324.5046	13	304.7600	300.0000	*
22	36	38	-128.2042	13	202.7200	200.0000	*
23	49	21	-128.2042	13	202.7200	200.0000	*
24	16	65	4163.5859	13	304.7600	300.0000	*
25	53	5	-1332.2264	13	304.7600	300.0000	*
26	20	27	311.6192	13	102.2600	100.0000	*
27	27	37	311.6192	13	102.2600	100.0000	*
28	20	23	3851.9663	13	304.7600	300.0000	*
29	23	9	1461.1008	13	304.7600	300.0000	*
30	33	19	11665.0752	13	387.3600	400.0000	*
31	9	22	1136.5961	13	154.0800	150.0000	*
32	23	26	2390.8652	13	154.0800	150.0000	*
33	32	55	2391.9851	13	154.0800	150.0000	*
34	18	49	-14.6428	13	304.7600	300.0000	*
35	30	39	365.6286	13	202.7200	200.0000	*
36	4	31	6169.2632	13	304.7600	300.0000	*
37	83	32	-3378.9644	13	304.7600	300.0000	*
38	19	34	5861.1777	13	387.3600	400.0000	*
39	21	17	-128.2042	13	202.7200	200.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
40	35	4	5316.4453	13	304.7600	300.0000	*
41	5	29	-350.9858	13	304.7600	300.0000	*
42	3	2	5803.8970	13	336.5600	350.0000	*
43	17	36	-128.2042	13	202.7200	200.0000	*
44	38	59	-128.2042	13	202.7200	200.0000	*
45	39	14	365.6286	13	202.7200	200.0000	*
46	40	30	365.6286	13	202.7200	200.0000	*
47	8	4	852.8174	13	254.5100	250.0000	*
48	43	42	981.2408	13	254.5100	250.0000	*
49	44	43	981.2408	13	254.5100	250.0000	*
50	28	53	-1332.2264	13	304.7600	300.0000	*
51	45	46	2199.6868	13	254.5100	250.0000	*
52	46	47	2199.6868	13	254.5100	250.0000	*
53	47	7	2199.6868	13	254.5100	250.0000	*
54	48	50	575.7181	13	202.7200	200.0000	*
55	14	57	128.2042	13	202.7200	200.0000	*
56	50	12	575.7181	13	202.7200	200.0000	*
57	37	52	-140.0609	13	102.2600	100.0000	*
58	52	28	-591.8491	13	102.2600	100.0000	*
59	6	56	1138.6903	13	154.0800	150.0000	*
60	37	58	451.6801	13	154.0800	150.0000	*
61	52	60	451.7882	13	154.0800	150.0000	*
62	49	29	113.5613	13	304.7600	300.0000	*
63	57	59	128.2042	13	202.7200	200.0000	*
64	59	61	0.0000	13	202.7200	200.0000	*
66	62	16	4148.9429	13	304.7600	300.0000	*
67	63	62	4148.9429	13	304.7600	300.0000	*
68	64	63	4148.9429	13	304.7600	300.0000	*
69	65	20	4163.5859	13	304.7600	300.0000	*
70	61	67	0.0000	13	102.2600	100.0000	*
71	67	68	0.0000	13	102.2600	100.0000	*
72	73	69	0.0000	13	102.2600	100.0000	*
73	69	71	0.0000	13	102.2600	100.0000	*
75	68	73	0.0000	13	102.2600	100.0000	*
76	68	72	0.0000	13	102.2600	100.0000	*
77	72	71	0.0000	13	102.2600	100.0000	*

A * indicates that this is a SET diameter

DESIGNED DIAMETERS & FLOWRATES

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
13 -- API5L GR.B PSL2, ERW	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	25	15	300.00	10.19	10.12	6.9265E-02	6.9265E-02	4149.
0.9479								
2	25	35	300.00	10.19	10.16	2.7440E-02	2.7440E-02	7516.
1.717								
3	83	84	150.00	10.03	9.923	0.1089	0.1089	3703.
3.310								
4	2	25	350.00	10.25	10.19	5.6370E-02	5.6370E-02	1.1665E+04
2.185								
5	35	45	250.00	10.16	10.16	8.1501E-03	8.1501E-03	2200.
0.7206								
6	7	8	250.00	10.11	10.09	1.9262E-02	1.9262E-02	1624.
0.5320								
7	42	5	250.00	10.08	10.07	2.3546E-03	2.3546E-03	981.2
0.3215								
8	31	6	300.00	10.07	10.07	1.7929E-04	1.7929E-04	398.3
9.1005E-02								
9	10	44	250.00	10.08	10.08	6.0682E-03	6.0682E-03	981.2
0.3215								
10	8	10	250.00	10.09	10.08	5.3396E-03	5.3396E-03	771.1
0.2526								
11	7	11	200.00	10.11	10.10	6.4573E-03	6.4573E-03	575.7
0.2973								
12	11	48	200.00	10.10	10.10	4.0874E-03	4.0874E-03	575.7
0.2973								
13	12	10	200.00	10.09	10.08	9.0408E-04	9.0408E-04	210.1
0.1085								
14	12	13	200.00	10.09	10.08	3.0966E-03	3.0966E-03	365.6
0.1888								
15	13	40	200.00	10.08	10.08	1.3151E-03	1.3151E-03	365.6
0.1888								
16	29	14	200.00	10.07	10.07	-1.3027E-03	1.3027E-03	-237.4
-0.1226								
17	6	28	300.00	10.07	10.07	-5.1689E-04	5.1689E-04	-740.4
-0.1692								
18	15	64	300.00	10.12	10.09	3.0743E-02	3.0743E-02	4149.
0.9479								
19	32	31	300.00	10.04	10.07	-2.6302E-02	2.6302E-02	-5771.
-1.319								
20	16	18	300.00	10.07	10.07	0.000	0.000	-14.64
-3.3455E-03								
21	9	83	300.00	10.03	10.03	3.2425E-05	3.2425E-05	324.5
7.4142E-02								
22	36	38	200.00	10.07	10.07	-1.0204E-04	1.0204E-04	-128.2
-6.6201E-02								
23	49	21	200.00	10.07	10.07	-2.1935E-04	2.1935E-04	-128.2
-6.6201E-02								
24	16	65	300.00	10.07	10.06	1.1935E-02	1.1935E-02	4164.
0.9513								
25	53	5	300.00	10.07	10.07	-1.9503E-03	1.9503E-03	-1332.
-0.3044								
26	20	27	100.00	10.05	10.01	3.5558E-02	3.5558E-02	311.6
0.6324								
27	27	37	100.00	10.01	9.943	6.7388E-02	6.7388E-02	311.6

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
42	3	2	350.00	10.30	10.25	5.5892E-02	5.5892E-02	5804.
1.087								
43	17	36	200.00	10.07	10.07	-2.7561E-04	2.7561E-04	-128.2
-6.6201E-02								
44	38	59	200.00	10.07	10.07	-4.8256E-04	4.8256E-04	-128.2
-6.6201E-02								
45	39	14	200.00	10.08	10.07	3.4304E-03	3.4304E-03	365.6
0.1888								
46	40	30	200.00	10.08	10.08	6.9332E-04	6.9332E-04	365.6
0.1888								
47	8	4	250.00	10.09	10.08	6.8550E-03	6.8550E-03	852.8
0.2794								
48	43	42	250.00	10.08	10.08	6.8283E-04	6.8283E-04	981.2
0.3215								
49	44	43	250.00	10.08	10.08	1.9894E-03	1.9894E-03	981.2
0.3215								
50	28	53	300.00	10.07	10.07	-2.1105E-03	2.1105E-03	-1332.
-0.3044								
51	45	46	250.00	10.16	10.15	5.1155E-03	5.1155E-03	2200.
0.7206								
52	46	47	250.00	10.15	10.13	2.2818E-02	2.2818E-02	2200.
0.7206								
53	47	7	250.00	10.13	10.11	1.9915E-02	1.9915E-02	2200.
0.7206								
54	48	50	200.00	10.10	10.09	4.8122E-03	4.8122E-03	575.7
0.2973								
55	14	57	200.00	10.07	10.07	1.2970E-04	1.2970E-04	128.2
6.6201E-02								
56	50	12	200.00	10.09	10.09	8.3408E-03	8.3408E-03	575.7
0.2973								
57	37	52	100.00	9.943	9.948	-4.7579E-03	4.7579E-03	-140.1
-0.2842								
58	52	28	100.00	9.948	10.07	-0.1209	0.1209	-591.8
-1.201								
59	6	56	150.00	10.07	10.06	7.9851E-03	7.9851E-03	1139.
1.018								
60	37	58	150.00	9.943	9.942	1.4420E-03	1.4420E-03	451.7
0.4037								
61	52	60	150.00	9.948	9.947	1.4429E-03	1.4429E-03	451.8
0.4038								
62	49	29	300.00	10.07	10.07	5.0545E-05	5.0545E-05	113.6
2.5946E-02								
63	57	59	200.00	10.07	10.07	2.2888E-05	2.2888E-05	128.2
6.6201E-02								
64	59	61	200.00	10.07	10.07	0.000	0.000	0.000
0.000								
66	62	16	300.00	10.08	10.07	9.1352E-03	9.1352E-03	4149.
0.9479								
67	63	62	300.00	10.09	10.08	4.7598E-03	4.7598E-03	4149.
0.9479								
68	64	63	300.00	10.09	10.09	5.0974E-03	5.0974E-03	4149.
0.9479								
69	65	20	300.00	10.06	10.05	1.4962E-02	1.4962E-02	4164.

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	58	0.99419E+01	379.0000	451.6792	19.18	
2	60	0.99467E+01	379.0000	451.7872	19.21	
3	26	0.10001E+02	1900.0000	2390.8601	25.83	
4	22	0.10024E+02	1000.0001	1136.5936	13.66	
5	84	0.99225E+01	2757.2000	3703.4604	34.32	
6	55	0.10011E+02	1900.0000	2391.9800	25.89	
7	56	0.10061E+02	1000.0001	1138.6879	13.87	

Note: A * after a value indicates that this is a specification

FLOW THROUGH PUMPS

Pump Setting (%)	Flowrate (lit/min)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Press Drop (bar)	NPSHA (metres)	Cavitation Parameter	Power Req. (Watts)
1	5861.	-5.3835E-02	10.25	10.30	9.617	9.1409E-02	1.0064E+05
100							
2	5804.	-4.4100E-02	10.30	10.35	9.716	9.1942E-02	1.0010E+05
100							

Note: The calculation of NPSHA and cavitation parameter is based on the vapour pressure of water at 60 F (15.6 C) --> -0.9956 bar G

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
33	0.000	* 1.1665E+04	0.0000

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : MAJOR FIRE_NETWORK
OF 20

DATE : 28-Jul-2014

PAGE 19

COMMENTS

Analysis Converged in 5 Iterations


WARNINGS

*** WARNING - Nozzle 3 above maximum operating pressure
*** WARNING - Nozzle 4 above maximum operating pressure
*** WARNING - Nozzle 6 above maximum operating pressure
*** WARNING - Nozzle 7 above maximum operating pressure

=====


MAJOR FIRE_NETWORK
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 La fuerza que transforma Bolivia PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

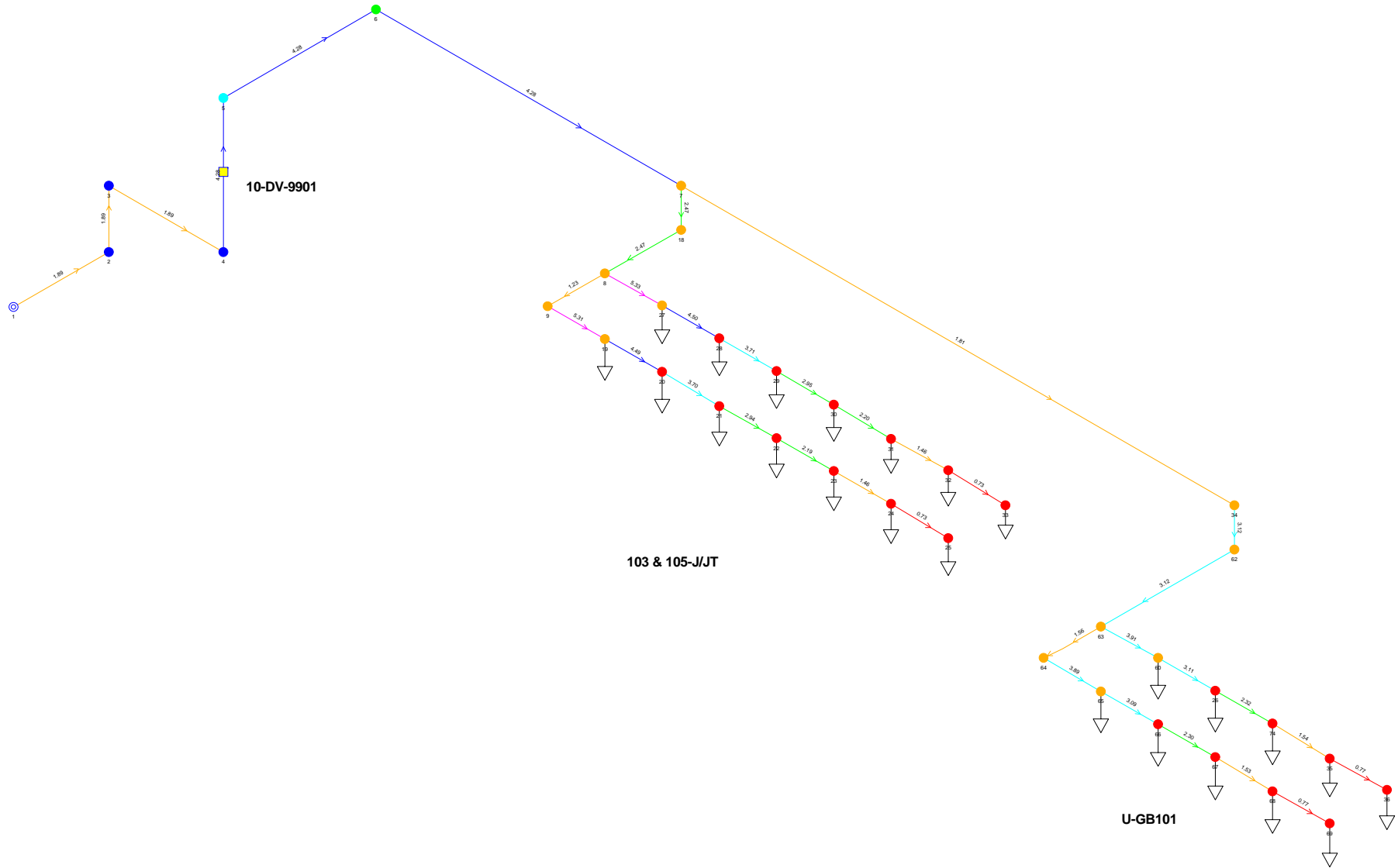
ANEXO #4

ANÁLISIS DEL CÁLCULO HIDRÁULICO PARA EL SISTEMA DE ROCIADO DE AGUA

 <p>YPFB Corporación <small>La fuerza que transforma Bolivia</small> PLANTAS DE AMONÍACO Y UREA, CARRASCO</p>	<p>INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS</p>	
	<p>N° del DOC. PAU-EFF-C-CAL-00001</p>	<p>Rev. 1</p>

ANEXO #4.1

CÁLCULO HIDRÁULICO DE DV NO. 10-DV-9901



AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (10-DV-9901)		
Kunkook Fire Protection Co., Ltd		
PIPENET Schematic	Thursday, March 27, 2014	Page 1 of 1
<div> <div>Pipe velocity</div> <div>(m/sec)</div> </div> <div> <div>< 1.000000</div> <div>< 2.000000</div> <div>< 3.000000</div> <div>< 4.000000</div> <div>< 5.000000</div> <div>> 5.000000</div> </div>		

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (10-DV-9901)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

09:06 on 27-Mar-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	7
Special Equipment.....	8
Designed Diameters & Flowrates.....	9
Flow in Pipes.....	11
Flow through Nozzles.....	12
Flow at Inlets.....	13
Important Notice.....	14
Comments.....	15
Warnings.....	16

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
9	-- A106 GR.B, SMLS Sch8	Not Lined	
12	-- A106 GR.B, SMLS Sch4	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS Sch8 Not lined			A106 GR.B, SMLS Sch4 Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	13.9000	6.0000	15.0000	13.9000	6.0000		
20.0000	18.8000	6.0000	20.0000	18.8000	6.0000		
25.0000	24.3000	6.0000	25.0000	24.3000	6.0000		
40.0000	38.1000	6.0000	40.0000	38.1000	6.0000		
50.0000	49.3000	6.0000	50.0000	49.3000	6.0000		
80.0000	77.9000	6.0000	80.0000	77.9000	6.0000		
100.0000	102.3000	6.0000	100.0000	102.3000	6.0000		
150.0000	154.1000	4.5000	150.0000	154.1000	4.5000		
200.0000	202.7000	4.5000	200.0000	202.7000	4.5000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	150.0	3.000	0.000	120.0	8.540
2	2	3	150.0	2.000	2.000	120.0	4.270
3	3	4	150.0	8.000	0.000	120.0	10.98
4	4	5	100.0	4.000	4.000	120.0	0.6108
5	5	6	100.0	15.00	0.000	120.0	6.108
6	6	7	100.0	12.00	0.000	120.0	12.22
7	18	8	100.0	4.000	0.000	120.0	6.108
8	8	9	100.0	3.000	0.000	120.0	6.108
17	24	25	50.00	2.000	0.000	120.0	2.248
18	9	19	50.00	2.000	0.000	120.0	2.248
19	19	20	50.00	2.000	0.000	120.0	2.248
20	20	21	50.00	2.000	0.000	120.0	2.248
21	21	22	50.00	2.000	0.000	120.0	2.248
22	22	23	50.00	2.000	0.000	120.0	2.248
23	23	24	50.00	2.000	0.000	120.0	2.248
24	32	33	50.00	2.000	0.000	120.0	2.248
25	8	27	50.00	2.000	0.000	120.0	2.248
26	27	28	50.00	2.000	0.000	120.0	2.248
27	28	29	50.00	2.000	0.000	120.0	2.248
28	29	30	50.00	2.000	0.000	120.0	2.248
29	30	31	50.00	2.000	0.000	120.0	2.248
30	31	32	50.00	2.000	0.000	120.0	2.248
31	7	18	100.0	2.000	-2.000	120.0	3.054
33	7	34	100.0	21.00	0.000	120.0	6.108
35	63	60	50.00	2.000	0.000	120.0	2.248
36	60	26	50.00	2.000	0.000	120.0	2.248
37	26	74	50.00	2.000	0.000	120.0	2.248
38	74	35	50.00	2.000	0.000	120.0	2.248
39	35	36	50.00	2.000	0.000	120.0	2.248
48	34	62	80.00	2.000	-2.000	120.0	2.131
50	62	63	80.00	8.000	0.000	120.0	4.566
51	63	64	80.00	3.000	0.000	120.0	4.566
52	64	65	50.00	2.000	0.000	120.0	2.248
53	65	66	50.00	2.000	0.000	120.0	2.248
54	66	67	50.00	2.000	0.000	120.0	2.248
55	67	68	50.00	2.000	0.000	120.0	2.248
56	68	69	50.00	2.000	0.000	120.0	2.248

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)

1	2 x 2	4.270
2	1 x 2	4.270
3	1 x 4	9.150
4	1 x 5	0.6108
5	2 x 2	3.054
6	2 x 2	3.054
7	1 x 4	6.108
8	1 x 4	6.108
17	1 x 4	2.248
18	1 x 4	2.248
19	1 x 4	2.248
20	1 x 4	2.248
21	1 x 4	2.248
22	1 x 4	2.248
23	1 x 4	2.248
24	1 x 4	2.248
25	1 x 4	2.248
26	1 x 4	2.248
27	1 x 4	2.248
28	1 x 4	2.248
29	1 x 4	2.248
30	1 x 4	2.248
31	1 x 2	3.054
33	1 x 4	6.108
35	1 x 4	2.248
36	1 x 4	2.248
37	1 x 4	2.248
38	1 x 4	2.248
39	1 x 4	2.248
48	1 x 2	2.131
50	1 x 4	4.566
51	1 x 4	4.566
52	1 x 4	2.248
53	1 x 4	2.248
54	1 x 4	2.248
55	1 x 4	2.248
56	1 x 4	2.248

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)

-
- 5 -- Gate Valve
 - 6 -- Swing Check Valve
 - 7 -- Non-Return Valve
 - 8 -- Ball Valve
 - 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
8	19	11	59.0000	83.4000	0.20000E+01	0.14400E+02
9	20	11	59.0000	83.4000	0.20000E+01	0.14400E+02
10	21	11	59.0000	83.4000	0.20000E+01	0.14400E+02
11	22	11	59.0000	83.4000	0.20000E+01	0.14400E+02
12	23	11	59.0000	83.4000	0.20000E+01	0.14400E+02
13	24	11	59.0000	83.4000	0.20000E+01	0.14400E+02
14	25	11	59.0000	83.4000	0.20000E+01	0.14400E+02
15	27	11	59.0000	83.4000	0.20000E+01	0.14400E+02
16	28	11	59.0000	83.4000	0.20000E+01	0.14400E+02
17	29	11	59.0000	83.4000	0.20000E+01	0.14400E+02
18	30	11	59.0000	83.4000	0.20000E+01	0.14400E+02
19	31	11	59.0000	83.4000	0.20000E+01	0.14400E+02
20	32	11	59.0000	83.4000	0.20000E+01	0.14400E+02
21	33	11	59.0000	83.4000	0.20000E+01	0.14400E+02
22	69	11	59.0000	83.4000	0.20000E+01	0.14400E+02
23	66	11	59.0000	83.4000	0.20000E+01	0.14400E+02
24	26	11	59.0000	83.4000	0.20000E+01	0.14400E+02
25	74	11	59.0000	83.4000	0.20000E+01	0.14400E+02
26	60	11	59.0000	83.4000	0.20000E+01	0.14400E+02
27	67	11	59.0000	83.4000	0.20000E+01	0.14400E+02
28	65	11	59.0000	83.4000	0.20000E+01	0.14400E+02
29	68	11	59.0000	83.4000	0.20000E+01	0.14400E+02
30	35	11	59.0000	83.4000	0.20000E+01	0.14400E+02
31	36	11	59.0000	83.4000	0.20000E+01	0.14400E+02

Nozzle types are :
11 -- K-factor 59.0

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	2111.6309	9	154.1000	150.0000	*
2	2	3	2111.6309	9	154.1000	150.0000	*
3	3	4	2111.6309	9	154.1000	150.0000	*
4	4	5	2111.6309	9	102.3000	100.0000	*
5	5	6	2111.6309	9	102.3000	100.0000	*
6	6	7	2111.6309	9	102.3000	100.0000	*
7	18	8	1218.4014	9	102.3000	100.0000	*
8	8	9	608.2206	9	102.3000	100.0000	*
17	24	25	83.4002	12	49.3000	50.0000	*
18	9	19	608.2206	12	49.3000	50.0000	*
19	19	20	513.8998	12	49.3000	50.0000	*
20	20	21	423.6526	12	49.3000	50.0000	*
21	21	22	336.3680	12	49.3000	50.0000	*
22	22	23	251.0724	12	49.3000	50.0000	*
23	23	24	166.9562	12	49.3000	50.0000	*
24	32	33	83.6706	12	49.3000	50.0000	*
25	8	27	610.1807	12	49.3000	50.0000	*
26	27	28	515.5593	12	49.3000	50.0000	*
27	28	29	425.0228	12	49.3000	50.0000	*
28	29	30	337.4572	12	49.3000	50.0000	*
29	30	31	251.8859	12	49.3000	50.0000	*
30	31	32	167.4974	12	49.3000	50.0000	*
31	7	18	1218.4014	9	102.3000	100.0000	*
33	7	34	893.2296	9	102.3000	100.0000	*
35	63	60	447.9931	12	49.3000	50.0000	*
36	60	26	355.7157	12	49.3000	50.0000	*
37	26	74	265.5244	12	49.3000	50.0000	*
38	74	35	176.5702	12	49.3000	50.0000	*
39	35	36	88.2034	12	49.3000	50.0000	*
48	34	62	893.2295	9	77.9000	80.0000	*
50	62	63	893.2295	9	77.9000	80.0000	*
51	63	64	445.2365	9	77.9000	80.0000	*
52	64	65	445.2365	12	49.3000	50.0000	*
53	65	66	353.5245	12	49.3000	50.0000	*
54	66	67	263.8877	12	49.3000	50.0000	*
55	67	68	175.4813	12	49.3000	50.0000	*
56	68	69	87.6594	12	49.3000	50.0000	*

A * indicates that this is a SET diameter

DESIGNED DIAMETERS & FLOWRATES

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
9	-- A106 GR.B, SMLS Sch8	Not Lined	
12	-- A106 GR.B, SMLS Sch4	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	150.00	4.559	4.528	3.1145E-02	3.1145E-02	2112.
1.887								
2	2	3	150.00	4.528	4.315	0.2127	1.6923E-02	2112.
1.887								
3	3	4	150.00	4.315	4.264	5.1230E-02	5.1230E-02	2112.
1.887								
4	4	5	100.00	4.264	3.681	0.5823	0.1907	2112.
4.282	E							
5	5	6	100.00	3.681	3.262	0.4189	0.4189	2112.
4.282								
6	6	7	100.00	3.262	2.782	0.4806	0.4806	2112.
4.282								
7	18	8	100.00	2.941	2.869	7.2535E-02	7.2535E-02	1218.
2.471								
8	8	9	100.00	2.869	2.851	1.8075E-02	1.8075E-02	608.2
1.233								
17	24	25	50.00	2.006	1.998	7.4700E-03	7.4700E-03	83.40
0.7282								
18	9	19	50.00	2.851	2.556	0.2950	0.2950	608.2
5.310								
19	19	20	50.00	2.556	2.340	0.2160	0.2160	513.9
4.487								
20	20	21	50.00	2.340	2.189	0.1511	0.1511	423.7
3.699								
21	21	22	50.00	2.189	2.090	9.8605E-02	9.8605E-02	336.4
2.937								
22	22	23	50.00	2.090	2.033	5.7400E-02	5.7400E-02	251.1
2.192								
23	23	24	50.00	2.033	2.006	2.6985E-02	2.6985E-02	167.0
1.458								
24	32	33	50.00	2.019	2.011	7.5200E-03	7.5200E-03	83.67
0.7305								
25	8	27	50.00	2.869	2.572	0.2968	0.2968	610.2
5.327								
26	27	28	50.00	2.572	2.355	0.2173	0.2173	515.6
4.501								
27	28	29	50.00	2.355	2.203	0.1520	0.1520	425.0
3.711								
28	29	30	50.00	2.203	2.104	9.9195E-02	9.9195E-02	337.5
2.946								
29	30	31	50.00	2.104	2.046	5.7745E-02	5.7745E-02	251.9
2.199								
30	31	32	50.00	2.046	2.019	2.7145E-02	2.7145E-02	167.5
1.462								
31	7	18	100.00	2.782	2.941	-0.1595	3.6267E-02	1218.
2.471								
33	7	34	100.00	2.782	2.672	0.1095	0.1095	893.2
1.811								
35	63	60	50.00	2.614	2.446	0.1675	0.1675	448.0
3.911								
36	60	26	50.00	2.446	2.337	0.1093	0.1093	355.7
3.106								
37	26	74	50.00	2.337	2.273	6.3665E-02	6.3665E-02	265.5

2.318								
38	74	35	50.00	2.273	2.243	2.9925E-02	2.9925E-02	176.6
1.542								
39	35	36	50.00	2.243	2.235	8.2901E-03	8.2901E-03	88.20
0.7701								
48	34	62	80.00	2.672	2.805	-0.1329	6.2922E-02	893.2
3.124								
50	62	63	80.00	2.805	2.614	0.1914	0.1914	893.2
3.124								
51	63	64	80.00	2.614	2.582	3.1785E-02	3.1785E-02	445.2
1.557								
52	64	65	50.00	2.582	2.416	0.1656	0.1656	445.2
3.887								
53	65	66	50.00	2.416	2.308	0.1081	0.1081	353.5
3.087								
54	66	67	50.00	2.308	2.245	6.2935E-02	6.2935E-02	263.9
2.304								
55	67	68	50.00	2.245	2.216	2.9585E-02	2.9585E-02	175.5
1.532								
56	68	69	50.00	2.216	2.207	8.1952E-03	8.1952E-03	87.66
0.7654								

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
8	19	0.25557E+01	83.4000	94.3205	13.09	
9	20	0.23397E+01	83.4000	90.2471	8.21	
10	21	0.21886E+01	83.4000	87.2844	4.66	
11	22	0.20900E+01	83.4000	85.2955	2.27	
12	23	0.20326E+01	83.4000	84.1160	0.86	
13	24	0.20056E+01	83.4000	83.5558	0.19	
14	25	0.19981E+01	83.4000	83.4000 *	0.00	
15	27	0.25720E+01	83.4000	94.6211	13.45	
16	28	0.23547E+01	83.4000	90.5364	8.56	
17	29	0.22027E+01	83.4000	87.5654	4.99	
18	30	0.21035E+01	83.4000	85.5711	2.60	
19	31	0.20458E+01	83.4000	84.3883	1.19	
20	32	0.20186E+01	83.4000	83.8266	0.51	
21	33	0.20111E+01	83.4000	83.6704	0.32	
22	69	0.22074E+01	83.4000	87.6592	5.11	
23	66	0.23082E+01	83.4000	89.6366	7.48	
24	26	0.23368E+01	83.4000	90.1911	8.14	
25	74	0.22731E+01	83.4000	88.9541	6.66	
26	60	0.24462E+01	83.4000	92.2772	10.64	
27	67	0.22452E+01	83.4000	88.4061	6.00	
28	65	0.24163E+01	83.4000	91.7118	9.97	
29	68	0.22156E+01	83.4000	87.8217	5.30	
30	35	0.22432E+01	83.4000	88.3666	5.96	
31	36	0.22349E+01	83.4000	88.2032	5.76	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	4.559	2112.	989.00

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
15 OF 16

DATE : 27-Mar-2014

PAGE

COMMENTS

Analysis Converged in 3 Iterations


WARNINGS

*** WARNING - Nozzle 14 below minimum operating pressure

=====

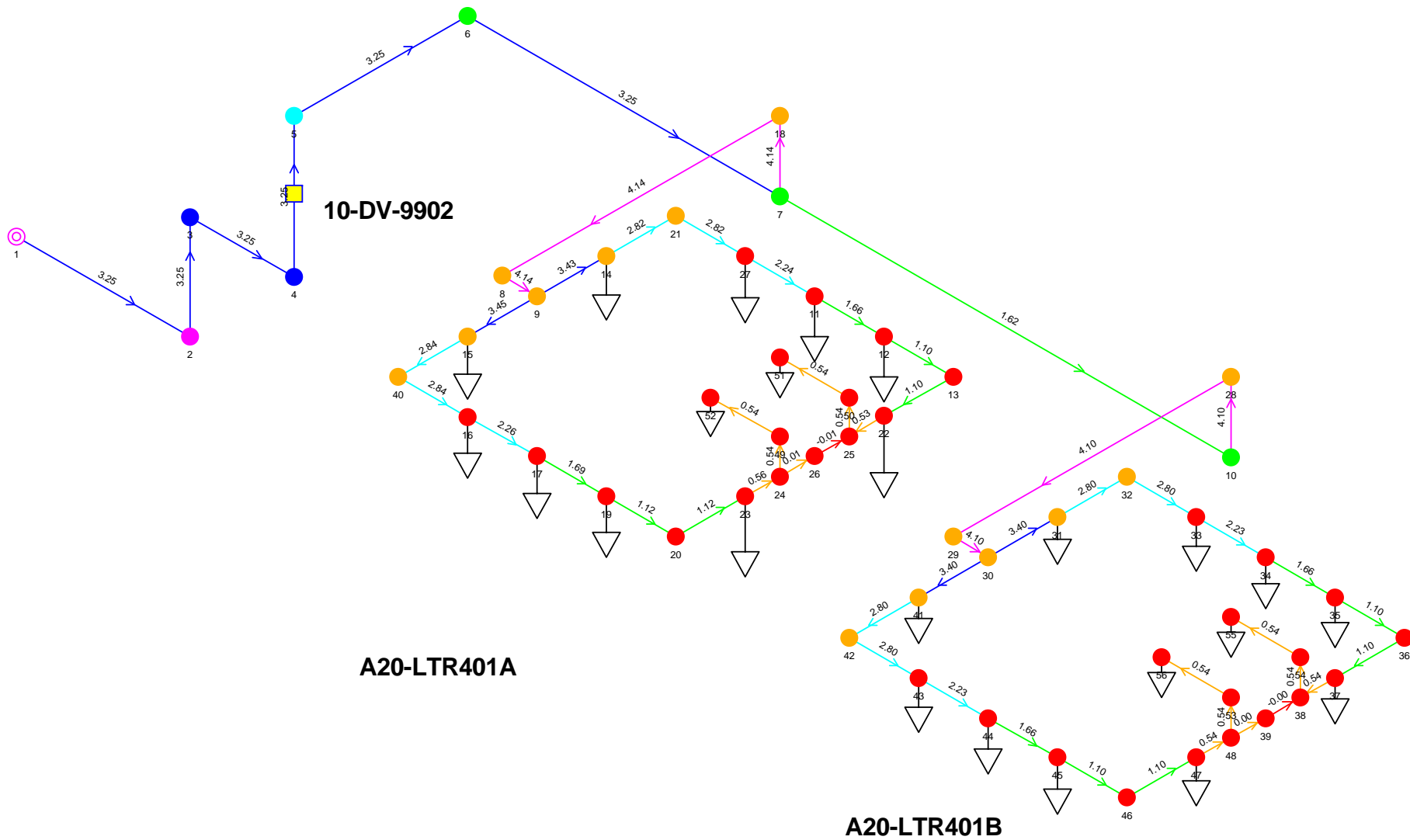
AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 La fuerza que transforma Bolivia PLANTAS DE AMONÍACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #4.2

CÁLCULO HIDRÁULICO DE DV NO. 10-DV-9902



AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (10-DV-9902)		
Kunkook Fire Protection Co., Ltd		
PIPENET Schematic	Thursday, March 13, 2014	Page 1 of 1
<div> <div>Pipe velocity</div> <div>(m/sec)</div> </div> <div> <div>< 0.000000</div> <div>< 1.000000</div> <div>< 2.000000</div> </div> <div> <div>< 3.000000</div> <div>< 4.000000</div> <div>> 4.000000</div> </div>		

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (10-DV-9902)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

16:09 on 13-Mar-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	8
Special Equipment.....	9
Designed Diameters & Flowrates.....	10
Flow in Pipes.....	12
Flow through Nozzles.....	14
Flow at Inlets.....	15
Important Notice.....	16
Comments.....	17
Warnings.....	18

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
10	-- A106 GR.B, SMLS, SCH	Not Lined	
9	-- A106 GR.B, SMLS, SCH	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS, SCH Not lined			A106 GR.B, SMLS, SCH Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	14.0000	6.0000	15.0000	14.0000	6.0000		
20.0000	19.0000	6.0000	20.0000	19.0000	6.0000		
25.0000	24.0000	6.0000	25.0000	24.0000	6.0000		
40.0000	38.0000	6.0000	40.0000	38.0000	6.0000		
50.0000	49.0000	6.0000	50.0000	49.0000	6.0000		
80.0000	78.0000	6.0000	80.0000	78.0000	6.0000		
100.0000	102.0000	6.0000	100.0000	102.0000	6.0000		
150.0000	154.0000	6.0000	150.0000	154.0000	6.0000		
200.0000	203.0000	6.0000	200.0000	203.0000	6.0000		
250.0000	255.0000	6.0000	250.0000	255.0000	6.0000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	80.00	3.000	0.000	120.0	2.144
2	2	3	80.00	2.000	2.000	120.0	2.144
3	3	4	80.00	5.000	0.000	120.0	4.901
4	4	5	80.00	4.000	2.000	120.0	0.9190
5	5	6	80.00	30.00	0.000	120.0	6.433
6	6	7	80.00	5.000	0.000	120.0	4.595
7	18	8	50.00	2.000	0.000	120.0	1.091
8	7	10	80.00	8.000	0.000	120.0	4.595
9	27	11	40.00	2.000	0.000	120.0	1.696
10	11	12	40.00	2.000	0.000	120.0	1.696
11	12	13	40.00	2.000	0.000	120.0	0.8481
12	40	16	40.00	2.000	0.000	120.0	1.696
13	16	17	40.00	2.000	0.000	120.0	1.696
14	17	19	40.00	2.000	0.000	120.0	1.696
15	19	20	40.00	2.000	0.000	120.0	0.8481
16	13	22	40.00	2.000	0.000	120.0	1.696
17	22	25	40.00	1.000	0.000	120.0	1.696
18	9	14	40.00	2.000	0.000	120.0	1.696
19	14	21	40.00	2.000	0.000	120.0	0.8481
20	9	15	40.00	2.000	0.000	120.0	1.696
21	15	40	40.00	2.000	0.000	120.0	0.8481
22	20	23	40.00	2.000	0.000	120.0	0.000
23	24	26	40.00	1.000	0.000	120.0	1.696
24	23	24	40.00	1.000	0.000	120.0	1.696
25	25	26	40.00	1.000	0.000	120.0	0.000
26	7	18	50.00	2.000	2.000	120.0	1.091
27	10	28	50.00	2.000	2.000	120.0	1.091
28	28	29	50.00	2.000	0.000	120.0	1.091
29	29	30	50.00	1.000	0.000	120.0	2.182
30	30	31	40.00	2.000	0.000	120.0	1.696
31	31	32	40.00	2.000	0.000	120.0	0.8481
32	32	33	40.00	2.000	0.000	120.0	1.696
33	33	34	40.00	2.000	0.000	120.0	1.696
34	34	35	40.00	2.000	0.000	120.0	1.696
35	35	36	40.00	2.000	0.000	120.0	0.8481
36	21	27	40.00	2.000	0.000	120.0	1.696
37	36	37	40.00	2.000	0.000	120.0	1.696
38	37	38	40.00	1.000	0.000	120.0	1.696
39	8	9	50.00	1.000	0.000	120.0	2.182
40	38	39	40.00	1.000	0.000	120.0	0.000
41	30	41	40.00	2.000	0.000	120.0	1.696
42	41	42	40.00	2.000	0.000	120.0	0.8481
43	42	43	40.00	2.000	0.000	120.0	1.696

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
44	43	44	40.00	2.000	0.000	120.0	1.696
45	44	45	40.00	2.000	0.000	120.0	1.696
46	45	46	40.00	2.000	0.000	120.0	0.8481
47	46	47	40.00	2.000	0.000	120.0	1.696
48	47	48	40.00	1.000	0.000	120.0	1.696
49	48	39	40.00	1.000	0.000	120.0	0.000
50	24	49	40.00	1.500	1.500	120.0	0.8481
51	25	50	40.00	1.500	1.500	120.0	0.8481
52	50	51	40.00	1.500	0.000	120.0	0.8481
53	49	52	40.00	1.500	0.000	120.0	0.8481
54	48	53	40.00	1.500	1.500	120.0	0.8481
55	38	54	40.00	1.500	1.500	120.0	0.8481
56	54	55	40.00	1.500	0.000	120.0	0.8481
57	53	56	40.00	1.500	0.000	120.0	0.8481

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	1 x 2	2.144
2	1 x 2	2.144
3	1 x 4	4.595
4	3 x 5	0.3063
5	3 x 2	2.144
6	1 x 4	4.595
7	1 x 2	1.091
8	1 x 4	4.595
9	1 x 4	1.696
10	1 x 4	1.696
11	1 x 2	0.8481
12	1 x 4	1.696
13	1 x 4	1.696
14	1 x 4	1.696
15	1 x 2	0.8481
16	1 x 4	1.696
17	1 x 4	1.696
18	1 x 4	1.696
19	1 x 2	0.8481
20	1 x 4	1.696
21	1 x 2	0.8481

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

23	1 x 4	1.696
24	1 x 4	1.696
26	1 x 2	1.091
27	1 x 2	1.091
28	1 x 2	1.091
29	1 x 4	2.182
30	1 x 4	1.696
31	1 x 2	0.8481
32	1 x 4	1.696
33	1 x 4	1.696
34	1 x 4	1.696
35	1 x 2	0.8481
36	1 x 4	1.696
37	1 x 4	1.696
38	1 x 4	1.696
39	1 x 4	2.182
41	1 x 4	1.696
42	1 x 2	0.8481
43	1 x 4	1.696
44	1 x 4	1.696
45	1 x 4	1.696
46	1 x 2	0.8481
47	1 x 4	1.696
48	1 x 4	1.696
50	1 x 2	0.8481
51	1 x 2	0.8481
52	1 x 2	0.8481
53	1 x 2	0.8481
54	1 x 2	0.8481
55	1 x 2	0.8481
56	1 x 2	0.8481
57	1 x 2	0.8481

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
- 5 -- Gate Valve
- 6 -- Swing Check Valve
- 7 -- Non-Return Valve
- 8 -- Ball Valve
- 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	11	8	25.9000	36.6000	0.10000E+01	0.14400E+02
2	12	8	25.9000	36.6000	0.10000E+01	0.14400E+02
3	14	8	25.9000	36.6000	0.10000E+01	0.14400E+02
4	15	8	25.9000	36.6000	0.10000E+01	0.14400E+02
5	16	8	25.9000	36.6000	0.10000E+01	0.14400E+02
6	17	8	25.9000	36.6000	0.10000E+01	0.14400E+02
7	19	8	25.9000	36.6000	0.10000E+01	0.14400E+02
8	22	8	25.9000	36.6000	0.10000E+01	0.14400E+02
9	23	8	25.9000	36.6000	0.10000E+01	0.14400E+02
10	55	1	25.9000	36.6000	0.20000E+01	0.14400E+02
11	56	1	25.9000	36.6000	0.20000E+01	0.14400E+02
12	31	8	25.9000	36.6000	0.10000E+01	0.14400E+02
13	44	8	25.9000	36.6000	0.10000E+01	0.14400E+02
14	45	8	25.9000	36.6000	0.10000E+01	0.14400E+02
15	27	8	25.9000	36.6000	0.10000E+01	0.14400E+02
16	43	8	25.9000	36.6000	0.10000E+01	0.14400E+02
17	33	8	25.9000	36.6000	0.10000E+01	0.14400E+02
18	34	8	25.9000	36.6000	0.10000E+01	0.14400E+02
19	35	8	25.9000	36.6000	0.10000E+01	0.14400E+02
20	52	1	25.9000	36.6000	0.20000E+01	0.14400E+02
21	47	8	25.9000	36.6000	0.10000E+01	0.14400E+02
22	51	1	25.9000	36.6000	0.20000E+01	0.14400E+02
23	37	8	25.9000	36.6000	0.10000E+01	0.14400E+02
24	41	8	25.9000	36.6000	0.10000E+01	0.14400E+02

Nozzle types are :
1 -- K-factor 25.9
8 -- User Defined

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	931.1968	10	78.0000	80.0000	*
2	2	3	931.1968	10	78.0000	80.0000	*
3	3	4	931.1968	10	78.0000	80.0000	*
4	4	5	931.1968	10	78.0000	80.0000	*
5	5	6	931.1968	10	78.0000	80.0000	*
6	6	7	931.1968	10	78.0000	80.0000	*
7	18	8	467.8610	9	49.0000	50.0000	*
8	7	10	463.3358	10	78.0000	80.0000	*
9	27	11	152.2899	9	38.0000	40.0000	*
10	11	12	113.2470	9	38.0000	40.0000	*
11	12	13	74.5553	9	38.0000	40.0000	*
12	40	16	193.4868	9	38.0000	40.0000	*
13	16	17	153.8843	9	38.0000	40.0000	*
14	17	19	114.8942	9	38.0000	40.0000	*
15	19	20	76.2652	9	38.0000	40.0000	*
16	13	22	74.5553	9	38.0000	40.0000	*
17	22	25	36.1527	9	38.0000	40.0000	*
18	9	14	233.1612	9	38.0000	40.0000	*
19	14	21	191.9327	9	38.0000	40.0000	*
20	9	15	234.6999	9	38.0000	40.0000	*
21	15	40	193.4868	9	38.0000	40.0000	*
22	20	23	76.2652	9	38.0000	40.0000	*
23	24	26	0.8535	9	38.0000	40.0000	*
24	23	24	37.8599	9	38.0000	40.0000	*
25	25	26	-0.8535	9	38.0000	40.0000	*
26	7	18	467.8610	9	49.0000	50.0000	*
27	10	28	463.3358	9	49.0000	50.0000	*
28	28	29	463.3358	9	49.0000	50.0000	*
29	29	30	463.3358	9	49.0000	50.0000	*
30	30	31	231.6679	9	38.0000	40.0000	*
31	31	32	190.8272	9	38.0000	40.0000	*
32	32	33	190.8272	9	38.0000	40.0000	*
33	33	34	151.5704	9	38.0000	40.0000	*
34	34	35	112.9143	9	38.0000	40.0000	*
35	35	36	74.6109	9	38.0000	40.0000	*
36	21	27	191.9327	9	38.0000	40.0000	*
37	36	37	74.6109	9	38.0000	40.0000	*
38	37	38	36.6001	9	38.0000	40.0000	*
39	8	9	467.8610	9	49.0000	50.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
40	38	39	0.0000	9	38.0000	40.0000	*
41	30	41	231.6679	9	38.0000	40.0000	*
42	41	42	190.8272	9	38.0000	40.0000	*
43	42	43	190.8272	9	38.0000	40.0000	*
44	43	44	151.5704	9	38.0000	40.0000	*
45	44	45	112.9143	9	38.0000	40.0000	*
46	45	46	74.6109	9	38.0000	40.0000	*
47	46	47	74.6109	9	38.0000	40.0000	*
48	47	48	36.6001	9	38.0000	40.0000	*
49	48	39	0.0000	9	38.0000	40.0000	*
50	24	49	37.0063	9	38.0000	40.0000	*
51	25	50	37.0063	9	38.0000	40.0000	*
52	50	51	37.0063	9	38.0000	40.0000	*
53	49	52	37.0063	9	38.0000	40.0000	*
54	48	53	36.6001	9	38.0000	40.0000	*
55	38	54	36.6001	9	38.0000	40.0000	*
56	54	55	36.6001	9	38.0000	40.0000	*
57	53	56	36.6001	9	38.0000	40.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
10 -- A106 GR.B, SMLS, SCH	Not Lined	
9 -- A106 GR.B, SMLS, SCH	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	80.00	4.917	4.833	8.4105E-02	8.4105E-02	931.2
3.248	2	3	80.00	4.833	4.569	0.2635	6.7753E-02	931.2
3.248	3	4	80.00	4.569	4.407	0.1619	0.1619	931.2
3.248	4	5	80.00	4.407	4.049	0.3579	0.1622	931.2
3.248	5	6	80.00	4.049	3.454	0.5956	0.5956	931.2
3.248	6	7	80.00	3.454	3.297	0.1569	0.1569	931.2
3.248	7	8	50.00	2.965	2.829	0.1361	0.1361	467.9
4.135	8	10	80.00	3.297	3.240	5.6610E-02	5.6610E-02	463.3
1.616	9	11	40.00	2.343	2.272	7.0375E-02	7.0375E-02	152.3
2.238	10	12	40.00	2.272	2.232	4.0680E-02	4.0680E-02	113.2
1.664	11	13	40.00	2.232	2.217	1.4470E-02	1.4470E-02	74.56
1.096	12	16	40.00	2.448	2.338	0.1096	0.1096	193.5
2.843	13	17	40.00	2.338	2.266	7.1745E-02	7.1745E-02	153.9
2.261	14	19	40.00	2.266	2.224	4.1785E-02	4.1785E-02	114.9
1.688	15	20	40.00	2.224	2.209	1.5085E-02	1.5085E-02	76.27
1.121	16	22	40.00	2.217	2.198	1.8770E-02	1.8770E-02	74.56
1.096	17	25	40.00	2.198	2.195	3.5901E-03	3.5901E-03	36.15
0.5313	18	14	40.00	2.689	2.534	0.1548	0.1548	233.2
3.426	19	21	40.00	2.534	2.451	8.3195E-02	8.3195E-02	191.9
2.821	20	15	40.00	2.689	2.532	0.1566	0.1566	234.7
3.449	21	40	40.00	2.532	2.448	8.4445E-02	8.4445E-02	193.5
2.843	22	23	40.00	2.209	2.199	1.0595E-02	1.0595E-02	76.27
1.121	23	26	40.00	2.195	2.195	5.0068E-06	0.000	0.8535
1.2543E-02	24	24	40.00	2.199	2.195	3.9051E-03	3.9051E-03	37.86
0.5564	25	26	40.00	2.195	2.195	0.000	0.000	-0.8535
-1.2543E-02	26	18	50.00	3.297	2.965	0.3319	0.1361	467.9
4.135	27	28	50.00	3.240	2.911	0.3295	0.1337	463.3

4.095								
28	28	29	50.00	2.911	2.777	0.1337	0.1337	463.3
4.095								
29	29	30	50.00	2.777	2.639	0.1376	0.1376	463.3
4.095								
30	30	31	40.00	2.639	2.486	0.1529	0.1529	231.7
3.405								
31	31	32	40.00	2.486	2.404	8.2315E-02	8.2315E-02	190.8
2.804								
32	32	33	40.00	2.404	2.297	0.1068	0.1068	190.8
2.804								
33	33	34	40.00	2.297	2.228	6.9760E-02	6.9760E-02	151.6
2.227								
34	34	35	40.00	2.228	2.187	4.0465E-02	4.0465E-02	112.9
1.659								
35	35	36	40.00	2.187	2.173	1.4490E-02	1.4490E-02	74.61
1.096								
36	21	27	40.00	2.451	2.343	0.1080	0.1080	191.9
2.821								
37	36	37	40.00	2.173	2.154	1.8800E-02	1.8800E-02	74.61
1.096								
38	37	38	40.00	2.154	2.150	3.6700E-03	3.6700E-03	36.60
0.5379								
39	8	9	50.00	2.829	2.689	0.1401	0.1401	467.9
4.135								
40	38	39	40.00	2.150	2.150	0.000	0.000	-7.4739E-13
-1.0983E-14								
41	30	41	40.00	2.639	2.486	0.1529	0.1529	231.7
3.405								

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
42 2.804	41	42	40.00	2.486	2.404	8.2315E-02	8.2315E-02	190.8
43 2.804	42	43	40.00	2.404	2.297	0.1068	0.1068	190.8
44 2.227	43	44	40.00	2.297	2.228	6.9760E-02	6.9760E-02	151.6
45 1.659	44	45	40.00	2.228	2.187	4.0465E-02	4.0465E-02	112.9
46 1.096	45	46	40.00	2.187	2.173	1.4490E-02	1.4490E-02	74.61
47 1.096	46	47	40.00	2.173	2.154	1.8800E-02	1.8800E-02	74.61
48 0.5379	47	48	40.00	2.154	2.150	3.6700E-03	3.6700E-03	36.60
49 1.0983E-14	48	39	40.00	2.150	2.150	0.000	0.000	7.4739E-13
50 0.5438	24	49	40.00	2.195	2.045	0.1501	3.2650E-03	37.01
51 0.5438	25	50	40.00	2.195	2.045	0.1501	3.2650E-03	37.01
52 0.5438	50	51	40.00	2.045	2.042	3.2649E-03	3.2649E-03	37.01
53 0.5438	49	52	40.00	2.045	2.042	3.2649E-03	3.2649E-03	37.01
54 0.5379	48	53	40.00	2.150	2.000	0.1500	3.2001E-03	36.60
55 0.5379	38	54	40.00	2.150	2.000	0.1500	3.2001E-03	36.60
56 0.5379	54	55	40.00	2.000	1.997	3.1949E-03	3.1949E-03	36.60
57 0.5379	53	56	40.00	2.000	1.997	3.1949E-03	3.1949E-03	36.60

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	11	0.22724E+01	36.6000	39.0428	6.67	
2	12	0.22317E+01	36.6000	38.6917	5.71	
3	14	0.25339E+01	36.6000	41.2284	12.65	
4	15	0.25320E+01	36.6000	41.2130	12.60	
5	16	0.23380E+01	36.6000	39.6024	8.20	
6	17	0.22662E+01	36.6000	38.9900	6.53	
7	19	0.22245E+01	36.6000	38.6289	5.54	
8	22	0.21985E+01	36.6000	38.4024	4.92	
9	23	0.21988E+01	36.6000	38.4053	4.93	
10	55	0.19969E+01	36.6000	36.6000 *	0.00	
11	56	0.19969E+01	36.6000	36.6000	0.00	
12	31	0.24865E+01	36.6000	40.8407	11.59	
13	44	0.22276E+01	36.6000	38.6560	5.62	
14	45	0.21871E+01	36.6000	38.3033	4.65	
15	27	0.23428E+01	36.6000	39.6427	8.31	
16	43	0.22973E+01	36.6000	39.2567	7.26	
17	33	0.22973E+01	36.6000	39.2567	7.26	
18	34	0.22276E+01	36.6000	38.6560	5.62	
19	35	0.21871E+01	36.6000	38.3033	4.65	
20	52	0.20415E+01	36.6000	37.0062	1.11	
21	47	0.21538E+01	36.6000	38.0107	3.85	
22	51	0.20415E+01	36.6000	37.0062	1.11	
23	37	0.21538E+01	36.6000	38.0107	3.85	
24	41	0.24865E+01	36.6000	40.8407	11.59	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	4.917	931.2	419.95

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
16 OF 18

DATE : 13-Mar-2014

PAGE

COMMENTS

Analysis Converged in 3 Iterations


WARNINGS

*** WARNING - Nozzle 10 below minimum operating pressure
*** WARNING - Nozzle 11 below minimum operating pressure

=====

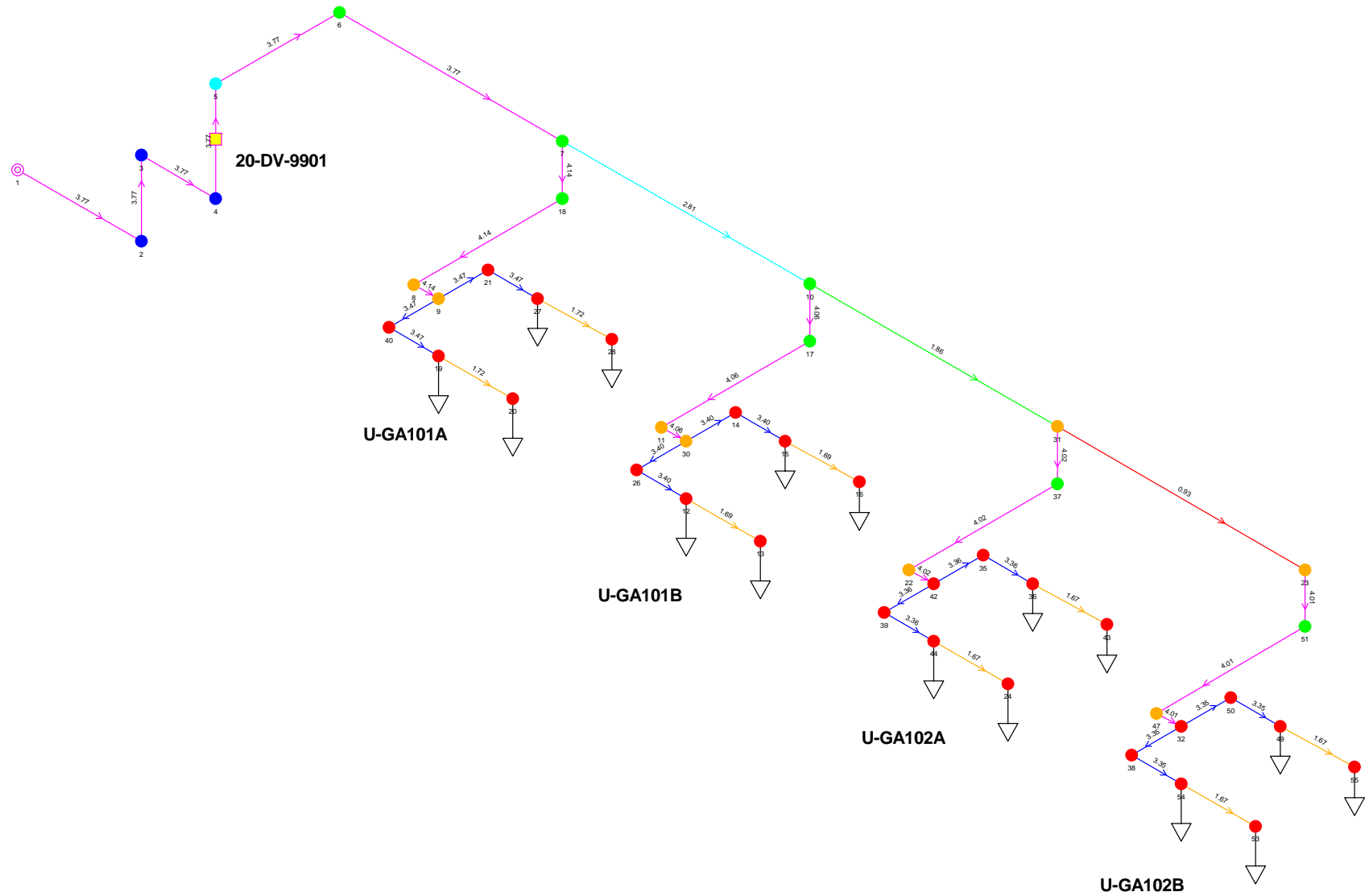
AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #4.3

CÁLCULO HIDRÁULICO DE DV NO. 20-DV-9901



UREA PLANT AREA FOR WATER SPRAY SYSTEM (20-DV-9901)			
		Kunkook Fire Protection Co., Ltd	
PIPENET Schematic	Wednesday, March 12, 2014		Page 1 of 1
Pressure (Bar G)	■ < 2.400000	■ < 3.000000	■ < 3.600000
	■ < 4.200000	■ < 4.800000	■ > 4.800000
Pipe velocity (m/sec)	■ < 1.200000	■ < 1.800000	■ < 2.400000
	■ < 3.000000	■ < 3.600000	■ > 3.600000

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : UREA PLANT AREA FOR WATER SPRAY SYSTEM (20-DV-9901)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

10:13 on 12-Mar-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	7
Special Equipment.....	8
Designed Diameters & Flowrates.....	9
Flow in Pipes.....	11
Flow through Nozzles.....	13
Flow at Inlets.....	14
Important Notice.....	15
Comments.....	16

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
9	-- A106 GR.B, SMLS Sch8	Not Lined	
12	-- A106 GR.B, SMLS Sch4	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS Sch8 Not lined			A106 GR.B, SMLS Sch4 Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	13.9000	6.0000	15.0000	13.9000	6.0000		
20.0000	18.8000	6.0000	20.0000	18.8000	6.0000		
25.0000	24.3000	6.0000	25.0000	24.3000	6.0000		
40.0000	38.1000	6.0000	40.0000	38.1000	6.0000		
50.0000	49.3000	6.0000	50.0000	49.3000	6.0000		
80.0000	77.9000	6.0000	80.0000	77.9000	6.0000		
100.0000	102.3000	6.0000	100.0000	102.3000	6.0000		
150.0000	154.1000	4.5000	150.0000	154.1000	4.5000		
200.0000	202.7000	4.5000	200.0000	202.7000	4.5000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	100.0	12.00	0.000	120.0	3.054
2	2	3	100.0	2.000	2.000	120.0	3.054
3	3	4	100.0	8.000	0.000	120.0	6.718
4	4	5	100.0	4.000	4.000	120.0	1.832
5	5	6	100.0	10.00	0.000	120.0	6.108
6	6	7	100.0	13.00	0.000	120.0	6.108
7	18	8	50.00	12.00	0.000	120.0	1.124
8	7	10	100.0	8.000	0.000	120.0	6.108
9	17	11	50.00	12.00	0.000	120.0	1.124
10	10	31	100.0	8.000	0.000	120.0	6.108
11	10	17	50.00	2.000	-2.000	120.0	1.124
12	12	13	40.00	3.000	0.000	120.0	1.718
13	15	16	40.00	3.000	0.000	120.0	1.718
14	14	15	40.00	3.000	0.000	120.0	1.718
15	26	12	40.00	3.000	0.000	120.0	1.718
16	30	14	40.00	2.000	0.000	120.0	0.8591
17	30	26	40.00	2.000	0.000	120.0	0.8591
18	9	40	40.00	2.000	0.000	120.0	0.8591
19	19	20	40.00	3.000	0.000	120.0	1.718
20	11	30	50.00	1.000	0.000	120.0	2.248
21	36	43	40.00	3.000	0.000	120.0	1.718
22	44	24	40.00	3.000	0.000	120.0	1.718
23	31	37	50.00	2.000	-2.000	120.0	1.124
24	37	22	50.00	12.00	0.000	120.0	1.124
25	42	35	40.00	2.000	0.000	120.0	0.8591
26	27	28	40.00	3.000	0.000	120.0	1.718
27	39	44	40.00	3.000	0.000	120.0	1.718
28	22	42	50.00	1.000	0.000	120.0	2.248
29	31	23	100.0	10.00	0.000	120.0	6.108
30	42	39	40.00	2.000	0.000	120.0	0.8591
31	7	18	50.00	2.000	-2.000	120.0	1.124
32	35	36	40.00	3.000	0.000	120.0	1.718
34	49	55	40.00	3.000	0.000	120.0	1.718
35	54	53	40.00	3.000	0.000	120.0	1.718
36	21	27	40.00	3.000	0.000	120.0	1.718
37	40	19	40.00	3.000	0.000	120.0	1.718
38	9	21	40.00	2.000	0.000	120.0	0.8591
39	8	9	50.00	1.000	0.000	120.0	2.248
40	23	51	50.00	2.000	-2.000	120.0	1.124
41	51	47	50.00	12.00	0.000	120.0	1.124
42	32	50	40.00	2.000	0.000	120.0	0.8591
43	38	54	40.00	3.000	0.000	120.0	1.718
44	47	32	50.00	1.000	0.000	120.0	2.248

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
46	50	49	40.00	3.000	0.000	120.0	1.718
47	32	38	40.00	2.000	0.000	120.0	0.8591

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	1 x 2	3.054
2	1 x 2	3.054
3	1 x 4	6.108
4	3 x 5	0.6108
5	2 x 2	3.054
6	1 x 4	6.108
7	1 x 2	1.124
8	1 x 4	6.108
9	1 x 2	1.124
10	1 x 4	6.108
11	1 x 2	1.124
12	1 x 4	1.718
13	1 x 4	1.718
14	1 x 4	1.718
15	1 x 4	1.718
16	1 x 2	0.8591
17	1 x 2	0.8591
18	1 x 2	0.8591
19	1 x 4	1.718
20	1 x 4	2.248
21	1 x 4	1.718
22	1 x 4	1.718
23	1 x 2	1.124
24	1 x 2	1.124
25	1 x 2	0.8591
26	1 x 4	1.718
27	1 x 4	1.718
28	1 x 4	2.248
29	1 x 4	6.108
30	1 x 2	0.8591
31	1 x 2	1.124
32	1 x 4	1.718
34	1 x 4	1.718

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

35	1 x 4	1.718
36	1 x 4	1.718
37	1 x 4	1.718
38	1 x 2	0.8591
39	1 x 4	2.248
40	1 x 2	1.124
41	1 x 2	1.124
42	1 x 2	0.8591
43	1 x 4	1.718
44	1 x 4	2.248
46	1 x 4	1.718
47	1 x 2	0.8591

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
- 5 -- Gate Valve
- 6 -- Swing Check Valve
- 7 -- Non-Return Valve
- 8 -- Ball Valve
- 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	12	7	80.6000	114.0000	0.10000E+01	0.14400E+02
2	13	7	80.6000	114.0000	0.10000E+01	0.14400E+02
3	15	7	80.6000	114.0000	0.10000E+01	0.14400E+02
4	16	7	80.6000	114.0000	0.10000E+01	0.14400E+02
5	44	7	80.6000	114.0000	0.10000E+01	0.14400E+02
6	24	7	80.6000	114.0000	0.10000E+01	0.14400E+02
7	36	7	80.6000	114.0000	0.10000E+01	0.14400E+02
8	19	7	80.6000	114.0000	0.10000E+01	0.14400E+02
9	20	7	80.6000	114.0000	0.10000E+01	0.14400E+02
10	43	7	80.6000	114.0000	0.10000E+01	0.14400E+02
11	54	7	80.6000	114.0000	0.10000E+01	0.14400E+02
12	53	7	80.6000	114.0000	0.10000E+01	0.14400E+02
13	49	7	80.6000	114.0000	0.10000E+01	0.14400E+02
14	55	7	80.6000	114.0000	0.10000E+01	0.14400E+02
15	27	7	80.6000	114.0000	0.10000E+01	0.14400E+02
16	28	7	80.6000	114.0000	0.10000E+01	0.14400E+02

Nozzle types are :
7 -- K-factor 80.6

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	1858.2755	12	102.3000	100.0000	*
2	2	3	1858.2755	12	102.3000	100.0000	*
3	3	4	1858.2755	12	102.3000	100.0000	*
4	4	5	1858.2755	12	102.3000	100.0000	*
5	5	6	1858.2755	12	102.3000	100.0000	*
6	6	7	1858.2755	12	102.3000	100.0000	*
7	18	8	474.1717	9	49.3000	50.0000	*
8	7	10	1384.1038	12	102.3000	100.0000	*
9	17	11	464.8088	9	49.3000	50.0000	*
10	10	31	919.2950	12	102.3000	100.0000	*
11	10	17	464.8088	9	49.3000	50.0000	*
12	12	13	115.4595	9	38.1000	40.0000	*
13	15	16	115.4595	9	38.1000	40.0000	*
14	14	15	232.4044	9	38.1000	40.0000	*
15	26	12	232.4044	9	38.1000	40.0000	*
16	30	14	232.4044	9	38.1000	40.0000	*
17	30	26	232.4044	9	38.1000	40.0000	*
18	9	40	237.0858	9	38.1000	40.0000	*
19	19	20	117.7875	9	38.1000	40.0000	*
20	11	30	464.8088	9	49.3000	50.0000	*
21	36	43	114.3521	9	38.1000	40.0000	*
22	44	24	114.3521	9	38.1000	40.0000	*
23	31	37	460.3550	9	49.3000	50.0000	*
24	37	22	460.3550	9	49.3000	50.0000	*
25	42	35	230.1775	9	38.1000	40.0000	*
26	27	28	117.7875	9	38.1000	40.0000	*
27	39	44	230.1775	9	38.1000	40.0000	*
28	22	42	460.3550	9	49.3000	50.0000	*
29	31	23	458.9399	12	102.3000	100.0000	*
30	42	39	230.1775	9	38.1000	40.0000	*
31	7	18	474.1717	9	49.3000	50.0000	*
32	35	36	230.1775	9	38.1000	40.0000	*
34	49	55	114.0003	9	38.1000	40.0000	*
35	54	53	114.0003	9	38.1000	40.0000	*
36	21	27	237.0858	9	38.1000	40.0000	*
37	40	19	237.0858	9	38.1000	40.0000	*
38	9	21	237.0858	9	38.1000	40.0000	*
39	8	9	474.1717	9	49.3000	50.0000	*
40	23	51	458.9399	9	49.3000	50.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
41	51	47	458.9399	9	49.3000	50.0000	*
42	32	50	229.4700	9	38.1000	40.0000	*
43	38	54	229.4700	9	38.1000	40.0000	*
44	47	32	458.9399	9	49.3000	50.0000	*
46	50	49	229.4700	9	38.1000	40.0000	*
47	32	38	229.4700	9	38.1000	40.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
9 -- A106 GR.B, SMLS Sch8	Not Lined	
12 -- A106 GR.B, SMLS Sch4	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	100.00	5.027	4.791	0.2359	0.2359	1858.
3.768								
2	2	3	100.00	4.791	4.516	0.2750	7.9183E-02	1858.
3.768								
3	3	4	100.00	4.516	4.285	0.2306	0.2306	1858.
3.768								
4	4	5	100.00	4.285	3.724	0.5613	0.1697	1858.
3.768	E							
5	5	6	100.00	3.724	3.471	0.2524	0.2524	1858.
3.768								
6	6	7	100.00	3.471	3.172	0.2994	0.2994	1858.
3.768								
7	18	8	50.00	3.231	2.656	0.5749	0.5749	474.2
4.140								
8	7	10	100.00	3.172	3.044	0.1282	0.1282	1384.
2.807								
9	17	11	50.00	3.108	2.554	0.5541	0.5541	464.8
4.058								
10	10	31	100.00	3.044	2.984	6.0120E-02	6.0120E-02	919.3
1.864								
11	10	17	50.00	3.044	3.108	-6.3880E-02	0.1319	464.8
4.058								
12	12	13	40.00	2.105	2.052	5.3140E-02	5.3140E-02	115.5
1.688								
13	15	16	40.00	2.105	2.052	5.3140E-02	5.3140E-02	115.5
1.688								
14	14	15	40.00	2.299	2.105	0.1939	0.1939	232.4
3.397								
15	26	12	40.00	2.299	2.105	0.1939	0.1939	232.4
3.397								
16	30	14	40.00	2.417	2.299	0.1175	0.1175	232.4
3.397								
17	30	26	40.00	2.417	2.299	0.1175	0.1175	232.4
3.397								
18	9	40	40.00	2.514	2.392	0.1219	0.1219	237.1
3.466								
19	19	20	40.00	2.191	2.136	5.5135E-02	5.5135E-02	117.8
1.722								
20	11	30	50.00	2.554	2.417	0.1371	0.1371	464.8
4.058								
21	36	43	40.00	2.065	2.013	5.2200E-02	5.2200E-02	114.4
1.672								
22	44	24	40.00	2.065	2.013	5.2200E-02	5.2200E-02	114.4
1.672								
23	31	37	50.00	2.984	3.050	-6.6210E-02	0.1296	460.4
4.019								
24	37	22	50.00	3.050	2.506	0.5444	0.5444	460.4
4.019								
25	42	35	40.00	2.371	2.256	0.1154	0.1154	230.2
3.365								
26	27	28	40.00	2.191	2.136	5.5135E-02	5.5135E-02	117.8
1.722								
27	39	44	40.00	2.256	2.065	0.1904	0.1904	230.2

3.365								
28	22	42	50.00	2.506	2.371	0.1347	0.1347	460.4
4.019								
29	31	23	100.00	2.984	2.965	1.8985E-02	1.8985E-02	458.9
0.9306								
30	42	39	40.00	2.371	2.256	0.1154	0.1154	230.2
3.365								
31	7	18	50.00	3.172	3.231	-5.8930E-02	0.1369	474.2
4.140								
32	35	36	40.00	2.256	2.065	0.1904	0.1904	230.2
3.365								
34	49	55	40.00	2.052	2.001	5.1905E-02	5.1905E-02	114.0
1.667								
35	54	53	40.00	2.052	2.001	5.1905E-02	5.1905E-02	114.0
1.667								
36	21	27	40.00	2.392	2.191	0.2011	0.2011	237.1
3.466								
37	40	19	40.00	2.392	2.191	0.2011	0.2011	237.1
3.466								
38	9	21	40.00	2.514	2.392	0.1219	0.1219	237.1
3.466								
39	8	9	50.00	2.656	2.514	0.1423	0.1423	474.2
4.140								
40	23	51	50.00	2.965	3.032	-6.6940E-02	0.1288	458.9
4.007								
41	51	47	50.00	3.032	2.490	0.5413	0.5413	458.9
4.007								
42	32	50	40.00	2.357	2.242	0.1147	0.1147	229.5
3.355								

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
43 3.355	38	54	40.00	2.242	2.052	0.1894	0.1894	229.5
44 4.007	47	32	50.00	2.490	2.357	0.1340	0.1340	458.9
46 3.355	50	49	40.00	2.242	2.052	0.1894	0.1894	229.5
47 3.355	32	38	40.00	2.357	2.242	0.1147	0.1147	229.5

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	12	0.21052E+01	114.0000	116.9446	2.58	
2	13	0.20520E+01	114.0000	115.4592	1.28	
3	15	0.21052E+01	114.0000	116.9446	2.58	
4	16	0.20520E+01	114.0000	115.4592	1.28	
5	44	0.20651E+01	114.0000	115.8251	1.60	
6	24	0.20129E+01	114.0000	114.3518	0.31	
7	36	0.20651E+01	114.0000	115.8251	1.60	
8	19	0.21908E+01	114.0000	119.2980	4.65	
9	20	0.21356E+01	114.0000	117.7873	3.32	
10	43	0.20129E+01	114.0000	114.3518	0.31	
11	54	0.20524E+01	114.0000	115.4694	1.29	
12	53	0.20005E+01	114.0000	114.0000 *	0.00	
13	49	0.20524E+01	114.0000	115.4694	1.29	
14	55	0.20005E+01	114.0000	114.0000	0.00	
15	27	0.21908E+01	114.0000	119.2980	4.65	
16	28	0.21356E+01	114.0000	117.7873	3.32	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	5.027	1858.	828.85

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
16 OF 16

DATE : 12-Mar-2014

PAGE


COMMENTS

Analysis Converged in 3 Iterations

=====

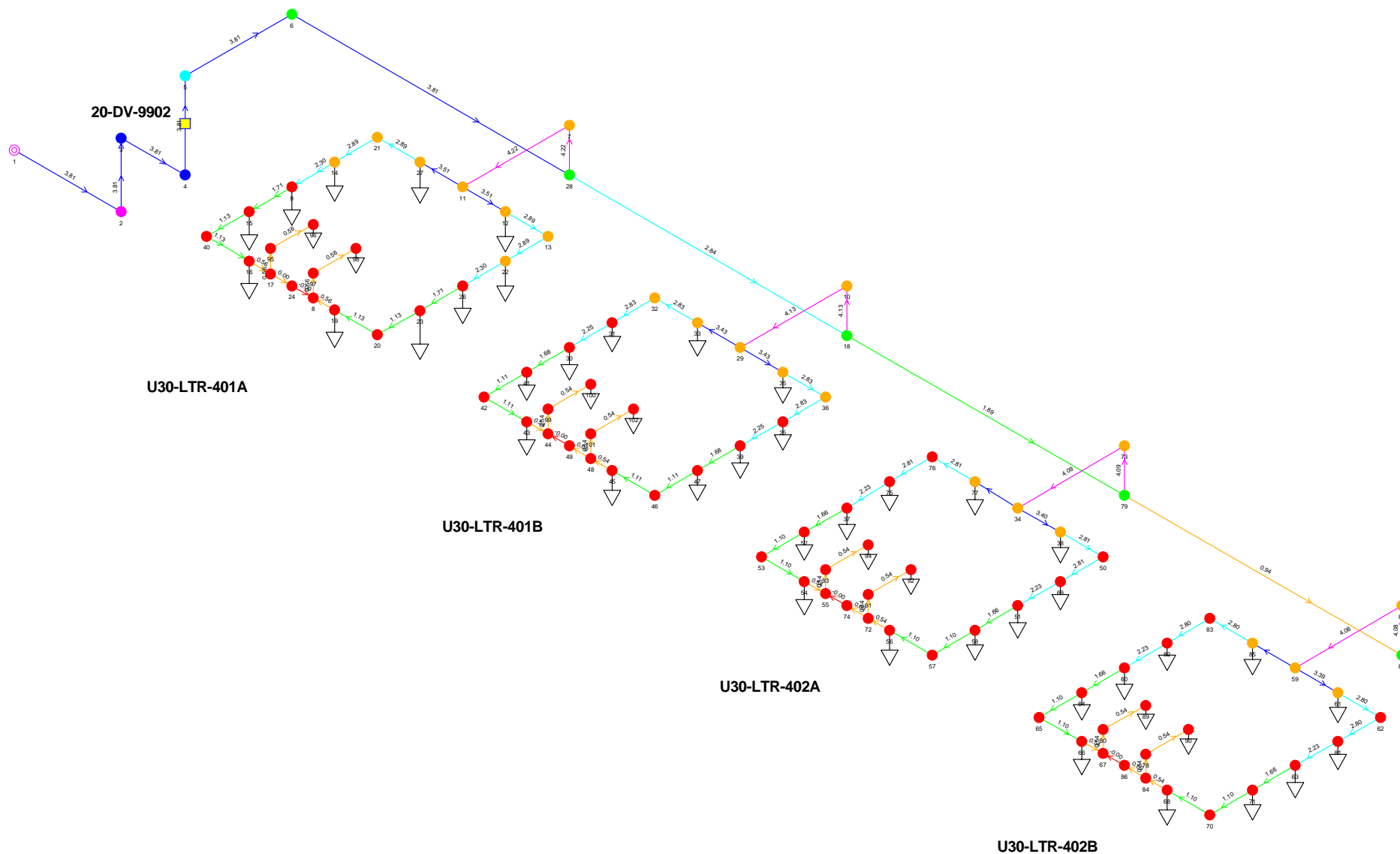
AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #4.4

CÁLCULO HIDRÁULICO DE DV NO. 20-DV-9902



UREA PROCESS AREA FOR WATER SPRAY SYSTEM (20-DV-9902)			
		Kunkook Fire Protection Co., Ltd	
PIPENET Schematic	Thursday, March 13, 2014		Page 1 of 1
Pipe velocity (m/sec)	<div><div></div>< 0.000000</div>	<div><div></div>< 1.000000</div>	<div><div></div>< 2.000000</div>
	<div><div></div>< 3.000000</div>	<div><div></div>< 4.000000</div>	<div><div></div>> 4.000000</div>

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : UREA PROCESS AREA FOR WATER SPRAY SYSTEM (20-DV-9902)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

17:54 on 13-Mar-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	10
Special Equipment.....	12
Designed Diameters & Flowrates.....	13
Flow in Pipes.....	16
Flow through Nozzles.....	19
Flow at Inlets.....	21
Important Notice.....	22
Comments.....	23
Warnings.....	24

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
10	-- A106 GR.B, SMLS, SCH	Not Lined	
9	-- A106 GR.B, SMLS, SCH	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS, SCH Not lined			A106 GR.B, SMLS, SCH Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	14.0000	6.0000	15.0000	14.0000	6.0000		
20.0000	19.0000	6.0000	20.0000	19.0000	6.0000		
25.0000	24.0000	6.0000	25.0000	24.0000	6.0000		
40.0000	38.0000	6.0000	40.0000	38.0000	6.0000		
50.0000	49.0000	6.0000	50.0000	49.0000	6.0000		
80.0000	78.0000	6.0000	80.0000	78.0000	6.0000		
100.0000	102.0000	6.0000	100.0000	102.0000	6.0000		
150.0000	154.0000	6.0000	150.0000	154.0000	6.0000		
200.0000	203.0000	6.0000	200.0000	203.0000	6.0000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	100.0	6.000	0.000	120.0	3.010
2	2	3	100.0	2.000	2.000	120.0	3.010
3	3	4	100.0	8.000	0.000	120.0	6.623
4	4	5	100.0	3.000	3.000	120.0	1.806
5	5	6	100.0	18.00	0.000	120.0	9.031
6	7	11	50.00	2.000	0.000	120.0	2.182
7	19	8	40.00	0.5000	0.000	120.0	1.696
8	28	18	100.0	7.000	0.000	120.0	6.021
9	11	27	40.00	1.000	0.000	120.0	1.696
10	11	12	40.00	1.000	0.000	120.0	1.696
11	12	13	40.00	1.500	0.000	120.0	0.8481
12	40	16	40.00	1.500	0.000	120.0	1.696
13	16	17	40.00	0.5000	0.000	120.0	1.696
14	17	24	40.00	0.5000	0.000	120.0	0.000
15	20	19	40.00	1.500	0.000	120.0	1.696
16	13	22	40.00	1.500	0.000	120.0	1.696
17	8	24	40.00	0.5000	0.000	120.0	0.000
18	14	9	40.00	1.500	0.000	120.0	1.696
19	21	14	40.00	1.500	0.000	120.0	1.696
20	9	15	40.00	1.500	0.000	120.0	1.696
21	15	40	40.00	1.500	0.000	120.0	0.8481
22	23	20	40.00	1.500	0.000	120.0	0.8481
23	26	23	40.00	1.500	0.000	120.0	1.696
24	39	47	40.00	1.500	0.000	120.0	1.696
25	22	26	40.00	1.500	0.000	120.0	1.696
26	18	10	50.00	2.000	2.000	120.0	1.091
27	28	7	50.00	2.000	2.000	120.0	1.091
28	10	29	50.00	2.000	0.000	120.0	2.182
29	6	28	100.0	5.000	0.000	120.0	6.021
30	31	30	40.00	1.500	0.000	120.0	1.696
31	32	31	40.00	1.500	0.000	120.0	1.696
32	33	32	40.00	1.500	0.000	120.0	0.8481
33	29	33	40.00	1.000	0.000	120.0	1.696
34	29	35	40.00	1.000	0.000	120.0	1.696
35	35	36	40.00	1.500	0.000	120.0	0.8481
36	27	21	40.00	1.500	0.000	120.0	0.8481
37	36	25	40.00	1.500	0.000	120.0	1.696
38	34	38	40.00	1.000	0.000	120.0	1.696
39	45	48	40.00	0.5000	0.000	120.0	1.696
40	25	39	40.00	1.500	0.000	120.0	1.696
41	30	41	40.00	1.500	0.000	120.0	1.696
42	41	42	40.00	1.500	0.000	120.0	0.8481
43	42	43	40.00	1.500	0.000	120.0	1.696

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
44	43	44	40.00	0.5000	0.000	120.0	1.696
45	48	49	40.00	0.5000	0.000	120.0	0.000
46	46	45	40.00	1.500	0.000	120.0	1.696
47	47	46	40.00	1.500	0.000	120.0	0.8481
48	44	49	40.00	0.5000	0.000	120.0	0.000
49	38	50	40.00	1.500	0.000	120.0	0.8481
50	50	69	40.00	1.500	0.000	120.0	1.696
51	69	51	40.00	1.500	0.000	120.0	1.696
52	37	52	40.00	1.500	0.000	120.0	1.696
53	52	53	40.00	1.500	0.000	120.0	0.8481
54	53	54	40.00	1.500	0.000	120.0	1.696
55	54	55	40.00	0.5000	0.000	120.0	1.696
56	57	56	40.00	1.500	0.000	120.0	1.696
57	58	57	40.00	1.500	0.000	120.0	0.8481
58	51	58	40.00	1.500	0.000	120.0	1.696
59	56	72	40.00	0.5000	0.000	120.0	1.696
60	72	74	40.00	0.5000	0.000	120.0	0.000
61	55	74	40.00	0.5000	0.000	120.0	0.000
62	59	61	40.00	1.000	0.000	120.0	1.696
63	61	62	40.00	1.500	0.000	120.0	0.8481
64	62	81	40.00	1.500	0.000	120.0	1.696
65	81	63	40.00	1.500	0.000	120.0	1.696
66	60	64	40.00	1.500	0.000	120.0	1.696
67	64	65	40.00	1.500	0.000	120.0	0.8481
68	65	66	40.00	1.500	0.000	120.0	1.696
69	66	67	40.00	0.5000	0.000	120.0	1.696
70	70	68	40.00	1.500	0.000	120.0	1.696
71	71	70	40.00	1.500	0.000	120.0	0.8481
72	63	71	40.00	1.500	0.000	120.0	1.696
73	68	84	40.00	0.5000	0.000	120.0	1.696
74	84	86	40.00	0.5000	0.000	120.0	0.000
75	67	86	40.00	0.5000	0.000	120.0	0.000
76	75	37	40.00	1.500	0.000	120.0	1.696
77	76	75	40.00	1.500	0.000	120.0	1.696
78	77	76	40.00	1.500	0.000	120.0	0.8481
79	34	77	40.00	1.000	0.000	120.0	1.696
80	73	34	50.00	2.000	0.000	120.0	2.182
81	79	73	50.00	2.000	2.000	120.0	1.091
82	18	79	100.0	6.000	0.000	120.0	6.021
83	82	60	40.00	1.500	0.000	120.0	1.696
84	83	82	40.00	1.500	0.000	120.0	1.696
85	85	83	40.00	1.500	0.000	120.0	0.8481
86	59	85	40.00	1.000	0.000	120.0	1.696

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
87	87	59	50.00	2.000	0.000	120.0	2.182
88	88	87	50.00	2.000	2.000	120.0	1.091
89	79	88	100.0	7.000	0.000	120.0	6.021
90	84	78	40.00	1.500	1.500	120.0	0.8481
91	67	80	40.00	1.500	1.500	120.0	0.8481
92	80	89	40.00	1.500	0.000	120.0	0.8481
93	78	90	40.00	1.500	0.000	120.0	0.8481
94	72	91	40.00	1.500	1.500	120.0	0.8481
95	91	92	40.00	1.500	0.000	120.0	0.8481
96	55	93	40.00	1.500	1.500	120.0	0.8481
97	93	94	40.00	1.500	0.000	120.0	0.8481
98	17	95	40.00	1.500	1.500	120.0	0.8481
99	95	96	40.00	1.500	0.000	120.0	0.8481
100	8	97	40.00	1.500	1.500	120.0	0.8481
101	97	98	40.00	1.500	0.000	120.0	0.8481
102	44	99	40.00	1.500	1.500	120.0	0.8481
103	99	100	40.00	1.500	0.000	120.0	0.8481
104	48	101	40.00	1.500	1.500	120.0	0.8481
105	101	102	40.00	1.500	0.000	120.0	0.8481

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	1 x 2	3.010
2	1 x 2	3.010
3	1 x 4	6.021
4	3 x 5	0.6021
5	3 x 2	3.010
6	1 x 4	2.182
7	1 x 4	1.696
8	1 x 4	6.021
9	1 x 4	1.696
10	1 x 4	1.696
11	1 x 2	0.8481
12	1 x 4	1.696
13	1 x 4	1.696
15	1 x 4	1.696
16	1 x 4	1.696
18	1 x 4	1.696

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

19	1 x 4	1.696
20	1 x 4	1.696
21	1 x 2	0.8481
22	1 x 2	0.8481
23	1 x 4	1.696
24	1 x 4	1.696
25	1 x 4	1.696
26	1 x 2	1.091
27	1 x 2	1.091
28	1 x 4	2.182
29	1 x 4	6.021
30	1 x 4	1.696
31	1 x 4	1.696
32	1 x 2	0.8481
33	1 x 4	1.696
34	1 x 4	1.696
35	1 x 2	0.8481
36	1 x 2	0.8481
37	1 x 4	1.696
38	1 x 4	1.696
39	1 x 4	1.696
40	1 x 4	1.696
41	1 x 4	1.696
42	1 x 2	0.8481
43	1 x 4	1.696
44	1 x 4	1.696
46	1 x 4	1.696
47	1 x 2	0.8481
49	1 x 2	0.8481
50	1 x 4	1.696
51	1 x 4	1.696
52	1 x 4	1.696
53	1 x 2	0.8481
54	1 x 4	1.696
55	1 x 4	1.696
56	1 x 4	1.696
57	1 x 2	0.8481
58	1 x 4	1.696
59	1 x 4	1.696
62	1 x 4	1.696
63	1 x 2	0.8481
64	1 x 4	1.696
65	1 x 4	1.696

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

66	1 x 4	1.696
67	1 x 2	0.8481
68	1 x 4	1.696
69	1 x 4	1.696
70	1 x 4	1.696
71	1 x 2	0.8481
72	1 x 4	1.696
73	1 x 4	1.696
76	1 x 4	1.696
77	1 x 4	1.696
78	1 x 2	0.8481
79	1 x 4	1.696
80	1 x 4	2.182
81	1 x 2	1.091
82	1 x 4	6.021
83	1 x 4	1.696
84	1 x 4	1.696
85	1 x 2	0.8481
86	1 x 4	1.696
87	1 x 4	2.182
88	1 x 2	1.091
89	1 x 4	6.021
90	1 x 2	0.8481
91	1 x 2	0.8481
92	1 x 2	0.8481
93	1 x 2	0.8481
94	1 x 2	0.8481
95	1 x 2	0.8481
96	1 x 2	0.8481
97	1 x 2	0.8481
98	1 x 2	0.8481
99	1 x 2	0.8481
100	1 x 2	0.8481
101	1 x 2	0.8481
102	1 x 2	0.8481
103	1 x 2	0.8481
104	1 x 2	0.8481
105	1 x 2	0.8481

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow

-
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
 - 5 -- Gate Valve
 - 6 -- Swing Check Valve
 - 7 -- Non-Return Valve
 - 8 -- Ball Valve
 - 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	9	8	25.9000	36.6000	0.10000E+01	0.14400E+02
2	12	8	25.9000	36.6000	0.10000E+01	0.14400E+02
3	14	8	25.9000	36.6000	0.10000E+01	0.14400E+02
4	15	8	25.9000	36.6000	0.10000E+01	0.14400E+02
5	16	8	25.9000	36.6000	0.10000E+01	0.14400E+02
6	96	2	25.9000	36.6000	0.20000E+01	0.14400E+02
7	19	8	25.9000	36.6000	0.10000E+01	0.14400E+02
8	22	8	25.9000	36.6000	0.10000E+01	0.14400E+02
9	23	8	25.9000	36.6000	0.10000E+01	0.14400E+02
10	26	8	25.9000	36.6000	0.10000E+01	0.14400E+02
11	98	2	25.9000	36.6000	0.20000E+01	0.14400E+02
12	31	8	25.9000	36.6000	0.10000E+01	0.14400E+02
13	100	2	25.9000	36.6000	0.20000E+01	0.14400E+02
14	45	8	25.9000	36.6000	0.10000E+01	0.14400E+02
15	27	8	25.9000	36.6000	0.10000E+01	0.14400E+02
16	43	8	25.9000	36.6000	0.10000E+01	0.14400E+02
17	33	8	25.9000	36.6000	0.10000E+01	0.14400E+02
18	30	8	25.9000	36.6000	0.10000E+01	0.14400E+02
19	35	8	25.9000	36.6000	0.10000E+01	0.14400E+02
20	39	8	25.9000	36.6000	0.10000E+01	0.14400E+02
21	47	8	25.9000	36.6000	0.10000E+01	0.14400E+02
22	102	2	25.9000	36.6000	0.20000E+01	0.14400E+02
23	25	8	25.9000	36.6000	0.10000E+01	0.14400E+02
24	41	8	25.9000	36.6000	0.10000E+01	0.14400E+02
25	94	2	25.9000	36.6000	0.20000E+01	0.14400E+02
26	56	8	25.9000	36.6000	0.10000E+01	0.14400E+02
27	54	8	25.9000	36.6000	0.10000E+01	0.14400E+02
28	38	8	25.9000	36.6000	0.10000E+01	0.14400E+02
29	58	8	25.9000	36.6000	0.10000E+01	0.14400E+02
30	69	8	25.9000	36.6000	0.10000E+01	0.14400E+02
31	52	8	25.9000	36.6000	0.10000E+01	0.14400E+02
32	37	8	25.9000	36.6000	0.10000E+01	0.14400E+02
33	51	8	25.9000	36.6000	0.10000E+01	0.14400E+02
34	92	2	25.9000	36.6000	0.20000E+01	0.14400E+02
35	89	2	25.9000	36.6000	0.20000E+01	0.14400E+02
36	68	8	25.9000	36.6000	0.10000E+01	0.14400E+02
37	66	8	25.9000	36.6000	0.10000E+01	0.14400E+02
38	61	8	25.9000	36.6000	0.10000E+01	0.14400E+02
39	71	8	25.9000	36.6000	0.10000E+01	0.14400E+02
40	81	8	25.9000	36.6000	0.10000E+01	0.14400E+02
41	64	8	25.9000	36.6000	0.10000E+01	0.14400E+02
42	60	8	25.9000	36.6000	0.10000E+01	0.14400E+02

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
43	63	8	25.9000	36.6000	0.10000E+01	0.14400E+02
44	90	2	25.9000	36.6000	0.20000E+01	0.14400E+02
45	77	8	25.9000	36.6000	0.10000E+01	0.14400E+02
46	75	8	25.9000	36.6000	0.10000E+01	0.14400E+02
47	85	8	25.9000	36.6000	0.10000E+01	0.14400E+02
48	82	8	25.9000	36.6000	0.10000E+01	0.14400E+02

Nozzle types are :
2 -- K-factor 25.9
8 -- User Defined

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	1869.7480	10	102.0000	100.0000	*
2	2	3	1869.7480	10	102.0000	100.0000	*
3	3	4	1869.7480	10	102.0000	100.0000	*
4	4	5	1869.7480	10	102.0000	100.0000	*
5	5	6	1869.7480	10	102.0000	100.0000	*
6	7	11	477.2988	9	49.0000	50.0000	*
7	19	8	37.9015	9	38.0000	40.0000	*
8	28	18	1392.4493	10	102.0000	100.0000	*
9	11	27	238.6494	9	38.0000	40.0000	*
10	11	12	238.6494	9	38.0000	40.0000	*
11	12	13	196.8923	9	38.0000	40.0000	*
12	40	16	77.1665	9	38.0000	40.0000	*
13	16	17	37.9015	9	38.0000	40.0000	*
14	17	24	0.0000	9	38.0000	40.0000	*
15	20	19	77.1665	9	38.0000	40.0000	*
16	13	22	196.8923	9	38.0000	40.0000	*
17	8	24	0.0000	9	38.0000	40.0000	*
18	14	9	156.5220	9	38.0000	40.0000	*
19	21	14	196.8923	9	38.0000	40.0000	*
20	9	15	116.6871	9	38.0000	40.0000	*
21	15	40	77.1665	9	38.0000	40.0000	*
22	23	20	77.1665	9	38.0000	40.0000	*
23	26	23	116.6871	9	38.0000	40.0000	*
24	39	47	114.2513	9	38.0000	40.0000	*
25	22	26	156.5220	9	38.0000	40.0000	*
26	18	10	467.4655	9	49.0000	50.0000	*
27	28	7	477.2988	9	49.0000	50.0000	*
28	10	29	467.4655	9	49.0000	50.0000	*
29	6	28	1869.7480	10	102.0000	100.0000	*
30	31	30	153.2740	9	38.0000	40.0000	*
31	32	31	192.8224	9	38.0000	40.0000	*
32	33	32	192.8224	9	38.0000	40.0000	*
33	29	33	233.7328	9	38.0000	40.0000	*
34	29	35	233.7328	9	38.0000	40.0000	*
35	35	36	192.8224	9	38.0000	40.0000	*
36	27	21	196.8923	9	38.0000	40.0000	*
37	36	25	192.8224	9	38.0000	40.0000	*
38	34	38	231.5717	9	38.0000	40.0000	*
39	45	48	37.0739	9	38.0000	40.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
40	25	39	153.2740	9	38.0000	40.0000	*
41	30	41	114.2513	9	38.0000	40.0000	*
42	41	42	75.5372	9	38.0000	40.0000	*
43	42	43	75.5372	9	38.0000	40.0000	*
44	43	44	37.0739	9	38.0000	40.0000	*
45	48	49	0.0000	9	38.0000	40.0000	*
46	46	45	75.5372	9	38.0000	40.0000	*
47	47	46	75.5372	9	38.0000	40.0000	*
48	44	49	0.0000	9	38.0000	40.0000	*
49	38	50	191.0335	9	38.0000	40.0000	*
50	50	69	191.0335	9	38.0000	40.0000	*
51	69	51	151.8463	9	38.0000	40.0000	*
52	37	52	113.1805	9	38.0000	40.0000	*
53	52	53	74.8209	9	38.0000	40.0000	*
54	53	54	74.8209	9	38.0000	40.0000	*
55	54	55	36.7099	9	38.0000	40.0000	*
56	57	56	74.8209	9	38.0000	40.0000	*
57	58	57	74.8209	9	38.0000	40.0000	*
58	51	58	113.1805	9	38.0000	40.0000	*
59	56	72	36.7099	9	38.0000	40.0000	*
60	72	74	0.0000	9	38.0000	40.0000	*
61	55	74	0.0000	9	38.0000	40.0000	*
62	59	61	230.9202	9	38.0000	40.0000	*
63	61	62	190.4942	9	38.0000	40.0000	*
64	62	81	190.4942	9	38.0000	40.0000	*
65	81	63	151.4159	9	38.0000	40.0000	*
66	60	64	112.8577	9	38.0000	40.0000	*
67	64	65	74.6049	9	38.0000	40.0000	*
68	65	66	74.6049	9	38.0000	40.0000	*
69	66	67	36.6001	9	38.0000	40.0000	*
70	70	68	74.6049	9	38.0000	40.0000	*
71	71	70	74.6049	9	38.0000	40.0000	*
72	63	71	112.8577	9	38.0000	40.0000	*
73	68	84	36.6001	9	38.0000	40.0000	*
74	84	86	0.0000	9	38.0000	40.0000	*
75	67	86	0.0000	9	38.0000	40.0000	*
76	75	37	151.8463	9	38.0000	40.0000	*
77	76	75	191.0335	9	38.0000	40.0000	*
78	77	76	191.0335	9	38.0000	40.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
79	34	77	231.5717	9	38.0000	40.0000	*
80	73	34	463.1434	9	49.0000	50.0000	*
81	79	73	463.1434	9	49.0000	50.0000	*
82	18	79	924.9838	10	102.0000	100.0000	*
83	82	60	151.4159	9	38.0000	40.0000	*
84	83	82	190.4942	9	38.0000	40.0000	*
85	85	83	190.4942	9	38.0000	40.0000	*
86	59	85	230.9202	9	38.0000	40.0000	*
87	87	59	461.8405	9	49.0000	50.0000	*
88	88	87	461.8405	9	49.0000	50.0000	*
89	79	88	461.8405	10	102.0000	100.0000	*
90	84	78	36.6001	9	38.0000	40.0000	*
91	67	80	36.6001	9	38.0000	40.0000	*
92	80	89	36.6001	9	38.0000	40.0000	*
93	78	90	36.6001	9	38.0000	40.0000	*
94	72	91	36.7099	9	38.0000	40.0000	*
95	91	92	36.7099	9	38.0000	40.0000	*
96	55	93	36.7099	9	38.0000	40.0000	*
97	93	94	36.7099	9	38.0000	40.0000	*
98	17	95	37.9015	9	38.0000	40.0000	*
99	95	96	37.9015	9	38.0000	40.0000	*
100	8	97	37.9015	9	38.0000	40.0000	*
101	97	98	37.9015	9	38.0000	40.0000	*
102	44	99	37.0739	9	38.0000	40.0000	*
103	99	100	37.0739	9	38.0000	40.0000	*
104	48	101	37.0739	9	38.0000	40.0000	*
105	101	102	37.0739	9	38.0000	40.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
10 -- A106 GR.B, SMLS, SCH	Not Lined	
9 -- A106 GR.B, SMLS, SCH	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	100.00	4.965	4.820	0.1448	0.1448	1870.
3.814	2	3	100.00	4.820	4.543	0.2763	8.0549E-02	1870.
3.814	3	4	100.00	4.543	4.308	0.2351	0.2351	1870.
3.814	4	5	100.00	4.308	3.857	0.4513	0.1576	1870.
3.814	5	6	100.00	3.857	3.422	0.4346	0.4346	1870.
3.814	7	11	50.00	2.908	2.717	0.1911	0.1911	477.3
4.218	19	8	40.00	2.298	2.295	3.1900E-03	3.1900E-03	37.90
0.5570	28	18	100.00	3.245	3.124	0.1213	0.1213	1392.
2.840	11	27	40.00	2.717	2.599	0.1179	0.1179	238.6
3.507	11	12	40.00	2.717	2.599	0.1179	0.1179	238.6
3.507	12	13	40.00	2.599	2.527	7.1900E-02	7.1900E-02	196.9
2.893	40	16	40.00	2.316	2.298	1.7300E-02	1.7300E-02	77.17
1.134	16	17	40.00	2.298	2.295	3.1900E-03	3.1900E-03	37.90
0.5570	17	24	40.00	2.295	2.295	0.000	0.000	2.1354E-13
3.1381E-15	20	19	40.00	2.316	2.298	1.7300E-02	1.7300E-02	77.17
1.134	13	22	40.00	2.527	2.430	9.7875E-02	9.7875E-02	196.9
2.893	8	24	40.00	2.295	2.295	0.000	0.000	-2.1354E-13
-3.1381E-15	14	9	40.00	2.430	2.366	6.4020E-02	6.4020E-02	156.5
2.300	21	14	40.00	2.527	2.430	9.7875E-02	9.7875E-02	196.9
2.893	9	15	40.00	2.366	2.328	3.7180E-02	3.7180E-02	116.7
1.715	15	40	40.00	2.328	2.316	1.2715E-02	1.2715E-02	77.17
1.134	23	20	40.00	2.328	2.316	1.2715E-02	1.2715E-02	77.17
1.134	26	23	40.00	2.366	2.328	3.7180E-02	3.7180E-02	116.7
1.715	39	47	40.00	2.270	2.234	3.5760E-02	3.5760E-02	114.3
1.679	22	26	40.00	2.430	2.366	6.4020E-02	6.4020E-02	156.5
2.300	18	10	50.00	3.124	2.792	0.3317	0.1359	467.5
4.132	28	7	50.00	3.245	2.908	0.3370	0.1412	477.3

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
42	41	42	40.00	2.234	2.222	1.2220E-02	1.2220E-02	75.54
1.110								
43	42	43	40.00	2.222	2.205	1.6630E-02	1.6630E-02	75.54
1.110								
44	43	44	40.00	2.205	2.202	3.0651E-03	3.0651E-03	37.07
0.5448								
45	48	49	40.00	2.202	2.202	0.000	0.000	4.2708E-13
6.2763E-15								
46	46	45	40.00	2.222	2.205	1.6630E-02	1.6630E-02	75.54
1.110								
47	47	46	40.00	2.234	2.222	1.2220E-02	1.2220E-02	75.54
1.110								
48	44	49	40.00	2.202	2.202	0.000	0.000	-4.2708E-13
-6.2763E-15								
49	38	50	40.00	2.450	2.382	6.8000E-02	6.8000E-02	191.0
2.807								
50	50	69	40.00	2.382	2.289	9.2555E-02	9.2555E-02	191.0
2.807								
51	69	51	40.00	2.289	2.229	6.0530E-02	6.0530E-02	151.8
2.231								
52	37	52	40.00	2.229	2.194	3.5140E-02	3.5140E-02	113.2
1.663								
53	52	53	40.00	2.194	2.182	1.2005E-02	1.2005E-02	74.82
1.100								
54	53	54	40.00	2.182	2.165	1.6345E-02	1.6345E-02	74.82
1.100								
55	54	55	40.00	2.165	2.162	3.0050E-03	3.0050E-03	36.71
0.5395								
56	57	56	40.00	2.182	2.165	1.6345E-02	1.6345E-02	74.82
1.100								
57	58	57	40.00	2.194	2.182	1.2005E-02	1.2005E-02	74.82
1.100								
58	51	58	40.00	2.229	2.194	3.5140E-02	3.5140E-02	113.2
1.663								
59	56	72	40.00	2.165	2.162	3.0050E-03	3.0050E-03	36.71
0.5395								
60	72	74	40.00	2.162	2.162	0.000	0.000	4.1106E-12
6.0409E-14								
61	55	74	40.00	2.162	2.162	0.000	0.000	-4.1106E-12
-6.0409E-14								
62	59	61	40.00	2.547	2.436	0.1109	0.1109	230.9
3.394								
63	61	62	40.00	2.436	2.369	6.7645E-02	6.7645E-02	190.5
2.799								
64	62	81	40.00	2.369	2.277	9.2075E-02	9.2075E-02	190.5
2.799								
65	81	63	40.00	2.277	2.216	6.0210E-02	6.0210E-02	151.4
2.225								
66	60	64	40.00	2.216	2.181	3.4960E-02	3.4960E-02	112.9
1.659								
67	64	65	40.00	2.181	2.169	1.1940E-02	1.1940E-02	74.60
1.096								
68	65	66	40.00	2.169	2.153	1.6255E-02	1.6255E-02	74.60

1.096 69	66	67	40.00	2.153	2.150	2.9900E-03	2.9900E-03	36.60
0.5379 70	70	68	40.00	2.169	2.153	1.6255E-02	1.6255E-02	74.60
1.096 71	71	70	40.00	2.181	2.169	1.1940E-02	1.1940E-02	74.60
1.096 72	63	71	40.00	2.216	2.181	3.4960E-02	3.4960E-02	112.9
1.659 73	68	84	40.00	2.153	2.150	2.9900E-03	2.9900E-03	36.60
0.5379 74	84	86	40.00	2.150	2.150	0.000	0.000	6.9934E-12
1.0277E-13 75	67	86	40.00	2.150	2.150	0.000	0.000	-6.9934E-12
-1.0277E-13 76	75	37	40.00	2.289	2.229	6.0530E-02	6.0530E-02	151.8
2.231 77	76	75	40.00	2.382	2.289	9.2555E-02	9.2555E-02	191.0
2.807 78	77	76	40.00	2.450	2.382	6.8000E-02	6.8000E-02	191.0
2.807 79	34	77	40.00	2.561	2.450	0.1115	0.1115	231.6
3.403 80	73	34	50.00	2.742	2.561	0.1807	0.1807	463.1
4.093 81	79	73	50.00	3.071	2.742	0.3294	0.1336	463.1
4.093 82	18	79	100.00	3.124	3.071	5.2560E-02	5.2560E-02	925.0
1.887								

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
83 2.225	82	60	40.00	2.277	2.216	6.0210E-02	6.0210E-02	151.4
84 2.799	83	82	40.00	2.369	2.277	9.2075E-02	9.2075E-02	190.5
85 2.799	85	83	40.00	2.436	2.369	6.7645E-02	6.7645E-02	190.5
86 3.394	59	85	40.00	2.547	2.436	0.1109	0.1109	230.9
87 4.082	87	59	50.00	2.727	2.547	0.1798	0.1798	461.8
88 4.082	88	87	50.00	3.056	2.727	0.3287	0.1329	461.8
89 0.9420	79	88	100.00	3.071	3.056	1.5755E-02	1.5755E-02	461.8
90 0.5379	84	78	40.00	2.150	2.000	0.1500	3.2001E-03	36.60
91 0.5379	67	80	40.00	2.150	2.000	0.1500	3.2001E-03	36.60
92 0.5379	80	89	40.00	2.000	1.997	3.1949E-03	3.1949E-03	36.60
93 0.5379	78	90	40.00	2.000	1.997	3.1949E-03	3.1949E-03	36.60
94 0.5395	72	91	40.00	2.162	2.012	0.1501	3.2199E-03	36.71
95 0.5395	91	92	40.00	2.012	2.009	3.2151E-03	3.2151E-03	36.71
96 0.5395	55	93	40.00	2.162	2.012	0.1501	3.2199E-03	36.71
97 0.5395	93	94	40.00	2.012	2.009	3.2151E-03	3.2151E-03	36.71
98 0.5570	17	95	40.00	2.295	2.145	0.1502	3.4100E-03	37.90
99 0.5570	95	96	40.00	2.145	2.141	3.4151E-03	3.4151E-03	37.90
100 0.5570	8	97	40.00	2.295	2.145	0.1502	3.4100E-03	37.90
101 0.5570	97	98	40.00	2.145	2.141	3.4151E-03	3.4151E-03	37.90
102 0.5448	44	99	40.00	2.202	2.052	0.1501	3.2750E-03	37.07
103 0.5448	99	100	40.00	2.052	2.049	3.2749E-03	3.2749E-03	37.07
104 0.5448	48	101	40.00	2.202	2.052	0.1501	3.2750E-03	37.07
105 0.5448	101	102	40.00	2.052	2.049	3.2749E-03	3.2749E-03	37.07

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	9	0.23655E+01	36.6000	39.8348	8.84	
2	12	0.25993E+01	36.6000	41.7570	14.09	
3	14	0.24295E+01	36.6000	40.3702	10.30	
4	15	0.23283E+01	36.6000	39.5205	7.98	
5	16	0.22983E+01	36.6000	39.2649	7.28	
6	96	0.21415E+01	36.6000	37.9014	3.56	
7	19	0.22983E+01	36.6000	39.2649	7.28	
8	22	0.24295E+01	36.6000	40.3702	10.30	
9	23	0.23283E+01	36.6000	39.5205	7.98	
10	26	0.23655E+01	36.6000	39.8348	8.84	
11	98	0.21415E+01	36.6000	37.9014	3.56	
12	31	0.23316E+01	36.6000	39.5484	8.06	
13	100	0.20490E+01	36.6000	37.0738	1.29	
14	45	0.22054E+01	36.6000	38.4632	5.09	
15	27	0.25993E+01	36.6000	41.7570	14.09	
16	43	0.22054E+01	36.6000	38.4632	5.09	
17	33	0.24950E+01	36.6000	40.9102	11.78	
18	30	0.22700E+01	36.6000	39.0226	6.62	
19	35	0.24950E+01	36.6000	40.9102	11.78	
20	39	0.22700E+01	36.6000	39.0226	6.62	
21	47	0.22343E+01	36.6000	38.7140	5.78	
22	102	0.20490E+01	36.6000	37.0738	1.29	
23	25	0.23316E+01	36.6000	39.5484	8.06	
24	41	0.22343E+01	36.6000	38.7140	5.78	
25	94	0.20089E+01	36.6000	36.7098	0.30	
26	56	0.21652E+01	36.6000	38.1109	4.13	
27	54	0.21652E+01	36.6000	38.1109	4.13	
28	38	0.24498E+01	36.6000	40.5381	10.76	
29	58	0.21936E+01	36.6000	38.3596	4.81	
30	69	0.22892E+01	36.6000	39.1872	7.07	
31	52	0.21936E+01	36.6000	38.3596	4.81	
32	37	0.22287E+01	36.6000	38.6656	5.64	
33	51	0.22287E+01	36.6000	38.6656	5.64	
34	92	0.20089E+01	36.6000	36.7098	0.30	
35	89	0.19969E+01	36.6000	36.6000 *	0.00	
36	68	0.21532E+01	36.6000	38.0047	3.84	
37	66	0.21532E+01	36.6000	38.0047	3.84	
38	61	0.24362E+01	36.6000	40.4259	10.45	
39	71	0.21813E+01	36.6000	38.2528	4.52	
40	81	0.22765E+01	36.6000	39.0783	6.77	

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
41	64	0.21813E+01	36.6000	38.2528	4.52	
42	60	0.22163E+01	36.6000	38.5580	5.35	
43	63	0.22163E+01	36.6000	38.5580	5.35	
44	90	0.19969E+01	36.6000	36.6000	0.00	
45	77	0.24498E+01	36.6000	40.5381	10.76	
46	75	0.22892E+01	36.6000	39.1872	7.07	
47	85	0.24362E+01	36.6000	40.4259	10.45	
48	82	0.22765E+01	36.6000	39.0783	6.77	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	4.965	1870.	839.16

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : UREA PROCESS AREA FOR WATER SPRAY SYSTEM (20-DV-9902)
23 OF 24

DATE : 13-Mar-2014

PAGE

COMMENTS

Analysis Converged in 4 Iterations


WARNINGS

*** WARNING - Nozzle 35 below minimum operating pressure
*** WARNING - Nozzle 44 below minimum operating pressure

=====

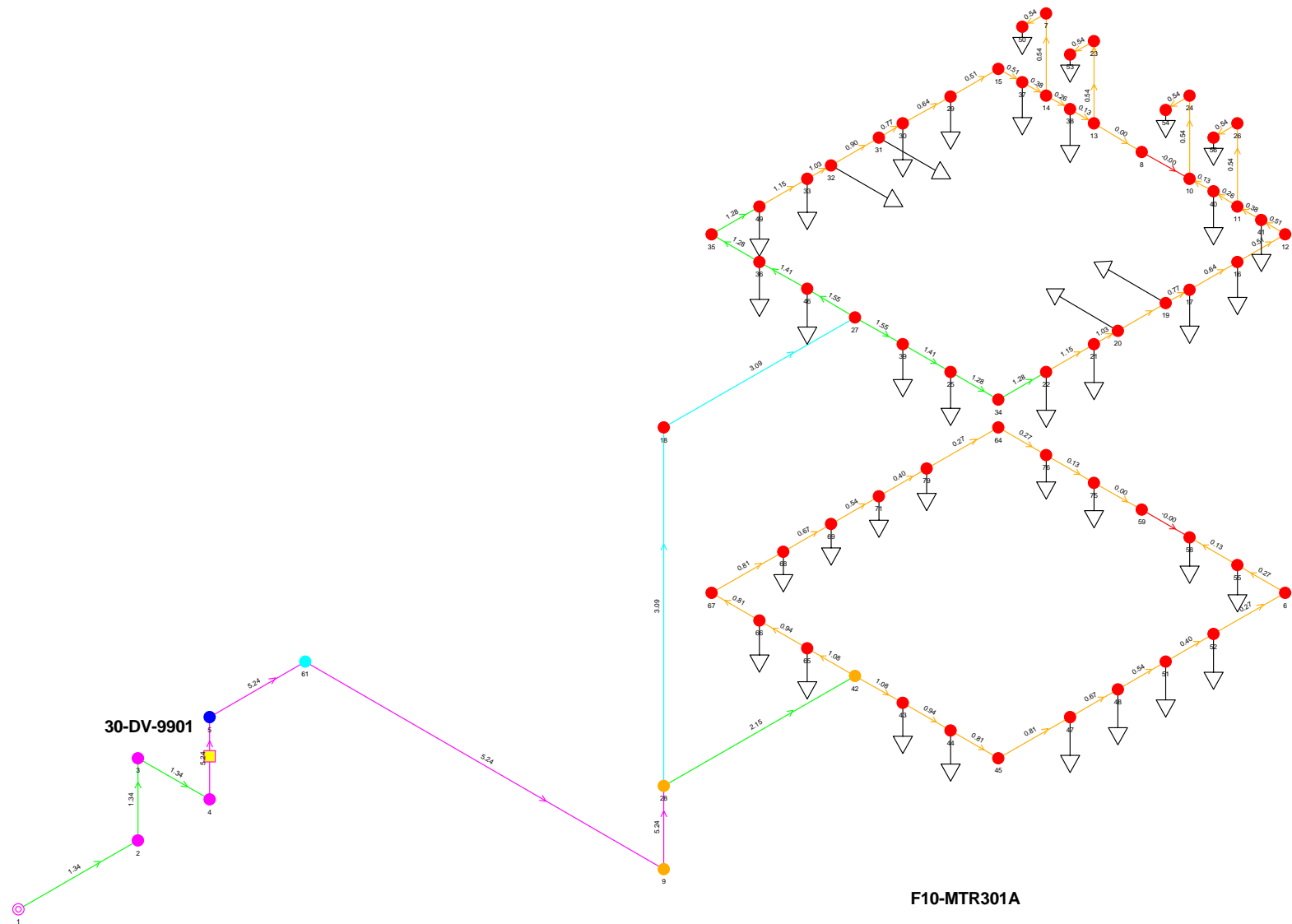
UREA PROCESS AREA FOR WATER SPRAY SYSTEM (20-DV-9902)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #4.5

CÁLCULO HIDRÁULICO DV NO. 30-DV-9901



F10-MTR301A

UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9901)			
		Kunkook Fire Protection Co., Ltd	
PIPENET Schematic	Thursday, March 13, 2014		Page 1 of 1
Pipe velocity (m/sec)	<div><div></div>< 0.000000</div>	<div><div></div>< 1.200000</div>	<div><div></div>< 2.400000</div>
	<div><div></div>< 3.600000</div>	<div><div></div>< 4.800000</div>	<div><div></div>> 4.800000</div>

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9901)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

15:33 on 13-Mar-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	8
Special Equipment.....	10
Designed Diameters & Flowrates.....	11
Flow in Pipes.....	13
Flow through Nozzles.....	15
Flow at Inlets.....	16
Important Notice.....	17
Comments.....	18
Warnings.....	19

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
10	-- A106 GR.B, SMLS, SCH	Not Lined	
9	-- A106 GR.B, SMLS, SCH	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS, SCH Not lined			A106 GR.B, SMLS, SCH Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	14.0000	6.0000	15.0000	14.0000	6.0000		
20.0000	19.0000	6.0000	20.0000	19.0000	6.0000		
25.0000	24.0000	6.0000	25.0000	24.0000	6.0000		
40.0000	38.0000	6.0000	40.0000	38.0000	6.0000		
50.0000	49.0000	6.0000	50.0000	49.0000	6.0000		
80.0000	78.0000	6.0000	80.0000	78.0000	6.0000		
100.0000	102.0000	6.0000	100.0000	102.0000	6.0000		
150.0000	154.0000	6.0000	150.0000	154.0000	6.0000		
200.0000	203.0000	6.0000	200.0000	203.0000	6.0000		
250.0000	255.0000	6.0000	250.0000	255.0000	6.0000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	150.0	7.000	0.000	120.0	4.256
2	2	3	150.0	2.000	2.000	120.0	4.256
3	3	4	150.0	5.000	0.000	120.0	10.03
4	4	5	80.00	5.000	5.000	120.0	0.9190
5	18	27	80.00	2.000	0.000	120.0	4.595
6	12	41	80.00	1.000	0.000	120.0	4.595
7	28	18	80.00	2.000	0.000	120.0	2.144
8	5	61	80.00	10.00	0.000	120.0	4.289
9	10	8	80.00	2.000	0.000	120.0	0.000
10	41	11	80.00	1.000	0.000	120.0	4.595
11	11	40	80.00	1.000	0.000	120.0	4.595
12	13	8	80.00	2.000	0.000	120.0	0.000
13	40	10	80.00	1.000	0.000	120.0	4.595
14	15	37	80.00	1.000	0.000	120.0	4.595
15	16	12	80.00	2.000	0.000	120.0	2.144
16	17	16	80.00	2.000	0.000	120.0	4.595
17	19	17	80.00	1.000	0.000	120.0	4.595
18	20	19	80.00	2.000	0.000	120.0	4.595
19	21	20	80.00	1.000	0.000	120.0	4.595
20	22	21	80.00	2.000	0.000	120.0	4.595
21	34	22	80.00	2.000	0.000	120.0	4.595
22	14	7	40.00	2.000	0.000	120.0	0.8481
23	25	34	80.00	2.000	0.000	120.0	2.144
24	13	23	40.00	2.000	0.000	120.0	0.8481
25	27	46	80.00	2.000	0.000	120.0	4.595
26	37	14	80.00	1.000	0.000	120.0	4.595
27	39	25	80.00	2.000	0.000	120.0	4.595
28	29	15	80.00	2.000	0.000	120.0	2.144
29	30	29	80.00	2.000	0.000	120.0	4.595
30	31	30	80.00	1.000	0.000	120.0	4.595
31	32	31	80.00	2.000	0.000	120.0	4.595
32	33	32	80.00	1.000	0.000	120.0	4.595
33	49	33	80.00	2.000	0.000	120.0	4.595
34	35	49	80.00	2.000	0.000	120.0	4.595
35	36	35	80.00	2.000	0.000	120.0	2.144
36	10	24	40.00	2.000	0.000	120.0	0.8481
37	46	36	80.00	2.000	0.000	120.0	4.595
38	14	38	80.00	1.000	0.000	120.0	4.595
39	11	26	40.00	2.000	0.000	120.0	0.8481
40	27	39	80.00	2.000	0.000	120.0	4.595
41	38	13	80.00	1.000	0.000	120.0	4.595
42	28	42	80.00	2.000	0.000	120.0	4.595
43	42	43	80.00	2.000	0.000	120.0	4.595

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
44	43	44	80.00	2.000	0.000	120.0	4.595
45	44	45	80.00	2.000	0.000	120.0	2.144
46	45	47	80.00	2.000	0.000	120.0	4.595
47	47	48	80.00	2.000	0.000	120.0	4.595
48	7	50	40.00	2.000	0.000	120.0	0.8481
49	48	51	80.00	2.000	0.000	120.0	4.595
50	51	52	80.00	2.000	0.000	120.0	4.595
51	23	53	40.00	2.000	0.000	120.0	0.8481
52	52	6	80.00	2.000	0.000	120.0	2.144
53	6	55	80.00	1.000	0.000	120.0	4.595
54	24	54	40.00	2.000	0.000	120.0	0.8481
55	58	59	80.00	1.000	0.000	120.0	0.000
56	55	58	80.00	1.000	0.000	120.0	4.595
57	26	56	40.00	2.000	0.000	120.0	0.8481
58	75	59	80.00	1.000	0.000	120.0	0.000
60	76	75	80.00	1.000	0.000	120.0	4.595
62	64	76	80.00	1.000	0.000	120.0	4.595
63	42	65	80.00	2.000	0.000	120.0	4.595
64	65	66	80.00	2.000	0.000	120.0	4.595
65	66	67	80.00	2.000	0.000	120.0	2.144
66	67	68	80.00	2.000	0.000	120.0	4.595
67	68	69	80.00	2.000	0.000	120.0	4.595
69	69	71	80.00	2.000	0.000	120.0	4.595
70	71	79	80.00	2.000	0.000	120.0	4.595
72	79	64	80.00	2.000	0.000	120.0	2.144
73	9	28	80.00	2.000	2.000	120.0	4.595
74	61	9	80.00	25.00	0.000	120.0	4.595

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	1 x 2	4.256
2	1 x 2	4.256
3	1 x 4	9.121
4	3 x 5	0.3063
5	1 x 4	4.595
6	1 x 4	4.595
7	1 x 2	2.144
8	2 x 2	2.144
		1 x 5 0.9121

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

10	1 x 4	4.595
11	1 x 4	4.595
13	1 x 4	4.595
14	1 x 4	4.595
15	1 x 2	2.144
16	1 x 4	4.595
17	1 x 4	4.595
18	1 x 4	4.595
19	1 x 4	4.595
20	1 x 4	4.595
21	1 x 4	4.595
22	1 x 2	0.8481
23	1 x 2	2.144
24	1 x 2	0.8481
25	1 x 4	4.595
26	1 x 4	4.595
27	1 x 4	4.595
28	1 x 2	2.144
29	1 x 4	4.595
30	1 x 4	4.595
31	1 x 4	4.595
32	1 x 4	4.595
33	1 x 4	4.595
34	1 x 4	4.595
35	1 x 2	2.144
36	1 x 2	0.8481
37	1 x 4	4.595
38	1 x 4	4.595
39	1 x 2	0.8481
40	1 x 4	4.595
41	1 x 4	4.595
42	1 x 4	4.595
43	1 x 4	4.595
44	1 x 4	4.595
45	1 x 2	2.144
46	1 x 4	4.595
47	1 x 4	4.595
48	1 x 2	0.8481
49	1 x 4	4.595
50	1 x 4	4.595
51	1 x 2	0.8481
52	1 x 2	2.144
53	1 x 4	4.595

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

54	1 x 2	0.8481
56	1 x 4	4.595
57	1 x 2	0.8481
60	1 x 4	4.595
62	1 x 4	4.595
63	1 x 4	4.595
64	1 x 4	4.595
65	1 x 2	2.144
66	1 x 4	4.595
67	1 x 4	4.595
69	1 x 4	4.595
70	1 x 4	4.595
72	1 x 2	2.144
73	1 x 4	4.595
74	1 x 4	4.595

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
- 5 -- Gate Valve
- 6 -- Swing Check Valve
- 7 -- Non-Return Valve
- 8 -- Ball Valve
- 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	22	1	25.9000	36.6000	0.20000E+01	0.14400E+02
2	21	1	25.9000	36.6000	0.20000E+01	0.14400E+02
3	20	1	25.9000	36.6000	0.20000E+01	0.14400E+02
4	19	1	25.9000	36.6000	0.20000E+01	0.14400E+02
5	17	1	25.9000	36.6000	0.20000E+01	0.14400E+02
6	16	1	25.9000	36.6000	0.20000E+01	0.14400E+02
7	37	1	25.9000	36.6000	0.20000E+01	0.14400E+02
8	25	1	25.9000	36.6000	0.20000E+01	0.14400E+02
9	38	1	25.9000	36.6000	0.20000E+01	0.14400E+02
10	39	1	25.9000	36.6000	0.20000E+01	0.14400E+02
11	40	1	25.9000	36.6000	0.20000E+01	0.14400E+02
12	36	1	25.9000	36.6000	0.20000E+01	0.14400E+02
13	41	1	25.9000	36.6000	0.20000E+01	0.14400E+02
14	46	1	25.9000	36.6000	0.20000E+01	0.14400E+02
18	50	1	25.9000	36.6000	0.20000E+01	0.14400E+02
19	29	1	25.9000	36.6000	0.20000E+01	0.14400E+02
20	30	1	25.9000	36.6000	0.20000E+01	0.14400E+02
21	31	1	25.9000	36.6000	0.20000E+01	0.14400E+02
22	32	1	25.9000	36.6000	0.20000E+01	0.14400E+02
23	33	1	25.9000	36.6000	0.20000E+01	0.14400E+02
24	49	1	25.9000	36.6000	0.20000E+01	0.14400E+02
25	66	1	25.9000	36.6000	0.20000E+01	0.14400E+02
26	65	1	25.9000	36.6000	0.20000E+01	0.14400E+02
27	43	1	25.9000	36.6000	0.20000E+01	0.14400E+02
28	53	1	25.9000	36.6000	0.20000E+01	0.14400E+02
29	44	1	25.9000	36.6000	0.20000E+01	0.14400E+02
30	75	1	25.9000	36.6000	0.20000E+01	0.14400E+02
31	47	1	25.9000	36.6000	0.20000E+01	0.14400E+02
32	54	1	25.9000	36.6000	0.20000E+01	0.14400E+02
33	56	1	25.9000	36.6000	0.20000E+01	0.14400E+02
34	76	1	25.9000	36.6000	0.20000E+01	0.14400E+02
35	48	1	25.9000	36.6000	0.20000E+01	0.14400E+02
37	51	1	25.9000	36.6000	0.20000E+01	0.14400E+02
38	79	1	25.9000	36.6000	0.20000E+01	0.14400E+02
41	52	1	25.9000	36.6000	0.20000E+01	0.14400E+02
42	71	1	25.9000	36.6000	0.20000E+01	0.14400E+02
44	69	1	25.9000	36.6000	0.20000E+01	0.14400E+02
47	55	1	25.9000	36.6000	0.20000E+01	0.14400E+02
48	68	1	25.9000	36.6000	0.20000E+01	0.14400E+02
49	58	1	25.9000	36.6000	0.20000E+01	0.14400E+02

Nozzle types are :
1 -- K-factor 25.9

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	1502.9960	10	154.0000	150.0000	*
2	2	3	1502.9960	10	154.0000	150.0000	*
3	3	4	1502.9960	10	154.0000	150.0000	*
4	4	5	1502.9960	10	78.0000	80.0000	*
5	18	27	886.5455	10	78.0000	80.0000	*
6	12	41	146.5799	10	78.0000	80.0000	*
7	28	18	886.5455	10	78.0000	80.0000	*
8	5	61	1502.9960	10	78.0000	80.0000	*
9	10	8	0.0000	10	78.0000	80.0000	*
10	41	11	109.8830	10	78.0000	80.0000	*
11	11	40	73.2733	10	78.0000	80.0000	*
12	13	8	0.0000	10	78.0000	80.0000	*
13	40	10	36.6001	10	78.0000	80.0000	*
14	15	37	146.5799	10	78.0000	80.0000	*
15	16	12	146.5799	10	78.0000	80.0000	*
16	17	16	183.3242	10	78.0000	80.0000	*
17	19	17	220.1173	10	78.0000	80.0000	*
18	20	19	256.9681	10	78.0000	80.0000	*
19	21	20	293.9095	10	78.0000	80.0000	*
20	22	21	330.9491	10	78.0000	80.0000	*
21	34	22	368.1324	10	78.0000	80.0000	*
22	14	7	36.6097	9	38.0000	40.0000	*
23	25	34	368.1324	10	78.0000	80.0000	*
24	13	23	36.6001	9	38.0000	40.0000	*
25	27	46	443.2728	10	78.0000	80.0000	*
26	37	14	109.8830	10	78.0000	80.0000	*
27	39	25	405.5992	10	78.0000	80.0000	*
28	29	15	146.5799	10	78.0000	80.0000	*
29	30	29	183.3242	10	78.0000	80.0000	*
30	31	30	220.1173	10	78.0000	80.0000	*
31	32	31	256.9681	10	78.0000	80.0000	*
32	33	32	293.9095	10	78.0000	80.0000	*
33	49	33	330.9491	10	78.0000	80.0000	*
34	35	49	368.1324	10	78.0000	80.0000	*
35	36	35	368.1324	10	78.0000	80.0000	*
36	10	24	36.6001	9	38.0000	40.0000	*
37	46	36	405.5992	10	78.0000	80.0000	*
38	14	38	73.2733	10	78.0000	80.0000	*
39	11	26	36.6097	9	38.0000	40.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
40	27	39	443.2728	10	78.0000	80.0000	*
41	38	13	36.6001	10	78.0000	80.0000	*
42	28	42	616.4503	10	78.0000	80.0000	*
43	42	43	308.2252	10	78.0000	80.0000	*
44	43	44	269.4684	10	78.0000	80.0000	*
45	44	45	230.8057	10	78.0000	80.0000	*
46	45	47	230.8057	10	78.0000	80.0000	*
47	47	48	192.2587	10	78.0000	80.0000	*
48	7	50	36.6097	9	38.0000	40.0000	*
49	48	51	153.7623	10	78.0000	80.0000	*
50	51	52	115.2995	10	78.0000	80.0000	*
51	23	53	36.6001	9	38.0000	40.0000	*
52	52	6	76.8564	10	78.0000	80.0000	*
53	6	55	76.8564	10	78.0000	80.0000	*
54	24	54	36.6001	9	38.0000	40.0000	*
55	58	59	0.0000	10	78.0000	80.0000	*
56	55	58	38.4271	10	78.0000	80.0000	*
57	26	56	36.6097	9	38.0000	40.0000	*
58	75	59	0.0000	10	78.0000	80.0000	*
60	76	75	38.4271	10	78.0000	80.0000	*
62	64	76	76.8564	10	78.0000	80.0000	*
63	42	65	308.2252	10	78.0000	80.0000	*
64	65	66	269.4684	10	78.0000	80.0000	*
65	66	67	230.8057	10	78.0000	80.0000	*
66	67	68	230.8057	10	78.0000	80.0000	*
67	68	69	192.2587	10	78.0000	80.0000	*
69	69	71	153.7623	10	78.0000	80.0000	*
70	71	79	115.2995	10	78.0000	80.0000	*
72	79	64	76.8564	10	78.0000	80.0000	*
73	9	28	1502.9960	10	78.0000	80.0000	*
74	61	9	1502.9960	10	78.0000	80.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
10 -- A106 GR.B, SMLS, SCH	Not Lined	
9 -- A106 GR.B, SMLS, SCH	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	150.00	5.665	5.649	1.6245E-02	1.6245E-02	1503.
1.345	2	3	150.00	5.649	5.444	0.2048	9.0335E-03	1503.
1.345	3	4	150.00	5.444	5.422	2.1700E-02	2.1700E-02	1503.
1.345	4	5	80.00	5.422	4.500	0.9223	0.4328	1503.
5.242	E	18	80.00	2.242	2.143	9.8455E-02	9.8455E-02	886.5
3.092	12	41	80.00	2.010	2.007	2.9900E-03	2.9900E-03	146.6
0.5113	28	18	80.00	2.303	2.242	6.1865E-02	6.1865E-02	886.5
3.092	5	61	80.00	4.500	3.934	0.5664	0.5664	1503.
5.242	10	8	80.00	2.005	2.005	0.000	0.000	-1.2552E-10
-4.3782E-13	41	11	80.00	2.007	2.006	1.7550E-03	1.7550E-03	109.9
0.3833	11	40	80.00	2.006	2.005	8.2994E-04	8.2994E-04	73.27
0.2556	13	8	80.00	2.005	2.005	0.000	0.000	1.2552E-10
4.3782E-13	40	10	80.00	2.005	2.005	2.3007E-04	2.3007E-04	36.60
0.1277	15	37	80.00	2.010	2.007	2.9900E-03	2.9900E-03	146.6
0.5113	16	12	80.00	2.013	2.010	2.2151E-03	2.2151E-03	146.6
0.5113	17	16	80.00	2.018	2.013	5.3349E-03	5.3349E-03	183.3
0.6394	19	17	80.00	2.024	2.018	6.3450E-03	6.3450E-03	220.1
0.7678	20	19	80.00	2.034	2.024	9.9599E-03	9.9599E-03	257.0
0.8963	21	20	80.00	2.045	2.034	1.0835E-02	1.0835E-02	293.9
1.025	22	21	80.00	2.061	2.045	1.5905E-02	1.5905E-02	330.9
1.154	34	22	80.00	2.080	2.061	1.9365E-02	1.9365E-02	368.1
1.284	14	7	40.00	2.006	2.002	3.8800E-03	3.8800E-03	36.61
0.5380	25	34	80.00	2.093	2.080	1.2170E-02	1.2170E-02	368.1
1.284	13	23	40.00	2.005	2.001	3.8750E-03	3.8750E-03	36.60
0.5379	27	46	80.00	2.143	2.116	2.7305E-02	2.7305E-02	443.3
1.546	37	14	80.00	2.007	2.006	1.7550E-03	1.7550E-03	109.9
0.3833	39	25	80.00	2.116	2.093	2.3175E-02	2.3175E-02	405.6

1.415								
28	29	15	80.00	2.013	2.010	2.2151E-03	2.2151E-03	146.6
0.5113								
29	30	29	80.00	2.018	2.013	5.3349E-03	5.3349E-03	183.3
0.6394								
30	31	30	80.00	2.024	2.018	6.3450E-03	6.3450E-03	220.1
0.7678								
31	32	31	80.00	2.034	2.024	9.9599E-03	9.9599E-03	257.0
0.8963								
32	33	32	80.00	2.045	2.034	1.0835E-02	1.0835E-02	293.9
1.025								
33	49	33	80.00	2.061	2.045	1.5905E-02	1.5905E-02	330.9
1.154								
34	35	49	80.00	2.080	2.061	1.9365E-02	1.9365E-02	368.1
1.284								
35	36	35	80.00	2.093	2.080	1.2170E-02	1.2170E-02	368.1
1.284								
36	10	24	40.00	2.005	2.001	3.8750E-03	3.8750E-03	36.60
0.5379								
37	46	36	80.00	2.116	2.093	2.3175E-02	2.3175E-02	405.6
1.415								
38	14	38	80.00	2.006	2.005	8.2994E-04	8.2994E-04	73.27
0.2556								
39	11	26	40.00	2.006	2.002	3.8800E-03	3.8800E-03	36.61
0.5380								
40	27	39	80.00	2.143	2.116	2.7305E-02	2.7305E-02	443.3
1.546								
41	38	13	80.00	2.005	2.005	2.3007E-04	2.3007E-04	36.60
0.1277								

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
42 2.150	28	42	80.00	2.303	2.253	5.0265E-02	5.0265E-02	616.4
43 1.075	42	43	80.00	2.253	2.239	1.3945E-02	1.3945E-02	308.2
44 0.9399	43	44	80.00	2.239	2.228	1.0875E-02	1.0875E-02	269.5
45 0.8050	44	45	80.00	2.228	2.223	5.1298E-03	5.1298E-03	230.8
46 0.8050	45	47	80.00	2.223	2.215	8.1651E-03	8.1651E-03	230.8
47 0.6706	47	48	80.00	2.215	2.209	5.8250E-03	5.8250E-03	192.3
48 0.5380	7	50	40.00	2.002	1.998	3.8799E-03	3.8799E-03	36.61
49 0.5363	48	51	80.00	2.209	2.205	3.8500E-03	3.8500E-03	153.8
50 0.4022	51	52	80.00	2.205	2.203	2.2600E-03	2.2600E-03	115.3
51 0.5379	23	53	40.00	2.001	1.997	3.8799E-03	3.8799E-03	36.60
52 0.2681	52	6	80.00	2.203	2.202	6.7496E-04	6.7496E-04	76.86
53 0.2681	6	55	80.00	2.202	2.202	9.0504E-04	9.0504E-04	76.86
54 0.5379	24	54	40.00	2.001	1.997	3.8799E-03	3.8799E-03	36.60
55 -1.9110E-13	58	59	80.00	2.201	2.201	0.000	0.000	-5.4789E-11
56 0.1340	55	58	80.00	2.202	2.201	2.4986E-04	2.4986E-04	38.43
57 0.5380	26	56	40.00	2.002	1.998	3.8799E-03	3.8799E-03	36.61
58 1.9110E-13	75	59	80.00	2.201	2.201	0.000	0.000	5.4789E-11
60 0.1340	76	75	80.00	2.202	2.201	2.4986E-04	2.4986E-04	38.43
62 0.2681	64	76	80.00	2.202	2.202	9.0504E-04	9.0504E-04	76.86
63 1.075	42	65	80.00	2.253	2.239	1.3945E-02	1.3945E-02	308.2
64 0.9399	65	66	80.00	2.239	2.228	1.0875E-02	1.0875E-02	269.5
65 0.8050	66	67	80.00	2.228	2.223	5.1298E-03	5.1298E-03	230.8
66 0.8050	67	68	80.00	2.223	2.215	8.1651E-03	8.1651E-03	230.8
67 0.6706	68	69	80.00	2.215	2.209	5.8250E-03	5.8250E-03	192.3
69 0.5363	69	71	80.00	2.209	2.205	3.8500E-03	3.8500E-03	153.8
70 0.4022	71	79	80.00	2.205	2.203	2.2600E-03	2.2600E-03	115.3
72	79	64	80.00	2.203	2.202	6.7496E-04	6.7496E-04	76.86

0.2681								
73	9	28	80.00	2.761	2.303	0.4572	0.2614	1503.
5.242								
74	61	9	80.00	3.934	2.761	1.173	1.173	1503.
5.242								

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	22	0.20611E+01	36.6000	37.1833	1.59	
2	21	0.20452E+01	36.6000	37.0395	1.20	
3	20	0.20343E+01	36.6000	36.9413	0.93	
4	19	0.20244E+01	36.6000	36.8507	0.69	
5	17	0.20180E+01	36.6000	36.7929	0.53	
6	16	0.20127E+01	36.6000	36.7443	0.39	
7	37	0.20075E+01	36.6000	36.6968	0.26	
8	25	0.20926E+01	36.6000	37.4667	2.37	
9	38	0.20049E+01	36.6000	36.6731	0.20	
10	39	0.21158E+01	36.6000	37.6735	2.93	
11	40	0.20049E+01	36.6000	36.6731	0.20	
12	36	0.20926E+01	36.6000	37.4667	2.37	
13	41	0.20075E+01	36.6000	36.6968	0.26	
14	46	0.21158E+01	36.6000	37.6735	2.93	
18	50	0.19980E+01	36.6000	36.6097	0.03	
19	29	0.20127E+01	36.6000	36.7443	0.39	
20	30	0.20180E+01	36.6000	36.7929	0.53	
21	31	0.20244E+01	36.6000	36.8507	0.69	
22	32	0.20343E+01	36.6000	36.9413	0.93	
23	33	0.20452E+01	36.6000	37.0395	1.20	
24	49	0.20611E+01	36.6000	37.1833	1.59	
25	66	0.22283E+01	36.6000	38.6625	5.64	
26	65	0.22392E+01	36.6000	38.7567	5.89	
27	43	0.22392E+01	36.6000	38.7567	5.89	
28	53	0.19969E+01	36.6000	36.6000 *	0.00	
29	44	0.22283E+01	36.6000	38.6625	5.64	
30	75	0.22013E+01	36.6000	38.4270	4.99	
31	47	0.22150E+01	36.6000	38.5470	5.32	
32	54	0.19969E+01	36.6000	36.6000	0.00	
33	56	0.19980E+01	36.6000	36.6097	0.03	
34	76	0.22015E+01	36.6000	38.4292	5.00	
35	48	0.22092E+01	36.6000	38.4963	5.18	
37	51	0.22054E+01	36.6000	38.4627	5.09	
38	79	0.22031E+01	36.6000	38.4430	5.04	
41	52	0.22031E+01	36.6000	38.4430	5.04	
42	71	0.22054E+01	36.6000	38.4627	5.09	
44	69	0.22092E+01	36.6000	38.4963	5.18	
47	55	0.22015E+01	36.6000	38.4292	5.00	
48	68	0.22150E+01	36.6000	38.5470	5.32	
49	58	0.22013E+01	36.6000	38.4270	4.99	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	5.665	1503.	631.46

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
18 OF 19

DATE : 13-Mar-2014

PAGE

COMMENTS

Analysis Converged in 3 Iterations


WARNINGS

*** WARNING - Nozzle 18 below minimum operating pressure
*** WARNING - Nozzle 28 below minimum operating pressure
*** WARNING - Nozzle 32 below minimum operating pressure
*** WARNING - Nozzle 33 below minimum operating pressure

=====

AMMONIA PROCESS AREA FOR WATER SPRAY SYSTEM (DV001)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 PLANTAS DE AMONIACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #4.6

CÁLCULO HIDRÁULICO DV NO. 30-DV-9902

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9902)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

16:57 on 24-Jul-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	6
Special Equipment.....	7
Designed Diameters & Flowrates.....	8
Flow in Pipes.....	9
Flow through Nozzles.....	10
Flow at Inlets.....	11
Important Notice.....	12
Comments.....	13
Warnings.....	14

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
10	-- A106 GR.B, SMLS, SCH	Not Lined	
9	-- A106 GR.B, SMLS, SCH	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS, SCH Not lined			A106 GR.B, SMLS, SCH Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	14.0000	6.0000	15.0000	14.0000	6.0000		
20.0000	19.0000	6.0000	20.0000	19.0000	6.0000		
25.0000	24.0000	6.0000	25.0000	24.0000	6.0000		
40.0000	38.0000	6.0000	40.0000	38.0000	6.0000		
50.0000	49.0000	6.0000	50.0000	49.0000	6.0000		
80.0000	78.0000	6.0000	80.0000	78.0000	6.0000		
100.0000	102.0000	6.0000	100.0000	102.0000	6.0000		
150.0000	154.0000	6.0000	150.0000	154.0000	6.0000		
200.0000	203.0000	6.0000	200.0000	203.0000	6.0000		
250.0000	255.0000	6.0000	250.0000	255.0000	6.0000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	150.0	12.00	0.000	120.0	4.256
2	2	3	150.0	2.000	2.000	120.0	4.256
3	3	4	150.0	5.000	0.000	120.0	10.03
4	4	5	80.00	3.000	3.000	120.0	0.9190
5	5	6	80.00	10.00	0.000	120.0	6.433
6	7	11	80.00	2.000	0.000	120.0	4.595
7	11	10	40.00	1.000	0.000	120.0	1.696
8	10	18	40.00	1.000	1.000	120.0	0.8481
9	10	27	40.00	1.000	0.000	120.0	1.696
10	11	12	40.00	1.000	0.000	120.0	1.696
11	12	13	40.00	1.500	0.000	120.0	0.8481
12	40	16	40.00	1.500	0.000	120.0	1.696
13	16	17	40.00	1.000	0.000	120.0	1.696
14	17	24	40.00	0.5000	0.000	120.0	0.000
15	20	8	40.00	1.500	0.000	120.0	1.696
16	13	22	40.00	1.500	0.000	120.0	1.696
17	8	24	40.00	0.5000	0.000	120.0	0.000
18	14	9	40.00	1.500	0.000	120.0	1.696
19	21	14	40.00	1.500	0.000	120.0	1.696
20	9	15	40.00	1.500	0.000	120.0	1.696
21	15	40	40.00	1.500	0.000	120.0	0.8481
22	23	20	40.00	1.500	0.000	120.0	0.8481
23	26	23	40.00	1.500	0.000	120.0	1.696
24	18	19	40.00	2.100	0.000	120.0	0.000
25	22	26	40.00	1.500	0.000	120.0	1.696
27	28	7	80.00	2.000	-2.000	120.0	2.144
29	6	28	80.00	21.00	0.000	120.0	2.144
36	27	21	40.00	1.500	0.000	120.0	0.8481
38	17	34	40.00	1.000	1.000	120.0	0.8481
54	34	53	40.00	1.800	0.000	120.0	0.8481

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	1 x 2	4.256
2	1 x 2	4.256
3	1 x 4	9.121
4	3 x 5	0.3063
5	3 x 2	2.144
1 x 5		0.9121

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

6	1 x 4	4.595
7	1 x 4	1.696
8	1 x 2	0.8481
9	1 x 4	1.696
10	1 x 4	1.696
11	1 x 2	0.8481
12	1 x 4	1.696
13	1 x 4	1.696
15	1 x 4	1.696
16	1 x 4	1.696
18	1 x 4	1.696
19	1 x 4	1.696
20	1 x 4	1.696
21	1 x 2	0.8481
22	1 x 2	0.8481
23	1 x 4	1.696
25	1 x 4	1.696
27	1 x 2	2.144
29	1 x 2	2.144
36	1 x 2	0.8481
38	1 x 2	0.8481
54	1 x 2	0.8481

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
- 5 -- Gate Valve
- 6 -- Swing Check Valve
- 7 -- Non-Return Valve
- 8 -- Ball Valve
- 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	9	3	33.1000	46.8000	0.20000E+01	0.14400E+02
2	12	3	33.1000	46.8000	0.20000E+01	0.14400E+02
3	14	3	33.1000	46.8000	0.20000E+01	0.14400E+02
4	15	3	33.1000	46.8000	0.20000E+01	0.14400E+02
5	16	3	33.1000	46.8000	0.20000E+01	0.14400E+02
6	19	3	33.1000	46.8000	0.20000E+01	0.14400E+02
7	8	3	33.1000	46.8000	0.20000E+01	0.14400E+02
8	22	3	33.1000	46.8000	0.20000E+01	0.14400E+02
9	23	3	33.1000	46.8000	0.20000E+01	0.14400E+02
10	26	3	33.1000	46.8000	0.20000E+01	0.14400E+02
13	53	3	33.1000	46.8000	0.20000E+01	0.14400E+02
15	27	3	33.1000	46.8000	0.20000E+01	0.14400E+02

Nozzle types are :
3 -- K-factor 33.1

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	591.5809	10	154.0000	150.0000	*
2	2	3	591.5809	10	154.0000	150.0000	*
3	3	4	591.5809	10	154.0000	150.0000	*
4	4	5	591.5808	10	78.0000	80.0000	*
5	5	6	591.5808	10	78.0000	80.0000	*
6	7	11	591.5808	9	78.0000	80.0000	*
7	11	10	301.9386	9	38.0000	40.0000	*
8	10	18	51.3344	9	38.0000	40.0000	*
9	10	27	250.6042	9	38.0000	40.0000	*
10	11	12	289.6422	9	38.0000	40.0000	*
11	12	13	237.0281	9	38.0000	40.0000	*
12	40	16	53.5242	9	38.0000	40.0000	*
13	16	17	5.4999	9	38.0000	40.0000	*
14	17	24	-41.3196	9	38.0000	40.0000	*
15	20	8	89.3814	9	38.0000	40.0000	*
16	13	22	237.0281	9	38.0000	40.0000	*
17	8	24	41.3196	9	38.0000	40.0000	*
18	14	9	150.2855	9	38.0000	40.0000	*
19	21	14	199.4950	9	38.0000	40.0000	*
20	9	15	101.7415	9	38.0000	40.0000	*
21	15	40	53.5242	9	38.0000	40.0000	*
22	23	20	89.3814	9	38.0000	40.0000	*
23	26	23	137.8903	9	38.0000	40.0000	*
24	18	19	51.3344	9	38.0000	40.0000	*
25	22	26	186.9677	9	38.0000	40.0000	*
27	28	7	591.5808	9	78.0000	80.0000	*
29	6	28	591.5808	10	78.0000	80.0000	*
36	27	21	199.4950	9	38.0000	40.0000	*
38	17	34	46.8001	9	38.0000	40.0000	*
54	34	53	46.8001	9	38.0000	40.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
10 -- A106 GR.B, SMLS, SCH	Not Lined	
9 -- A106 GR.B, SMLS, SCH	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	150.00	3.417	3.413	4.1800E-03	4.1800E-03	591.6
0.5293	2	3	150.00	3.413	3.215	0.1974	1.6084E-03	591.6
0.5293	3	4	150.00	3.215	3.212	3.8700E-03	3.8700E-03	591.6
0.5293	4	5	80.00	3.212	2.855	0.3567	6.2995E-02	591.6
2.063	E	5	80.00	2.855	2.739	0.1161	0.1161	591.6
2.063	5	6	80.00	2.742	2.695	4.6580E-02	4.6580E-02	591.6
2.063	7	11	40.00	2.695	2.513	0.1821	0.1821	301.9
4.437	11	10	40.00	2.513	2.411	0.1026	4.7068E-03	51.33
0.7544	8	18	40.00	2.513	2.384	0.1290	0.1290	250.6
3.683	10	27	40.00	2.695	2.527	0.1686	0.1686	289.6
4.256	11	12	40.00	2.527	2.425	0.1014	0.1014	237.0
3.483	12	13	40.00	2.116	2.107	8.7900E-03	8.7900E-03	53.52
0.7866	40	16	40.00	2.107	2.107	1.0991E-04	1.0991E-04	5.500
8.0826E-02	13	17	40.00	2.107	2.108	-8.4996E-04	8.4996E-04	-41.32
-0.6072	14	24	40.00	2.131	2.108	2.2710E-02	2.2710E-02	89.38
1.314	15	8	40.00	2.425	2.287	0.1380	0.1380	237.0
3.483	16	22	40.00	2.108	2.108	8.5497E-04	8.5497E-04	41.32
0.6072	17	24	40.00	2.210	2.151	5.9380E-02	5.9380E-02	150.3
2.209	18	9	40.00	2.311	2.210	0.1003	0.1003	199.5
2.932	21	14	40.00	2.151	2.122	2.8850E-02	2.8850E-02	101.7
1.495	9	15	40.00	2.122	2.116	6.4600E-03	6.4600E-03	53.52
0.7866	21	40	40.00	2.148	2.131	1.6685E-02	1.6685E-02	89.38
1.314	22	20	40.00	2.198	2.148	5.0640E-02	5.0640E-02	137.9
2.026	23	23	40.00	2.411	2.405	5.3499E-03	5.3499E-03	51.33
0.7544	24	19	40.00	2.287	2.198	8.8955E-02	8.8955E-02	187.0
2.748	25	26	80.00	2.575	2.742	-0.1665	2.9272E-02	591.6
2.063	27	7	80.00	2.739	2.575	0.1635	0.1635	591.6
2.063	28	7	80.00	2.739	2.575	0.1635	0.1635	591.6
2.063	29	6	80.00	2.739	2.575	0.1635	0.1635	591.6

2.063								
36	27	21	40.00	2.384	2.311	7.3670E-02	7.3670E-02	199.5
2.932								
38	17	34	40.00	2.107	2.005	0.1019	3.9668E-03	46.80
0.6878								
54	34	53	40.00	2.005	1.999	5.6851E-03	5.6851E-03	46.80
0.6878								

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (barG)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	9	0.21509E+01	46.8000	48.5439	3.73	
2	12	0.25267E+01	46.8000	52.6140	12.42	
3	14	0.22102E+01	46.8000	49.2094	5.15	
4	15	0.21220E+01	46.8000	48.2172	3.03	
5	16	0.21068E+01	46.8000	48.0436	2.66	
6	19	0.24052E+01	46.8000	51.3343	9.69	
7	8	0.21084E+01	46.8000	48.0618	2.70	
8	22	0.22873E+01	46.8000	50.0603	6.97	
9	23	0.21477E+01	46.8000	48.5087	3.65	
10	26	0.21984E+01	46.8000	49.0773	4.87	
13	53	0.19991E+01	46.8000	46.8000 *	0.00	
15	27	0.23842E+01	46.8000	51.1091	9.21	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	3.417	591.6	320.03

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9902)
13 OF 14

DATE : 24-Jul-2014

PAGE

COMMENTS

Analysis Converged in 3 Iterations

TITLE : UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9902)
14 OF 14

DATE : 24-Jul-2014

PAGE


WARNINGS

*** WARNING - Nozzle 13 below minimum operating pressure

=====

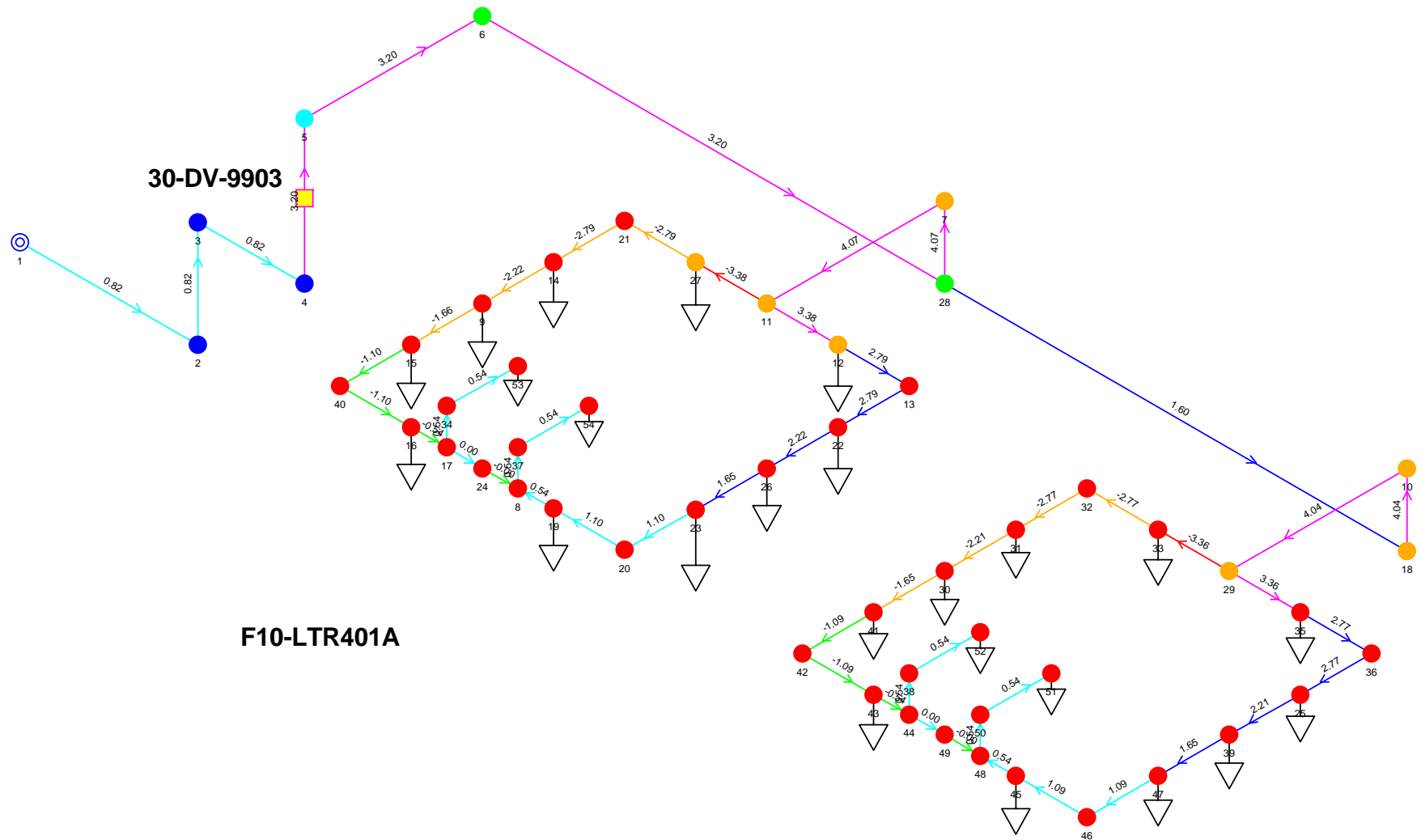
UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9902)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 La fuerza que transforma Bolivia PLANTAS DE AMONÍACO Y UREA, CARRASCO	INFORME DEL CÁLCULO HIDRÁULICO DE AGUA CONTRA INCENDIOS	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 1

ANEXO #4.7

CÁLCULO HIDRÁULICO DV NO. 30-DV-9903



UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9903)		
		Kunkook Fire Protection Co., Ltd
PIPENET Schematic	Thursday, July 24, 2014	Page 1 of 1
Pipe velocity (m/sec)	<div style="display: inline-block; width: 15px; height: 15px; background-color: red; margin-right: 5px;"></div> < -3.000000 <div style="display: inline-block; width: 15px; height: 15px; background-color: yellow; margin-left: 10px; margin-right: 5px;"></div> < -1.500000 <div style="display: inline-block; width: 15px; height: 15px; background-color: green; margin-left: 10px; margin-right: 5px;"></div> < 0.000000 <div style="display: inline-block; width: 15px; height: 15px; background-color: cyan; margin-left: 10px; margin-right: 5px;"></div> < 1.500000 <div style="display: inline-block; width: 15px; height: 15px; background-color: blue; margin-left: 10px; margin-right: 5px;"></div> < 3.000000 <div style="display: inline-block; width: 15px; height: 15px; background-color: magenta; margin-left: 10px;"></div> > 3.000000	

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9903)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

17:24 on 24-Jul-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	7
Special Equipment.....	8
Designed Diameters & Flowrates.....	9
Flow in Pipes.....	11
Flow through Nozzles.....	13
Flow at Inlets.....	14
Important Notice.....	15
Comments.....	16
Warnings.....	17

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
10	-- A106 GR.B, SMLS, SCH	Not Lined	
9	-- A106 GR.B, SMLS, SCH	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS, SCH Not lined			A106 GR.B, SMLS, SCH Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	14.0000	6.0000	15.0000	14.0000	6.0000		
20.0000	19.0000	6.0000	20.0000	19.0000	6.0000		
25.0000	24.0000	6.0000	25.0000	24.0000	6.0000		
40.0000	38.0000	6.0000	40.0000	38.0000	6.0000		
50.0000	49.0000	6.0000	50.0000	49.0000	6.0000		
80.0000	78.0000	6.0000	80.0000	78.0000	6.0000		
100.0000	102.0000	6.0000	100.0000	102.0000	6.0000		
150.0000	154.0000	6.0000	150.0000	154.0000	6.0000		
200.0000	203.0000	6.0000	200.0000	203.0000	6.0000		
250.0000	255.0000	6.0000	250.0000	255.0000	6.0000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	150.0	10.00	0.000	120.0	4.256
2	2	3	150.0	2.000	2.000	120.0	4.256
3	3	4	150.0	5.000	0.000	120.0	10.03
4	4	5	80.00	3.000	3.000	120.0	0.9190
5	5	6	80.00	25.00	0.000	120.0	6.433
6	7	11	50.00	2.000	0.000	120.0	2.182
7	19	8	40.00	0.5000	0.000	120.0	1.696
8	28	18	80.00	7.000	0.000	120.0	0.000
9	27	11	40.00	1.000	0.000	120.0	1.696
10	11	12	40.00	1.000	0.000	120.0	1.696
11	12	13	40.00	1.500	0.000	120.0	0.8481
12	16	40	40.00	1.500	0.000	120.0	1.696
13	17	16	40.00	0.5000	0.000	120.0	1.696
14	17	24	40.00	0.5000	0.000	120.0	0.000
15	20	19	40.00	1.500	0.000	120.0	1.696
16	13	22	40.00	1.500	0.000	120.0	1.696
17	8	24	40.00	0.5000	0.000	120.0	0.000
18	9	14	40.00	1.500	0.000	120.0	1.696
19	14	21	40.00	1.500	0.000	120.0	1.696
20	15	9	40.00	1.500	0.000	120.0	1.696
21	40	15	40.00	1.500	0.000	120.0	0.8481
22	23	20	40.00	1.500	0.000	120.0	0.8481
23	26	23	40.00	1.500	0.000	120.0	1.696
24	39	47	40.00	1.500	0.000	120.0	1.696
25	22	26	40.00	1.500	0.000	120.0	1.696
26	18	10	50.00	2.000	2.000	120.0	1.091
27	28	7	50.00	2.000	2.000	120.0	1.091
28	10	29	50.00	2.000	0.000	120.0	2.182
29	6	28	80.00	21.00	0.000	120.0	4.595
30	30	31	40.00	1.500	0.000	120.0	1.696
31	31	32	40.00	1.500	0.000	120.0	1.696
32	32	33	40.00	1.500	0.000	120.0	0.8481
33	33	29	40.00	1.000	0.000	120.0	1.696
34	29	35	40.00	1.000	0.000	120.0	1.696
35	35	36	40.00	1.500	0.000	120.0	0.8481
36	21	27	40.00	1.500	0.000	120.0	0.8481
37	36	25	40.00	1.500	0.000	120.0	1.696
38	17	34	40.00	1.000	1.000	120.0	0.8481
39	45	48	40.00	0.5000	0.000	120.0	1.696
40	25	39	40.00	1.500	0.000	120.0	1.696
41	41	30	40.00	1.500	0.000	120.0	1.696
42	42	41	40.00	1.500	0.000	120.0	0.8481
43	43	42	40.00	1.500	0.000	120.0	1.696

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
44	44	43	40.00	0.5000	0.000	120.0	1.696
45	48	49	40.00	0.5000	0.000	120.0	0.000
46	46	45	40.00	1.500	0.000	120.0	1.696
47	47	46	40.00	1.500	0.000	120.0	0.8481
48	44	49	40.00	0.5000	0.000	120.0	0.000
49	8	37	40.00	1.000	1.000	120.0	0.8481
50	44	38	40.00	1.000	1.000	120.0	0.8481
51	48	50	40.00	1.000	1.000	120.0	0.8481
52	50	51	40.00	1.500	0.000	120.0	0.8481
53	38	52	40.00	1.500	0.000	120.0	0.8481
54	34	53	40.00	1.500	0.000	120.0	0.8481
55	37	54	40.00	1.500	0.000	120.0	0.8481

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
1	1 x 2	4.256
2	1 x 2	4.256
3	1 x 4	9.121
4	3 x 5	0.3063
5	3 x 2	2.144
6	1 x 4	2.182
7	1 x 4	1.696
9	1 x 4	1.696
10	1 x 4	1.696
11	1 x 2	0.8481
12	1 x 4	1.696
13	1 x 4	1.696
15	1 x 4	1.696
16	1 x 4	1.696
18	1 x 4	1.696
19	1 x 4	1.696
20	1 x 4	1.696
21	1 x 2	0.8481
22	1 x 2	0.8481
23	1 x 4	1.696
24	1 x 4	1.696
25	1 x 4	1.696
26	1 x 2	1.091

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)
---------------	---------------	--------------------------------

27	1 x 2	1.091
28	1 x 4	2.182
29	1 x 4	4.595
30	1 x 4	1.696
31	1 x 4	1.696
32	1 x 2	0.8481
33	1 x 4	1.696
34	1 x 4	1.696
35	1 x 2	0.8481
36	1 x 2	0.8481
37	1 x 4	1.696
38	1 x 2	0.8481
39	1 x 4	1.696
40	1 x 4	1.696
41	1 x 4	1.696
42	1 x 2	0.8481
43	1 x 4	1.696
44	1 x 4	1.696
46	1 x 4	1.696
47	1 x 2	0.8481
49	1 x 2	0.8481
50	1 x 2	0.8481
51	1 x 2	0.8481
52	1 x 2	0.8481
53	1 x 2	0.8481
54	1 x 2	0.8481
55	1 x 2	0.8481

Fitting types are :

- 1 -- 45 Deg Elbow
- 2 -- 90 Deg Standard Elbow
- 3 -- 90 Deg Long Radius Elbow
- 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
- 5 -- Gate Valve
- 6 -- Swing Check Valve
- 7 -- Non-Return Valve
- 8 -- Ball Valve
- 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	9	8	25.9000	36.6000	0.10000E+01	0.14400E+02
2	12	8	25.9000	36.6000	0.10000E+01	0.14400E+02
3	14	8	25.9000	36.6000	0.10000E+01	0.14400E+02
4	15	8	25.9000	36.6000	0.10000E+01	0.14400E+02
5	16	8	25.9000	36.6000	0.10000E+01	0.14400E+02
6	51	1	25.9000	36.6000	0.20000E+01	0.14400E+02
7	19	8	25.9000	36.6000	0.10000E+01	0.14400E+02
8	22	8	25.9000	36.6000	0.10000E+01	0.14400E+02
9	23	8	25.9000	36.6000	0.10000E+01	0.14400E+02
10	26	8	25.9000	36.6000	0.10000E+01	0.14400E+02
11	52	1	25.9000	36.6000	0.20000E+01	0.14400E+02
12	31	8	25.9000	36.6000	0.10000E+01	0.14400E+02
13	53	1	25.9000	36.6000	0.20000E+01	0.14400E+02
14	45	1	25.9000	36.6000	0.20000E+01	0.14400E+02
15	27	8	25.9000	36.6000	0.10000E+01	0.14400E+02
16	43	1	25.9000	36.6000	0.20000E+01	0.14400E+02
17	33	8	25.9000	36.6000	0.10000E+01	0.14400E+02
18	30	8	25.9000	36.6000	0.10000E+01	0.14400E+02
19	35	8	25.9000	36.6000	0.10000E+01	0.14400E+02
20	39	8	25.9000	36.6000	0.10000E+01	0.14400E+02
21	47	8	25.9000	36.6000	0.10000E+01	0.14400E+02
22	54	1	25.9000	36.6000	0.20000E+01	0.14400E+02
23	25	8	25.9000	36.6000	0.10000E+01	0.14400E+02
24	41	8	25.9000	36.6000	0.10000E+01	0.14400E+02

Nozzle types are :
1 -- K-factor 25.9
8 -- User Defined

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	917.3716	10	154.0000	150.0000	*
2	2	3	917.3716	10	154.0000	150.0000	*
3	3	4	917.3716	10	154.0000	150.0000	*
4	4	5	917.3716	10	78.0000	80.0000	*
5	5	6	917.3716	10	78.0000	80.0000	*
6	7	11	459.9663	9	49.0000	50.0000	*
7	19	8	36.7806	9	38.0000	40.0000	*
8	28	18	457.4052	10	78.0000	80.0000	*
9	27	11	-230.0165	9	38.0000	40.0000	*
10	11	12	229.9499	9	38.0000	40.0000	*
11	12	13	189.7547	9	38.0000	40.0000	*
12	16	40	-74.6206	9	38.0000	40.0000	*
13	17	16	-36.8472	9	38.0000	40.0000	*
14	17	24	0.0333	9	38.0000	40.0000	*
15	20	19	74.5540	9	38.0000	40.0000	*
16	13	22	189.7547	9	38.0000	40.0000	*
17	8	24	-0.0333	9	38.0000	40.0000	*
18	9	14	-150.9722	9	38.0000	40.0000	*
19	14	21	-189.8213	9	38.0000	40.0000	*
20	15	9	-112.6435	9	38.0000	40.0000	*
21	40	15	-74.6206	9	38.0000	40.0000	*
22	23	20	74.5540	9	38.0000	40.0000	*
23	26	23	112.5769	9	38.0000	40.0000	*
24	39	47	111.9435	9	38.0000	40.0000	*
25	22	26	150.9056	9	38.0000	40.0000	*
26	18	10	457.4052	9	49.0000	50.0000	*
27	28	7	459.9663	9	49.0000	50.0000	*
28	10	29	457.4052	9	49.0000	50.0000	*
29	6	28	917.3716	10	78.0000	80.0000	*
30	30	31	-150.1270	9	38.0000	40.0000	*
31	31	32	-188.7616	9	38.0000	40.0000	*
32	32	33	-188.7616	9	38.0000	40.0000	*
33	33	29	-228.7359	9	38.0000	40.0000	*
34	29	35	228.6693	9	38.0000	40.0000	*
35	35	36	188.6950	9	38.0000	40.0000	*
36	21	27	-189.8213	9	38.0000	40.0000	*
37	36	25	188.6950	9	38.0000	40.0000	*
38	17	34	36.8139	9	38.0000	40.0000	*
39	45	48	36.5668	9	38.0000	40.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
40	25	39	150.0604	9	38.0000	40.0000	*
41	41	30	-112.0101	9	38.0000	40.0000	*
42	42	41	-74.1977	9	38.0000	40.0000	*
43	43	42	-74.1977	9	38.0000	40.0000	*
44	44	43	-36.6334	9	38.0000	40.0000	*
45	48	49	-0.0333	9	38.0000	40.0000	*
46	46	45	74.1310	9	38.0000	40.0000	*
47	47	46	74.1310	9	38.0000	40.0000	*
48	44	49	0.0333	9	38.0000	40.0000	*
49	8	37	36.8139	9	38.0000	40.0000	*
50	44	38	36.6001	9	38.0000	40.0000	*
51	48	50	36.6001	9	38.0000	40.0000	*
52	50	51	36.6001	9	38.0000	40.0000	*
53	38	52	36.6001	9	38.0000	40.0000	*
54	34	53	36.8139	9	38.0000	40.0000	*
55	37	54	36.8139	9	38.0000	40.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
10 -- A106 GR.B, SMLS, SCH	Not Lined	
9 -- A106 GR.B, SMLS, SCH	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	150.00	4.583	4.575	8.2550E-03	8.2550E-03	917.4
0.8208								
2	2	3	150.00	4.575	4.376	0.1994	3.6233E-03	917.4
0.8208								
3	3	4	150.00	4.376	4.367	8.7051E-03	8.7051E-03	917.4
0.8208								
4	4	5	80.00	4.367	3.932	0.4355	0.1418	917.4
3.200	E							
5	5	6	80.00	3.932	3.432	0.4999	0.4999	917.4
3.200								
6	7	11	50.00	2.697	2.519	0.1784	0.1784	460.0
4.065								
7	19	8	40.00	2.127	2.124	3.0248E-03	3.0248E-03	36.78
0.5405								
8	28	18	80.00	3.025	2.994	3.0720E-02	3.0720E-02	457.4
1.595								
9	27	11	40.00	2.409	2.519	-0.1101	0.1101	-230.0
-3.380								
10	11	12	40.00	2.519	2.409	0.1101	0.1101	229.9
3.379								
11	12	13	40.00	2.409	2.341	6.7180E-02	6.7180E-02	189.8
2.789								
12	16	40	40.00	2.127	2.143	-1.6245E-02	1.6245E-02	-74.62
-1.097								
13	17	16	40.00	2.124	2.127	-3.0248E-03	3.0248E-03	-36.85
-0.5415								
14	17	24	40.00	2.124	2.124	0.000	0.000	3.3292E-02
4.8925E-04								
15	20	19	40.00	2.143	2.127	1.6245E-02	1.6245E-02	74.55
1.096								
16	13	22	40.00	2.341	2.250	9.1445E-02	9.1445E-02	189.8
2.789								
17	8	24	40.00	2.124	2.124	0.000	0.000	-3.3292E-02
-4.8925E-04								
18	9	14	40.00	2.190	2.250	-5.9860E-02	5.9860E-02	-151.0
-2.219								
19	14	21	40.00	2.250	2.341	-9.1445E-02	9.1445E-02	-189.8
-2.790								
20	15	9	40.00	2.155	2.190	-3.4815E-02	3.4815E-02	-112.6
-1.655								
21	40	15	40.00	2.143	2.155	-1.1940E-02	1.1940E-02	-74.62
-1.097								
22	23	20	40.00	2.155	2.143	1.1940E-02	1.1940E-02	74.55
1.096								
23	26	23	40.00	2.190	2.155	3.4815E-02	3.4815E-02	112.6
1.654								
24	39	47	40.00	2.166	2.131	3.4455E-02	3.4455E-02	111.9
1.645								
25	22	26	40.00	2.250	2.190	5.9860E-02	5.9860E-02	150.9
2.218								
26	18	10	50.00	2.994	2.668	0.3263	0.1305	457.4
4.043								
27	28	7	50.00	3.025	2.697	0.3277	0.1319	460.0

4.065								
28	10	29	50.00	2.668	2.491	0.1766	0.1766	457.4
4.043								
29	6	28	80.00	3.432	3.025	0.4070	0.4070	917.4
3.200								
30	30	31	40.00	2.166	2.225	-5.9245E-02	5.9245E-02	-150.1
-2.206								
31	31	32	40.00	2.225	2.316	-9.0500E-02	9.0500E-02	-188.8
-2.774								
32	32	33	40.00	2.316	2.382	-6.6490E-02	6.6490E-02	-188.8
-2.774								
33	33	29	40.00	2.382	2.491	-0.1089	0.1089	-228.7
-3.361								
34	29	35	40.00	2.491	2.382	0.1089	0.1089	228.7
3.360								
35	35	36	40.00	2.382	2.316	6.6490E-02	6.6490E-02	188.7
2.773								
36	21	27	40.00	2.341	2.409	-6.7180E-02	6.7180E-02	-189.8
-2.790								
37	36	25	40.00	2.316	2.225	9.0500E-02	9.0500E-02	188.7
2.773								
38	17	34	40.00	2.124	2.024	0.1004	2.5417E-03	36.81
0.5410								
39	45	48	40.00	2.104	2.101	2.9950E-03	2.9950E-03	36.57
0.5374								
40	25	39	40.00	2.225	2.166	5.9245E-02	5.9245E-02	150.1
2.205								
41	41	30	40.00	2.131	2.166	-3.4455E-02	3.4455E-02	-112.0
-1.646								

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
42 -1.090	42	41	40.00	2.120	2.131	-1.1810E-02	1.1810E-02	-74.20
43 -1.090	43	42	40.00	2.104	2.120	-1.6075E-02	1.6075E-02	-74.20
44 -0.5384	44	43	40.00	2.101	2.104	-2.9950E-03	2.9950E-03	-36.63
45 -4.8966E-04	48	49	40.00	2.101	2.101	0.000	0.000	-3.3320E-02
46 1.089	46	45	40.00	2.120	2.104	1.6075E-02	1.6075E-02	74.13
47 1.089	47	46	40.00	2.131	2.120	1.1810E-02	1.1810E-02	74.13
48 4.8966E-04	44	49	40.00	2.101	2.101	0.000	0.000	3.3320E-02
49 0.5410	8	37	40.00	2.124	2.024	0.1004	2.5417E-03	36.81
50 0.5379	44	38	40.00	2.101	2.000	0.1004	2.5167E-03	36.60
51 0.5379	48	50	40.00	2.101	2.000	0.1004	2.5167E-03	36.60
52 0.5379	50	51	40.00	2.000	1.997	3.1949E-03	3.1949E-03	36.60
53 0.5379	38	52	40.00	2.000	1.997	3.1949E-03	3.1949E-03	36.60
54 0.5410	34	53	40.00	2.024	2.020	3.2351E-03	3.2351E-03	36.81
55 0.5410	37	54	40.00	2.024	2.020	3.2351E-03	3.2351E-03	36.81

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	9	0.21900E+01	36.6000	38.3287	4.72	
2	12	0.24085E+01	36.6000	40.1951	9.82	
3	14	0.22499E+01	36.6000	38.8490	6.14	
4	15	0.21552E+01	36.6000	38.0228	3.89	
5	16	0.21270E+01	36.6000	37.7733	3.21	
6	51	0.19969E+01	36.6000	36.6000 *	0.00	
7	19	0.21270E+01	36.6000	37.7733	3.21	
8	22	0.22499E+01	36.6000	38.8490	6.14	
9	23	0.21552E+01	36.6000	38.0228	3.89	
10	26	0.21900E+01	36.6000	38.3287	4.72	
11	52	0.19969E+01	36.6000	36.6000	0.00	
12	31	0.22251E+01	36.6000	38.6346	5.56	
13	53	0.20203E+01	36.6000	36.8138	0.58	
14	45	0.21035E+01	36.6000	37.5642	2.63	
15	27	0.24085E+01	36.6000	40.1951	9.82	
16	43	0.21035E+01	36.6000	37.5642	2.63	
17	33	0.23821E+01	36.6000	39.9742	9.22	
18	30	0.21659E+01	36.6000	38.1168	4.14	
19	35	0.23821E+01	36.6000	39.9742	9.22	
20	39	0.21659E+01	36.6000	38.1168	4.14	
21	47	0.21314E+01	36.6000	37.8124	3.31	
22	54	0.20203E+01	36.6000	36.8138	0.58	
23	25	0.22251E+01	36.6000	38.6346	5.56	
24	41	0.21314E+01	36.6000	37.8124	3.31	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	4.583	917.4	428.50

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9903)
16 OF 17

DATE : 24-Jul-2014

PAGE

COMMENTS

Analysis Converged in 6 Iterations


WARNINGS

*** WARNING - Nozzle 6 below minimum operating pressure
*** WARNING - Nozzle 11 below minimum operating pressure

=====

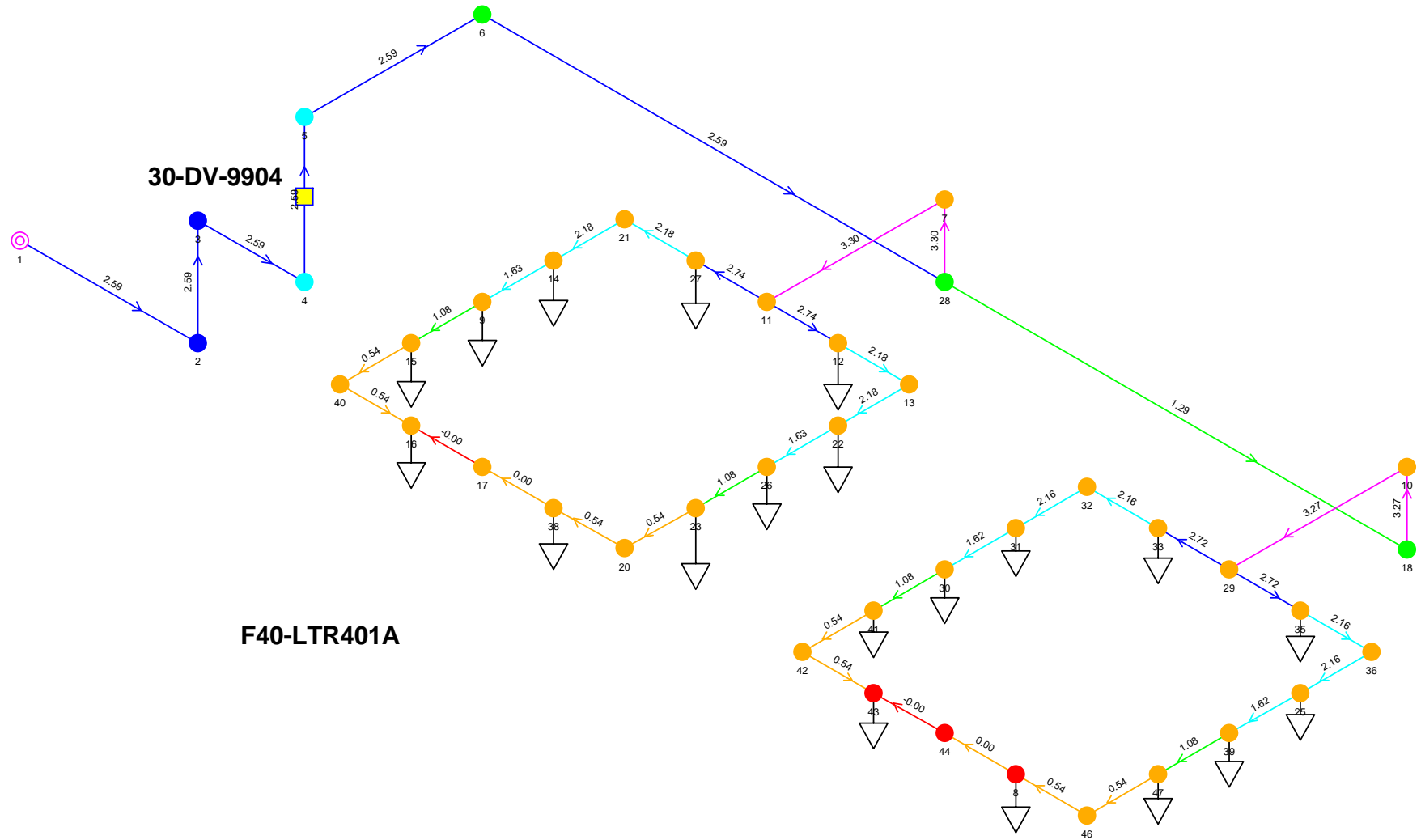
UTILITY AREA FOR WATER SPRAY SYSTEM (30-DV-9903)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====

 PLANTAS DE AMONIACO Y UREA, CARRASCO	FIRE WATER HYDRAULIC CALCULATION REPORT	
	N° del DOC. PAU-EFF-C-CAL-00001	Rev. 0

ATTACHMENT #4.8

CÁLCULO HIDRÁULICO DE DV NO. 30-DV-9904



F40-LTR401B

BUILDING AREA FOR WATER SPRAY SYSTEM (30-DV-9904)		
Kunkook Fire Protection Co., Ltd		
PIPENET Schematic	Thursday, March 27, 2014	Page 1 of 1
<div> <div>Pipe velocity (m/sec)</div> <div> <div>< 0.000000</div> <div>< 0.750000</div> <div>< 1.500000</div> <div>< 2.250000</div> <div>< 3.000000</div> <div>> 3.000000</div> </div> </div>		

=====

PIPENET SPRAY/SPRINKLER MODULE

=====

VERSION 1.6.0

=====

Results for : BUILDING AREA FOR WATER SPRAY SYSTEM (30-DV-9904)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

Licence Owner from key: Kunkook Fire Protection Co., Ltd

=====

09:15 on 27-Mar-2014

LIST OF CONTENTS
=====

	Page

Control Information.....	1
Fluid System.....	1
Design Information.....	2
Pipe Configuration.....	4
Nozzle Configuration.....	7
Special Equipment.....	8
Designed Diameters & Flowrates.....	9
Flow in Pipes.....	11
Flow through Nozzles.....	13
Flow at Inlets.....	14
Important Notice.....	15
Comments.....	16

CONTROL INFORMATION

Convergence accuracy = 1.00E-03
Maximum no. of iterations = 50
Elevation Check Tolerance = 0.50 metres
Warnings Control Option = 0
***** Diagnostic level = 2

FLUID SYSTEM

Fluid Class = 1 (Liquid)
Density = 998.2 kg/cu.m
Viscosity = 1.0000E-03 Pa.s

DESIGN INFORMATION

Waterspray System

Pipe Materials are :

Pipe Type		Lining Type	Thickness(milli.m.)
10	-- A106 GR.B, SMLS, SCH	Not Lined	
9	-- A106 GR.B, SMLS, SCH	Not Lined	

Design to NFPA 1996/2001 Rules
Using the Hazen-Williams Equation

Velocity Pressure Model: Ignore velocity pressure

Pressure loss at entrance: Ignore

Pressure loss at entrance: Ignore

AVAILABLE PIPE SIZES AND MAXIMUM VELOCITIES USED FOR PIPE SIZING

A106 GR.B, SMLS, SCH Not lined			A106 GR.B, SMLS, SCH Not lined				
Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam	Max.Vel.	Nom.Bore	Act.Diam
Max.Vel.							
(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	(milli.m.)	(m/sec)	(milli.m.)	
(milli.m.)	(m/sec)						
15.0000	14.0000	6.0000	15.0000	14.0000	6.0000		
20.0000	19.0000	6.0000	20.0000	19.0000	6.0000		
25.0000	24.0000	6.0000	25.0000	24.0000	6.0000		
40.0000	38.0000	6.0000	40.0000	38.0000	6.0000		
50.0000	49.0000	6.0000	50.0000	49.0000	6.0000		
80.0000	78.0000	6.0000	80.0000	78.0000	6.0000		
100.0000	102.0000	6.0000	100.0000	102.0000	6.0000		
150.0000	154.0000	6.0000	150.0000	154.0000	6.0000		
200.0000	203.0000	6.0000	200.0000	203.0000	6.0000		

PIPE CONFIGURATION

Pipe Label	Input Node	Output Node	Nom.Bore (milli.m.)	Length (metres)	Elevation (metres)	C Factor	Fitt.eq.lnth (metres)
1	1	2	80.00	15.00	0.000	120.0	2.144
2	2	3	80.00	2.000	2.000	120.0	2.144
3	3	4	80.00	10.00	0.000	120.0	4.901
4	4	5	80.00	3.000	3.000	120.0	0.9190
5	5	6	80.00	20.00	0.000	120.0	6.433
6	7	11	50.00	2.000	0.000	120.0	2.182
8	28	18	80.00	7.000	0.000	120.0	4.595
9	11	27	40.00	1.000	0.000	120.0	1.696
10	11	12	40.00	1.000	0.000	120.0	1.696
11	12	13	40.00	1.500	0.000	120.0	0.8481
12	40	16	40.00	1.500	0.000	120.0	1.696
13	16	17	40.00	0.5000	0.000	120.0	1.696
15	20	38	40.00	1.500	0.000	120.0	1.696
16	13	22	40.00	1.500	0.000	120.0	1.696
17	38	17	40.00	0.5000	0.000	120.0	0.000
18	14	9	40.00	1.500	0.000	120.0	1.696
19	21	14	40.00	1.500	0.000	120.0	1.696
20	9	15	40.00	1.500	0.000	120.0	1.696
21	15	40	40.00	1.500	0.000	120.0	0.8481
22	23	20	40.00	1.500	0.000	120.0	0.8481
23	26	23	40.00	1.500	0.000	120.0	1.696
24	39	47	40.00	1.500	0.000	120.0	1.696
25	22	26	40.00	1.500	0.000	120.0	1.696
26	18	10	50.00	2.000	2.000	120.0	1.091
27	28	7	50.00	2.000	2.000	120.0	1.091
28	10	29	50.00	2.000	0.000	120.0	2.182
29	6	28	80.00	5.000	0.000	120.0	4.595
30	31	30	40.00	1.500	0.000	120.0	1.696
31	32	31	40.00	1.500	0.000	120.0	1.696
32	33	32	40.00	1.500	0.000	120.0	0.8481
33	29	33	40.00	1.000	0.000	120.0	1.696
34	29	35	40.00	1.000	0.000	120.0	1.696
35	35	36	40.00	1.500	0.000	120.0	0.8481
36	27	21	40.00	1.500	0.000	120.0	0.8481
37	36	25	40.00	1.500	0.000	120.0	1.696
40	25	39	40.00	1.500	0.000	120.0	1.696
41	30	41	40.00	1.500	0.000	120.0	1.696
42	41	42	40.00	1.500	0.000	120.0	0.8481
43	42	43	40.00	1.500	0.000	120.0	1.696
44	43	44	40.00	0.5000	0.000	120.0	1.696
45	8	44	40.00	0.5000	0.000	120.0	0.000
46	46	8	40.00	1.500	0.000	120.0	1.696
47	47	46	40.00	1.500	0.000	120.0	0.8481

PIPE FITTINGS

Pipe Label	Number x Type	Equivalent Length (metres)	
1	1 x 2	2.144	
2	1 x 2	2.144	
3	1 x 4	4.595	1 x 5 0.3063
4	3 x 5	0.3063	
5	3 x 2	2.144	
6	1 x 4	2.182	
8	1 x 4	4.595	
9	1 x 4	1.696	
10	1 x 4	1.696	
11	1 x 2	0.8481	
12	1 x 4	1.696	
13	1 x 4	1.696	
15	1 x 4	1.696	
16	1 x 4	1.696	
18	1 x 4	1.696	
19	1 x 4	1.696	
20	1 x 4	1.696	
21	1 x 2	0.8481	
22	1 x 2	0.8481	
23	1 x 4	1.696	
24	1 x 4	1.696	
25	1 x 4	1.696	
26	1 x 2	1.091	
27	1 x 2	1.091	
28	1 x 4	2.182	
29	1 x 4	4.595	
30	1 x 4	1.696	
31	1 x 4	1.696	
32	1 x 2	0.8481	
33	1 x 4	1.696	
34	1 x 4	1.696	
35	1 x 2	0.8481	
36	1 x 2	0.8481	
37	1 x 4	1.696	
40	1 x 4	1.696	
41	1 x 4	1.696	
42	1 x 2	0.8481	
43	1 x 4	1.696	
44	1 x 4	1.696	
46	1 x 4	1.696	
47	1 x 2	0.8481	

Fitting types are :

-
- 1 -- 45 Deg Elbow
 - 2 -- 90 Deg Standard Elbow
 - 3 -- 90 Deg Long Radius Elbow
 - 4 -- Tee or Cross (Flow Turned Thro 90 Deg)
 - 5 -- Gate Valve
 - 6 -- Swing Check Valve
 - 7 -- Non-Return Valve
 - 8 -- Ball Valve
 - 9 -- Butterfly Valve

NOZZLE CONFIGURATION

Nozzle Label	Input Node	Nozzle Type	K-Factor	Req Flow (lit/min)	Min Press (bar G)	Max Press (bar G)
--						
1	9	8	25.9000	36.6000	0.10000E+01	0.14400E+02
2	12	8	25.9000	36.6000	0.10000E+01	0.14400E+02
3	14	8	25.9000	36.6000	0.10000E+01	0.14400E+02
4	15	8	25.9000	36.6000	0.10000E+01	0.14400E+02
5	16	8	25.9000	36.6000	0.10000E+01	0.14400E+02
7	38	8	25.9000	36.6000	0.10000E+01	0.14400E+02
8	22	8	25.9000	36.6000	0.10000E+01	0.14400E+02
9	23	8	25.9000	36.6000	0.10000E+01	0.14400E+02
10	26	8	25.9000	36.6000	0.10000E+01	0.14400E+02
12	31	8	25.9000	36.6000	0.10000E+01	0.14400E+02
14	8	8	25.9000	36.6000	0.10000E+01	0.14400E+02
15	27	8	25.9000	36.6000	0.10000E+01	0.14400E+02
16	43	8	25.9000	36.6000	0.10000E+01	0.14400E+02
17	33	8	25.9000	36.6000	0.10000E+01	0.14400E+02
18	30	8	25.9000	36.6000	0.10000E+01	0.14400E+02
19	35	8	25.9000	36.6000	0.10000E+01	0.14400E+02
20	39	8	25.9000	36.6000	0.10000E+01	0.14400E+02
21	47	8	25.9000	36.6000	0.10000E+01	0.14400E+02
23	25	8	25.9000	36.6000	0.10000E+01	0.14400E+02
24	41	8	25.9000	36.6000	0.10000E+01	0.14400E+02

Nozzle types are :
8 -- User Defined

SPECIAL EQUIPMENT

Equipment Label	Pipe Label	Equivalent Length (metres)	Description
1	4	0.50000E+01	DELUGE VALVE

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
1	1	2	743.4370	10	78.0000	80.0000	*
2	2	3	743.4370	10	78.0000	80.0000	*
3	3	4	743.4370	10	78.0000	80.0000	*
4	4	5	743.4370	10	78.0000	80.0000	*
5	5	6	743.4370	10	78.0000	80.0000	*
6	7	11	373.0398	9	49.0000	50.0000	*
8	28	18	370.3971	10	78.0000	80.0000	*
9	11	27	186.5199	9	38.0000	40.0000	*
10	11	12	186.5200	9	38.0000	40.0000	*
11	12	13	148.2490	9	38.0000	40.0000	*
12	40	16	36.8616	9	38.0000	40.0000	*
13	16	17	-0.0001	9	38.0000	40.0000	*
15	20	38	36.8618	9	38.0000	40.0000	*
16	13	22	148.2490	9	38.0000	40.0000	*
17	38	17	0.0001	9	38.0000	40.0000	*
18	14	9	110.8685	9	38.0000	40.0000	*
19	21	14	148.2488	9	38.0000	40.0000	*
20	9	15	73.7928	9	38.0000	40.0000	*
21	15	40	36.8616	9	38.0000	40.0000	*
22	23	20	36.8618	9	38.0000	40.0000	*
23	26	23	73.7930	9	38.0000	40.0000	*
24	39	47	73.2694	9	38.0000	40.0000	*
25	22	26	110.8686	9	38.0000	40.0000	*
26	18	10	370.3971	9	49.0000	50.0000	*
27	28	7	373.0398	9	49.0000	50.0000	*
28	10	29	370.3971	9	49.0000	50.0000	*
29	6	28	743.4370	10	78.0000	80.0000	*
30	31	30	110.0819	9	38.0000	40.0000	*
31	32	31	147.1976	9	38.0000	40.0000	*
32	33	32	147.1976	9	38.0000	40.0000	*
33	29	33	185.1985	9	38.0000	40.0000	*
34	29	35	185.1986	9	38.0000	40.0000	*
35	35	36	147.1978	9	38.0000	40.0000	*
36	27	21	148.2488	9	38.0000	40.0000	*
37	36	25	147.1978	9	38.0000	40.0000	*
40	25	39	110.0821	9	38.0000	40.0000	*
41	30	41	73.2692	9	38.0000	40.0000	*
42	41	42	36.6000	9	38.0000	40.0000	*
43	42	43	36.6000	9	38.0000	40.0000	*

DESIGNED DIAMETERS & FLOWRATES

Pipe Label	Input Node	Output Node	Flowrate (lit/min)	Pipe Type	Act. Bore (milli.m.)	Nom. Size (milli.m.)	Pipe Group
44	43	44	-0.0001	9	38.0000	40.0000	*
45	8	44	0.0001	9	38.0000	40.0000	*
46	46	8	36.6002	9	38.0000	40.0000	*
47	47	46	36.6002	9	38.0000	40.0000	*

A * indicates that this is a SET diameter

Pipe Materials are :

Pipe Type	Lining Type	Thickness(milli.m.)
10 -- A106 GR.B, SMLS, SCH	Not Lined	
9 -- A106 GR.B, SMLS, SCH	Not Lined	

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
1	1	2	80.00	4.029	3.844	0.1848	0.1848	743.4
2.593	2	3	80.00	3.844	3.603	0.2405	4.4673E-02	743.4
2.593	3	4	80.00	3.603	3.443	0.1606	0.1606	743.4
2.593	4	5	80.00	3.443	3.053	0.3898	9.6135E-02	743.4
2.593	5	6	80.00	3.053	2.768	0.2849	0.2849	743.4
2.593	6	11	50.00	2.379	2.258	0.1211	0.1211	373.0
3.297	8	18	80.00	2.665	2.630	3.4440E-02	3.4440E-02	370.4
1.292	9	27	40.00	2.258	2.183	7.4700E-02	7.4700E-02	186.5
2.741	10	12	40.00	2.258	2.183	7.4700E-02	7.4700E-02	186.5
2.741	11	13	40.00	2.183	2.141	4.2540E-02	4.2540E-02	148.2
2.179	12	16	40.00	2.030	2.026	4.4100E-03	4.4100E-03	36.86
0.5417	13	17	40.00	2.026	2.026	0.000	0.000	-8.7717E-05
-1.2891E-06	15	38	40.00	2.030	2.026	4.4100E-03	4.4100E-03	36.86
0.5417	16	22	40.00	2.141	2.083	5.7900E-02	5.7900E-02	148.2
2.179	17	17	40.00	2.026	2.026	0.000	0.000	8.7717E-05
1.2891E-06	18	9	40.00	2.083	2.049	3.3825E-02	3.3825E-02	110.9
1.629	19	14	40.00	2.141	2.083	5.7900E-02	5.7900E-02	148.2
2.179	20	15	40.00	2.049	2.033	1.5930E-02	1.5930E-02	73.79
1.084	21	40	40.00	2.033	2.030	3.2401E-03	3.2401E-03	36.86
0.5417	22	20	40.00	2.033	2.030	3.2401E-03	3.2401E-03	36.86
0.5417	23	23	40.00	2.049	2.033	1.5930E-02	1.5930E-02	73.79
1.084	24	47	40.00	2.020	2.004	1.5720E-02	1.5720E-02	73.27
1.077	25	26	40.00	2.083	2.049	3.3825E-02	3.3825E-02	110.9
1.629	26	10	50.00	2.630	2.346	0.2841	8.8338E-02	370.4
3.274	27	7	50.00	2.665	2.379	0.2853	8.9508E-02	373.0
3.297	28	29	50.00	2.346	2.226	0.1195	0.1195	370.4
3.274	29	28	80.00	2.768	2.665	0.1034	0.1034	743.4

2.593								
30	31	30	40.00	2.054	2.020	3.3385E-02	3.3385E-02	110.1
1.618								
31	32	31	40.00	2.111	2.054	5.7145E-02	5.7145E-02	147.2
2.163								
32	33	32	40.00	2.153	2.111	4.1980E-02	4.1980E-02	147.2
2.163								
33	29	33	40.00	2.226	2.153	7.3725E-02	7.3725E-02	185.2
2.722								
34	29	35	40.00	2.226	2.153	7.3725E-02	7.3725E-02	185.2
2.722								
35	35	36	40.00	2.153	2.111	4.1980E-02	4.1980E-02	147.2
2.163								
36	27	21	40.00	2.183	2.141	4.2540E-02	4.2540E-02	148.2
2.179								
37	36	25	40.00	2.111	2.054	5.7145E-02	5.7145E-02	147.2
2.163								
40	25	39	40.00	2.054	2.020	3.3385E-02	3.3385E-02	110.1
1.618								
41	30	41	40.00	2.020	2.004	1.5720E-02	1.5720E-02	73.27
1.077								
42	41	42	40.00	2.004	2.001	3.1998E-03	3.1998E-03	36.60
0.5379								
43	42	43	40.00	2.001	1.997	4.3501E-03	4.3501E-03	36.60
0.5379								
44	43	44	40.00	1.997	1.997	0.000	0.000	-8.4019E-05
-1.2347E-06								
45	8	44	40.00	1.997	1.997	0.000	0.000	8.4019E-05
1.2347E-06								

FLOW IN PIPES

Pipe Velocity Label (m/sec)	Input Node	Output Node	Nom.Bore (milli.m.)	Inlet Pr. (bar G)	Outlet Pr. (bar G)	Drop in Pr. (bar)	Frict. Loss (bar)	Flowrate (lit/min)
46 0.5379	46	8	40.00	2.001	1.997	4.3501E-03	4.3501E-03	36.60
47 0.5379	47	46	40.00	2.004	2.001	3.1998E-03	3.1998E-03	36.60

NOTE: An E indicates a Pipe containing a Special Equipment

FLOW THROUGH NOZZLES

Nozzle FlowDens Label	Input Label	Inlet Press (bar G)	Req. Flow (lit/min)	Flowrate (lit/min)	% Deviation	Req. FlowDens (lit/min/metres **2)
1	9	0.20492E+01	36.6000	37.0755	1.30	
2	12	0.21834E+01	36.6000	38.2709	4.57	
3	14	0.20830E+01	36.6000	37.3803	2.13	
4	15	0.20332E+01	36.6000	36.9312	0.90	
5	16	0.20256E+01	36.6000	36.8616	0.71	
7	38	0.20256E+01	36.6000	36.8616	0.71	
8	22	0.20830E+01	36.6000	37.3803	2.13	
9	23	0.20332E+01	36.6000	36.9312	0.90	
10	26	0.20492E+01	36.6000	37.0755	1.30	
12	31	0.20536E+01	36.6000	37.1156	1.41	
14	8	0.19969E+01	36.6000	36.6000 *	0.00	
15	27	0.21834E+01	36.6000	38.2709	4.57	
16	43	0.19969E+01	36.6000	36.6000	0.00	
17	33	0.21527E+01	36.6000	38.0008	3.83	
18	30	0.20202E+01	36.6000	36.8126	0.58	
19	35	0.21527E+01	36.6000	38.0008	3.83	
20	39	0.20202E+01	36.6000	36.8126	0.58	
21	47	0.20045E+01	36.6000	36.6691	0.19	
23	25	0.20536E+01	36.6000	37.1156	1.41	
24	41	0.20045E+01	36.6000	36.6691	0.19	

Note: A * after a value indicates that this is a specification

FLOW AT INLETS

Inlet Node	Pressure (bar G)	Flowrate (lit/min)	Equivalent K-factor (lit/min , bar G)
1	4.029	743.4	370.40

Note: A * after a value indicates that this is a specification

IMPORTANT NOTICE

Your attention is drawn to the need to maintain adequate standards. SUNRISE SYSTEMS Ltd has itself taken steps to ensure that this program produces valid results when properly used. Users are reminded of their responsibilities in the application of program results and, in particular, you should ensure that pertinent output documents are examined and approved by qualified staff prior to use.

TITLE : BUILDING AREA FOR WATER SPRAY SYSTEM (30-DV-9904)
16 OF 16

DATE : 27-Mar-2014

PAGE

COMMENTS

Analysis Converged in 3 Iterations

=====

BUILDING AREA FOR WATER SPRAY SYSTEM (30-DV-9904)
PROJECT: BOLIVIA PAU PROJECT
CLIENT: SAMSUNG ENGINEERING CO, LTD.

=====