

A	05.09.2024	ISSUED FOR APPROVAL.		MCM	TT
REV.	DATE	DESCRIPTION		MOD.BY	CKD.BY
<b>REVISIONS</b>					
 <b>Goltens</b> Singapore Pte Ltd.		SHIP	<b>JP 88 STORK</b>		
		TITLE	PRESSURE LOSS CALCULATION OF BWTS RETROFIT		
SCALE N.T.S.	DRAWN	MCM	DRAWING NUMBER <b>GSPL-P1482-PI-0006</b>	HULL NUMBER --	REV <b>A</b>
	CHECKED	TT			
SIZE: A4	VERIFIED	GC	DATE:-05.09.2024	SHEET:- 1 OF 4	

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## 1. Introduction

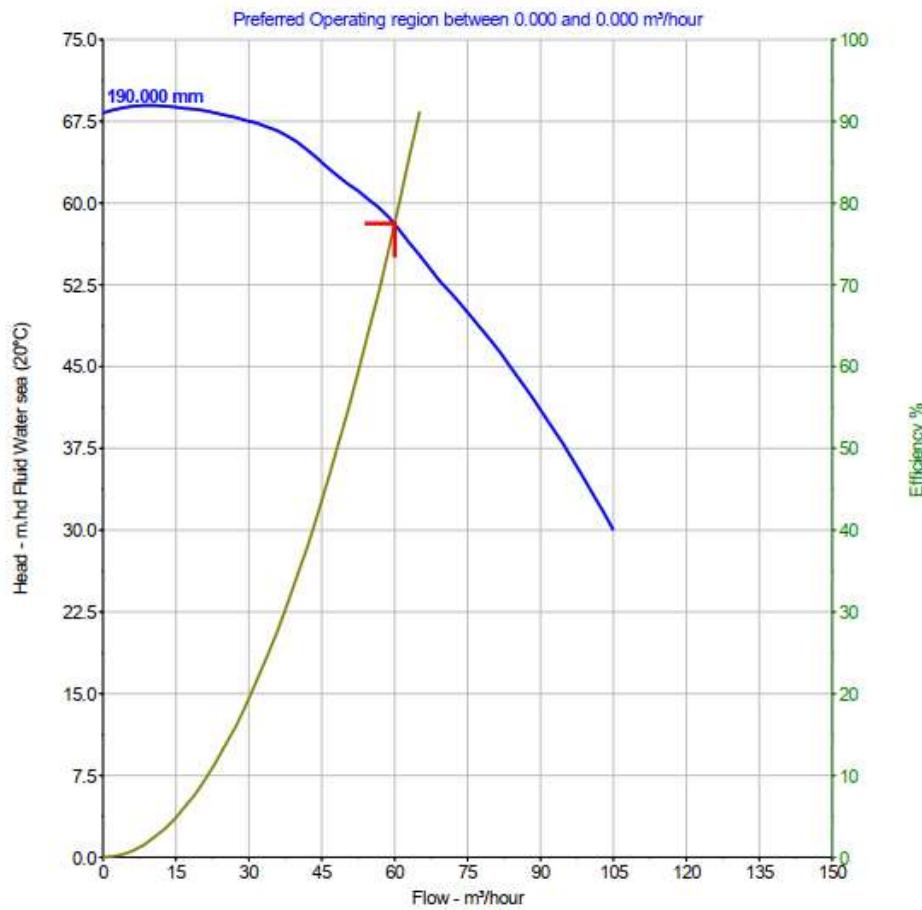
### Nominal Specification of the pumps

No 1 Ballast pump = 60 m<sup>3</sup>/hr @ 60 m Total Head

No 2 Ballast Pump = 60 m<sup>3</sup>/hr @ 60 m Total Head

### Assumptions

- 1) Draft considered 1 meter.
- 2) The loss due to BWTS equipment is considered as 0.6 bar.



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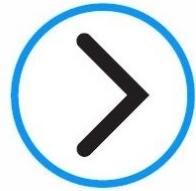
## 2. Conclusion

As per the analysis, the pump can generate sufficient flow and pressure.

**Refer Annexure-1**



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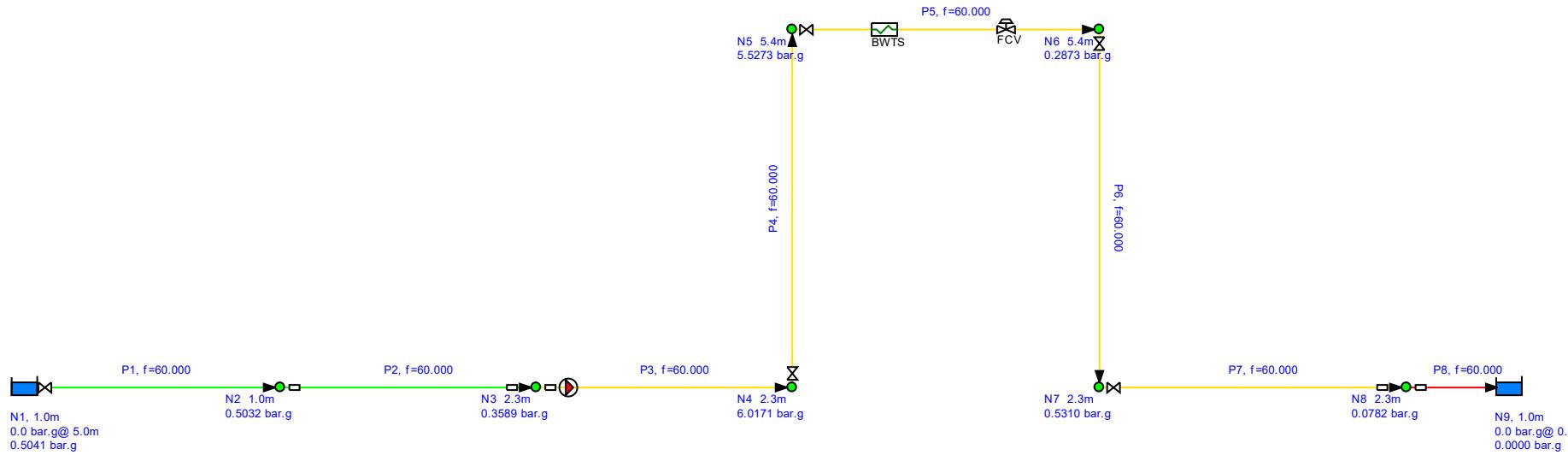
**pipeFlow**

# Pipe Flow Design 1

## Results Data

ANNEXURE-1

Pipe Flow Expert Results Key	
f = flow in m <sup>3</sup> /hour	Color of Pipe: Velocity in m/sec
0.146	0.821
0.2873	1.495
0.517	2.169
0.843	2.843
1.173	3.517



## Fluid Data

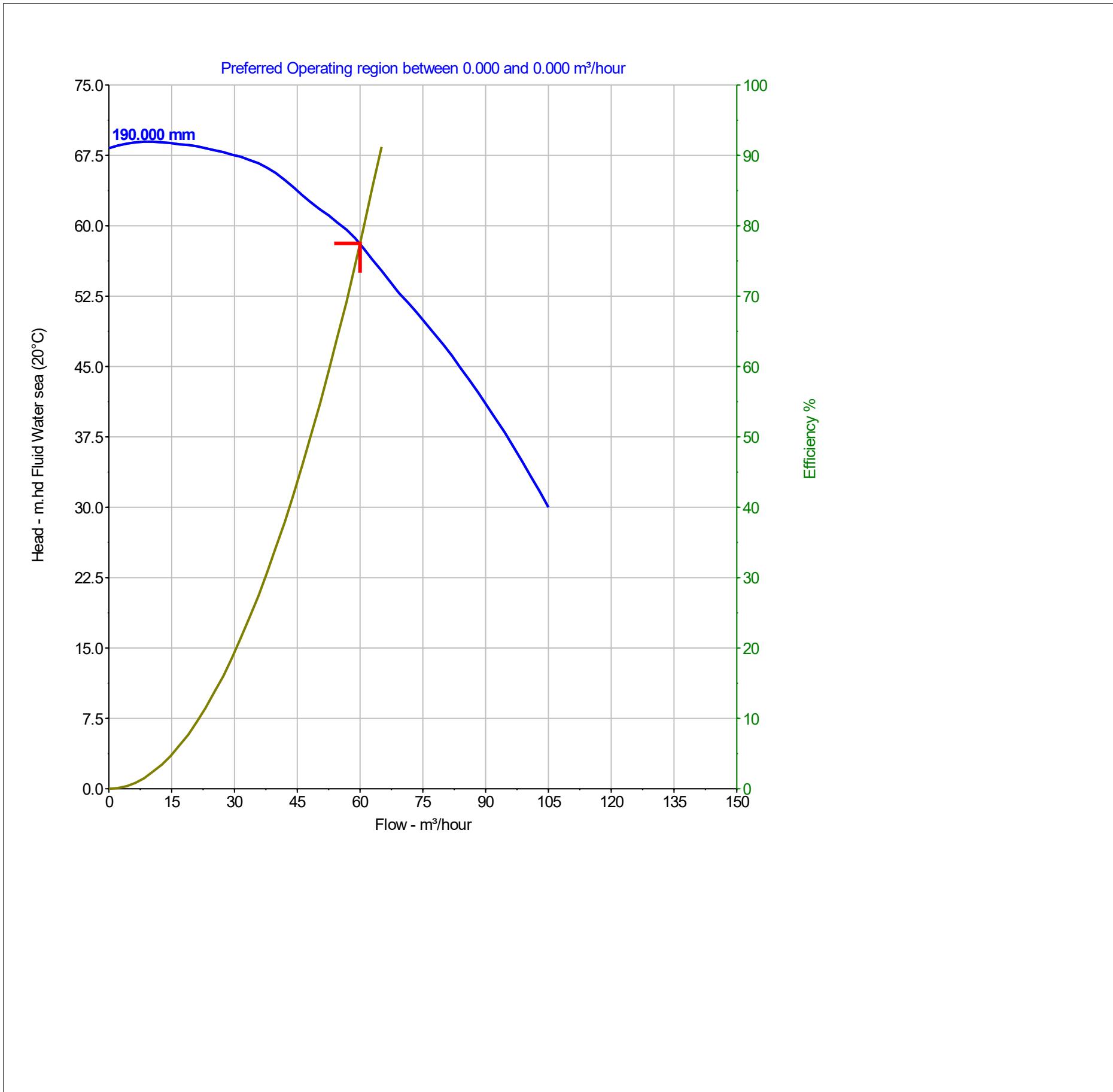
Zone	Fluid Name	Chemical Formula	Temperature °C	Pressure bar.g	Density kg/m³	Centistokes	Centipoise	Vapour Pressure bar.a	State
1	Water sea	N/A	20.000	0.0000	1028.000000	1.040856	1.070000	0.023400	Liquid

## Pump Data

Pipe Id	Pipe Name	Pump Name	Speed rpm	Pref. Op From m³/hour	Pref. Op To m³/hour	Flow In/Out m³/hour	Velocity m/sec	Suction Pressure bar.g	Discharge Pressure bar.g	Pump Head (+) m.hd Fluid	Pump NPSHr m.hd (absolute)	Pump NPSHa m.hd (absolute)	Pump Efficiency Percentage	Pump Power Kilowatts
3	P3	BALLAST PUMP	3500	0.000	0.000	60.000	2.039	0.2049	6.0647	58.125	0.000	11.852	Not known	Not Known

<b>Pump Data</b>		<b>Fluid Data</b>	<b>Operating Notes</b>
Name:	BALLAST PUMP	Fluid:	Water sea
Catalog:		Density:	1028.000000 kg/m <sup>3</sup>
Manufacturer:		Viscosity:	1.0700 cP
Type:		Temperature:	20.000 °C
Size:		Vapor Pressure:	0.0234 bar.a
Stages:	0	Atm Pressure:	1.0132 bar.a
Speed:	3500 Rpm	<b>Design Curve</b>	
Impeller Diam:	190.000 mm	Shutoff Head:	68.250 m.hd Fluid
Min Speed:	Not Specified	Shutoff dP:	6.8804 bar.g
Max Speed:	Not Specified	BEP:	0.0% @ 0.000 m <sup>3</sup> /hour
Min Diam:	Not Specified	Power at BEP:	Not known
Max Diam:	Not Specified	NPSH <sub>r</sub> at BEP:	0.000 m.hd Fluid
		Max Flow Power:	Not known
		<b>Data Point</b>	
		Flow:	60.000 m <sup>3</sup> /hour
		Head:	58.125 m.hd Fluid
		Efficiency:	0.00%
		Power:	Not known
		NPSH <sub>r</sub> :	0.000 m.hd Fluid

Pump graph is shown on next page (when document is in landscape format).



## Pipe Data

Pipe Id	Pipe Name and Notes	Inner Diameter mm	Length m	Mass Flow kg/sec	Vol Flow m <sup>3</sup> /hour	Velocity m/sec	dP Total Loss bar	Entry Pressure bar.g	Exit Pressure bar.g
1	P1	380.746	4.000	17.1333	60.000	0.146	0.0009	0.5041	0.5032
2	P2	380.746	2.000	17.1333	60.000	0.146	0.1443	0.5032	0.3589
3	P3	102.006	10.000	17.1333	60.000	2.039	-5.6582	0.3589	6.0171
4	P4	102.006	5.000	17.1333	60.000	2.039	0.4898	6.0171	5.5273
5	P5	102.006	6.000	17.1333	60.000	2.039	5.2400	5.5273	0.2873
6	P6	102.006	4.000	17.1333	60.000	2.039	-0.2437	0.2873	0.5310
7	P7	102.006	46.000	17.1333	60.000	2.039	0.4528	0.5310	0.0782
8	P8	77.673	4.000	17.1333	60.000	3.517	0.0782	0.0782	0.0000

# Pipe Materials

Pipe Id	Pipe Name	Nominal Size	Material	Schedule Class	Roughness mm	Inner Diameter mm	Wall Thickness mm	Outer Diameter mm	Length m	Weight kgs (full length)	Internal Volume m³
1	P1	400 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	380.746	12.827	406.400	4.000	498.004	0.455
2	P2	400 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	380.746	12.827	406.400	2.000	249.002	0.228
3	P3	100 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	102.006	6.147	114.300	10.000	163.950	0.082
4	P4	100 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	102.006	6.147	114.300	5.000	81.975	0.041
5	P5	100 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	102.006	6.147	114.300	6.000	98.370	0.049
6	P6	100 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	102.006	6.147	114.300	4.000	65.580	0.033
7	P7	100 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	102.006	6.147	114.300	46.000	754.170	0.376
8	P8	80 mm	Steel (ANSI) Galvanised	Sch. 40	0.150000	77.673	5.613	88.900	4.000	46.120	0.019

# Pipe Fittings

Pipe Id	Pipe	Fitting Position	Description	Imperial Size	Metric Size	Database Ref	K Value	Quantity	K Total	Entry K Total	Exit K Total
1	P1	Start of Pipe	Pipe Entry Sharp	16"	400 mm	EntSharp	0.5000	1	0.5000		
1	P1	Start of Pipe	Gate Valve	16"	400 mm	Gate	0.1000	1	0.1000		
1	P1	Start of Pipe	Globe Valve	16"	400 mm	Globe	4.4000	1	4.4000		
1	P1	Start of Pipe	Strainer	16"	400 mm	St	1.0000	1	1.0000		
1	P1	Start of Pipe	Standard Bend	16"	400 mm	SB	0.3900	4	1.5600		
										7.5600	0.0000
2	P2	Start of Pipe	Elbow 45 deg.	16"	400 mm	E45	0.2100	2	0.4200		
2	P2	End of Pipe	Gradual contraction	400*100	N/A	N/A	GrCon	120.0000	1	120.0000	
										0.4200	120.0000
3	P3	Start of Pipe	Branch Tee	4"	100 mm	BT	1.0200	3	3.0600		
3	P3	Start of Pipe	Elbow 45 deg.	4"	100 mm	E45	0.2700	4	1.0800		
3	P3	Start of Pipe	Standard Bend	4"	100 mm	SB	0.5100	6	3.0600		
										7.2000	0.0000
4	P4	Start of Pipe	Butterfly Valve	4"	100 mm	Bfly	0.7700	1	0.7700		
4	P4	Start of Pipe	Swing Check Valve	4"	100 mm	SwCh	2.0000	1	2.0000		
4	P4	Start of Pipe	Branch Tee	4"	100 mm	BT	1.0200	2	2.0400		
4	P4	Start of Pipe	Standard Bend	4"	100 mm	SB	0.5100	2	1.0200		
4	P4	Start of Pipe	Elbow 45 deg.	4"	100 mm	E45	0.2700	5	1.3500		
										7.1800	0.0000
5	P5	Start of Pipe	Branch Tee	4"	100 mm	BT	1.0200	2	2.0400		
5	P5	Start of Pipe	Standard Bend	4"	100 mm	SB	0.5100	5	2.5500		
5	P5	Start of Pipe	Elbow 45 deg.	4"	100 mm	E45	0.2700	3	0.8100		
5	P5	Start of Pipe	Butterfly Valve	4"	100 mm	Bfly	0.7700	2	1.5400		
										6.9400	0.0000
6	P6	Start of Pipe	Standard Bend	4"	100 mm	SB	0.5100	2	1.0200		
6	P6	Start of Pipe	Elbow 45 deg.	4"	100 mm	E45	0.2700	2	0.5400		

Pipe Id	Pipe	Fitting Position	Description	Imperial Size	Metric Size	Database Ref	K Value	Quantity	K Total	Entry K Total	Exit K Total
6	P6	Start of Pipe	Butterfly Valve	4"	100 mm	Bfly	0.7700	1	0.7700		
									2.3300	0.0000	
7	P7	Start of Pipe	Butterfly Valve	4"	100 mm	Bfly	0.7700	2	1.5400		
7	P7	Start of Pipe	Standard Bend	4"	100 mm	SB	0.5100	8	4.0800		
7	P7	Start of Pipe	Elbow 45 deg.	4"	100 mm	E45	0.2700	3	0.8100		
7	P7	Start of Pipe	Branch Tee	4"	100 mm	BT	1.0200	4	4.0800		
7	P7	End of Pipe	Gradual contraction100*80	N/A	N/A	GrCon	0.4400	1	0.4400		
									10.5100	0.4400	
8	P8	Start of Pipe	Standard Bend	3"	80 mm	SB	0.5300	2	1.0600		
8	P8	Start of Pipe	Pipe Exit to Container	3"	80 mm	ExitCon	1.0000	1	1.0000		
									2.0600	0.0000	

# Components

Pipe Id	Pipe Name	Inner Diameter mm	Comp. Name	Comp. Type	Comp. Value	Flow m <sup>3</sup> /hour	Mass Flow kg/sec	Comp. Loss m.hd
5	P5	102.006	BWTS	Fixed Loss bar	0.6000	60.000	17.1333	5.9517

## Flow Control Valves (FCVs)

Pipe Id	Pipe Name	Inner Diameter mm	FCV Name	FCV Mass Flow kg/sec	FCV Vol Flow m <sup>3</sup> /hour	FCV Loss m.hd
5	P5	102.006	FCV	17.1333	60.0000	44.271

## Node Data

Node Id	Node Type	Node	Elevation m	Liquid Level m	Surface Press. bar.g	Press. at Node bar.g	HGL at Node m.hd Fluid	Demand In (Mass) kg/sec	Demand Out (Mass) kg/sec	Demand In (Vol) @ Fluid Zone Density Downstream m³/hour	Demand Out (Vol) @ Fluid Zone Density Downstream m³/hour
1	Tank	N1	1.000	5.000	0.0000	0.5041	6.000	N/A	N/A	N/A	N/A
2	Join Point	N2	1.000	N/A	N/A	0.5032	5.991	0.0000	0.0000	0.000	0.000
3	Join Point	N3	2.300	N/A	N/A	0.3589	5.860	0.0000	0.0000	0.000	0.000
4	Join Point	N4	2.300	N/A	N/A	6.0171	61.986	0.0000	0.0000	0.000	0.000
5	Join Point	N5	5.400	N/A	N/A	5.5273	60.228	0.0000	0.0000	0.000	0.000
6	Join Point	N6	5.400	N/A	N/A	0.2873	8.250	0.0000	0.0000	0.000	0.000
7	Join Point	N7	2.300	N/A	N/A	0.5310	7.567	0.0000	0.0000	0.000	0.000
8	Join Point	N8	2.300	N/A	N/A	0.0782	3.075	0.0000	0.0000	0.000	0.000
9	Tank	N9	1.000	0.000	0.0000	0.0000	1.000	N/A	N/A	N/A	N/A