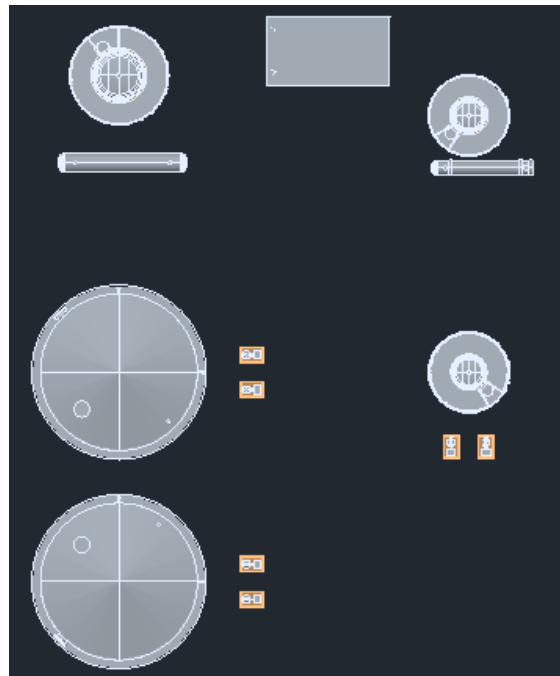


BAB VI

PEMBAHASAN

6.1. Desain *Equipment*

Setelah melakukan pemodelan ulang menggunakan *software autoCAD plant 3D*, maka didapat hasil *pemodelan equipment* berupa *Equipment layout* seperti pada Gambar 6.1. Adapun *design equipment* yang di modelkan ulang yaitu : C-101, C-103, E-101, E-102, P-101 AB, P-102 AB, P-103 AB, T-101, T-102, V-101 dan V-102.



Gambar 6.1 *Equipment Layout*

6.1.1. *Equipment C-101 (Coloumn)*



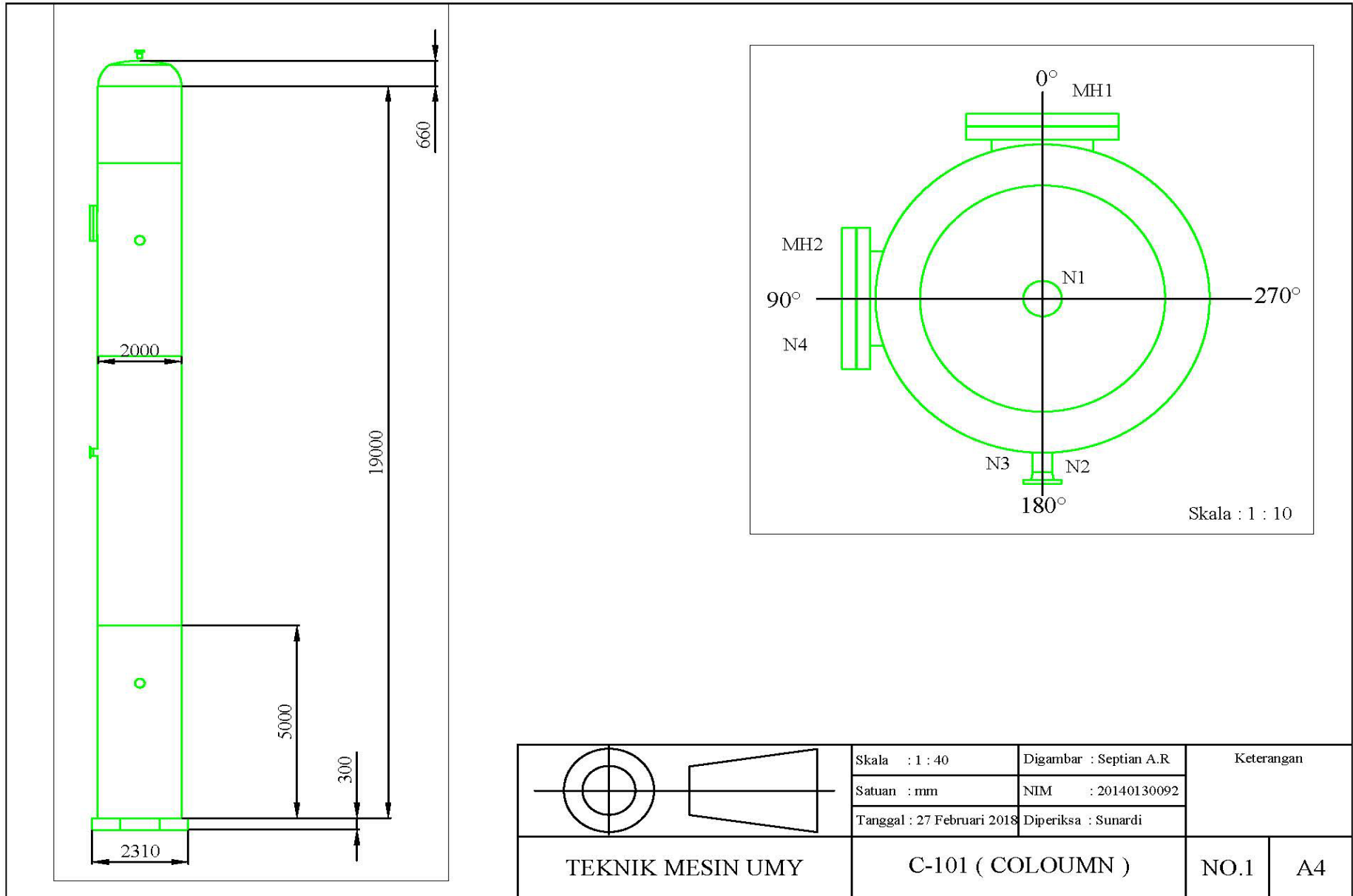
Gambar 6.2 Hasil pemodelan *equipment C-101*

Equipment C-101 merupakan *equipment* jenis *coloumn* seperti Gambar 6.2. *Equipment C-101* terdiri dari 1 *shell*, 2 *head* jenis *ellipsoidal*, 1 *skirt*, 1 *plate*, dan terdiri dari 6 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.1 berikut :

Tabel 6.1 Spesifikasi *Nozzle C-101*

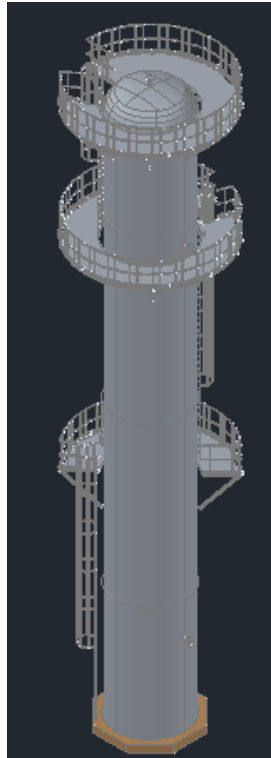
Nozzle	Size	Projection	Rating
N1	4"	700	150#RF
N2	4"	700	150#RF
N3	4"	650	150#RF
N4	6"	700	150#RF
MH1	24"	800	150#RF
MH2	24"	800	150#RF

Adapun hasil gambar 2D dari *equipment C-101* dapat dilihat pada gambar 6.3.



Gambar 6.3 Gambar 2D equipment C-101 (coloumn)

6.1.2. *Equipment C-103 (Coloumn)*



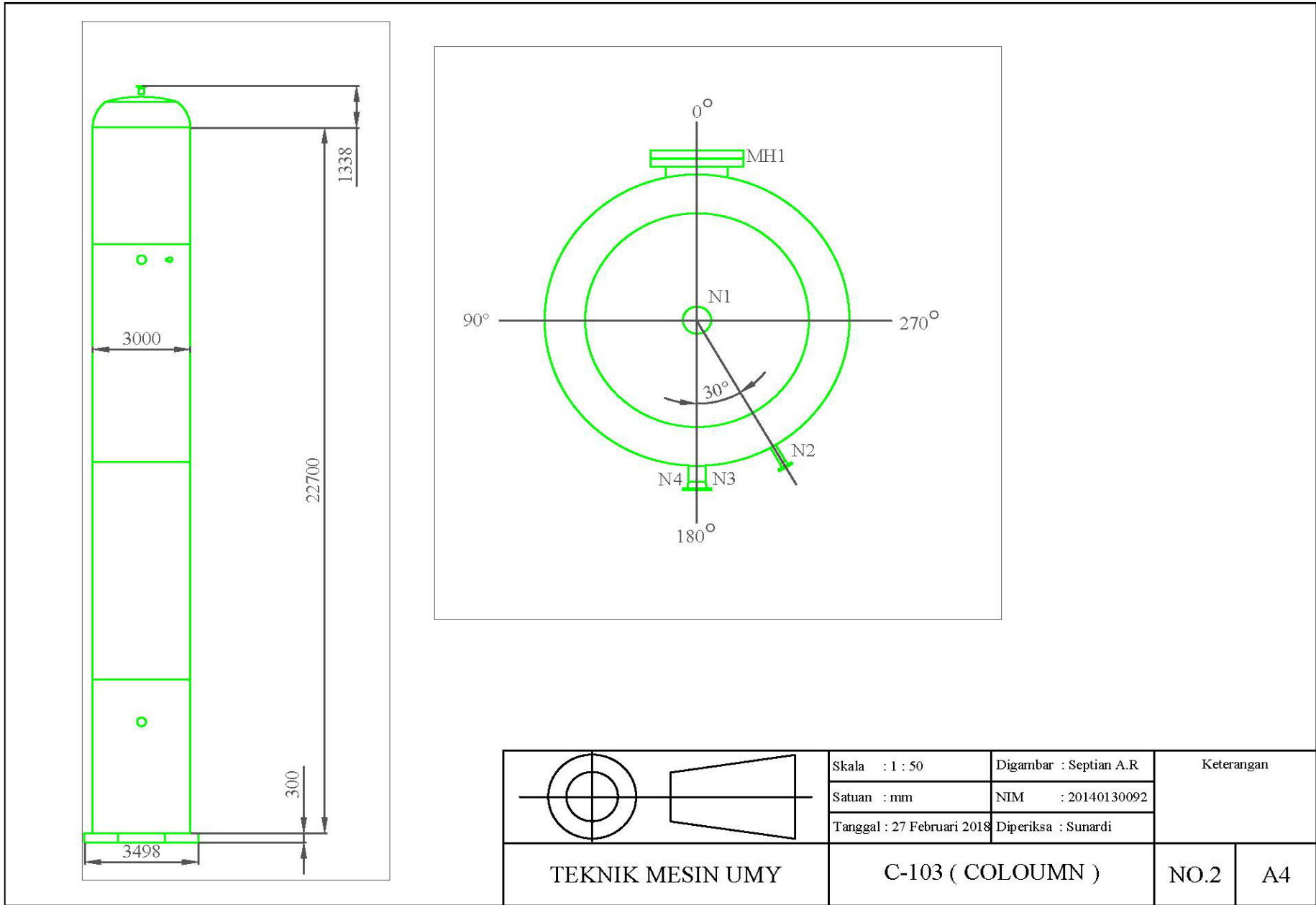
Gambar 6.4 Hasil pemodelan *equipment C-103*

Equipment C-103 merupakan *equipment* jenis *coloumn* seperti Gambar 6.4. *Equipment C-103* terdiri dari 1 *shell*, 2 *head* jenis *ellipsoidal*, 1 *skirt*, 1 *plate*, dan terdiri dari 5 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.2 berikut :

Tabel 6.2 Spesifikasi *Nozzle C-103*

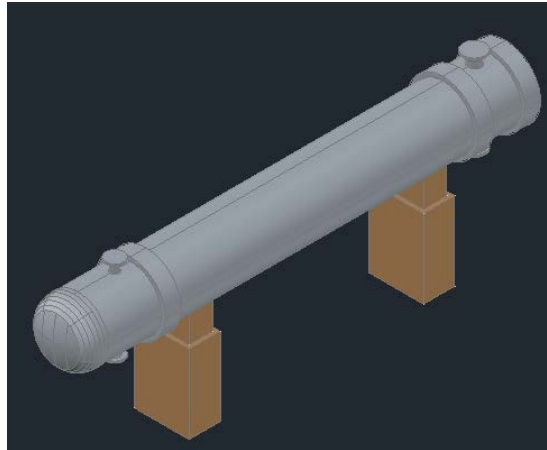
Nozzle	Size	Projection	Rating
N1	6"	250	150#RF
N2	2"	200	150#RF
N3	6"	250	150#RF
N4	6"	250	150#RF
MH1	24"	300	150#RF

Adapun hasil gambar 2D dari *equipment C-103* dapat dilihat pada gambar 6.5.



Gambar 6.5 Gambar 2D *equipment C-103 (coloumn)*

6.1.3. *Equipment E-101 (Heat Exchanger)*



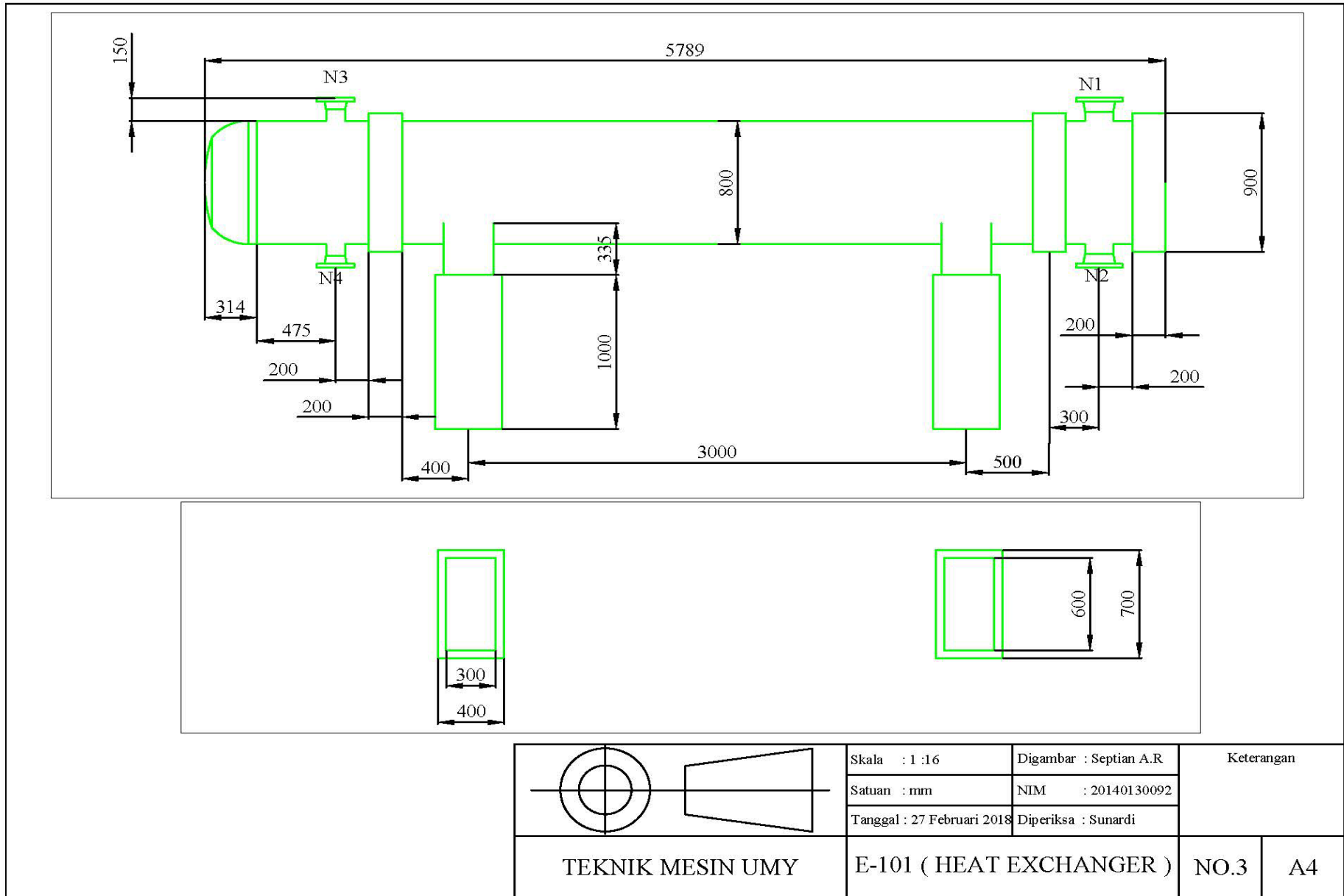
Gambar 6.6 Hasil pemodelan *equipment E-101*

Equipment E-101 merupakan *equipment* jenis *Heat Exchanger* seperti Gambar 6.6. *Equipment* biasa digunakan untuk menukarkan kalor. *Equipment E-101* terdiri dari 1 *shell*, 2 *head* jenis *ellipsoidal*, 2 *skirt*, 2 *saddle*, dan terdiri dari 4 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.3 berikut :

Tabel 6.3 Spesifikasi *Nozzle E-101*

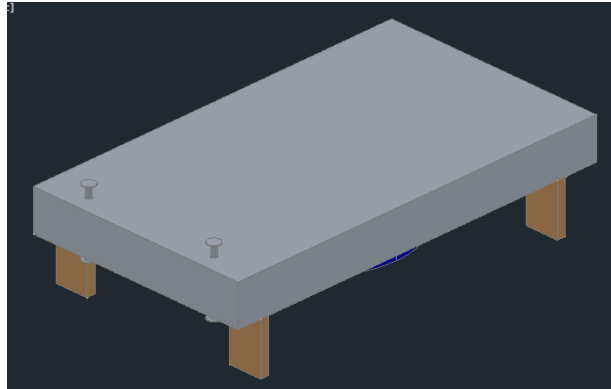
Nozzle	Size	Projection	Rating
N1	6"	600	150#RF
N2	6"	600	150#RF
N3	4"	600	150#RF
N4	4"	600	150#RF

Adapun hasil gambar 2D dari *equipment E-101* dapat dilihat pada gambar 6.7.



Gambar 6.7 Gambar 2D equipment E-101 (Heat Exchanger)

6.1.4. *Equipment E-102 (Fin Fan)*



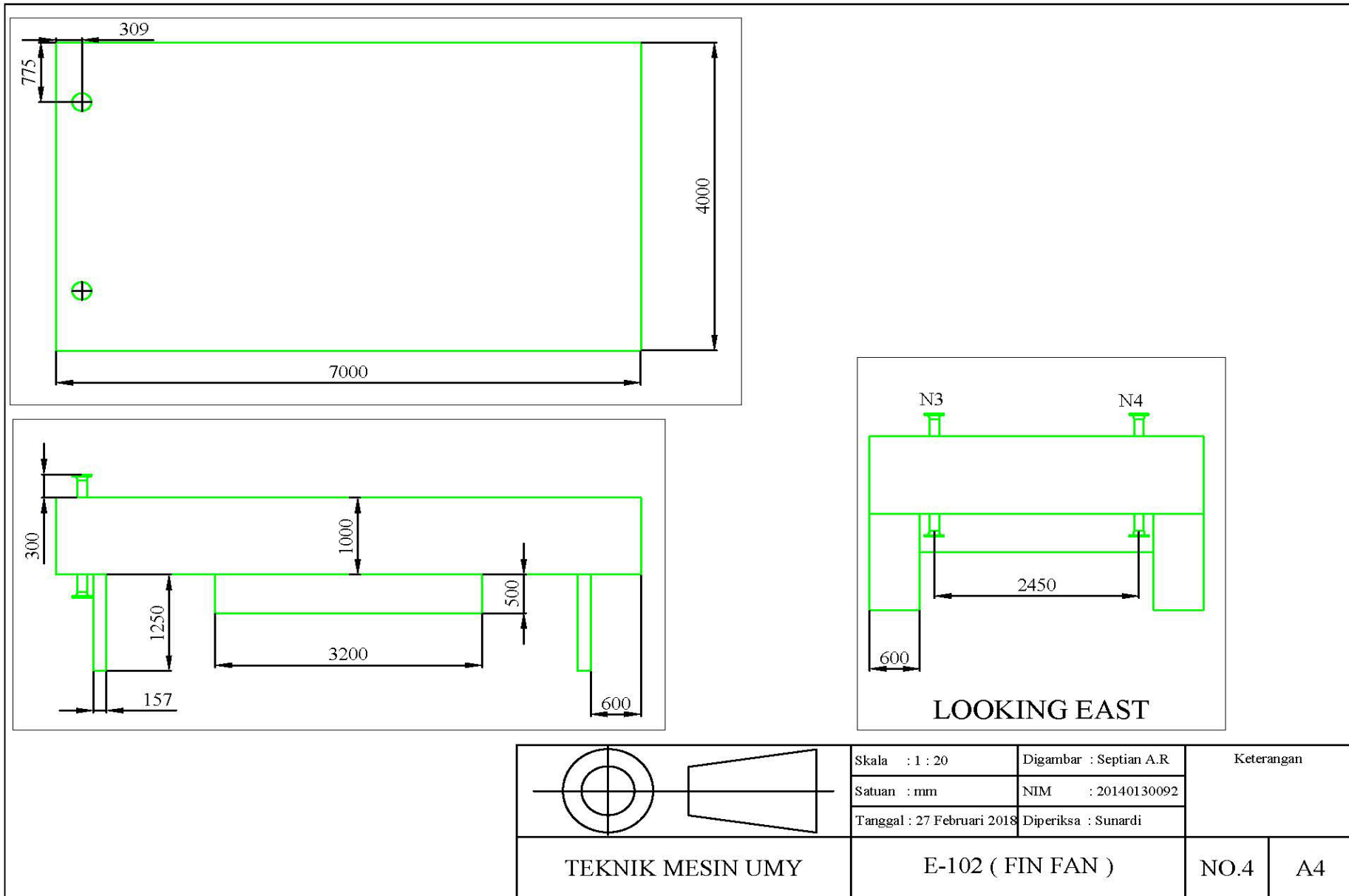
Gambar 6.8 Hasil pemodelan *equipment E-102*

Equipment E-102 merupakan *equipment* jenis *Fin Fan* seperti Gambar 6.8. *Equipment* biasa digunakan untuk melepaskan kalor. *Equipment E-102* biasanya di sediakan oleh *vendor*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.4 berikut :

Tabel 6.4 Spesifikasi *Nozzle E-103*

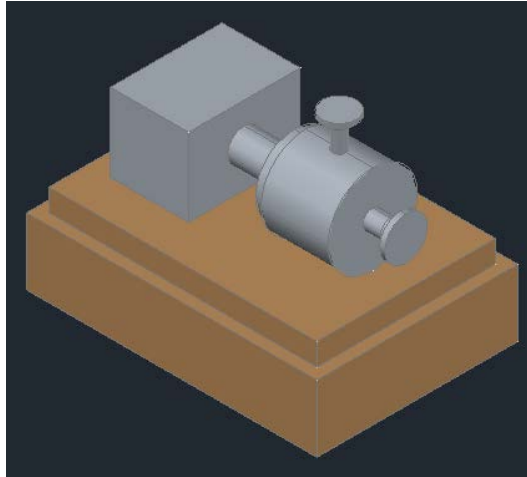
Nozzle	Size	Projection	Rating
N1	4"	300	150#RF
N2	4"	300	150#RF
N3	4"	300	150#RF
N4	4"	300	150#RF

Adapun hasil gambar 2D dari *equipment E-102* dapat dilihat pada gambar 6.9.



Gambar 6.9 Gambar 2D equipment E-102 (fin fan)

6.1.5. *Equipment P-101 A,B (Pump)*



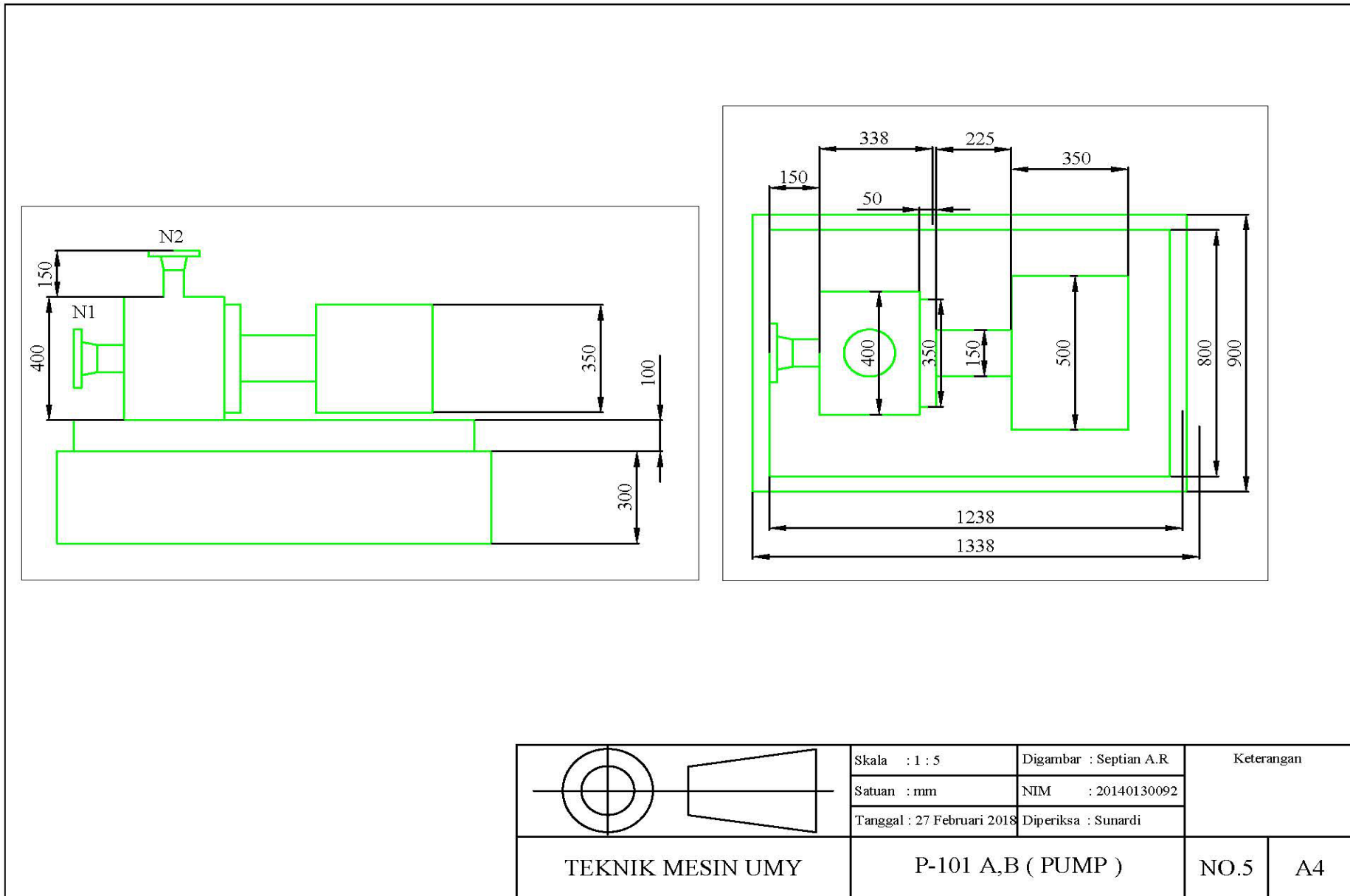
Gambar 6.10 Hasil pemodelan *equipment P-101 A,B*

Equipment P-101 A,B merupakan *equipment* jenis Pump seperti Gambar 6.10. *Equipment* biasa digunakan untuk memindahkan fluida dari tekanan rendah ke tekanan tinggi. *Equipment P-101 A,B* biasanya di sediakan oleh *vendor*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.5 berikut :

Tabel 6.5 Spesifikasi *Nozzle P-101 A,B*

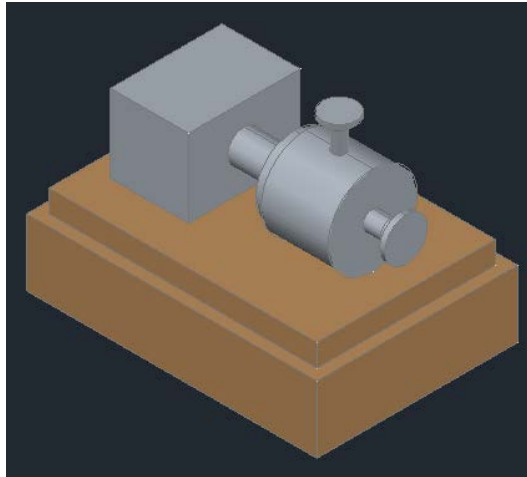
Nozzle	Size	Projection	Rating
N1	3"	300	150#RF
N2	2"	350	150#RF

Adapun hasil gambar 2D dari *equipment P-101 A,B* dapat dilihat pada gambar 6.11.



Gambar 6.11 Gambar 2D *equipment* P-101 A,B (*pump*)

6.1.6. *Equipment P-102 A,B (Pump)*



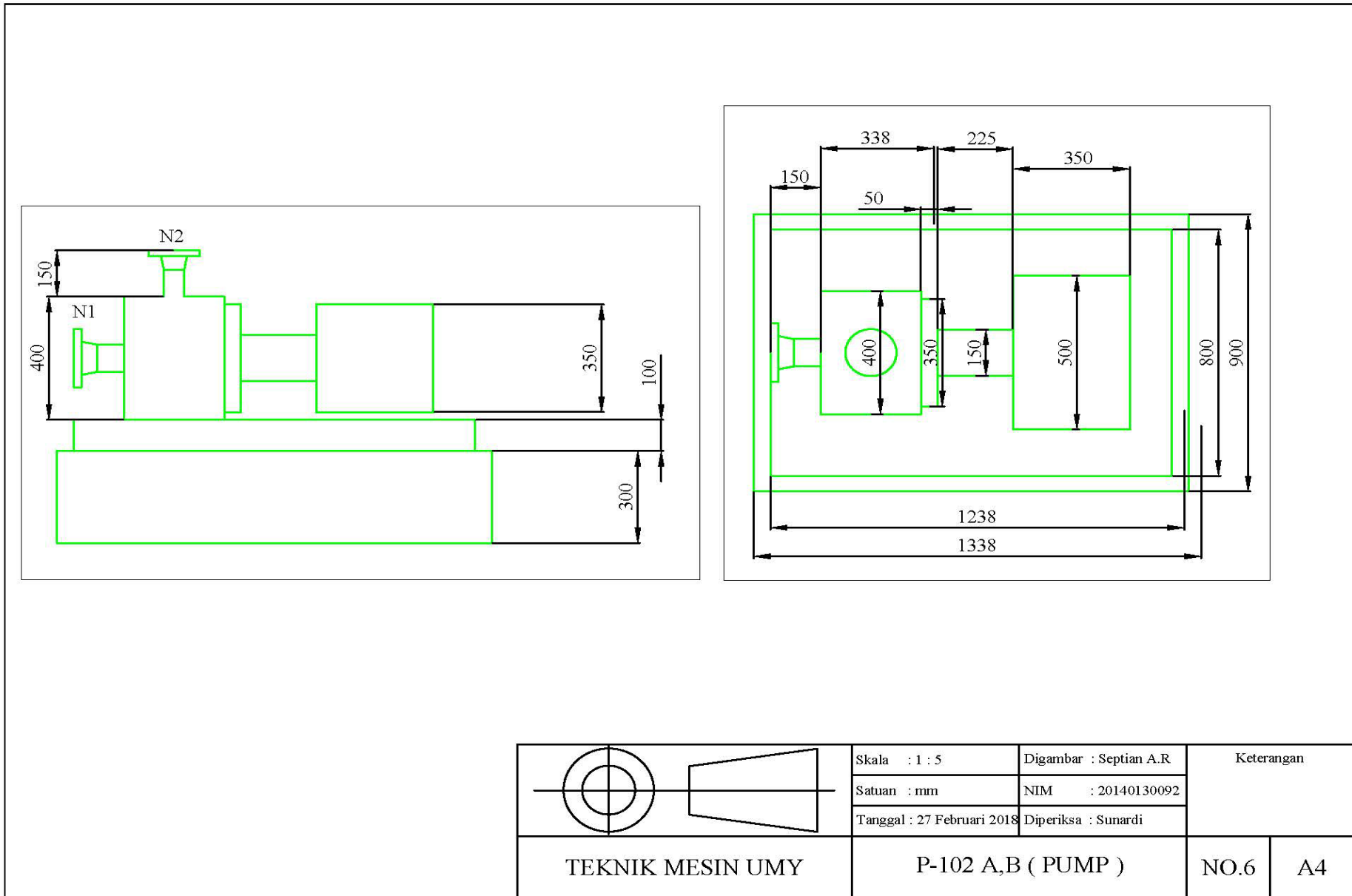
Gambar 6.12 Hasil pemodelan *equipment P-102 A,B*

Equipment P-102 A,B merupakan *equipment* jenis *Pump* seperti Gambar 6.12. *Equipment* biasa digunakan untuk memindahkan fluida dari tekanan rendah ke tekanan tinggi. *Equipment P-102 A,B* biasanya di sediakan oleh *vendor*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.6 berikut :

Tabel 6.6 Spesifikasi *Nozzle P-102 A,B*

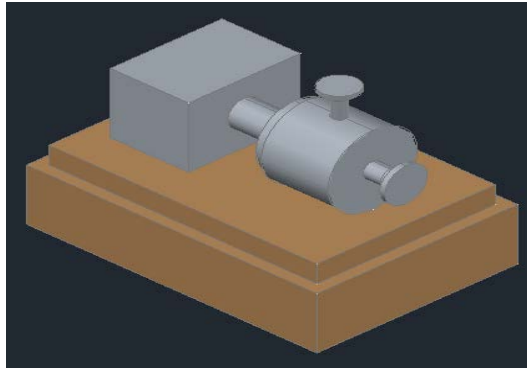
Nozzle	Size	Projection	Rating
N1	3"	300	150#RF
N2	2"	350	150#RF

Adapun hasil gambar 2D dari *equipment P-102 A,B* dapat dilihat pada gambar 6.13.



Gambar 6.13 Gambar 2D equipment P-102 A,B (pump)

6.1.7. *Equipment P-103 A,B (Pump)*



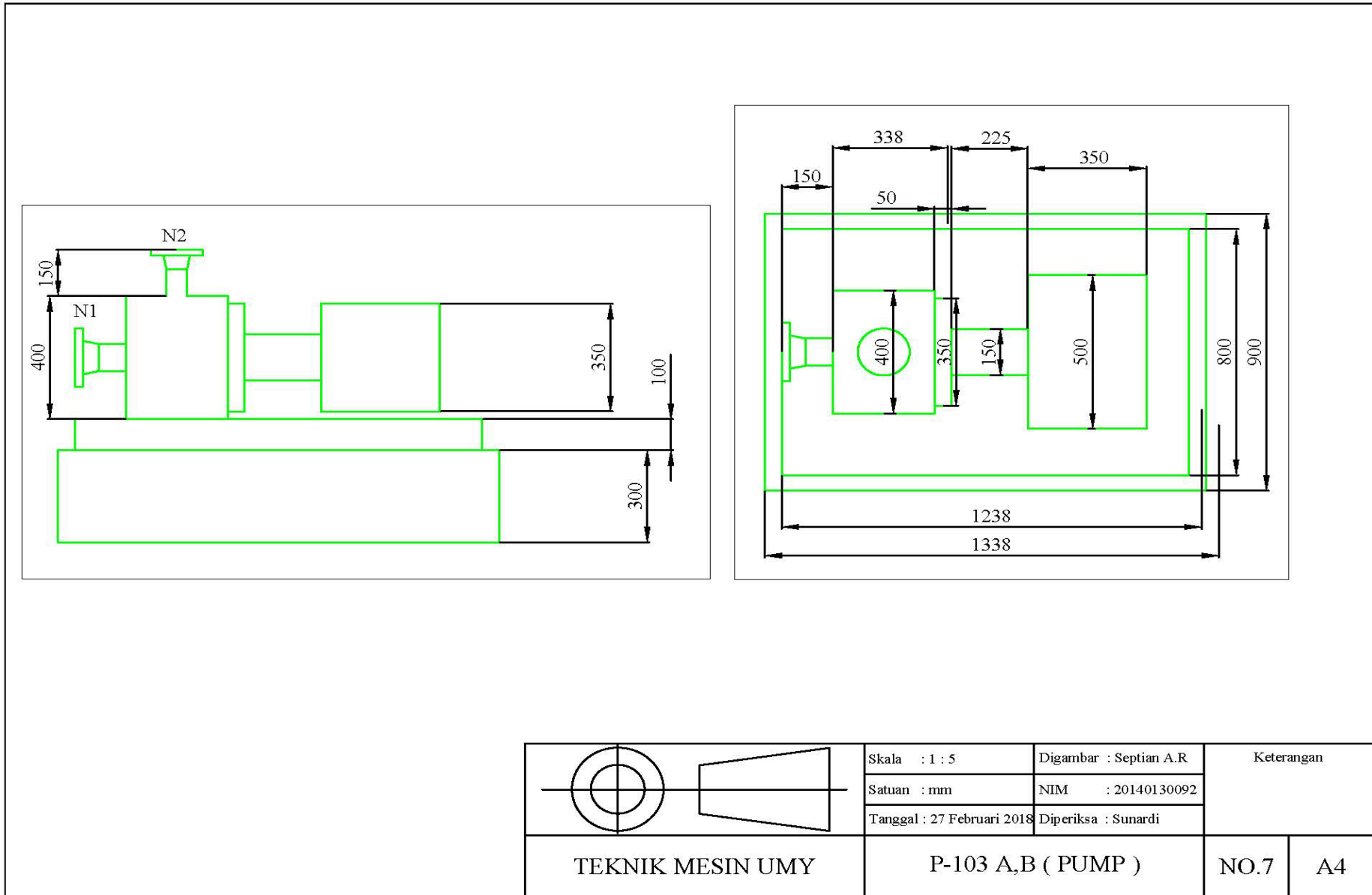
Gambar 6.14 Hasil pemodelan *equipment P-103 A,B*

Equipment P-103 A,B merupakan *equipment* jenis *Pump* seperti Gambar 6.14. *Equipment* biasa digunakan untuk memindahkan fluida dari tekanan rendah ke tekanan tinggi. *Equipment P-103 A,B* biasanya di sediakan oleh *vendor*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.7 berikut :

Tabel 6.7 Spesifikasi *Nozzle P-103 A,B*

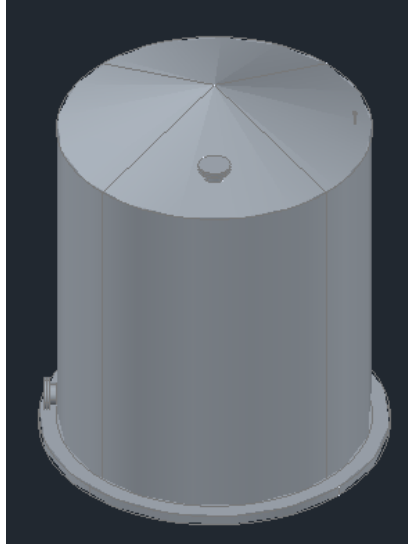
Nozzle	Size	Projection	Rating
N1	3"	300	150#RF
N2	2"	350	150#RF

Adapun hasil gambar 2D dari *equipment P-103 A,B* dapat dilihat pada gambar 6.15.



Gambar 6.15 Gambar 2D equipment P-103 A,B (pump)

6.1.8. *Equipment T-101 (Tank)*



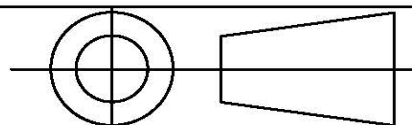
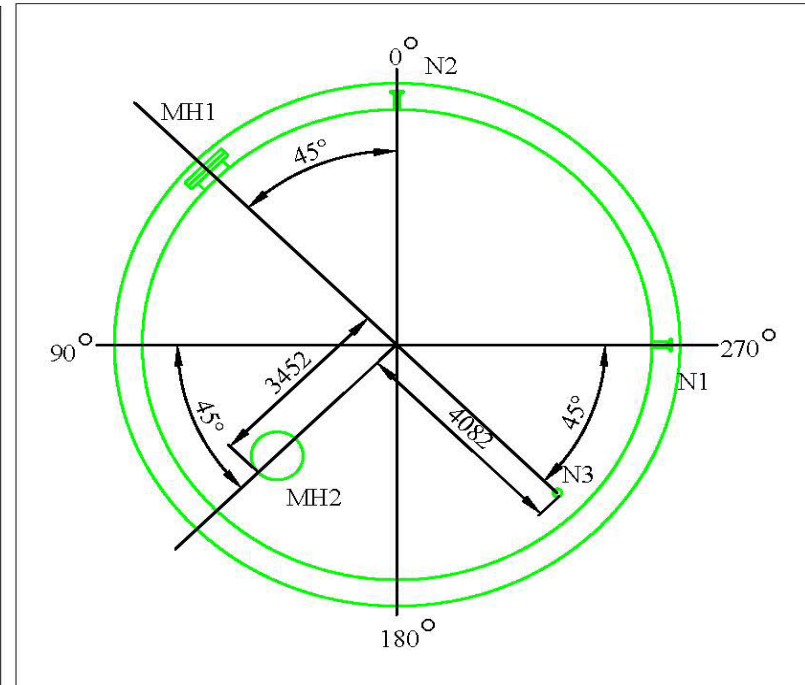
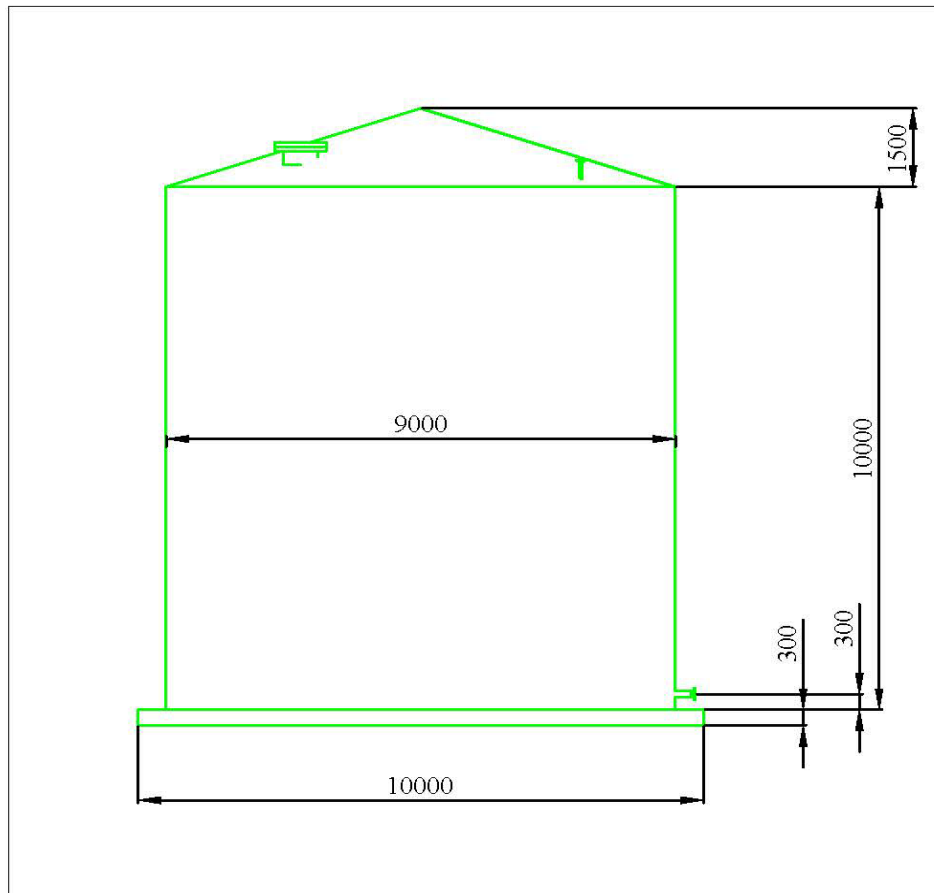
Gambar 6.16 Hasil pemodelan *equipment T-101*

Equipment T-101 merupakan *equipment* jenis Tangki seperti Gambar 6.16. *Equipment* biasa digunakan untuk penyimpanan dari bahan bakar atau fluida. *Equipment T-101* terdiri dari 1 *shell*, 1 *head* jenis *conical*, 1 *plate* dan terdiri dari 5 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.8 berikut :

Tabel 6.8 Spesifikasi *Nozzle T-101*

Nozzle	Size	Projection	Rating
N1	4"	4700	150#RF
N2	4"	4700	150#RF
N3	2"	10350	150#RF
MH1	24"	4800	150#RF
MH2	24"	10800	150#RF

Adapun hasil gambar 2D dari *equipment T-101* dapat dilihat pada gambar 6.17.



TEKNIK MESIN UMY

Skala : 1 : 40	Digambar : Septian A.R
Satuan : mm	NIM : 20140130092
Tanggal : 27 Februari 2018	Diperiksa : Sunardi

Keterangan

T-101 (TANK)

NO.8

A4

Gambar 6.17 Gambar 2D equipment T-101 (tank)

6.1.9. *Equipment T-102 (Tank)*



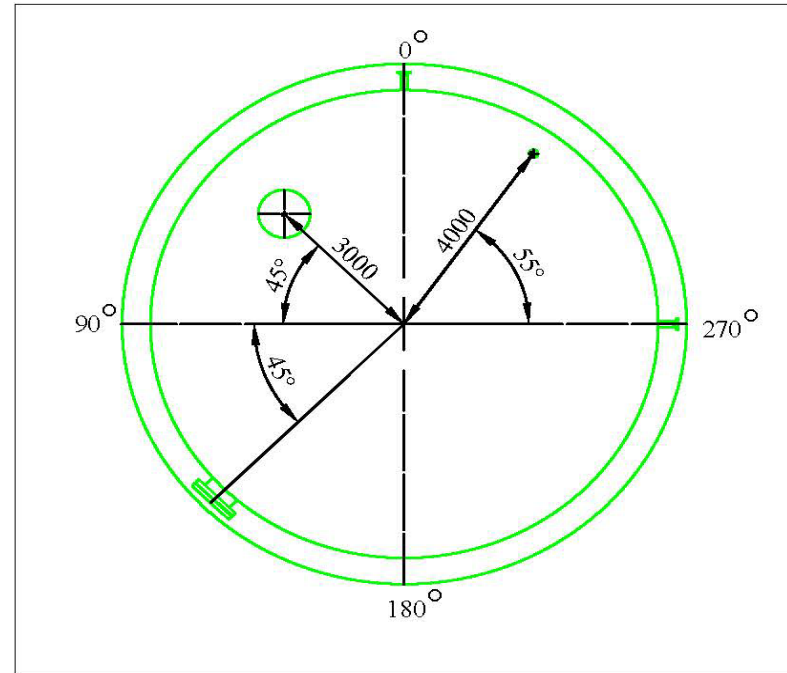
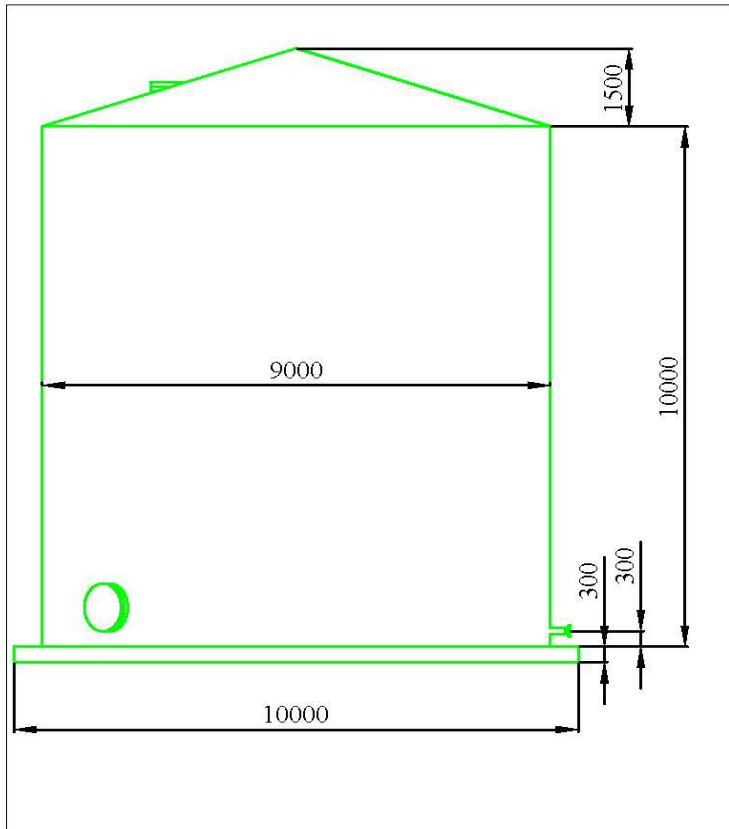
Gambar 6.18 Hasil pemodelan *equipment T-102*

Equipment T-102 merupakan *equipment* jenis Tangki seperti Gambar 6.18. *Equipment* biasa digunakan untuk penyimpanan dari bahan bakar atau fluida. *Equipment T-102* terdiri dari 1 *shell*, 1 *head* jenis *conical*, 1 *plate* dan terdiri dari 5 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.9 berikut :

Tabel 6.9 Spesifikasi *Nozzle T-101*

Nozzle	Size	Projection	Rating
N1	4"	4700	150#RF
N2	4"	4650	150#RF
N3	4"	10350	150#RF
MH1	24"	4800	150#RF
MH2	24"	10800	150#RF

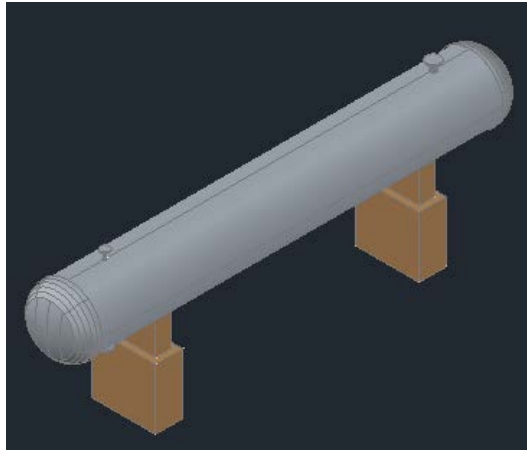
Adapun hasil gambar 2D dari *equipment T-102* dapat dilihat pada gambar 6.19.



	Skala : 1 : 40	Digambar : Septian A.R	Keterangan	
	Satuan : mm	NIM : 20140130092		
	Tanggal : 27 Februari 2018	Diperiksa : Sunardi		
TEKNIK MESIN UMY	T-102 (TANK)		NO.9	A4

Gambar 6. 19 Gambar 2D *equipment* T-102 (tank)

6.1.10. *Equipment V-101 (Vessel)*



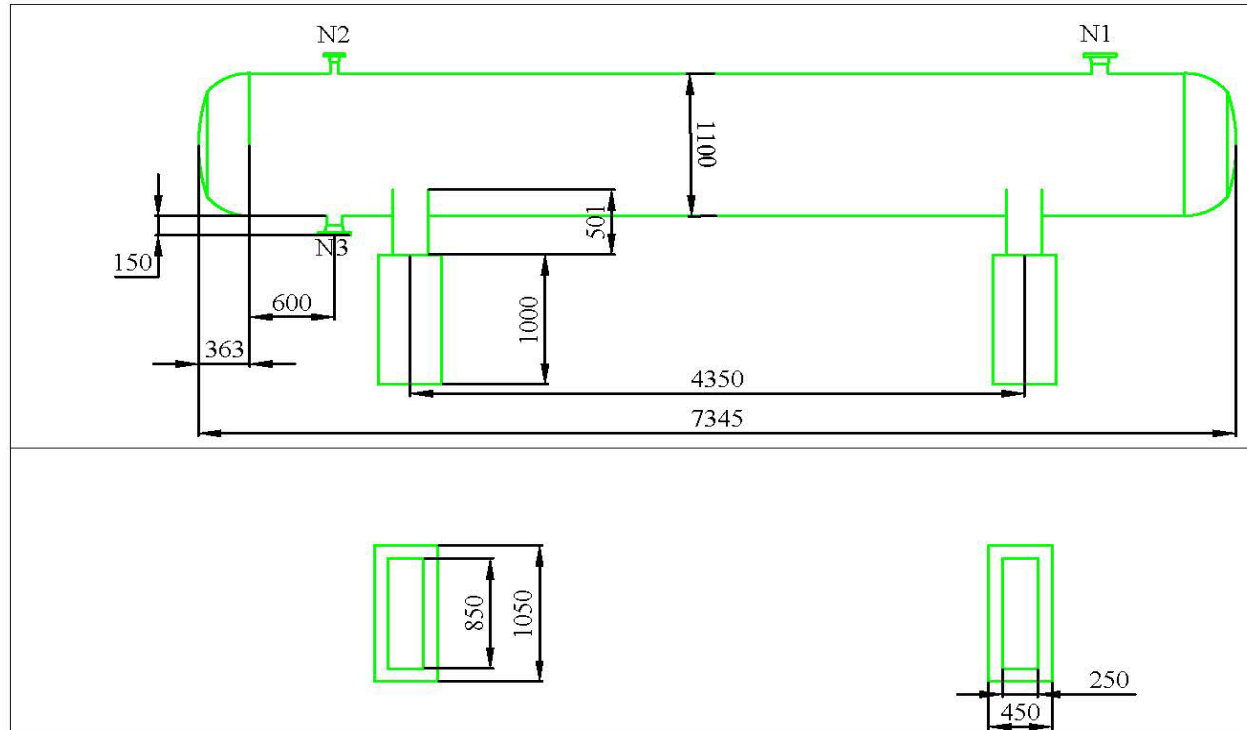
Gambar 6.20 Hasil pemodelan *equipment V-101*

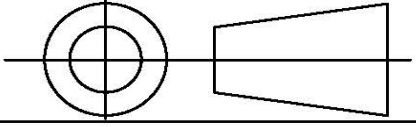
Equipment V-101 merupakan *equipment* jenis *Vessel Horizontal* seperti Gambar 6.20. *Equipment V-101* terdiri dari 1 *shell*, 2 *head* jenis *ellipsoidal*, 2 *skirt*, 2 *saddle*, dan terdiri dari 3 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.10 berikut :

Tabel 6.10 Spesifikasi *Nozzle V-101*

Nozzle	Size	Projection	Rating
N1	6"	750	150#RF
N2	2"	750	150#RF
N3	4"	750	150#RF

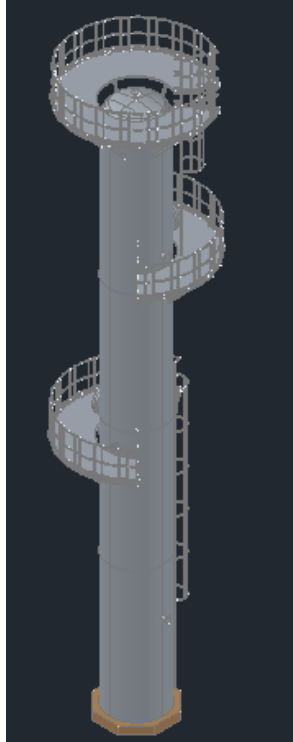
Adapun hasil gambar 2D dari *equipment V-101* dapat dilihat pada gambar 6.21.



	Skala : 1 : 16	Digambar : Septian A.R	Keterangan	
	Satuan : mm	NIM : 20140130092		
	Tanggal : 27 Februari 2018	Diperiksa : Sunardi		
TEKNIK MESIN UMY	V-101 (VESSEL)		NO.10	A4

Gambar 6.21 Gambar 2D equipment V-101 (vessel)

6.1.11. *Equipment V-102 (Vessel)*



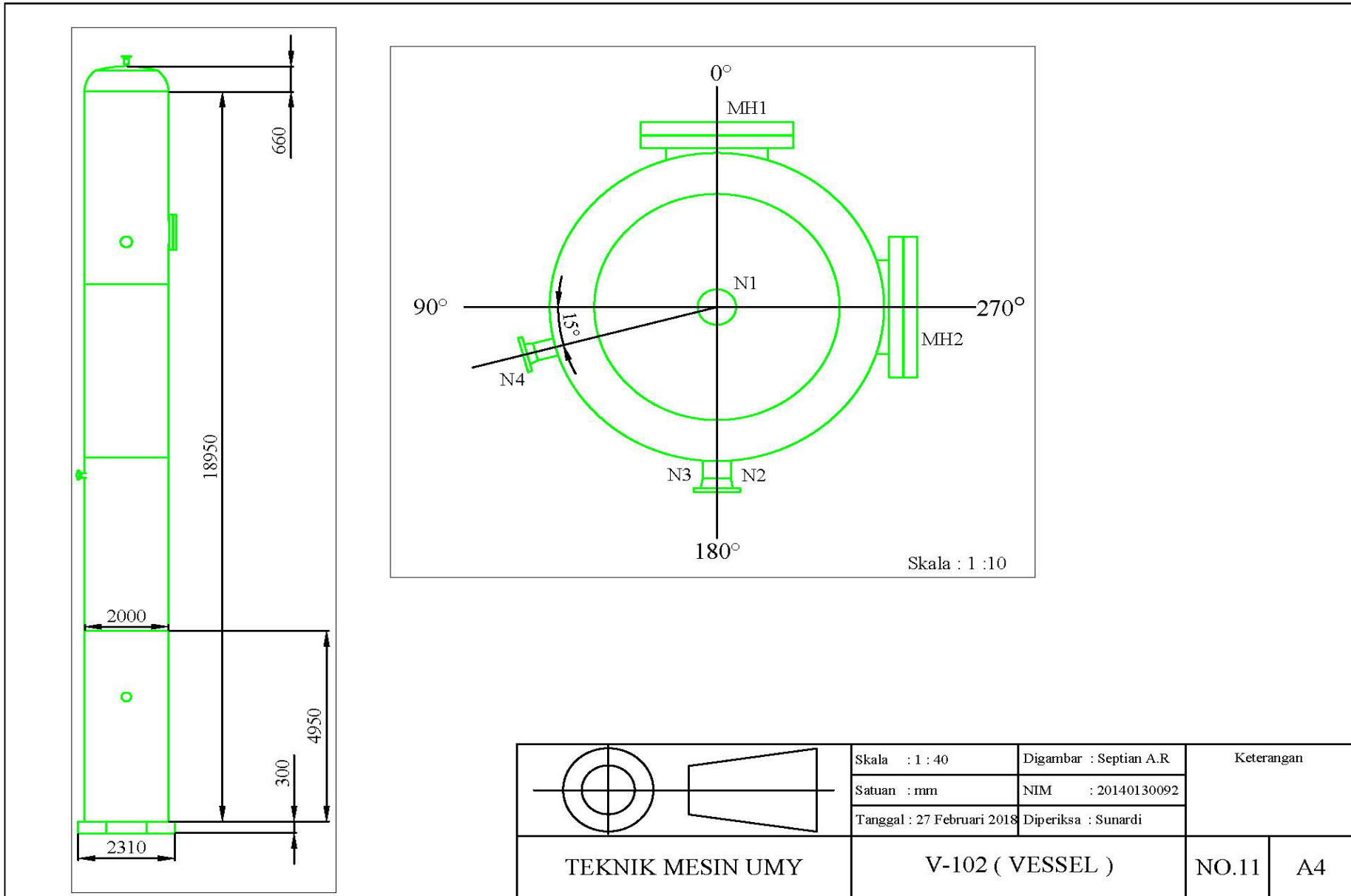
Gambar 6.22 Hasil pemodelan *equipment V-102*

Equipment V-102 merupakan *equipment* jenis *Vessel Vertikal* seperti Gambar 6.22. *Equipment V-102* terdiri dari 1 *shell*, 2 *head* jenis *ellipsoidal*, 1 *skirt*, 1 *plate*, dan terdiri dari 6 *nozzle*. Spesifikasi *nozzle* dapat dilihat pada tabel 6.11 berikut :

Tabel 6.11 Spesifikasi *Nozzle V-102*

Nozzle	Size	Projection	Rating
N1	4"	200	150#RF
N2	6"	200	150#RF
N3	4"	150	150#RF
N4	4"	200	150#RF
MH1	24	300	150#RF
MH2	24	300	150#RF

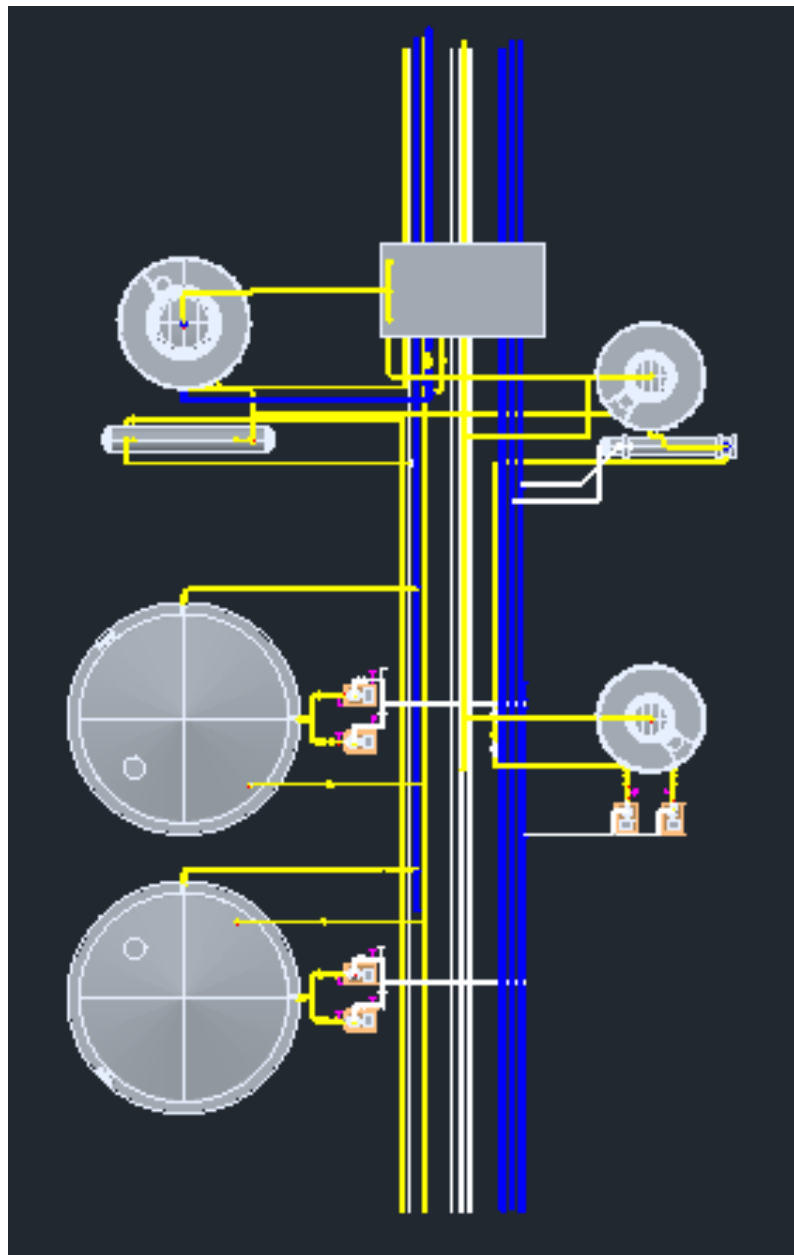
Adapun hasil gambar 2D dari *equipment V-102* dapat dilihat pada gambar 6.23.



Gambar 6.23 Gambar 2D equipment V-102 (vessel)

6.2. Desain Piping

Setelah melakukan pemodelan ulang menggunakan *software AutoCAD plant* 3D, maka didapat hasil desain *piping*. Adapun *design piping* yang di modelkan ulang menghasilkan *output* berupa *piping layout* seperti Gambar 6.24, *isometric piping* dan gambar 3D.



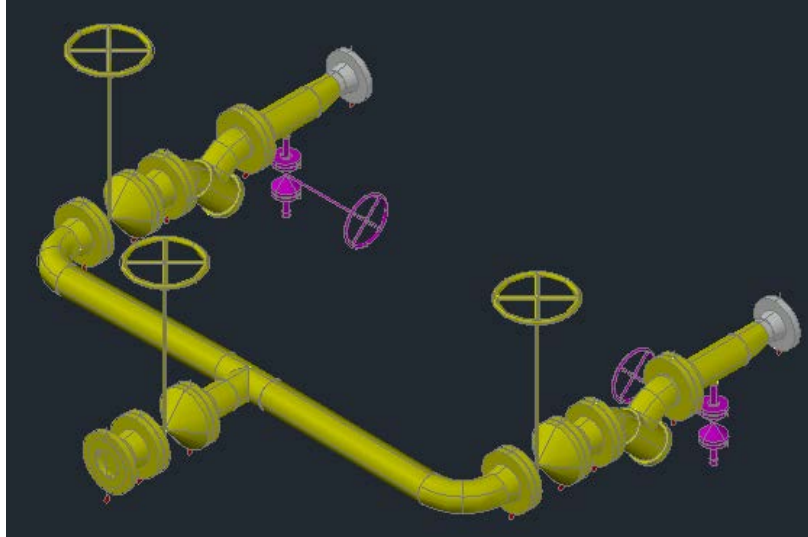
Gambar 6.24 *Piping Layout*

Selain *piping layout* adapun gambar 3D dan 2D *isometri piping* yang bisa dikeluarkan oleh *software AutoCAD Plant 3D*. Berikut adalah hasil gambar 3D dan 2D *piping isometri* yang dibuat berdasarkan studi kasus *piping drafting training plus P.I.n.D training course* yaitu :

1. Pipa 4"-WP-10006-CS150
2. Pipa 2"-SN-10006-CS150
3. Pipa 3"-WP-10008-CS150
4. Pipa 6"-P-10004-CS150
5. Pipa 4"-WP-10003-CS150
6. Pipa 2"-SN-10005-CS150
7. Pipa 4"-WP-10005-CS150
8. Pipa 3"-WP-10007-CS150
9. Pipa 4"-WP-10004-CS150
10. Pipa 2"-SN-10007-CS150
11. Pipa 4"-KF-10003-CS150
12. Pipa 4"-KF-10002-CS150
13. Pipa 2"-G-10004-CS150
14. Pipa 4"-GS-10001-CS150
15. Pipa 3"-GS-10009-CS150
16. Pipa 4"-GS-10007-CS150
17. Pipa 4"-GS-10004-CS150
18. Pipa 4"-GS-10006-CS150
19. Pipa 3"-WCS-10003-CS150
20. Pipa 3"-WCR-10003-CS150
21. Pipa 4"-GS-10003-CS150
22. Pipa 4"-GS-10005-CS150
23. Pipa 4"-GS-10002-CS150

Berikut adalah rincian dari tiap-tiap jalur pipa yang telah dibuat berdasarkan gambar 2D *isometric piping* :

6.2.1. Pipa 4"-WP-10006-CS150

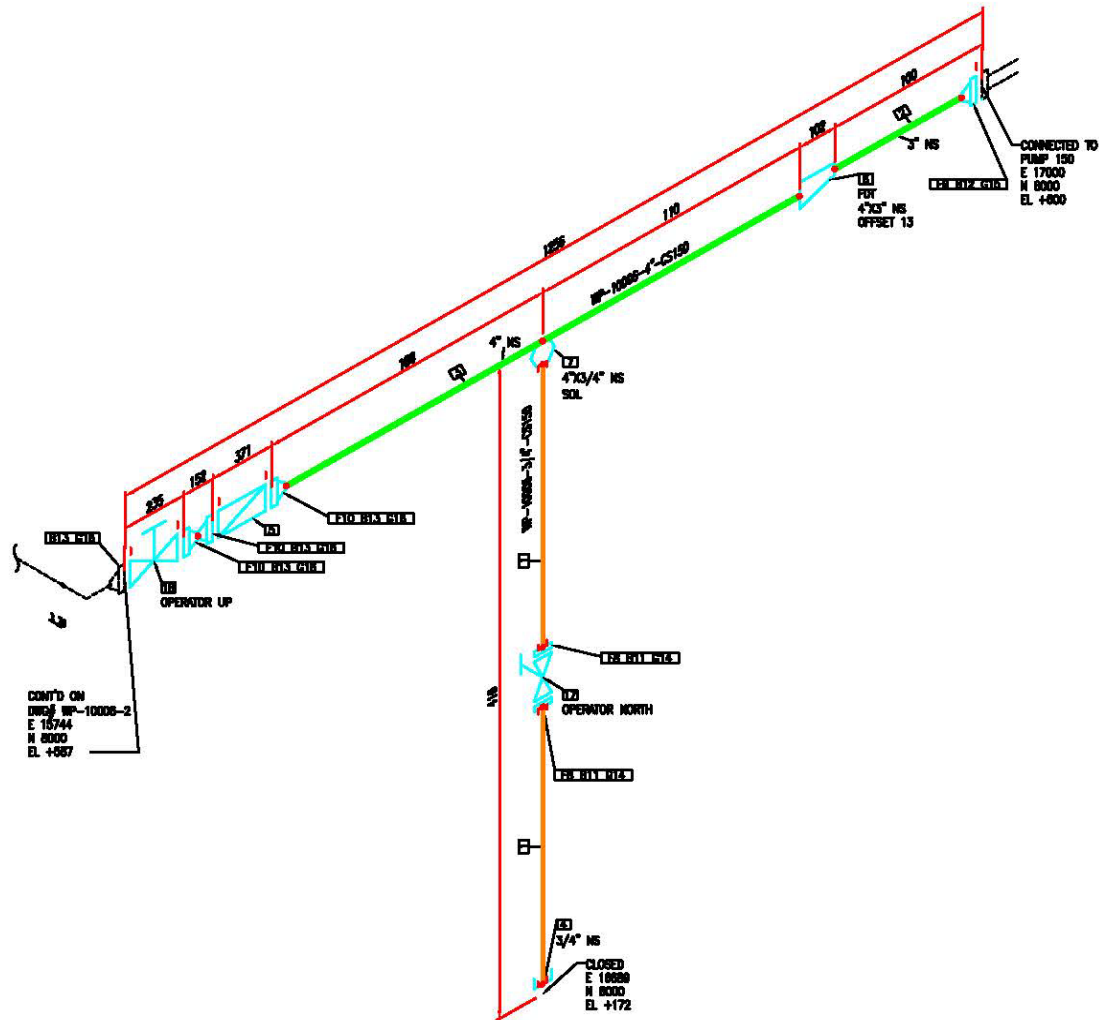


Gambar 6.25 Hasil pemodelan pipa 3D *line number* 4"-WP-10006-CS150

Pipa 4"-WP-10006-CS150 seperti Gambar 6.25 merupakan pipa yang menghubungkan antara N1 pada T-102 ke N1 pada *equipment* P-103 A,B. Adapun maksud dari nama jalur pipa 4"-WP-10006-CS150 adalah :

- 4" : *Size piping*
- WP : *Service line code (Potable Water)*
- 10006 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-WP-10006-CS150 dapat dilihat pada Gambar 6.26.



CONT'D ON
DRAWING WP-10006-2
E 15744
N 8000
EL +587

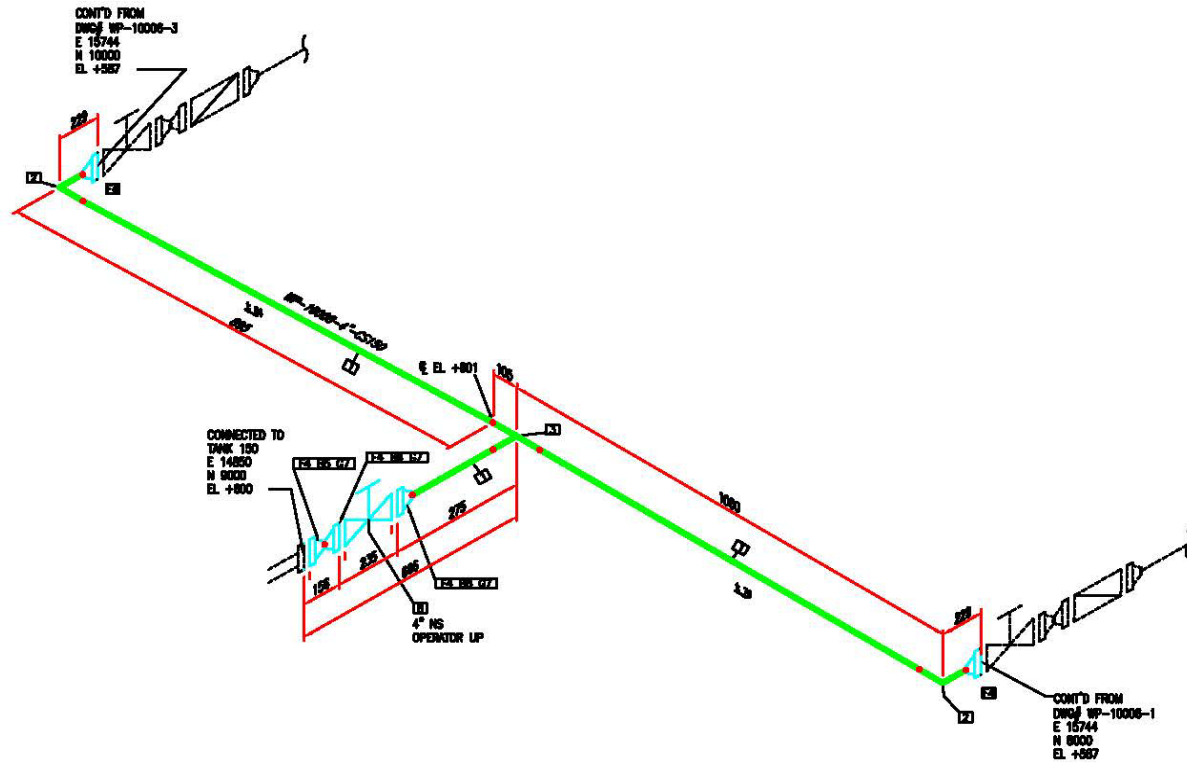
					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPO	INSULATION THK

BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.3M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	GNP, 3000 LB. SN, ASME B16.11, ASTM A105
5	1	4"	Y-TYPE STRAINER, RF, 150 LB, ASME B16.10
6	1	4x3"	REDUCER (ERC), ER, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
7	1	4x3/4"	SOCKET, 3000 LB. DRWSN, 9/16" LG, ASME B16.11, ASTM A105
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
9	1	3"	FLANGE WA, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	3	4"	FLANGE WA, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	1/2"x84	BOLT SET, RF, 150 LB, STUD BOLT
12	4	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
13	32	5/8"x200	BOLT SET, RF, 150 LB, STUD BOLT
14	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
15	1	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	4	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

PROJECT NAME:	Septian Andri Riswana		
DATE:			
DRAWING NUMBER:	WP-10006-1		
DATE:	WP-10006	ASME	TYPE
JOB NUMBER:		NO. mm	TYPE
	N.T.S.	1	3
		OF	0

C:\Users\septianandri\Documents\Septian Andri Riswana\Documents\Drawing\WP-10006-1.dwg

Gambar 6.26 Piping isometric pipa 4"-WP-10006-CS150



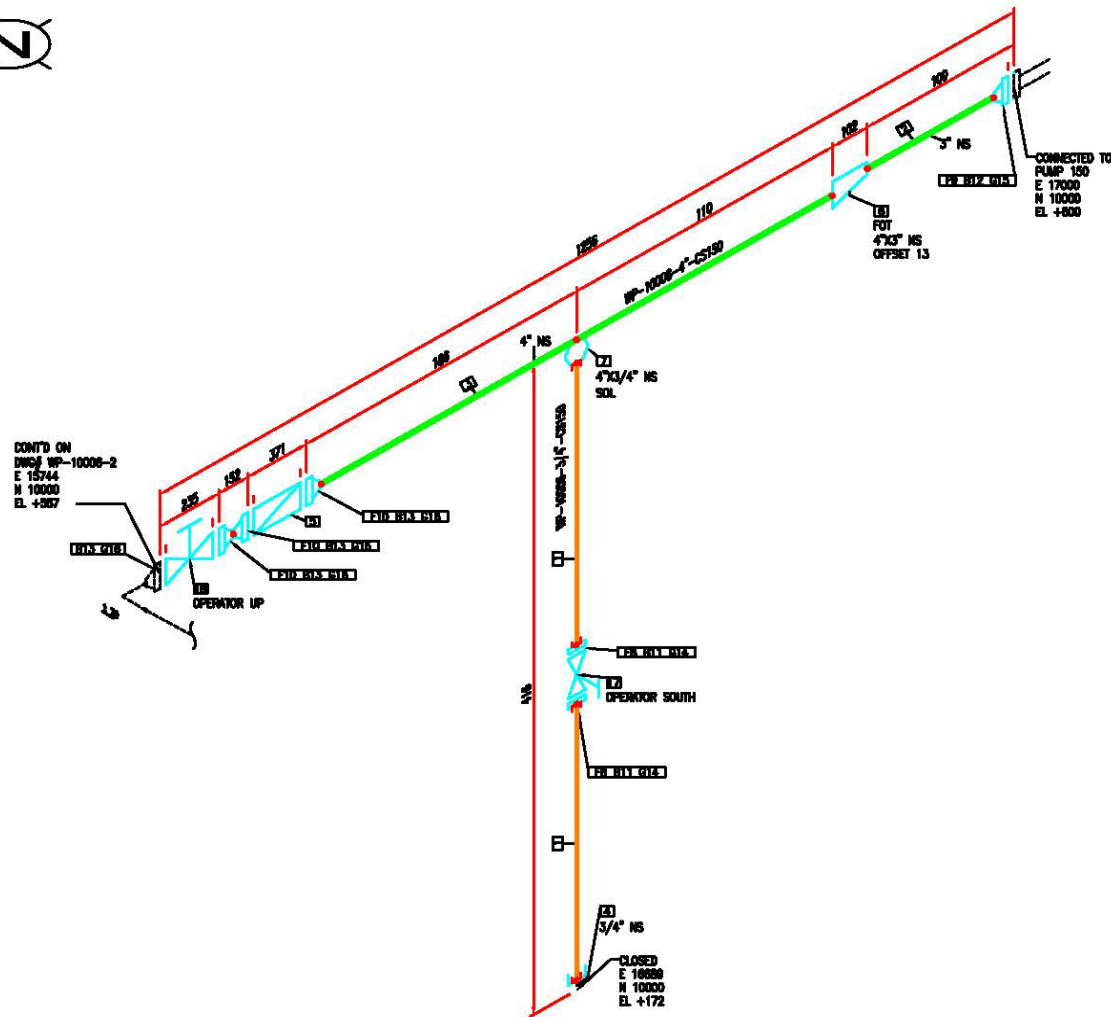
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	1.00	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	2	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	4"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	5	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
5	8	5/8"x70	BOLT SET, RF, 100 LB, STUD BOLT
6	16	5/8"x90	BOLT SET, RF, 100 LB, STUD BOLT
7	3	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.30, CS/PFPE
8	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME				Septian Andri Riswana			
DRAWN NUMBER				WP-10006-2			
DATE		USER		TYPE			
02/16/18		WP-10006					
JOB NUMBER		SHEET		OF		REV	
		N.T.S.		2		3 0	

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Gambar 6.26 Lanjutan Piping isometric pipa 4"-WP-10006-CS150



CONT'D ON
DWG# WP-10006-2
E 15744
N 10000
EL +367

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	SERVICE	INSULATION THK
		02/16/18					

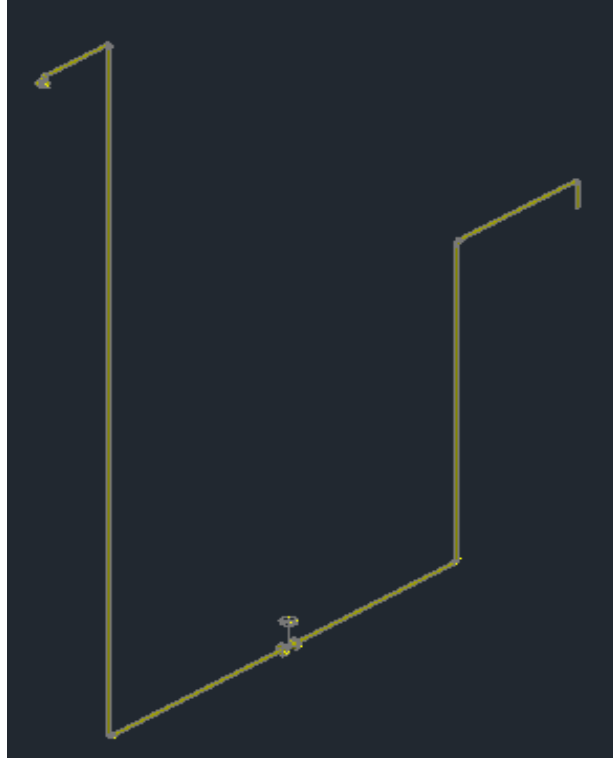
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.3M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	CAP, 3000 LB, SML, ASME B16.11, ASTM A106
5	1	4"	Y-TYPE STRAINER, RF, 150 LB, ASME B16.10
6	1	4"x3"	REDUCER (ECC), BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
7	1	4"x3/4"	SOCKET, 3000 LB, BRN, 3/16" LG, ASME B16.11, ASTM A106
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
9	1	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	1/2"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT
12	4	5/8"x7/8"	BOLT SET, RF, 150 LB, STUD BOLT
13	32	5/8"x3/8"	BOLT SET, RF, 150 LB, STUD BOLT
14	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
15	1	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	4	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	WP-10006-3		
DATE:	WP-10006	DATE:	
JOB NUMBER:	N.T.S.	QUANTITY:	3 OF 3
		REV:	0

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Gambar 6.26 Lanjutan Piping isometric pipa 4"-WP-10006-CS150

6.2.2. Pipa 2"-SN-10006-CS150

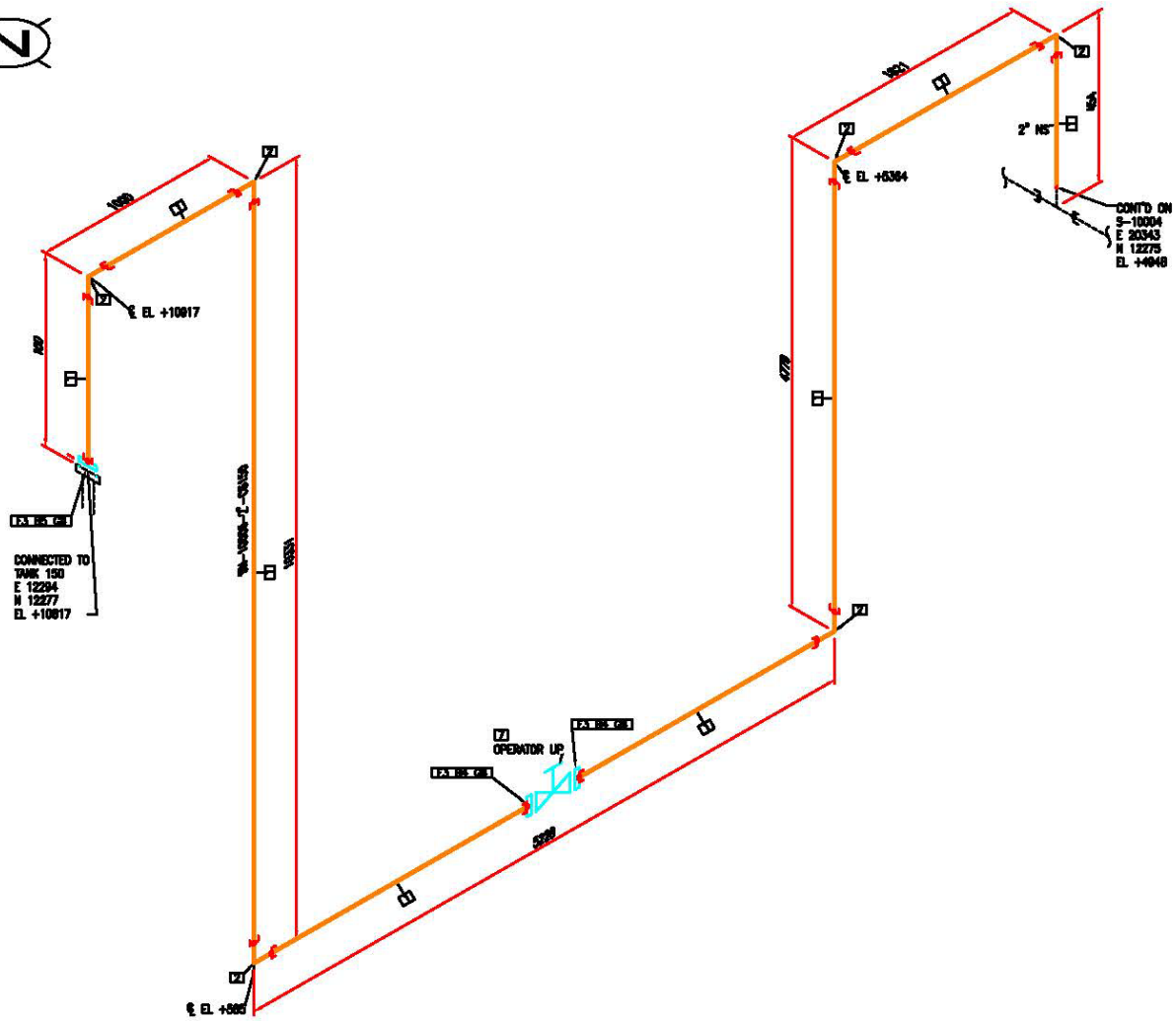


Gambar 6.27 Hasil pemodelan pipa 3D *line number* 2"-SN-10006-CS150

Pipa 2"-SN-10006-CS150 seperti Gambar 6.27 merupakan pipa yang menghubungkan antara N1 pada T-102 ke N1 pada *equipment* P-103 A,B. Adapun maksud dari nama jalur pipa 2"-SN-10006-CS150 adalah :

- 2" : *Size piping*
- SN : *Service line code (Steam Condensate)*
- 10006 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 2"-SN-10006-CS150 dapat dilihat pada Gambar 6.28.



CONT'D ON
S-10004
E 20343
N 12279
EL. +1048

BILL OF MATERIALS

ID	QTY	NO	DESCRIPTION
1	23.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	6	2"	ELL 90, 3000 LB, SW, ASME B16.11, ASTM A105
3	3	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WP8
4	8	5/8x83	BOLT SET, RF, 150 LB, STUD BOLT
5	4	5/8x70	BOLT SET, RF, 150 LB, STUD BOLT
6	3	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
7	1	2"	GATE VALVE, SOLID WEDGE, 150 LB, RF, ASME B16.10, ASTM A216 OR WP8, HAND WHEEL

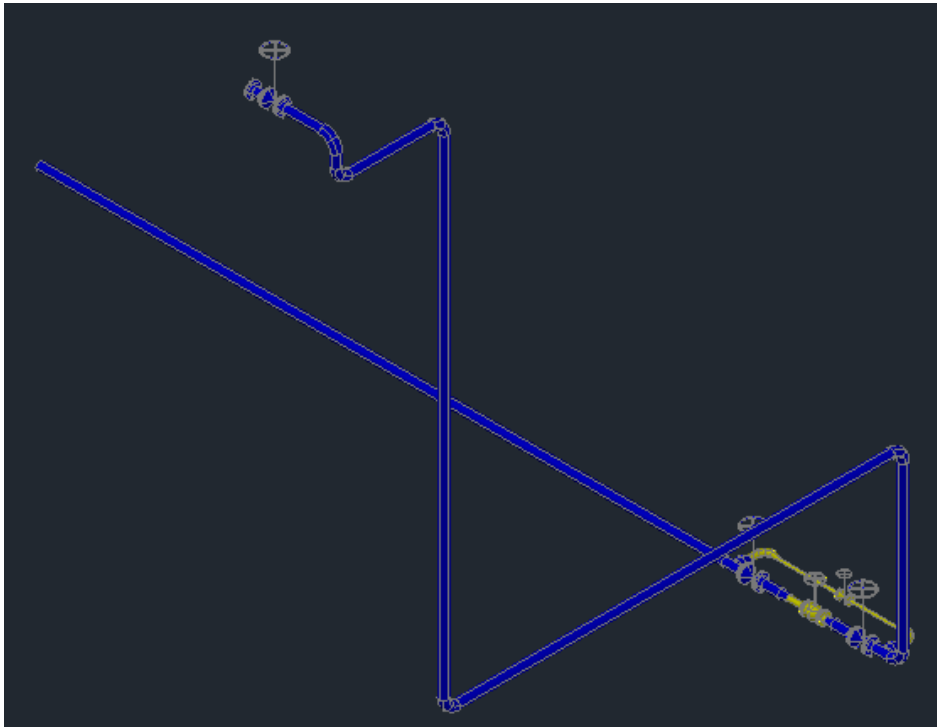
					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	SN-10006		
DATE:	SN-10006	APPD:	TYPE:
JOB NUMBER:		SCALE:	REV:
		N.T.S.	1 of 1
			0

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Gambar 6.28 Piping isometric pipa 2"-SN-10006-CS150

6.2.3. Pipa 6"-P-10004-CS150

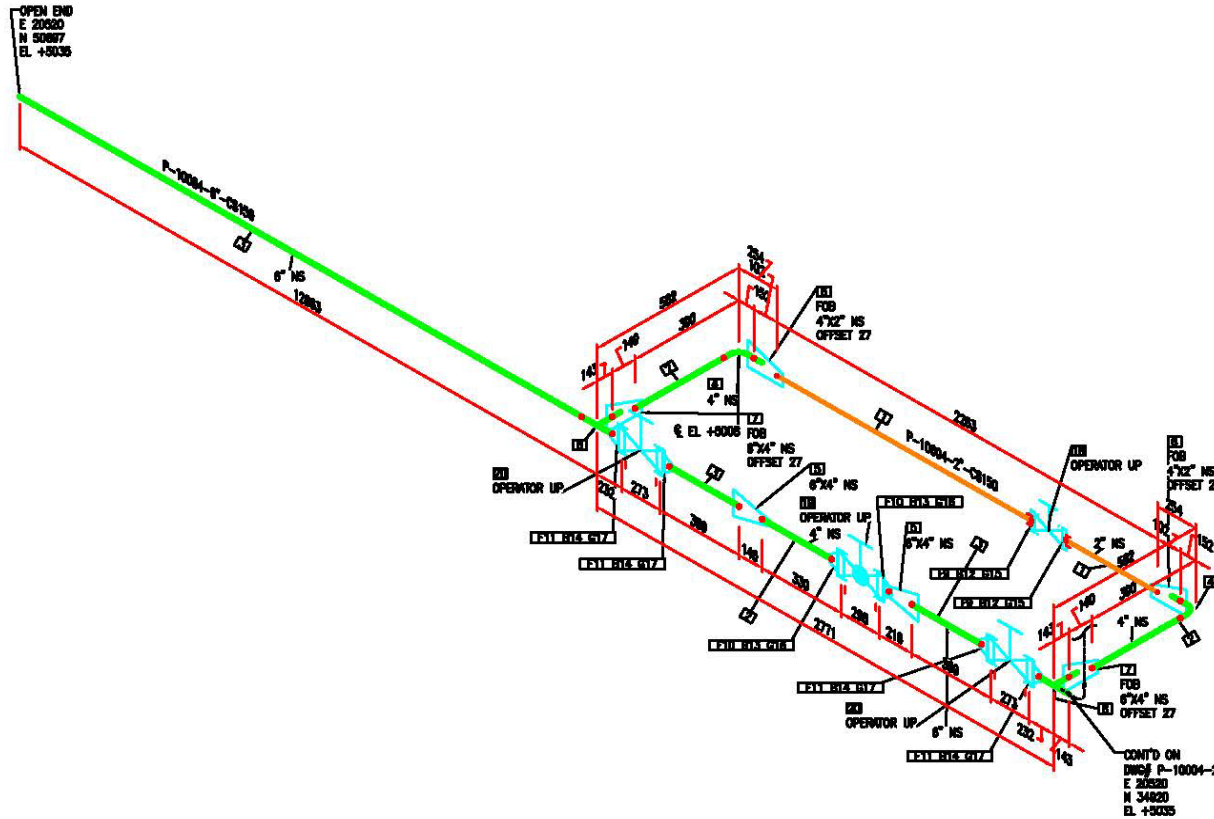


Gambar 6.29 Hasil pemodelan pipa 3D *line number* 6"-P-10004-CS150

Pipa 6"-P-10004-CS150 seperti Gambar 6.29 merupakan pipa yang menghubungkan antara N4 pada C-103 dari unit 200. Adapun maksud dari nama jalur pipa 6"-P-10004-CS150 adalah :

- 6" : *Size piping*
- P : *Service line code (General Proses)*
- 10004 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 6"-P-10004-CS150 dapat dilihat pada Gambar 6.30.

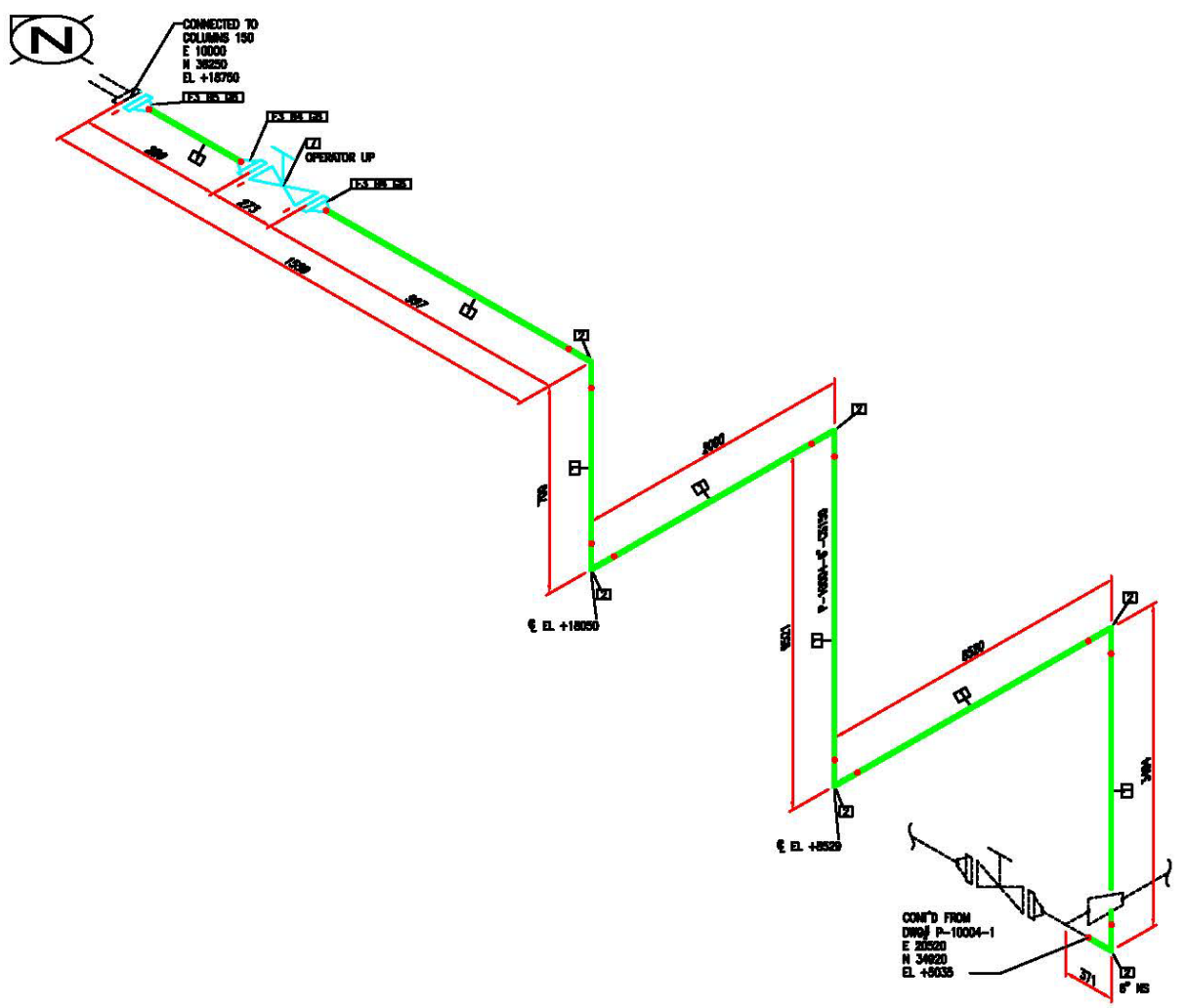


BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	2.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.0M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	13.4M	6"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	2	4"	ELL 90 LR, BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
5	2	6"x4"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
6	2	4"x2"	REDUCER (ECC), BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
7	2	6"x4"	REDUCER (ECC), BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
8	2	6"	TEE, BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
9	2	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 OR WPB
10	2	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 OR WPB
11	4	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 OR WPB
12	8	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
13	16	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
14	32	3/4"x102	BOLT SET, RF, 150 LB, STUD BOLT
15	2	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PITE
16	2	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PITE

					SERVICE
					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
					INSULATION THK
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD

PROJECT NAME	Septian Andri Riswana			
TITLE				
DRAWING NUMBER	P-10004-1			
LINE NO.	P-10004	ASH	USR	TYPE
JOB NUMBER	SCALE	SHEET	NO.	
	N.T.S.	1	OF 2	
			0	

Gambar 6.30 Piping isometric pipa 6"-P-10004-CS150



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	22.8M	6"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	6	6"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	3	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
4	16	3/4"x102	BOLT SET, RF, 150 LB, STUD BOLT
5	8	3/4"x83	BOLT SET, RF, 150 LB, STUD BOLT
6	3	6"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
7	1	6"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

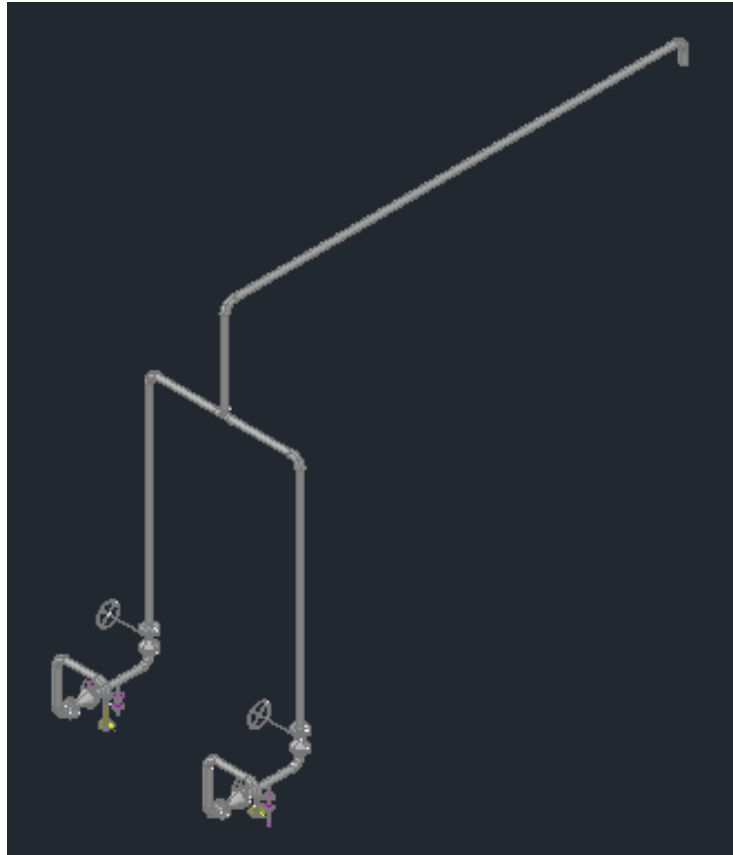
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK
		02/16/18				

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	P-10004-2		
DATE:	P-10004	APPR:	TYPE:
JOB NUMBER:		SCALE:	NO. OF SHEETS:
		N.T.S.	2 OF 2
			0

Gambar 6.30 Lanjutan Piping isometric pipa 6"-P-10004-CS150

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6.2.4. Pipa 3"-WP-10008-CS150

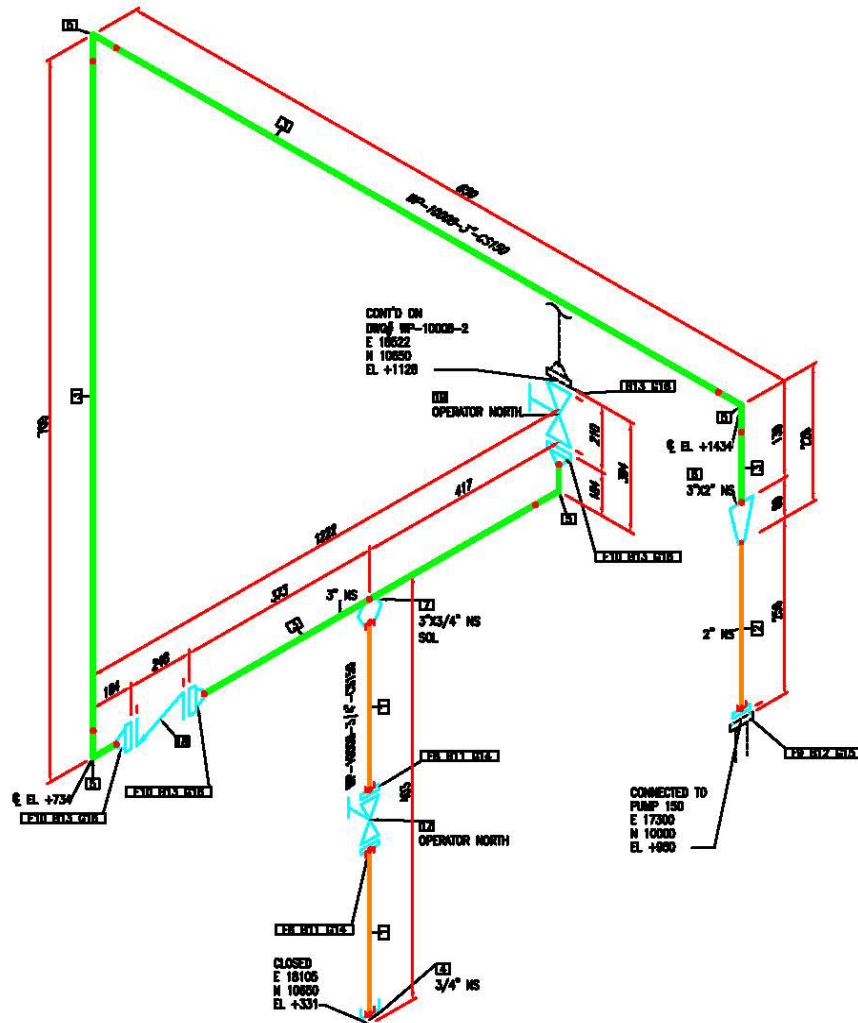


Gambar 6.31 Hasil pemodelan pipa 3D *line number* 3"-WP-10008-CS150

Pipa 3"-WP-10008-CS150 seperti Gambar 6.31 merupakan pipa yang menghubungkan antara N2 pada P-103 B ke unit 300. Adapun maksud dari nama jalur pipa 3"-WP-10008-CS150 adalah :

- 3" : *Size piping*
- WP : *Service line code (POTABLE WATER)*
- 10008 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 3"-WP-10008-CS150 dapat dilihat pada Gambar 6.32.



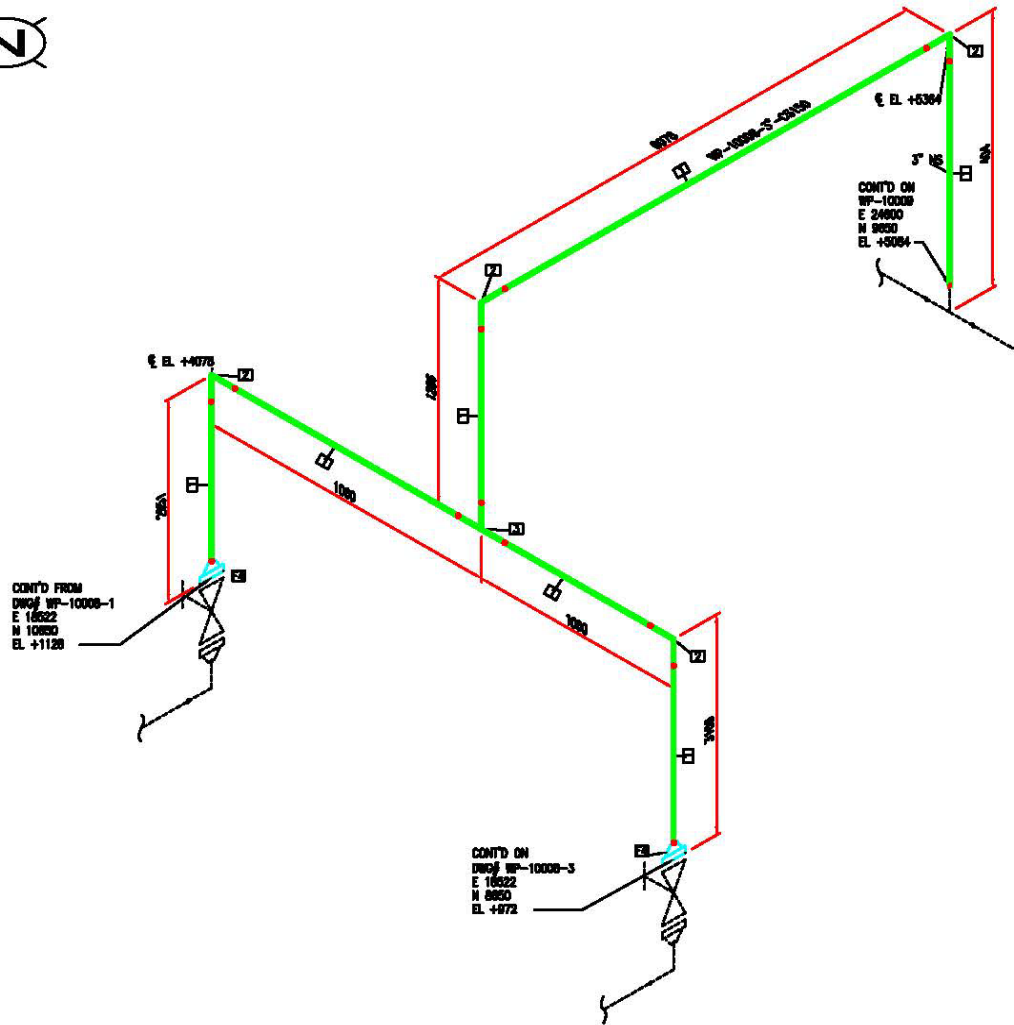
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK
		02/16/18				

BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.3M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	1.0M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	CAP, 3000 LB, SW, ASME B16.11, ASTM A106
5	4	3"	ELL 90 LR, BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
6	1	3"x2"	REDUCER (CONC), BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
7	1	3"x3/4"	SOCKET, 3000 LB, BUSH, 9/16" LG, ASME B16.11, ASTM A106
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
9	1	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	3	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	1/2"x3/4	BOLT SET, RF, 150 LB, STUD BOLT
12	4	5/8"x7/8	BOLT SET, RF, 150 LB, STUD BOLT
13	16	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
14	2	3/4"	GASKET, SW, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
15	1	2"	GASKET, SW, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	4	3"	GASKET, SW, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	WP-10008-1		
DATE:	WP-10008	APPD:	CHKD:
JOB NUMBER:		DATE:	REV:
		N.T.S.	1 of 4
			0

Gambar 6.32 Piping isometric pipa 3"-WP-10008-CS150

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BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	14.4M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 OR B SMLS, SCH 40
2	4	3"	ELL 90 LR, BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
3	1	3"	TEE, BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
4	2	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 OR WPB

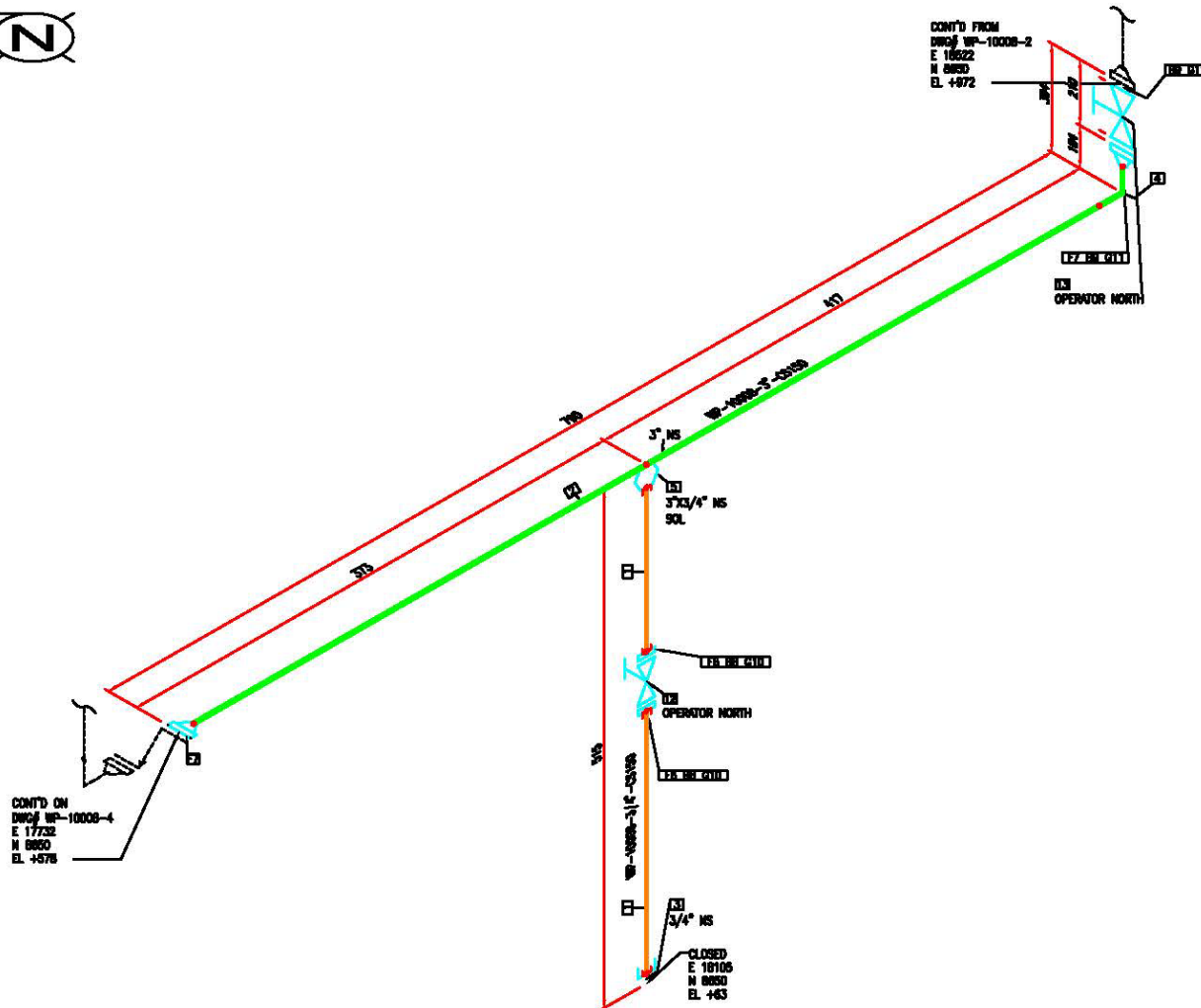
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

SERVICE
PIPE SPEC
MAX PRESSURE
MAX TEMPERATURE
P&ID DWG
INSULATION SPEC

PROJECT NAME:	Septian Andri Riswana		
DATE:			
DRAWING NUMBER:	WP-10008-2		
DATE:	WP-10008	USER:	TYPE:
JOB NUMBER:		QUANTITY:	
	N.T.S.		
	2	OF	4
			0

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Gambar 6.32 Lanjutan Piping isometric pipa 3"-WP-10008-CS150



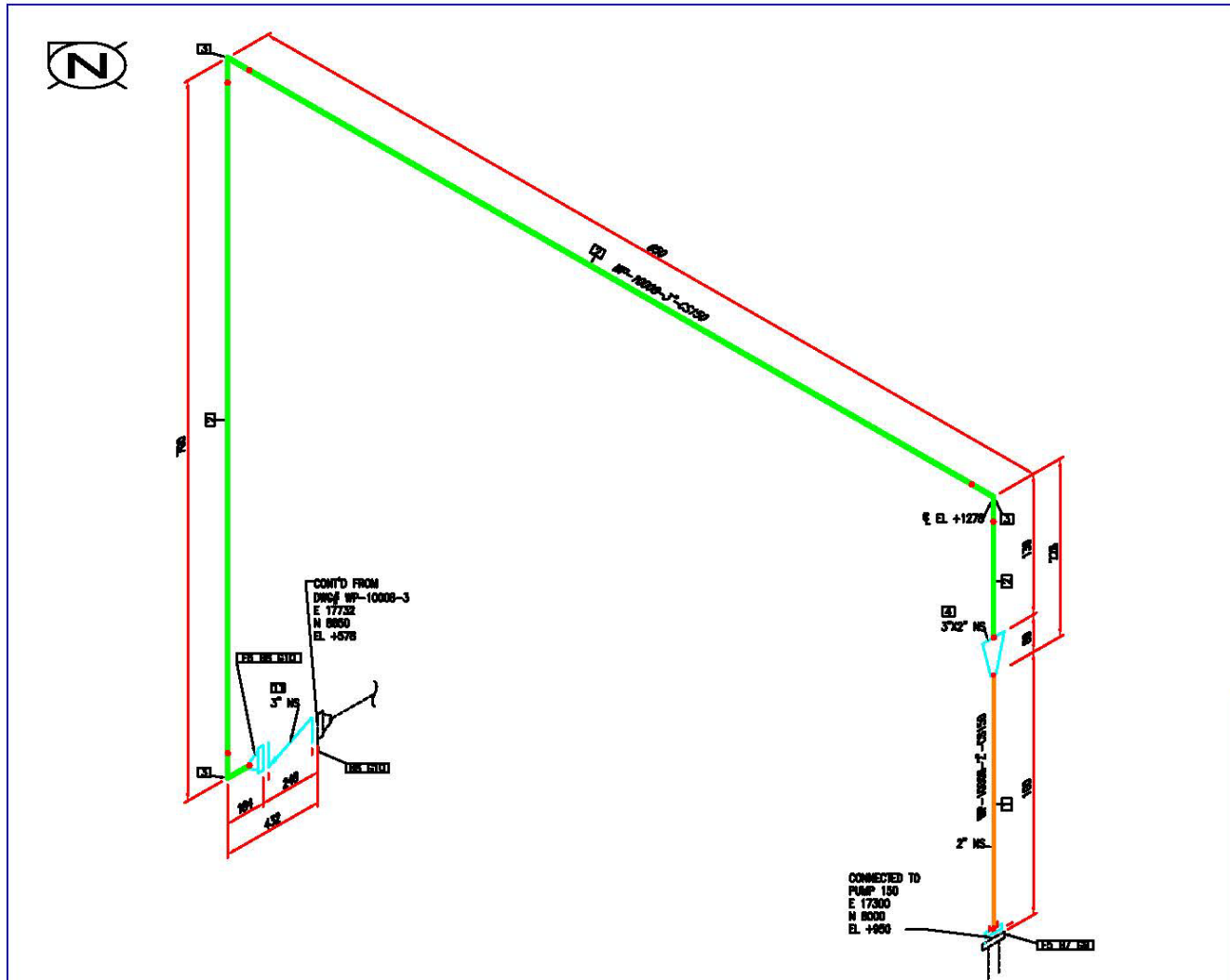
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.4M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.7M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	1	3/4"	CNP, 3000 LB, SW, ASME B16.11, ASTM A105
4	1	3"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	3 3/4"	SOCKET, 3000 LB, BWSW, 3/16" LG, ASME B16.11, ASTM A105
6	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
7	2	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
8	8	1/2"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT
9	8	5/8"x3/8"	BOLT SET, RF, 150 LB, STUD BOLT
10	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	2	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
12	1	3/4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL
13	1	3"	GATE VALVE, SOLID WEDGE, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	SERVICE	PIPE SPEC	MAX PRESSURE	MAX TEMPERATURE	P&ID DWG	INSULATION SPEC	INSULATION THK
		02/16/18										

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	WP-10008-3		
DATE:	VP-10008	REV:	TYPE:
JOB NUMBER:		NO. OF SHEETS:	NO. OF SHEETS:
		N.T.S.	3 OF 4
			0

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Gambar 6.32 Lanjutan Piping isometric pipa 3"-WP-10008-CS150



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	1.0M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	3	3"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	3"x2"	REDUCER (CONC), BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	1	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
7	4	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
8	8	5/8"x200	BOLT SET, RF, 150 LB, STUD BOLT
9	1	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
10	2	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	1	3"	CHECK VALVE, SWING, 150 LB, RF, ASME B16.10, ASTM A210 GR WPB

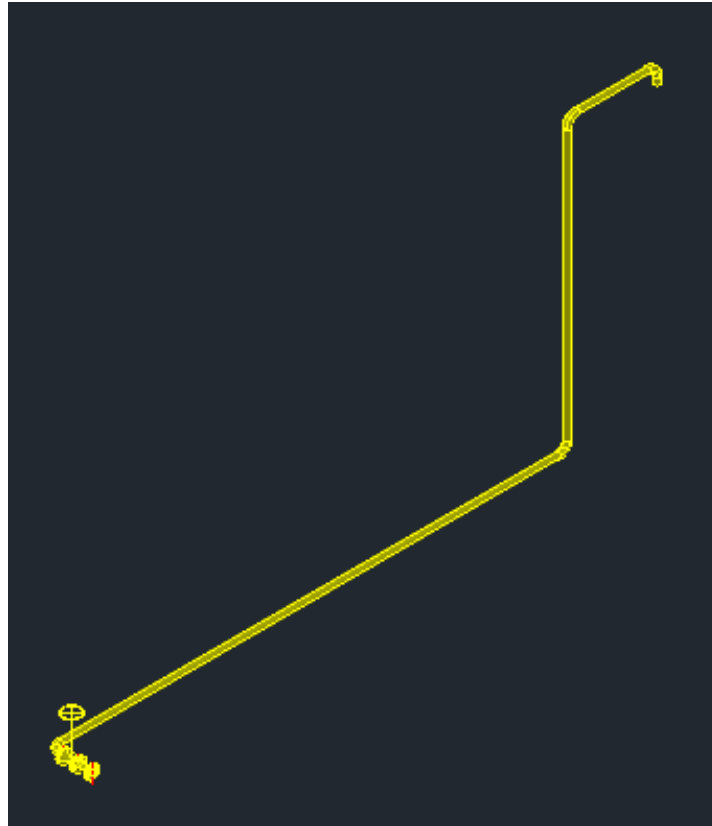
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					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME				Septian Andri Riswana			
TITLE							
DRAWING NUMBER				WP-10008-4			
DATE	NO	BY	TYPE	DATE	NO	BY	TYPE
	WP-10008						
JOB NUMBER				SCALE	CHECK	REV	0
				N.T.S.	4	4	0

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Gambar 6.32 Lanjutan Piping isometric pipa 3"-WP-10008-CS150

6.2.5. Pipa 4"-WP-10003-CS150

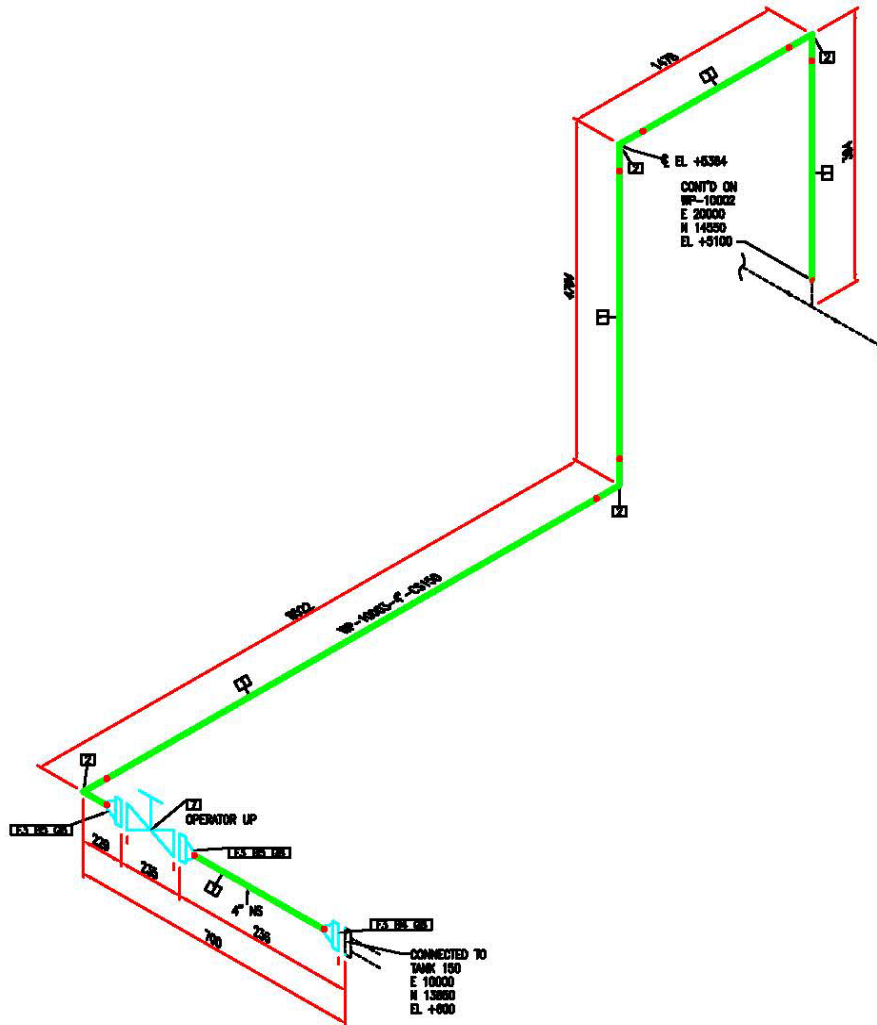


Gambar 6.33 Hasil pemodelan pipa 3D *line number* 4"-WP-10003-CS150

Pipa 4"-WP-10003-CS150 seperti Gambar 6.33 merupakan pipa yang menghubungkan antara N2 pada T-102 dengan unit 200. Adapun maksud dari nama jalur pipa 4"-WP-10003-CS150 adalah :

- 4" : *Size piping*
- WP : *Service line code (Potable Water)*
- 10003 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-WP-10003-CS150 dapat dilihat pada Gambar 6.34.



BILL OF MATERIALS

ID	QTY	MD	DESCRIPTION
1	14.1M	4"	PIPE, SEAMLESS, FE, ASME B30.10, ASTM A106 OR B SMLS, SCH 40
2	4	4"	ELL 90 LR, DR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	3	4"	FLANGE WRL 150 LB, RF, ASME B16.3, ASTM A234 GR WPB
4	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
5	16	5/8"x80	BOLT SET, RF, 150 LB, STUD BOLT
6	3	4"	GASKET, SMO, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PIPE
7	1	4"	GATE VALVE, SOLID WEDGE, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

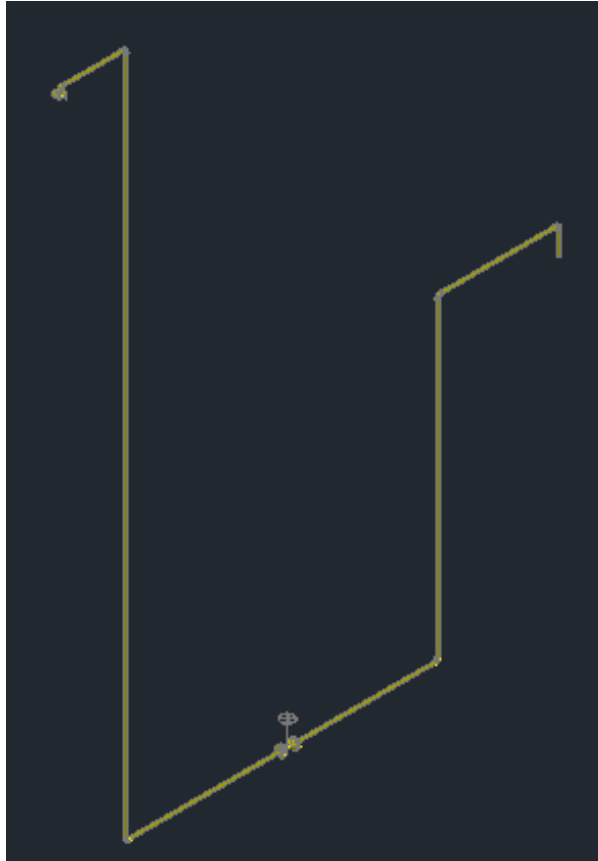
						SERVICE
						PIPE SPEC
						MAX PRESSURE
						MAX TEMPERATURE
						P&ID DWG
						INSULATION SPEC
						INSULATION THK
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	

PROJECT NAME:				Septian Andri Riswana			
TITLE:							
DRAWING NUMBER:				WP-10003			
LINE NO:		WP-10003		DATE:	02/16/18	USER:	
JOB NUMBER:				SCALE:	N.T.S.	QUANTITY:	1 of 1
				REVISIONS:		REVISIONS:	0

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Gambar 6.34 Piping isometric pipa 4"-WP-10003-CS150

6.2.6. Pipa 2"-SN-10005-CS150



Gambar 6.35 Hasil pemodelan pipa 3D *line number* 2"-SN-10005-CS150

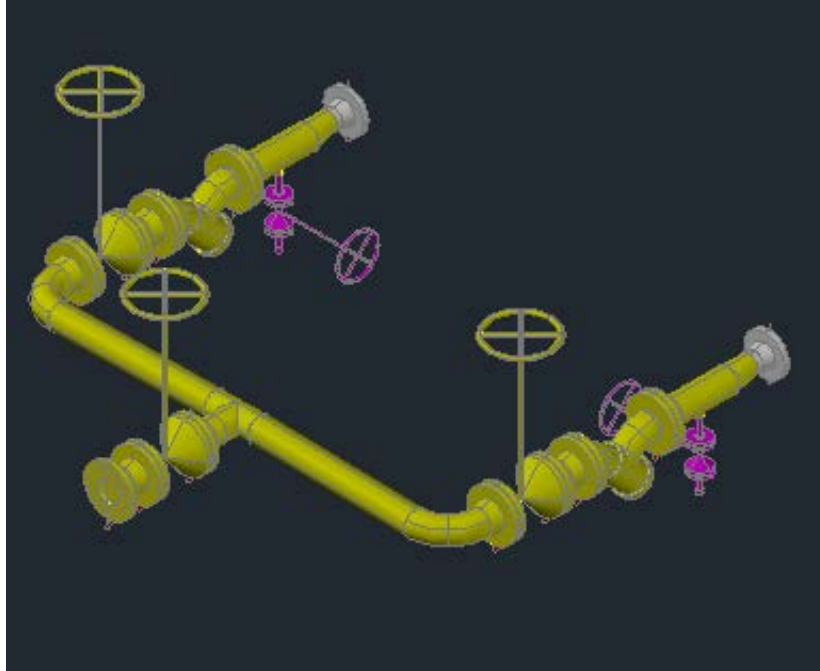
Pipa 2"-SN-10005-CS150 seperti Gambar 6.35 merupakan pipa yang menghubungkan antara N3 pada T-101 dengan jalur pipa 2"-S-10004-CS150.

Adapun maksud dari nama jalur pipa 2"-SN-10005-CS150 adalah :

- 2" : *Size piping*
- SN : *Service line code (Steam Condensate)*
- 10005 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 2"-SN-10005-CS150 dapat dilihat pada Gambar 6.36.

6.2.7. Pipa 4"-WP-10005-CS150

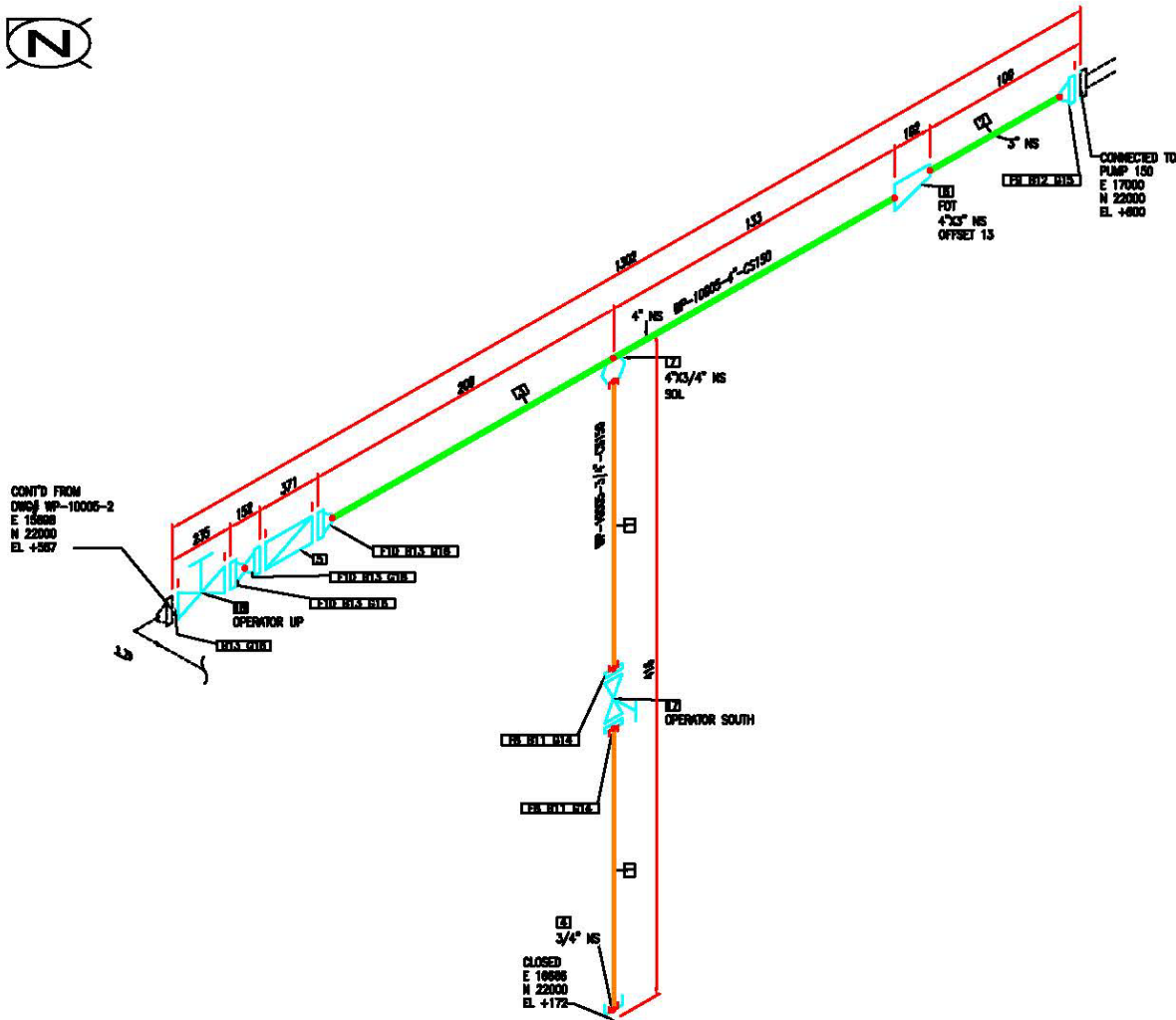


Gambar 6.37 Hasil pemodelan pipa 3D *line number* 4"-WP-10005-CS150

Pipa 4"-WP-10005-CS150 seperti Gambar 6.37 merupakan pipa yang menghubungkan antara N1 pada T-101 dengan N1 pada P-102 A. Adapun maksud dari nama jalur pipa 4"-WP-10005-CS150 adalah :

- 4" : *Size piping*
- WP : *Service line code (Potable Water)*
- 10005 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-WP-10005-CS150 dapat dilihat pada Gambar 6.38.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.2M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	GNP, 3000 LB, SW, ASME B16.11, ASTM A105
5	1	4"	Y-TYPE STRAINER, RF, 150 LB, ASME B16.10
6	1	4"x3"	REDUCER (ECC), BW, ASME B16.5, ASTM A234 GR WPB SMLS, SCH 40
7	1	4"x3/4"	SCHEDULE, 3000 LB, BIRCH, 9/16" LG, ASME B16.11, ASTM A105
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
9	1	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	1/2"x3/4	BOLT SET, RF, 150 LB, STUD BOLT
12	4	5/8"x7/8	BOLT SET, RF, 150 LB, STUD BOLT
13	32	5/8"x3/8	BOLT SET, RF, 150 LB, STUD BOLT
14	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
15	1	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	4	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

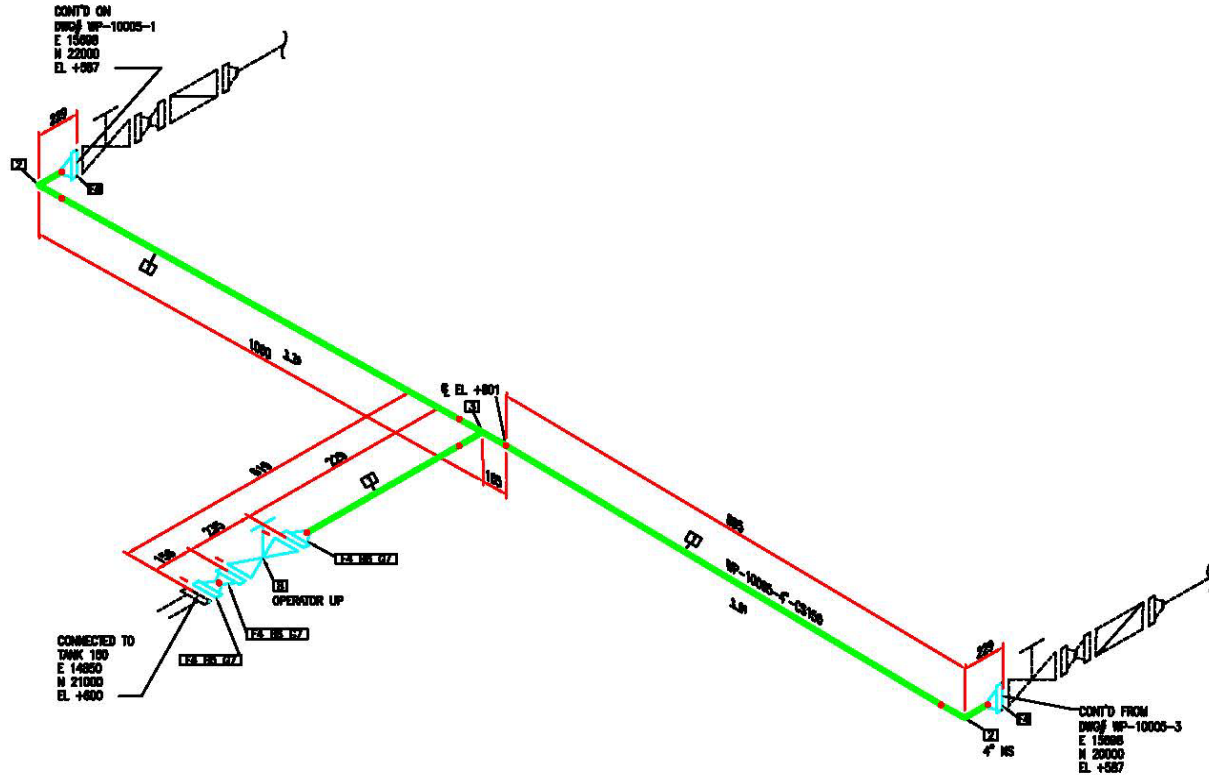
					SERVICE
					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
					INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
DATE:			
DRAWING NUMBER:	WP-10005-1		
LINE NO.:	WP-10005	REV:	1
JOB NUMBER:		NO. OF SHEETS:	3
			0

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD
		02/16/18			

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Gambar 6.38 Piping isometric pipa 4"-WP-10005-CS150



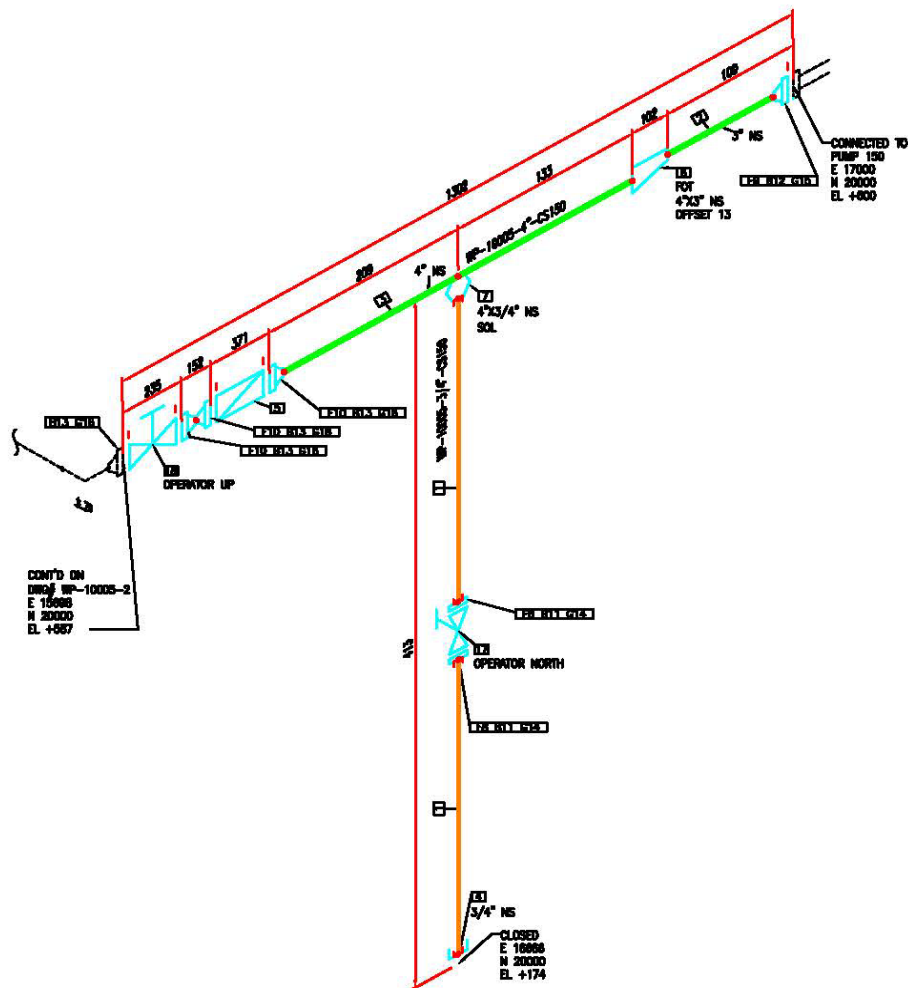
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	1.0M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	2	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	4"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	5	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
5	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
6	16	5/8"x80	BOLT SET, RF, 150 LB, STUD BOLT
7	3	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
8	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPL, HAND WHEEL

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana			
TITLE:				
DRAWING NUMBER:	WP-10005-2			
DATE:	WP-10005	APPR:	CHKD:	TYPD:
JOB NUMBER:		SCALE:	QTY:	REL:
		N.T.S.	2 of 3	0

C:\Users\septianandri\Documents\Septian Andri Riswana\Isometric\Check_A32P\ndriss\Drawings\WP-10005-2.dwg

Gambar 6.38 Lanjutan Piping isometric pipa 4"-WP-10005-CS150



CONT'D ON
DRAWING WP-10005-2
E 16886
N 20000
EL +1687

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

SERVICE	
PIPE SPEC	
MAX PRESSURE	
MAX TEMPERATURE	
P&ID DWG	
INSULATION SPEC	
INSULATION THK	

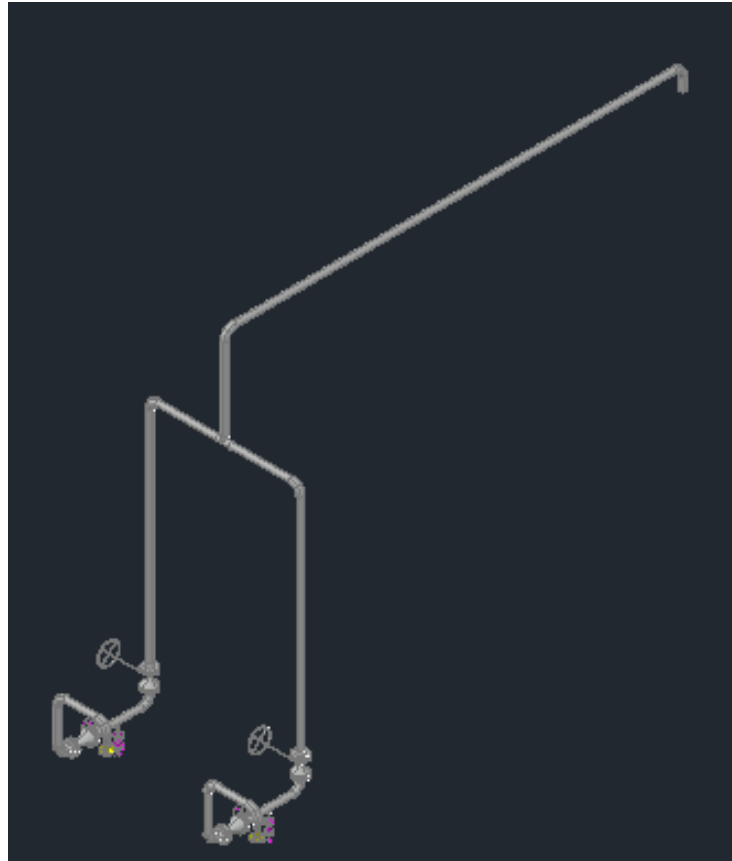
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.2M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	CAP, 3000 LB, SW, ASME B16.11, ASTM A105
5	1	4"	Y-TYPE STRAINER, RF, 150 LB, ASME B16.10
6	1	4"x3"	REDUCER (ECC), SW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
7	1	4"x3/4"	SOCKET, 3000 LB, BRKSW, 3/16" LG, ASME B16.11, ASTM A105
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
9	1	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	1/2"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT
12	4	5/8"x7/8"	BOLT SET, RF, 150 LB, STUD BOLT
13	32	5/8"x2 1/2"	BOLT SET, RF, 150 LB, STUD BOLT
14	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
15	1	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	4	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

PROJECT NAME	Septian Andri Riswana		
TITLE			
DRAWING NUMBER	WP-10005-3		
DATE	WP-10005	SCALE	
JOB NUMBER			

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Gambar 6.38 Lanjutan Piping isometric pipa 4"-WP-10005-CS150

6.2.8. Pipa 3"-WP-10007-CS150

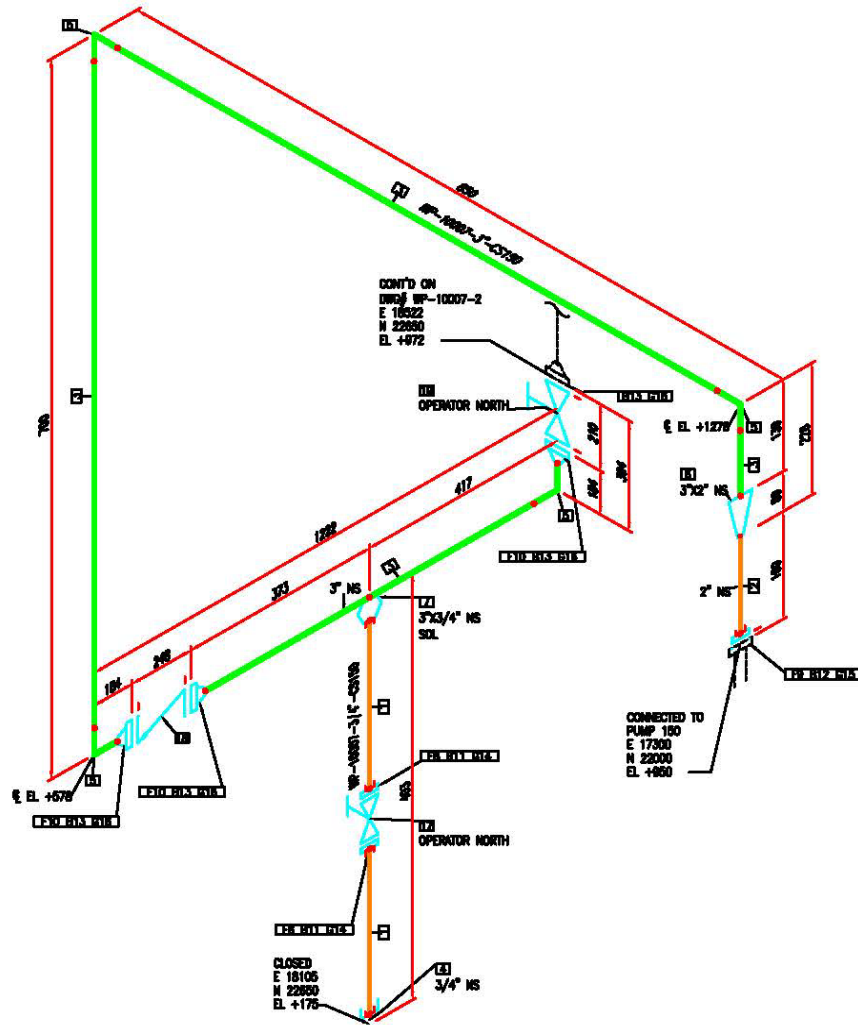


Gambar 6.39 Hasil pemodelan pipa 3D *line number* 3"-WP-10007-CS150

Pipa 3"-WP-10007-CS150 seperti Gambar 6.39 merupakan pipa yang menghubungkan antara N2 pada P-102 A dengan jalur pipa 6"-WP-10009-CS150 ke unit 300. Adapun maksud dari nama jalur pipa 3"-WP-10007-CS150 adalah :

- 3" : *Size piping*
- WP : *Service line code (Potable Water)*
- 10007 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 3"-WP-10007-CS150 dapat dilihat pada Gambar 6.40.



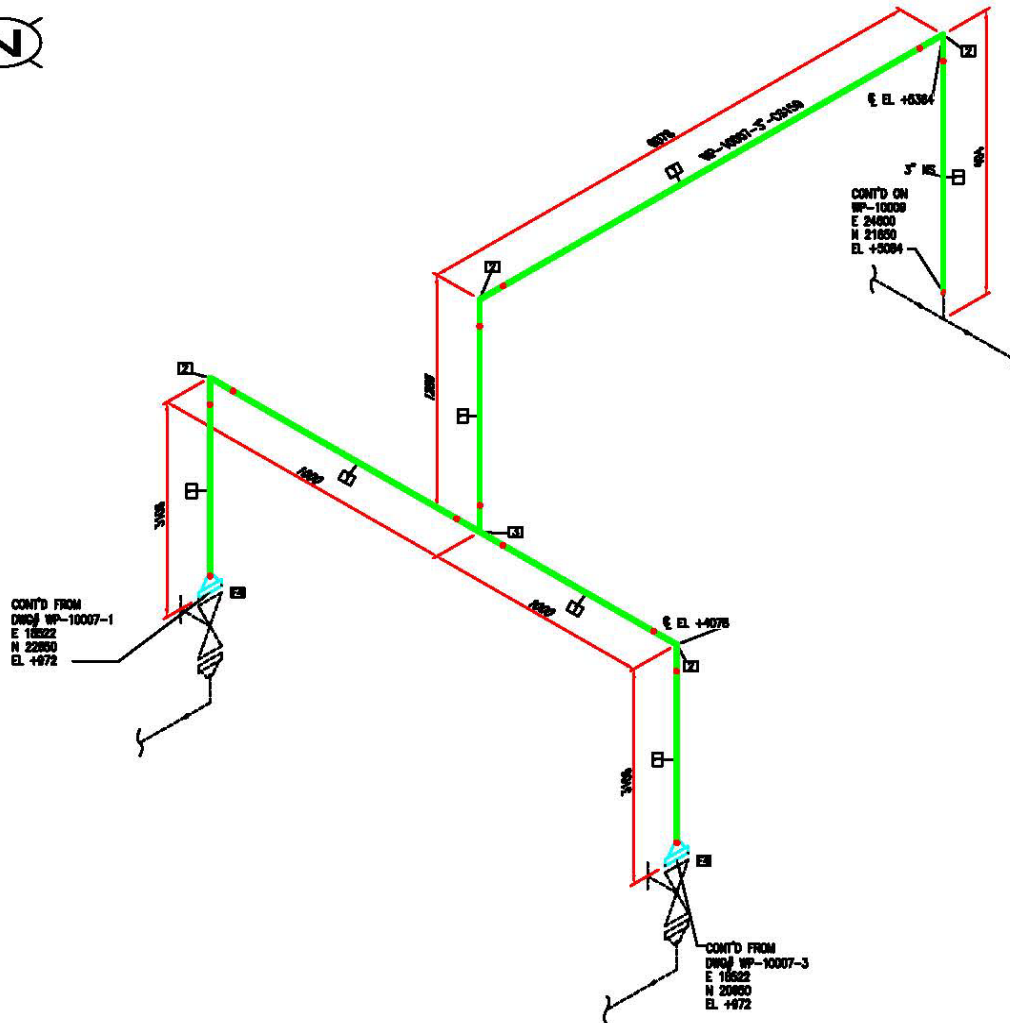
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	1.0M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	CAP, 3000 LB, SW, ASME B16.11, ASTM A106
5	4	3"	ELL 90 LR, RW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
6	1	3"x2"	REDUCER (CONC), RW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
7	1	3"x3/4"	SOCKET, 3000 LB, BRKSW, 9/16" LG, ASME B16.11, ASTM A106
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
9	1	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	3	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	1/2"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT
12	4	5/8"x7/8"	BOLT SET, RF, 150 LB, STUD BOLT
13	16	5/8"x20"	BOLT SET, RF, 150 LB, STUD BOLT
14	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
15	1	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	4	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	WP-10007-1		
DATE:	WP-10007	APPD:	CHKD:
JOB NUMBER:		SCALE:	REV:
		N.T.S.	1 of 3

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Gambar 6.40 Piping isometric pipa 3"-WP-10007-CS150



BILL OF MATERIALS

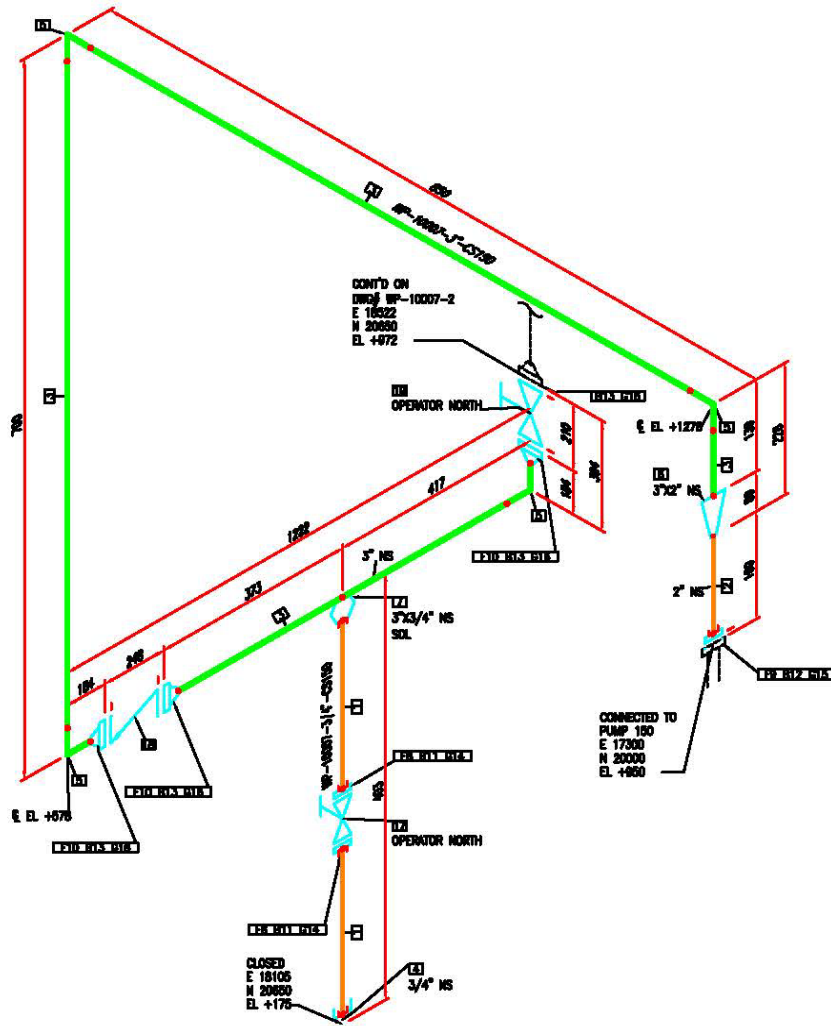
ID	QTY	NO	DESCRIPTION
1	14.6M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	4	3"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	3"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	2	3"	FLANGE WN, 150 LB, WF, ASME B16.5, ASTM A234 GR WPB

					SERVICE
					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
		02/16/18			INSULATION THK
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD

PROJECT NAME:	Septian Andri Riswana				
DATE:					
DRAWING NUMBER:	WP-10007-2				
DATE:	WP-10007	APPR:	USER:	TITLE:	
JOB NUMBER:		SCALE:	CHECK:	NO.:	
		N.T.S.	2	OF 3	0

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Gambar 6.40 Lanjutan Piping isometric pipa 3"-WP-10007-CS150



					SERVICE
					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
		02/16/18			INSULATION THK
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD

BILL OF MATERIALS					
ID	QTY	NO	DESCRIPTION		
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40		
2	0.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40		
3	1.0M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40		
4	1	3/4"	CAP, 3000 LB, SW, ASME B16.11, ASTM A106		
5	4	3"	ELL 90 LR, BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40		
6	1	3"x2"	REDUCER (CONC), BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40		
7	1	3"x3/4"	SOCKET, 3000 LB, BSW, 9/16" LG, ASME B16.11, ASTM A106		
8	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB		
9	1	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB		
10	3	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB		
11	8	1/2"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT		
12	4	5/8"x7/8"	BOLT SET, RF, 150 LB, STUD BOLT		
13	16	5/8"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT		
14	2	3/4"	GASKET, SW, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE		
15	1	2"	GASKET, SW, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE		
16	4	3"	GASKET, SW, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE		

PROJECT NAME:	Septian Andri Riswana			
DATE:				
DRAWING NUMBER:	WP-10007-3			
DATE:	WP-10007	DATE:		TYPE:
DRAWN BY:		CHECKED:		REV:
		N.T.S.	3	0

Gambar 6.40 Lanjutan Piping isometric pipa 4"-WP-10007-CS150

6.2.9. Pipa 4''-WP-10004-CS150

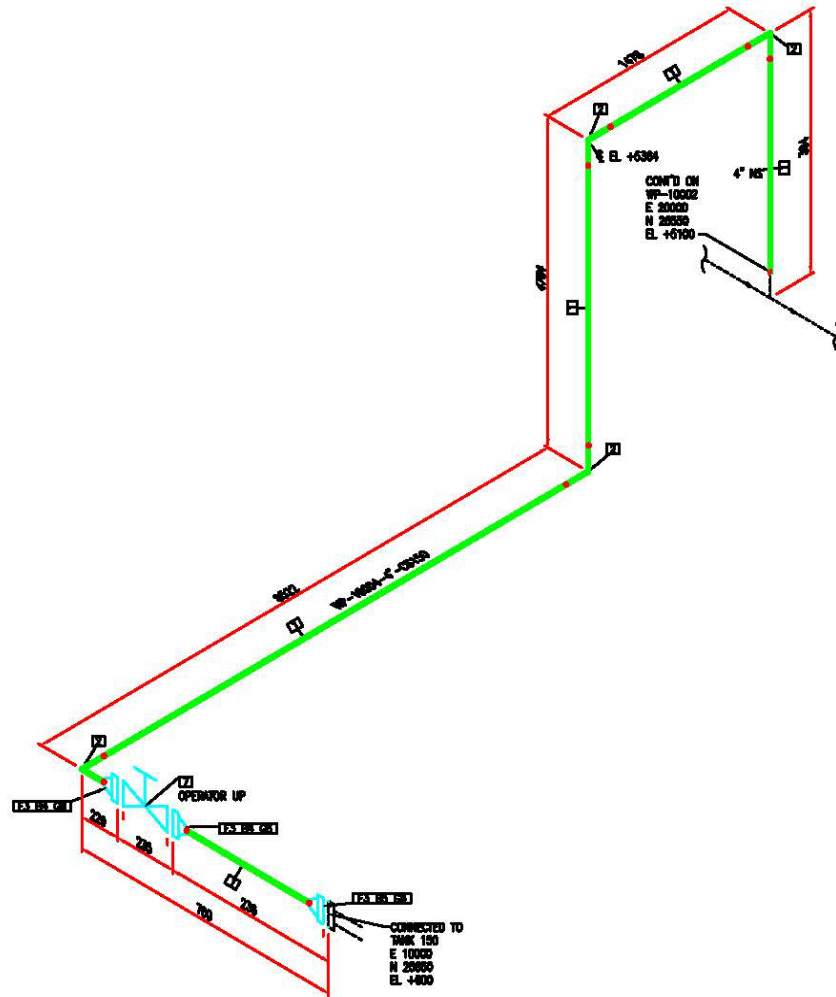


Gambar 6.41 Hasil pemodelan pipa 3D *line number* 4''-WP-10004-CS150

Pipa 4''-WP-10004-CS150 seperti Gambar 6.41 merupakan pipa yang menghubungkan antara N2 pada T-101 dengan jalur pipa 6''-WP-10002-CS150 dari unit 200. Adapun maksud dari nama jalur pipa 4''-WP-10004-CS150 adalah :

- 4'' : *Size piping*
- WP : *Service line code (Potable Water)*
- 10004 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4''-WP-10004-CS150 dapat dilihat pada Gambar 6.42.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	14.1M	4"	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	4	4"	ELL 90 LR, RW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
4	16	5/8"X20	BOLT SET, RF, 150 LB, STUD BOLT
5	8	5/8"X10	BOLT SET, RF, 150 LB, STUD BOLT
6	3	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PFTE
7	1	4"	GATE VALVE, SOLID WEDGE, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

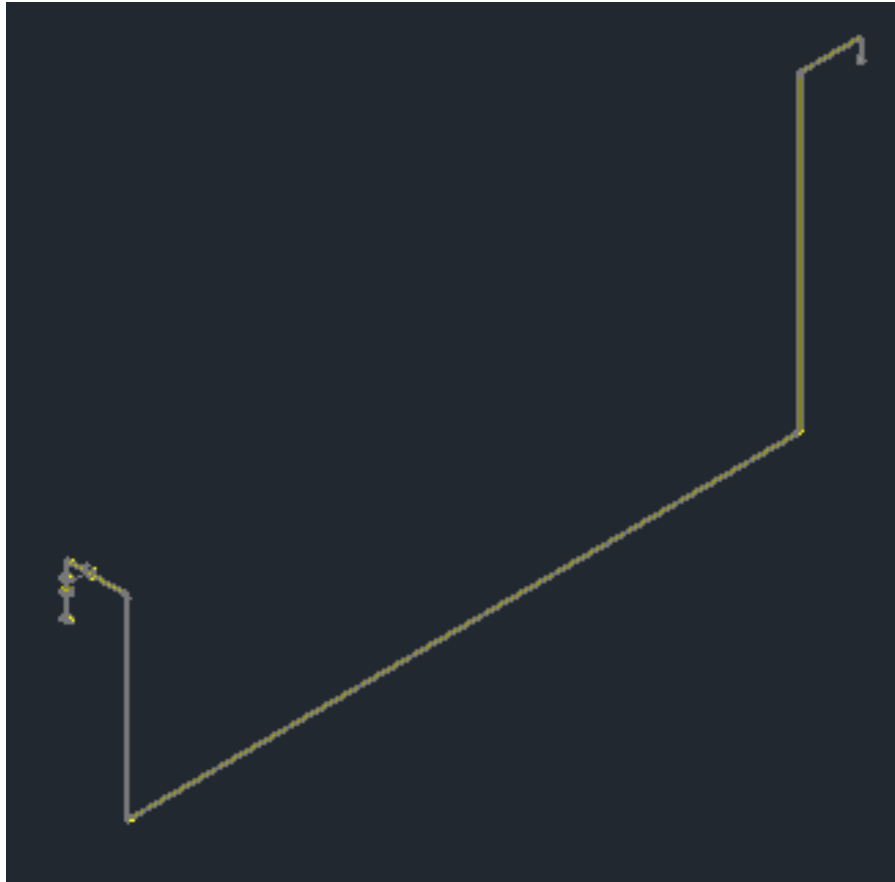
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT ENG: Septian Andri Riswana			
TITLE			
DESIGN NUMBER: WP-10004			
LINE NO:	WP-10004	REV:	TYP:
DATE: 02/16/18		APPD:	CHK:
REV NUMBER:		WELD:	QC:
		N.T.S.	1 of 1
			0

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Gambar 6.42 Piping isometric pipa 4"-WP-10004-CS150

6.2.10. Pipa 2"-SN-10007-CS150

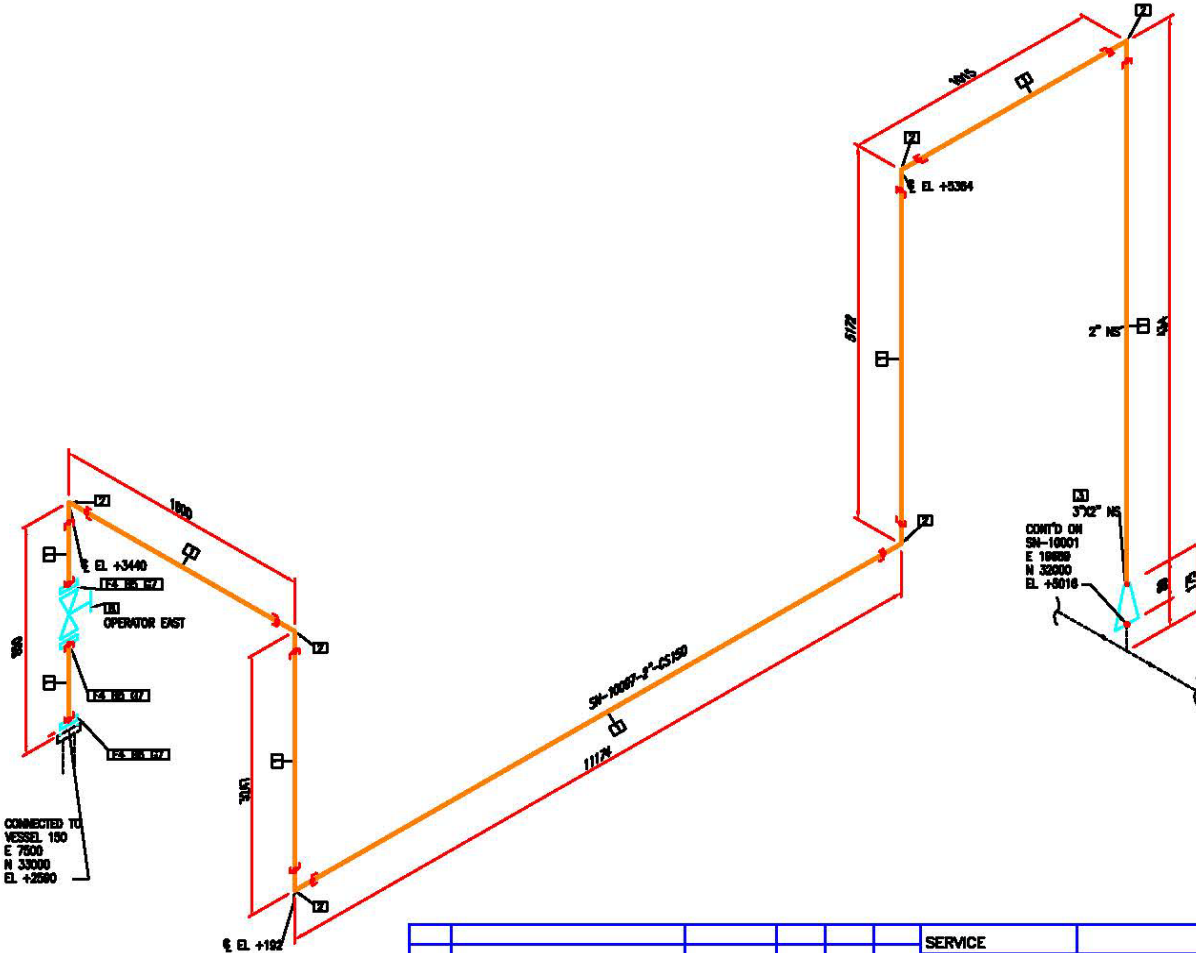


Gambar 6.43 Hasil pemodelan pipa 3D *line number* 2"-SN-10007-CS150

Pipa 2"-SN-10007-CS150 seperti Gambar 6.43 merupakan pipa yang menghubungkan antara SN *header* dengan N2 pada V-101. Adapun maksud dari nama jalur pipa 2-SN-10007-CS150 adalah :

- 2" : *Size piping*
- SN : *Service line code (Steam Condensate)*
- 10007 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 2"-SN-10007-CS150 dapat dilihat pada Gambar 6.44



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	22.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	6	2"	ELL 90, 3000 LB. SW, ASME B16.11, ASTM A105
3	1	3"x2"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	3	2"	FLANGE SW, 150 LB. RF, ASME B16.5, ASTM A234 GR WPB
5	8	5/8"x3/32	BOLT SET, RF, 150 LB. STUD BOLT
6	4	5/8"x7/16	BOLT SET, RF, 150 LB. STUD BOLT
7	3	2"	GASKET, SWG, 1/8" THK, RF, 150 LB. ASME B16.20, CS/PTFE
8	1	2"	GATE VALVE, DOUBLE DISC, 150 LB. RF, ASME B16.10, ASTM A216 GR WPS, HAND WHEEL

CONNECTED TO
VESSEL 150
E 7600
N 33000
EL. +2690

CONT'D ON
SN-10001
E 18828
N 33000
EL. +5016

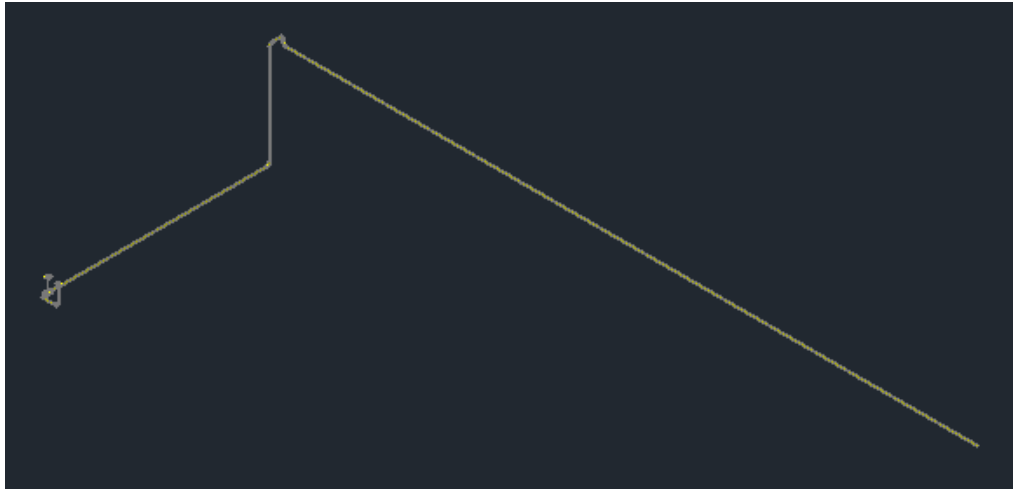
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					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana			
TITLE:				
DRAWING NUMBER:	SN-10007			
DATE:	SN-10007	APPD:	CHKD:	TYPD:
JOB NUMBER:		SCALE:	QTY:	REV:
		N.T.S.	1 of 1	0

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Gambar 6.44 Piping isometric pipa 2"-SN-10007-CS150

6.2.11. Pipa 4"-KF-10003-CS150

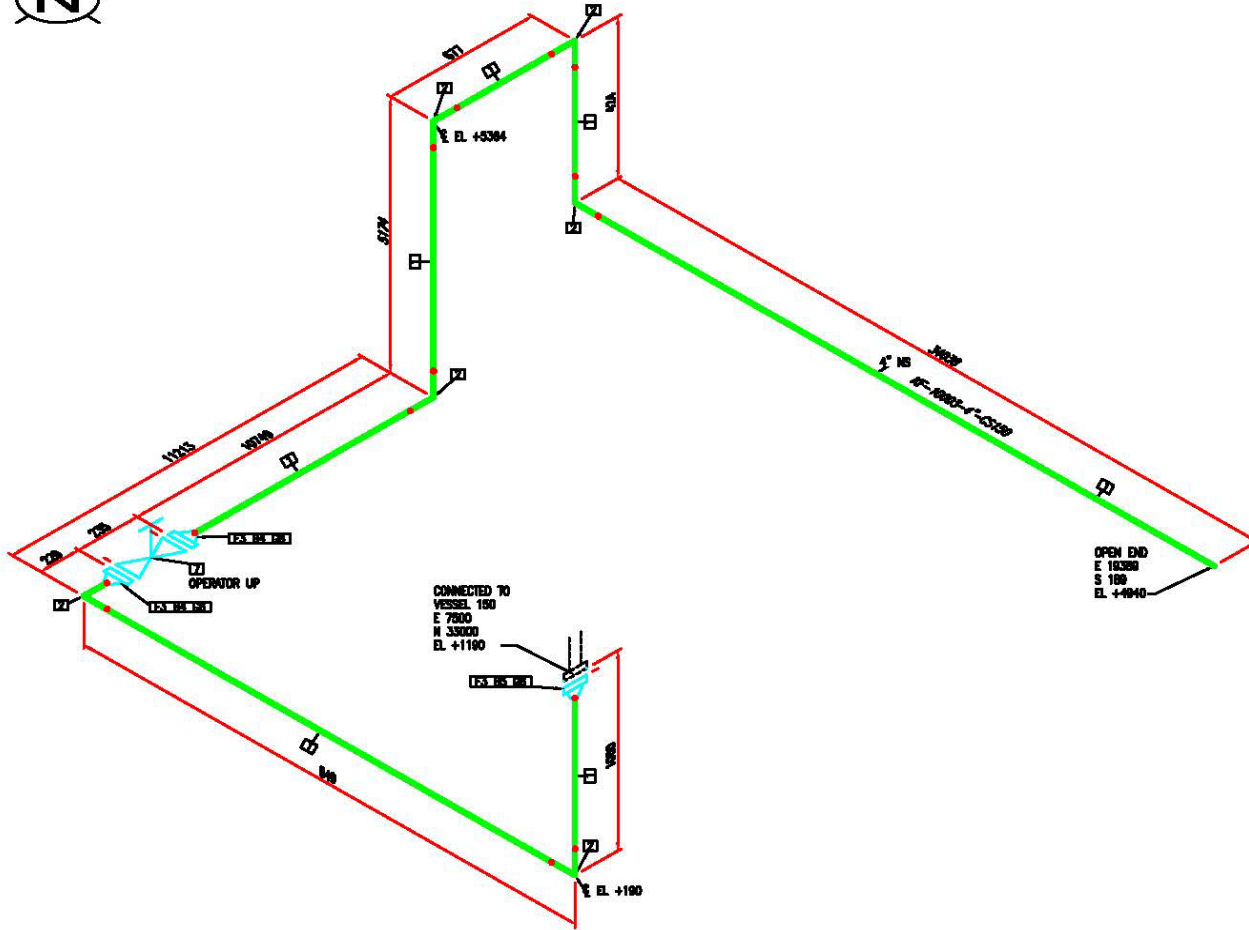


Gambar 6.45 Hasil pemodelan pipa 3D *line number* 4"-KF-10003-CS150

Pipa 4"-KF-10003-CS150 seperti Gambar 6.45 merupakan pipa yang menghubungkan antara N3 pada V-101 *to unit* 300. Adapun maksud dari nama jalur pipa 4"-KF-10003-CS150 adalah :

- 4" : *Size piping*
- KF : *Service line code (Aviation Fuel)*
- 10003 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-KF-10003-CS150 dapat dilihat pada Gambar 6.46.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	51.1M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	6	4"	ELL 90 LR, DR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
4	16	5/8"x90	BOLT SET, RF, 150 LB, STUD BOLT
5	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
6	3	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
7	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

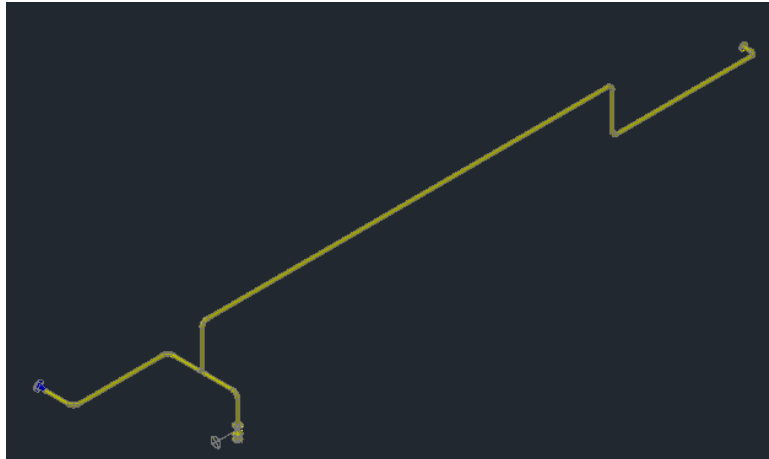
					SERVICE
					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
					INSULATION THK
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD

PROJECT NAME:	Septian Andri Riswana			
TITLE:				
DRAWING NUMBER:	KF-10003			
DATE:	KF-10003	APPD:	USER:	TYPE:
JOB NUMBER:		SCALE:	SHEET:	TOTAL SHEETS:
		N.T.S.	1 OF 1	0

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Gambar 6.46 Piping isometric pipa 4"-KF-10003-CS150

6.2.12. Pipa 4"-KF-10002-CS150



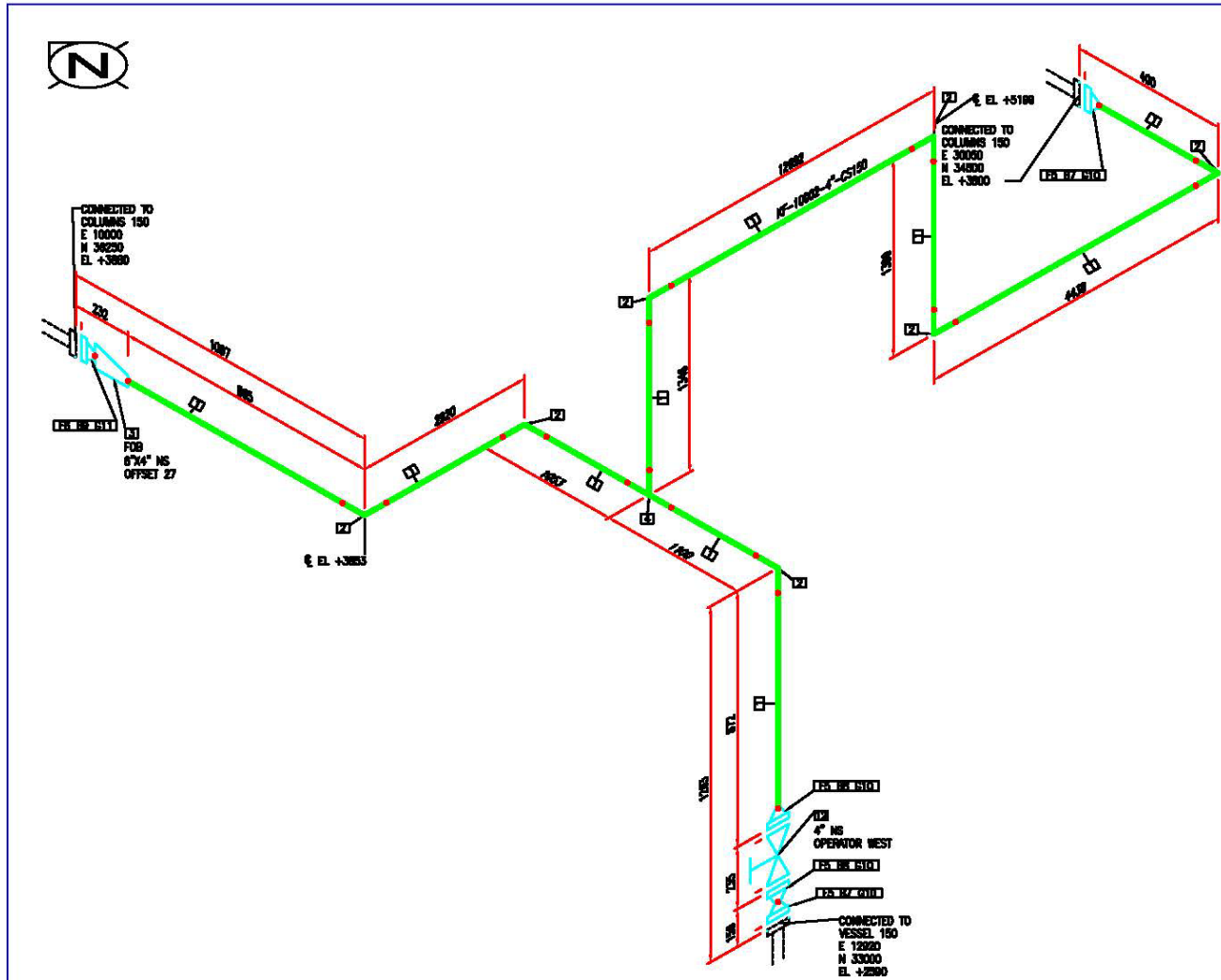
Gambar 6.47 Hasil pemodelan pipa 3D *line number* 4"-KF-10002-CS150

Pipa 4"-KF-10002-CS150 seperti Gambar 6.47 merupakan pipa yang menghubungkan antara N3 pada C-101 dengan jalur pipa 6"-GF-10001-CS150.

Adapun maksud dari nama jalur pipa 4"-KF-10002-CS150 adalah :

- 4" : *Size piping*
- KF : *Service line code (Aviation Fuel)*
- 10002 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-KF-10002-CS150 dapat dilihat pada Gambar 6.48.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	24.5M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	7	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	6"x4"	REDUCER (ECC), BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	4"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	4	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	1	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
7	16	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
8	16	5/8"x80	BOLT SET, RF, 150 LB, STUD BOLT
9	8	3/4"x53	BOLT SET, RF, 150 LB, STUD BOLT
10	4	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	1	6"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
12	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

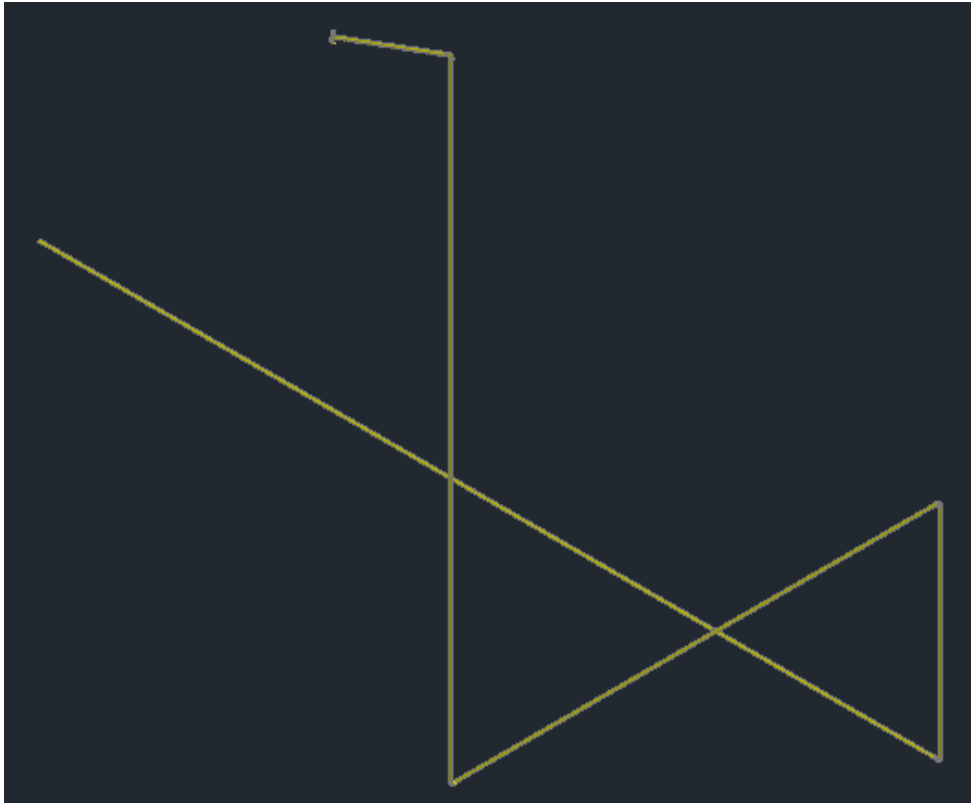
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					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT HEAD:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	KF-10002		
DATE:	KF-10002	APPD:	TYPE:
JOB NUMBER:	SCALE:	SHEET:	TOTAL:
	N.T.S.	1	1
			0

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Gambar 6.48 Piping isometric pipa 4"-KF-10002-CS150

6.2.13. Pipa 2"-G-10004-CS150

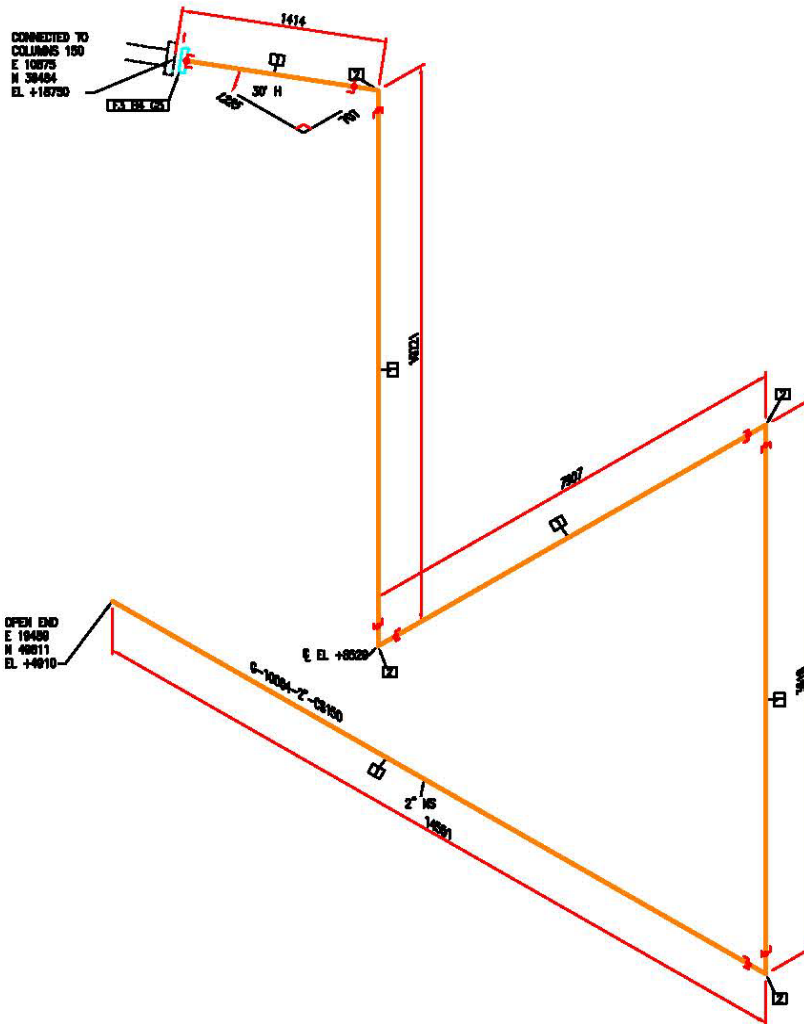


Gambar 6.49 Hasil pemodelan pipa 3D *line number* 2"-G-10004-CS150

Pipa 2"-G-10004-CS150 seperti Gambar 6.49 merupakan pipa yang menghubungkan antara N2 pada C-103 dengan unit 300. Adapun maksud dari nama jalur pipa 2"-G-10004-CS150 adalah :

- 2" : *Size piping*
- G : *Service line code (Proses PTFE packing gasket)*
- 10004 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 2"-G-10004-CS150 dapat dilihat pada Gambar 6.50.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	37.4M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	4	2"	ELL 90, 3000 LB, SW, ASME B16.11, ASTM A105
3	1	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WP8
4	4	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
5	1	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

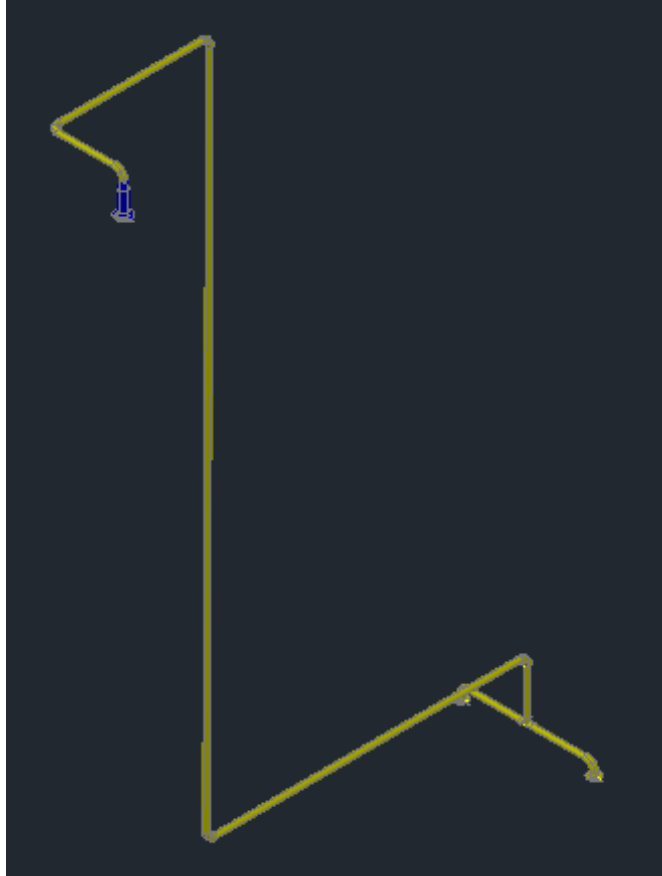
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK
		02/18/18				

PROJECT NAME				Septian Andri Riswana			
TITLE							
DRAWING NUMBER				G-10004			
LINE NO:		G-10004		JOB NO:		TYPE	
JOB NUMBER		SCALE		SHEET		REV	
		N.T.S.		1 of 1		0	

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Gambar 6.50 Piping isometric pipa 2"-G-10004-CS150

6.2.14. Pipa 4"-GS-10001-CS150

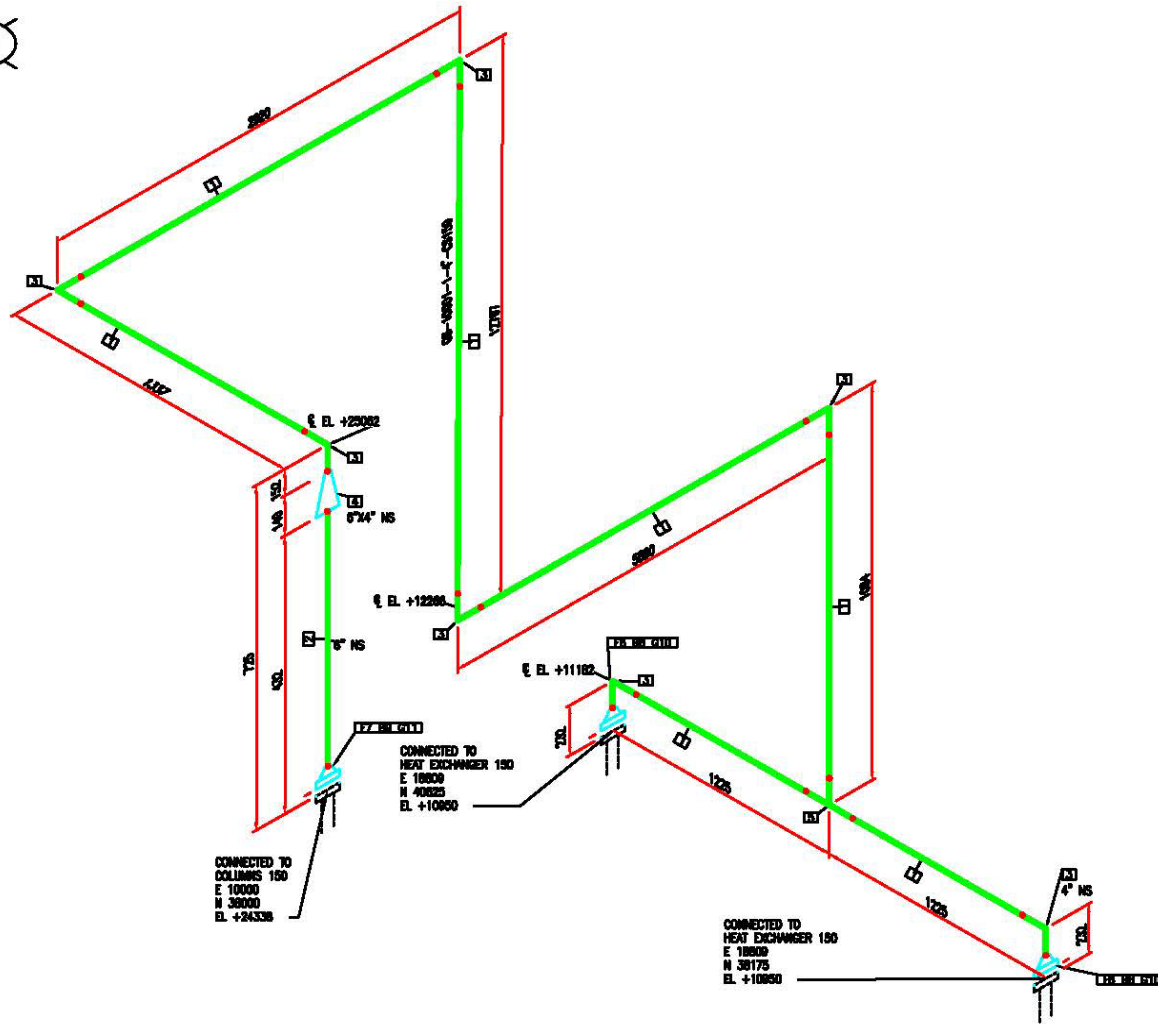


Gambar 6.51 Hasil pemodelan pipa 3D *line number* 4"-GS-10001-CS150

Pipa 4"-GS-10001-CS150 seperti Gambar 6.51 merupakan pipa yang menghubungkan antara N1 pada C-103 dengan N1 dan N2 pada E-102. Adapun maksud dari nama jalur pipa 4-GS-10001-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10001 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10001-CS150 dapat dilihat pada Gambar 6.52.

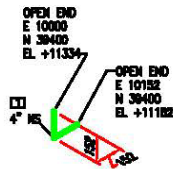


					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
DATE:			
DRAWING NUMBER:	GS-10001-1		
DATE:	GS-10001	APPD:	CHKD:
JOB NUMBER:		SCALE:	NO. OF SHEETS:
		N.T.S.	1 OF 2

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Gambar 6.52 Piping isometric pipa 4"-GS-10001-CS150



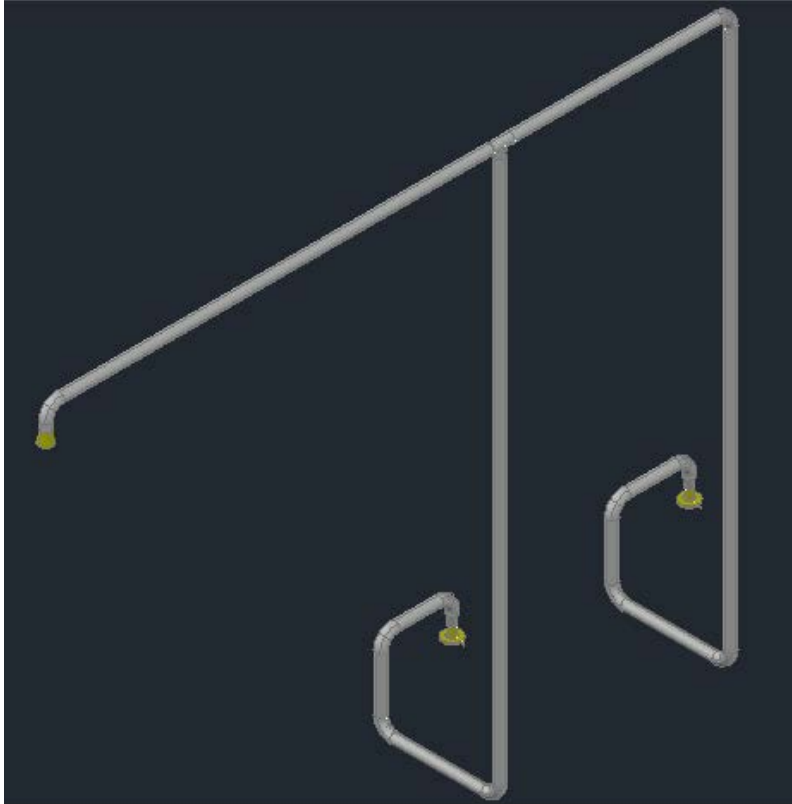
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	1	4"	ELL. 90 LR, BW, ASME B16.9, ASTM A234- GR WPB SMLS, SCH 40

					SERVICE	PROJECT NAME	Septian Andri Riswana				
					PIPE SPEC	TITLE					
					MAX PRESSURE	DRAWING NUMBER	GS-10001-2				
					MAX TEMPERATURE	DATE	GS-10001	APPD	CHKD	TYPE	
					P&ID DWG	JOB NUMBER					
		02/16/18			INSULATION SPEC	SCALE					
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK	N.T.S.	2	OF	2	0

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Gambar 6.52 Lanjutan Piping isometric pipa 4"-GS-10001-CS150

6.2.15. Pipa 4"-GS-10009-CS150

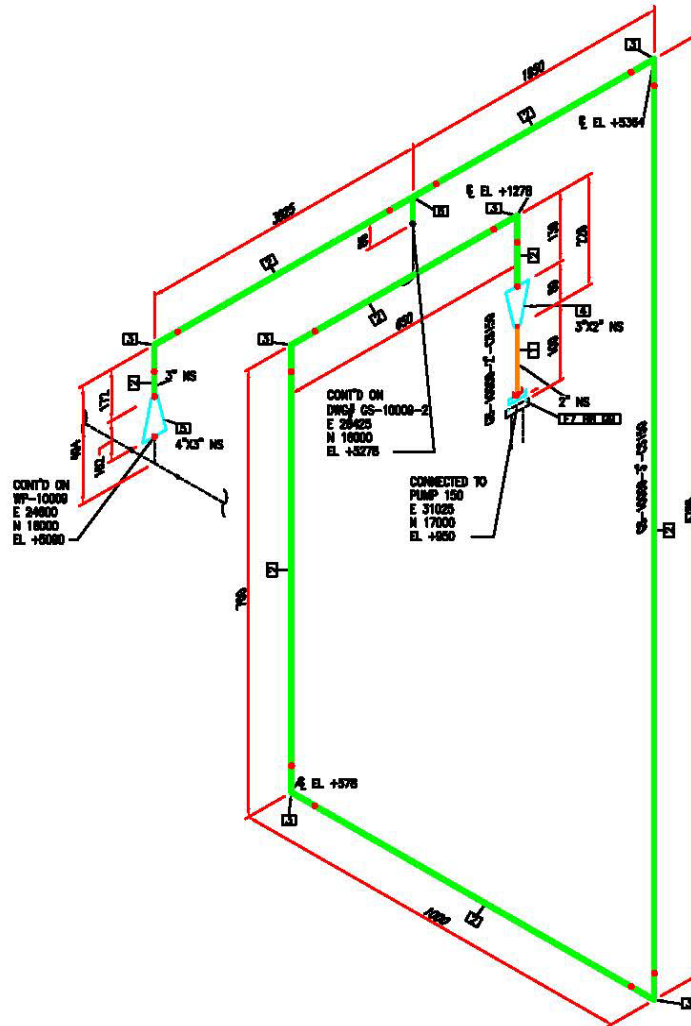


Gambar 6.53 Hasil pemodelan pipa 3D *line number* 4"-GS-10009-CS150

Pipa 4"-GS-10009-CS150 seperti Gambar 6.53 merupakan pipa yang menghubungkan antara N2 pada P-101 A,B *to unit* 300. Adapun maksud dari nama jalur pipa 4"-GS-10009-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10009 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10009-CS150 dapat dilihat pada Gambar 6.54.



BILL OF MATERIALS

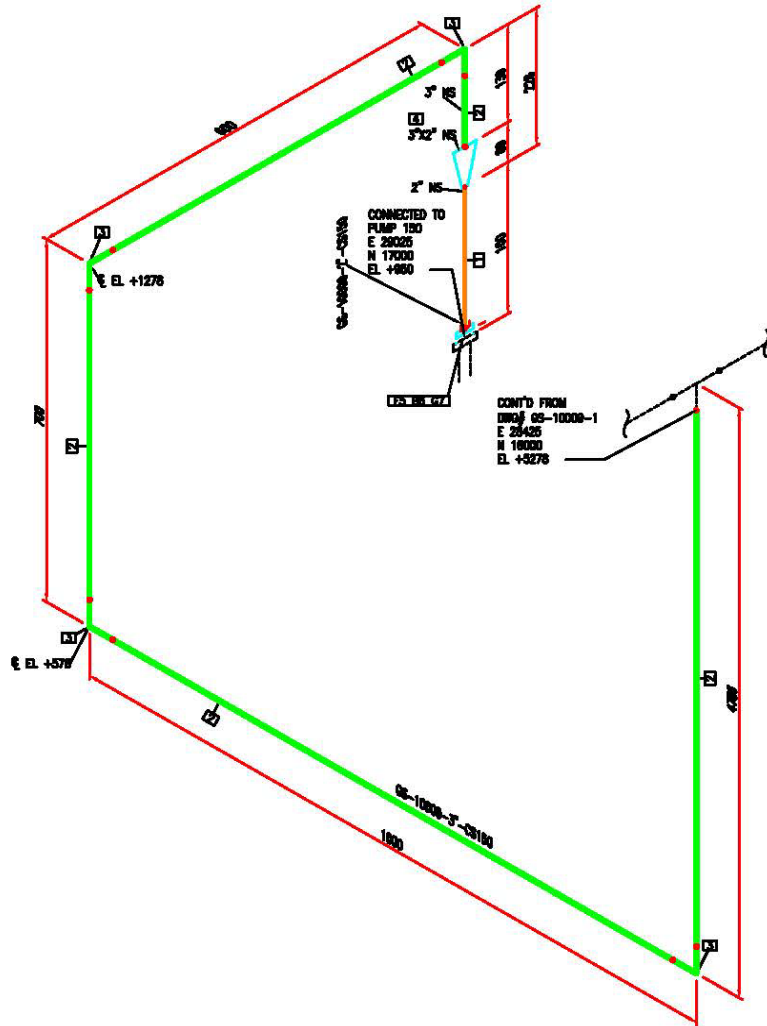
ID	QTY	NO	DESCRIPTION
1	0.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	11.7M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	6	3"	ELL 90 LR, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	3"x2"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	4"x3"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
6	1	3"	TEE, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
7	1	2"	FLANGE SW, 180 LB, RF, ASME B16.5, ASTM A234 GR WPB
8	4	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
9	1	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PIPE

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
					INSULATION SPEC	
		02/16/18			INSULATION THK	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	GS-10009-1		
DATE:	GS-10009	APPD:	TYPD:
JOB NUMBER:		SCALE:	NO. OF SHEETS:
		N.T.S.	1 OF 2

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Gambar 6.54 Piping isometric pipa 4"-GS-10009-CS150



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.1M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.3M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	4	3"	ELL 90 LR, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	3"x2"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	4	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
7	1	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

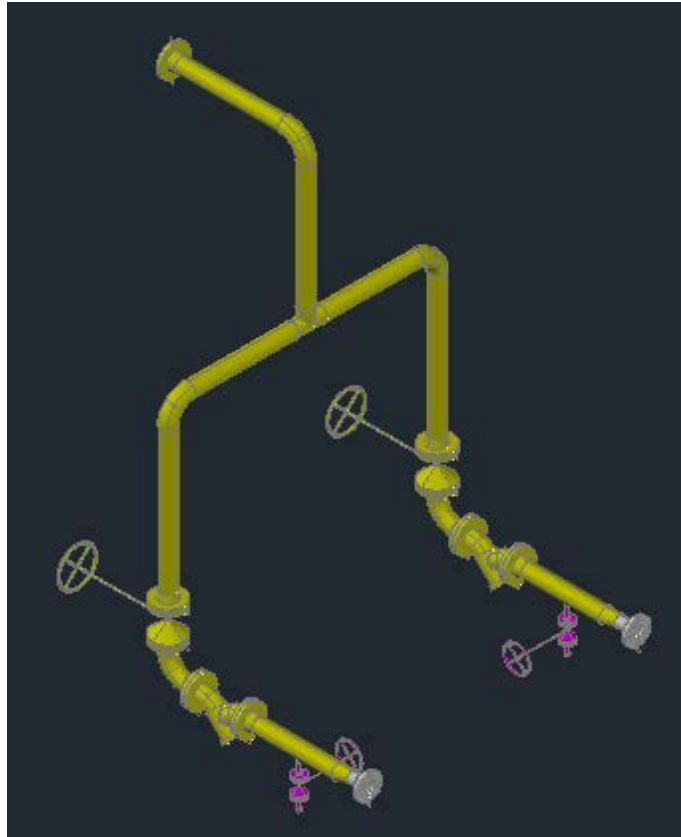
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK
		02/16/18				

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	GS-10009-2		
DATE:	GS-10009	APPR:	TYPE:
JOB NUMBER:		SCALE:	NO. OF SHEETS:
		N.T.S.	2 OF 2
			0

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Gambar 6.54 Lanjutan Piping isometric pipa 4"-GS-10009-CS150

6.2.16. Pipa 4''-GS-10007-CS150

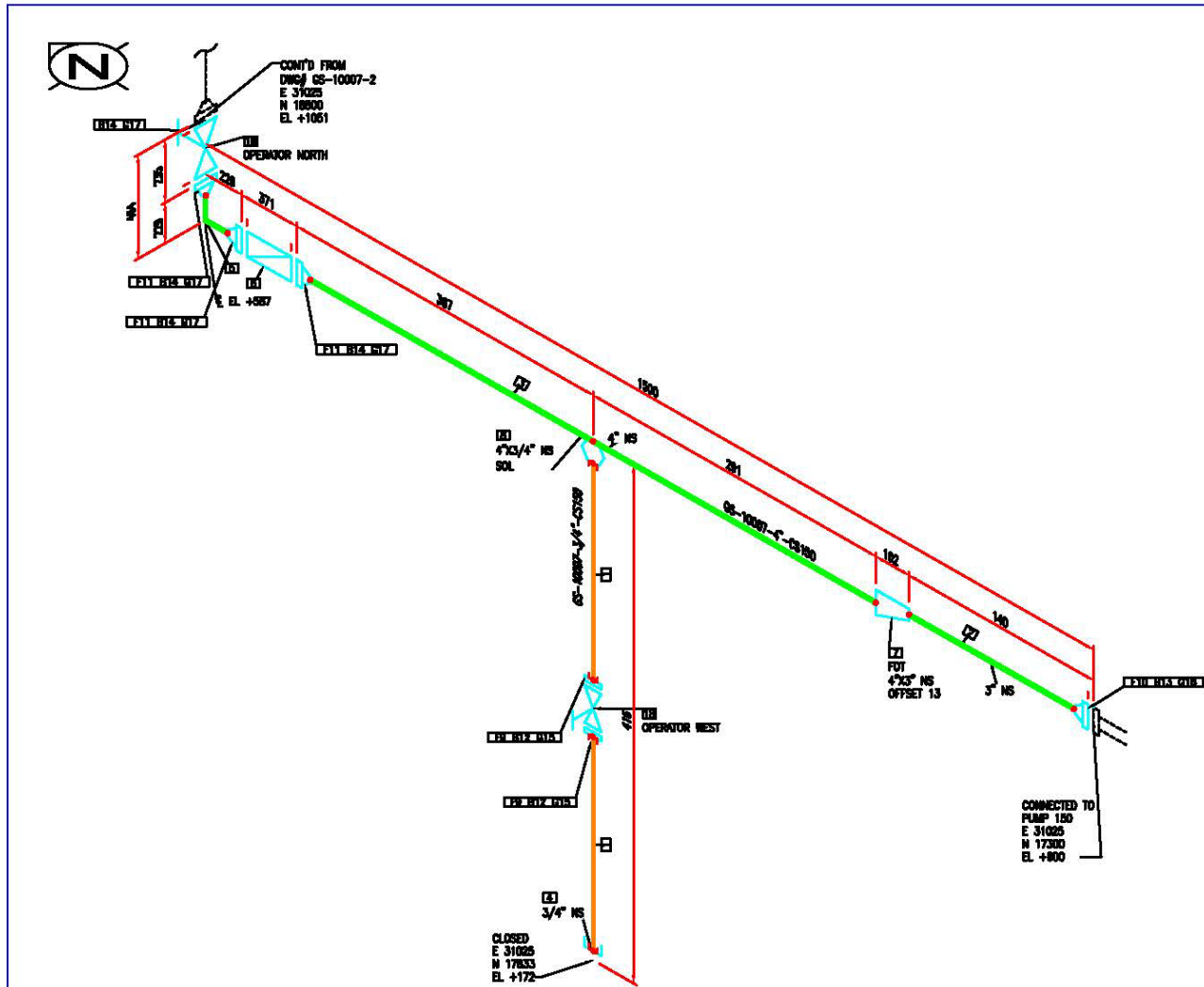


Gambar 6.55 Hasil pemodelan pipa 3D *line number* 4''-GS-10007-CS150

Pipa 4''-GS-10007-CS150 seperti Gambar 6.55 merupakan pipa yang menghubungkan antara N1 pada P-101 A,B dengan N3 pada V-102. Adapun maksud dari nama jalur pipa 4''-GS-10007-CS150 adalah :

- 4'' : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10007 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4''-GS-10007-CS150 dapat dilihat pada Gambar 6.56.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.0M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	CAP, 3000 LB, SW, ASME B16.11, ASTM A105
5	1	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
6	1	4"	Y-TYPE STRAINER, RF, 100 LB, ASME B16.10
7	1	4x3"	REDUCER (ECC), BW, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
8	1	4x3/4"	SOCKET, 3000 LB, BRKSW, 3/16 LG, ASME B16.11, ASTM A105
9	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	1	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
12	8	1/2"x34	BOLT SET, RF, 150 LB, STUD BOLT
13	4	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
14	32	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
15	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	1	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

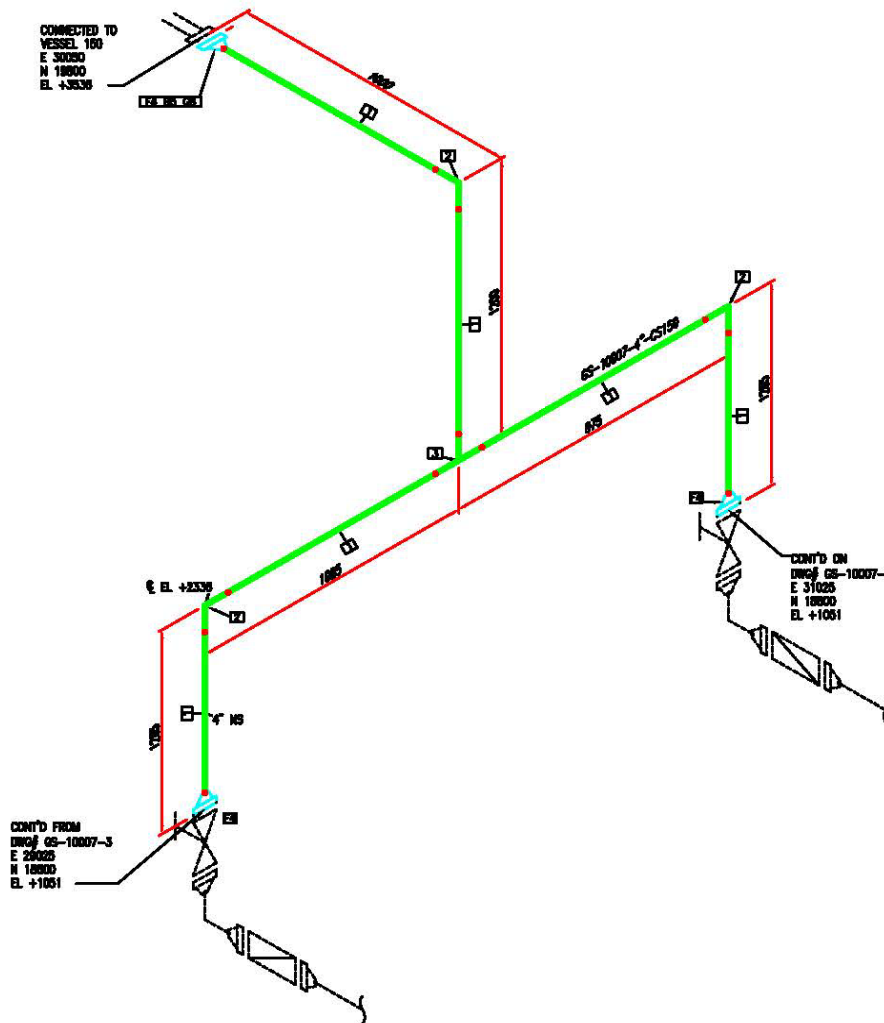
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					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
		02/16/18			INSULATION THK
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD

PROJECT NAME	Septian Andri Riswana		
TITLE			
DRAWING NUMBER	GS-10007-1		
DATE	GS-10007	APPD	TYPE
JOB NUMBER	SCALE	CHG	REV
	N.T.S.	1	3 0

Gambar 6.56 Piping isometric pipa 4"-GS-10007-CS150



CONNECTED TO
VESSEL 100
E 30080
N 18900
EL. +3638



CONT'D FROM
DWG# GS-10007-3
E 28025
N 18900
EL. +1051

CONT'D ON
DWG# GS-10007-1
E 31025
N 18900
EL. +1051

BILL OF MATERIALS

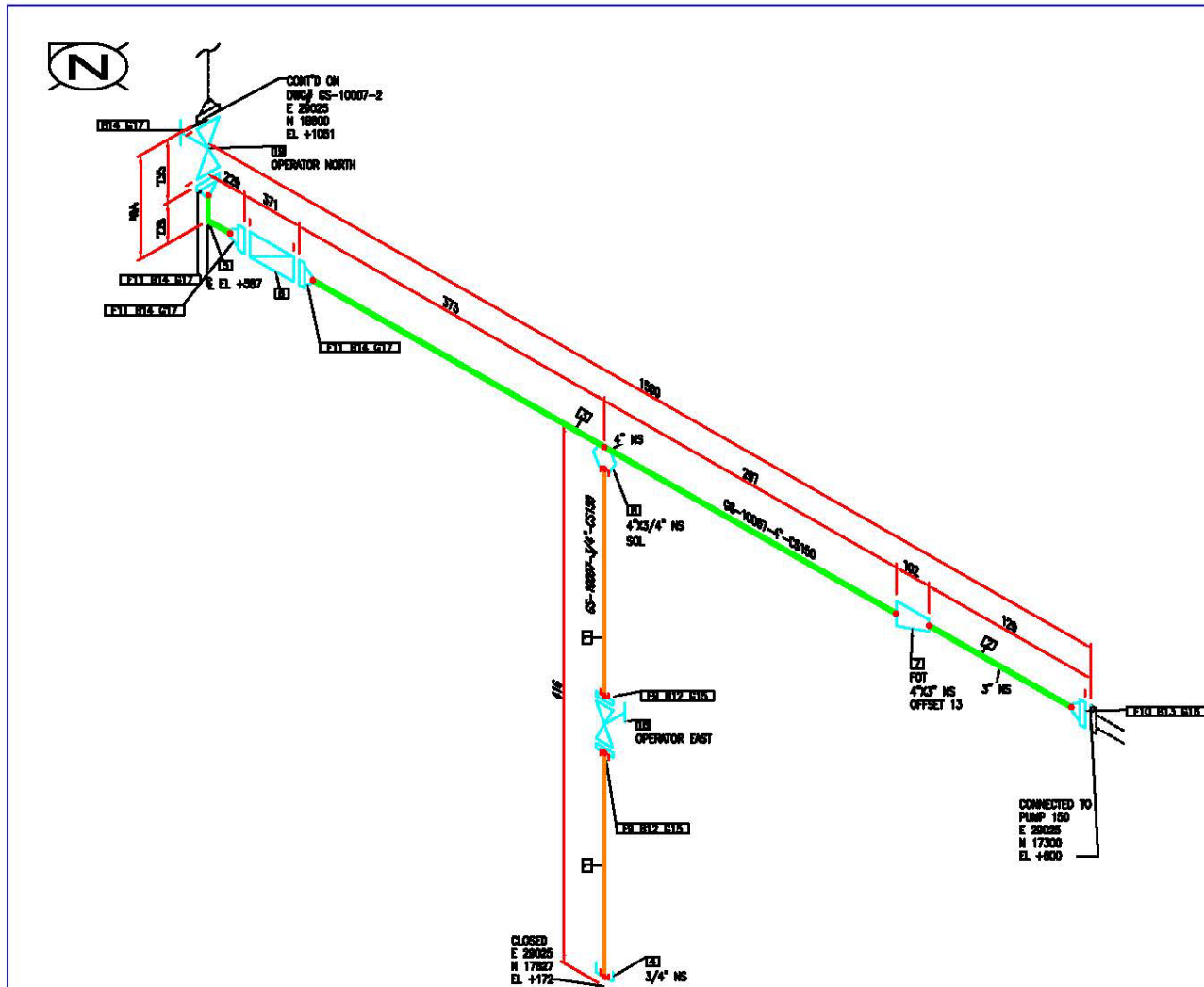
ID	QTY	NO	DESCRIPTION
1	5.4M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	3	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	4"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
5	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
6	1	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	SERVICE	INSULATION THK
		02/16/18					

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	GS-10007-2		
DATE:	GS-10007	APPR:	TYPE:
JOB NUMBER:		SCALE:	NO. OF SHEETS:
		N.T.S.	2 OF 3

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Gambar 6.56 Lanjutan Piping isometric pipa 4"-GS-10007-CS150



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.2M	3/4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.0M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	3/4"	CAP, 3000 LB, SW, ASME B16.11, ASTM A106
5	1	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
6	1	4"	Y-TYPE STRAINER, RF, 150 LB, ASME B16.10
7	1	4"x3"	REDUCER (ECC), BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
8	1	4"x3/4"	SOCKET, 3000 LB, BRKSW, 9/16" LG, ASME B16.11, ASTM A106
9	2	3/4"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	1	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
12	8	1/2"x3/4"	BOLT SET, RF, 150 LB, STUD BOLT
13	4	5/8"x7/8"	BOLT SET, RF, 150 LB, STUD BOLT
14	32	5/8"x20"	BOLT SET, RF, 150 LB, STUD BOLT
15	2	3/4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
16	1	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

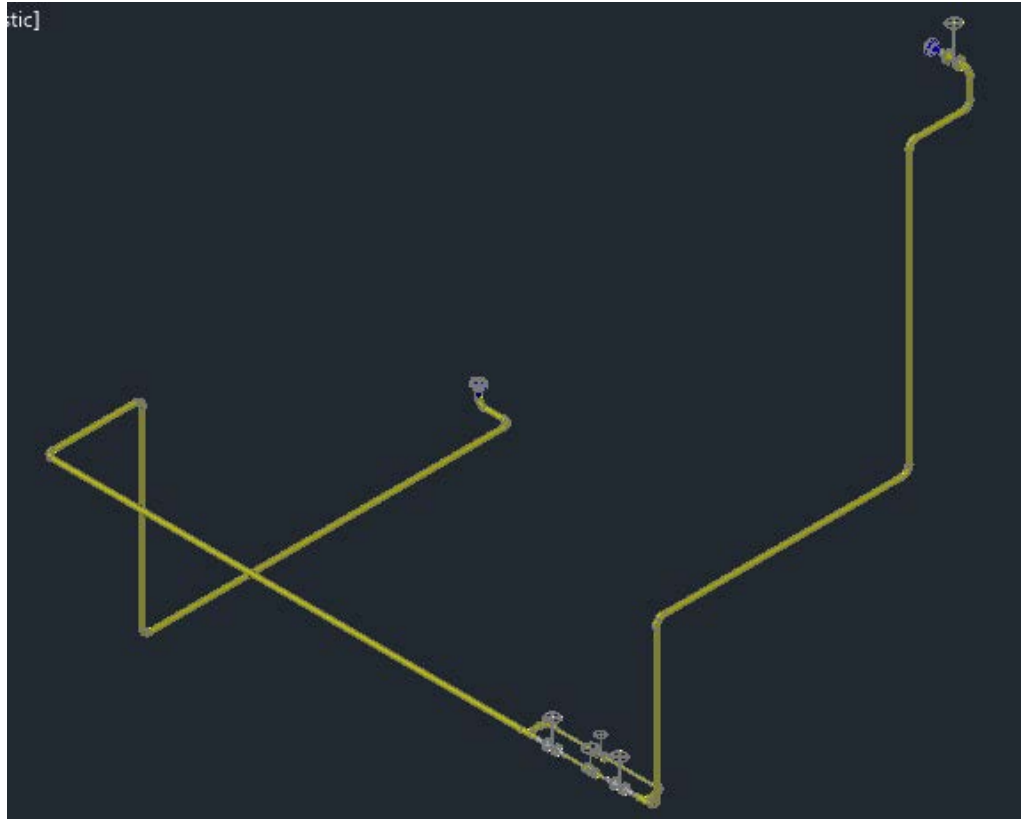
					SERVICE
					PIPE SPEC
					MAX PRESSURE
					MAX TEMPERATURE
					P&ID DWG
					INSULATION SPEC
		02/16/18			INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	GS-10007-3		
DATE:	GS-10007	APPD:	TYPE:
JOB NUMBER:		WELD:	ORIG:
		N.T.S.	3 of 3
			0

Gambar 6.56 Lanjutan Piping isometric pipa 4"-GS-10007-CS150

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6.2.17. Pipa 4"-GS-10004-CS150

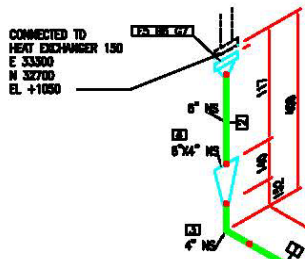
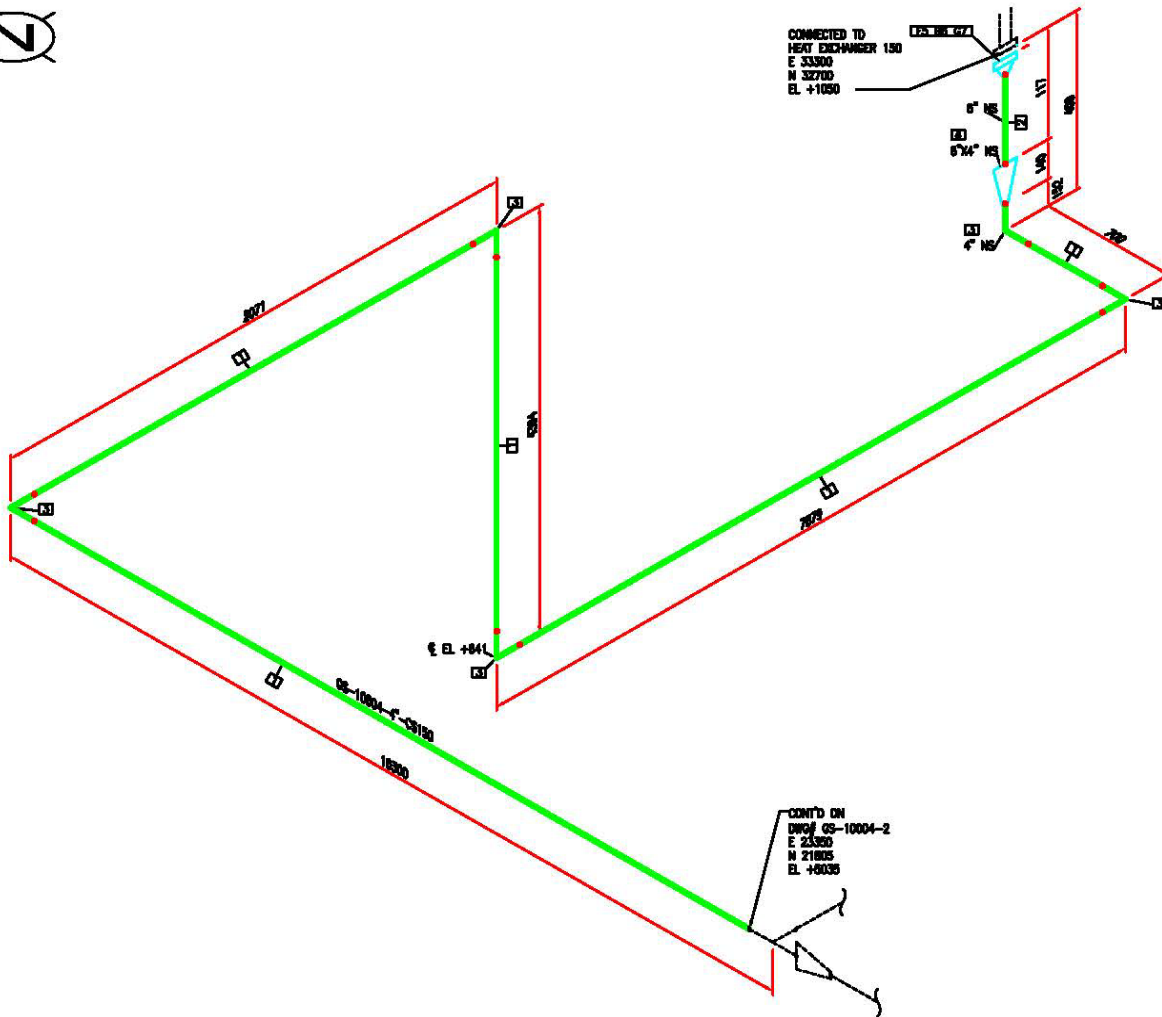


Gambar 6.57 Hasil pemodelan pipa 3D *line number* 4"-GS-10004-CS150

Pipa 4"-GS-10004-CS150 seperti Gambar 6.58 merupakan pipa yang menghubungkan antara N2 pada V-102 dengan E-101. Adapun maksud dari nama jalur pipa 4"-GS-10004-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10004 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10004-CS150 dapat dilihat pada Gambar 6.58.



CONT'D ON
DWG GS-10004-2
E 23300
N 21800
EL. +0030

BILL OF MATERIALS

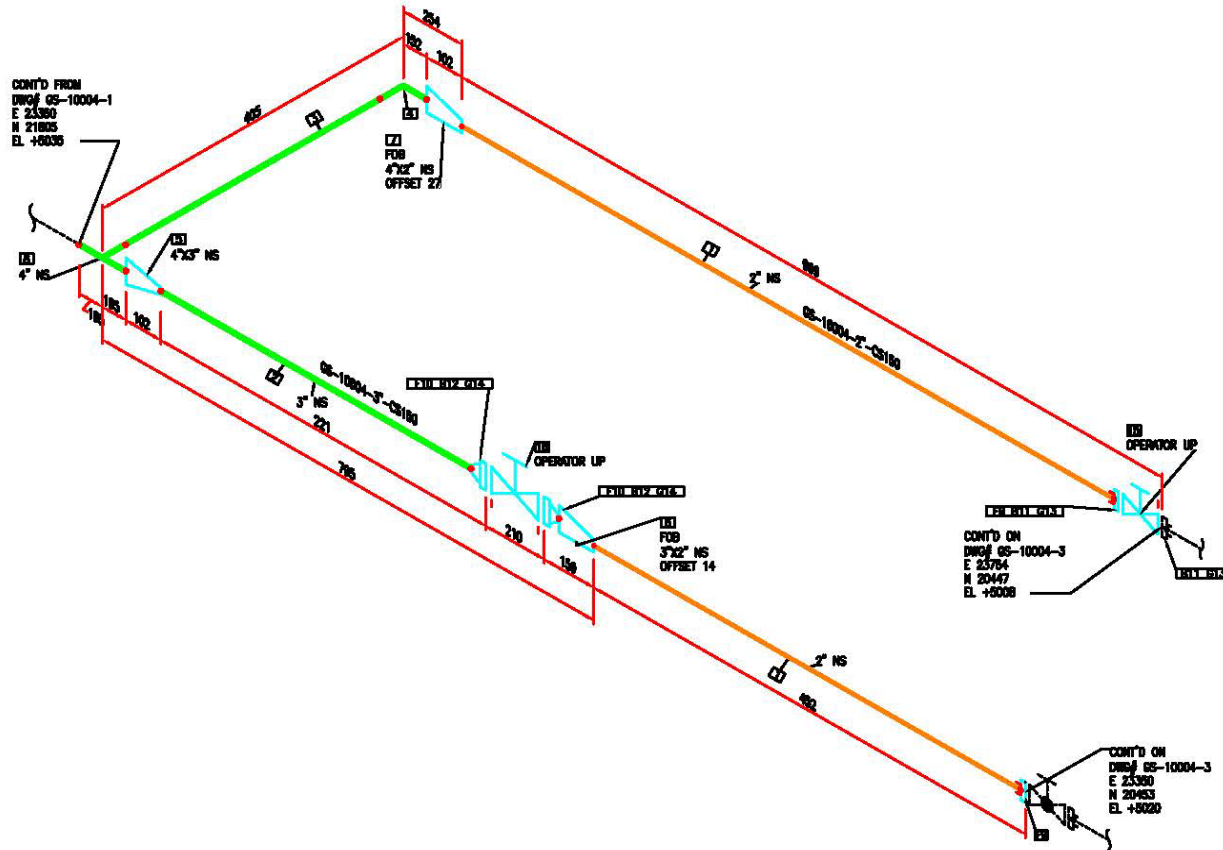
ID	QTY	NO	DESCRIPTION
1	23.8M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	6"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	5	4"	ELL 90 LR, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	6"x4"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	8	3/4"x3	BOLT SET, RF, 150 LB, STUD BOLT
7	1	6"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	SERVICE	INSULATION THK
		02/16/18					

PROJECT NAME				Septian Andri Riswana			
TITLE							
DRAWING NUMBER				GS-10004-1			
DATE	SCALE	USER	TYPE	SCALE	QTY	REV	REV
GS-10004	N.T.S.				1 of 4		0

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Gambar 6.58 Piping isometric pipa 4"-GS-10004-CS150



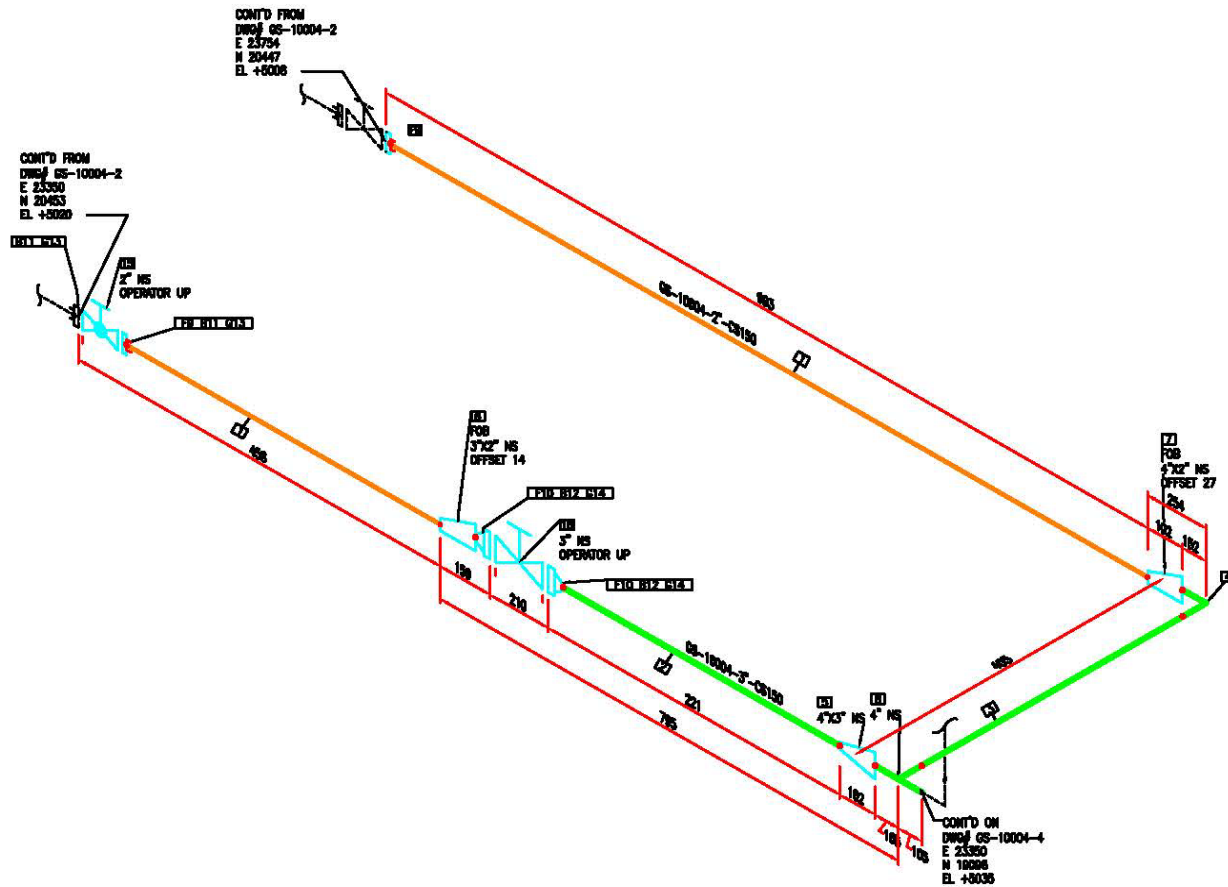
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	1.3M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.2M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.2M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	4"	ELL 90 LR, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	4"x3"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
6	1	3"x2"	REDUCER (EDC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
7	1	4"x2"	REDUCER (EDC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
8	1	4"	TEE, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
9	2	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	2	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	5/8"x25	BOLT SET, RF, 150 LB, STUD BOLT
12	8	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
13	2	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PIPE
14	2	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PIPE
15	1	2"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL
16	1	3"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	GS-10004-2		
DATE:	GS-10004	USER:	TYPE:
JOB NUMBER:		WELD:	ORIG:
		N.T.S.	2 of 4
			0

Gambar 6.58 Lanjutan Piping isometric pipa 4"-GS-10004-CS150

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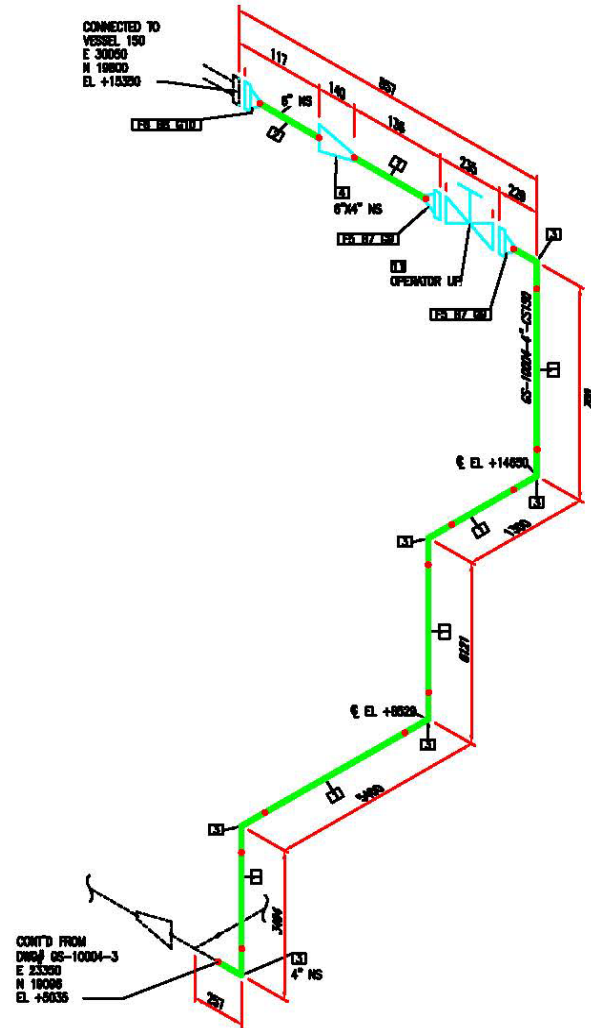
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	1.2M	2"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.2M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	0.2M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
4	1	4"	ELL 90 LR, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	4"x3"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
6	1	3"x2"	REDUCER (ECC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
7	1	4"x2"	REDUCER (ECC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
8	1	4"	TEE, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
9	2	2"	FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
10	2	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
11	8	5/8"x23	BOLT SET, RF, 150 LB, STUD BOLT
12	8	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
13	2	2"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PIPE
14	2	3"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PIPE
15	1	2"	GLOBE VALVE, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL
16	1	3"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
TITLE:			
DRAWING NUMBER:	GS-10004-3		
DATE:	GS-10004	APPD:	TYPE:
JOB NUMBER:		WELD:	3 OF 4
		CHECK:	0

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Gambar 6.58 Lanjutan Piping isometric pipa 4"-GS-10004-CS150



CONT'D FROM
DWG# GS-10004-3
E 23300
N 18008
EL +9035

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	SERVICE
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						MAX PRESSURE
						MAX TEMPERATURE
						P&ID DWG
		02/16/18				INSULATION SPEC
						INSULATION THK

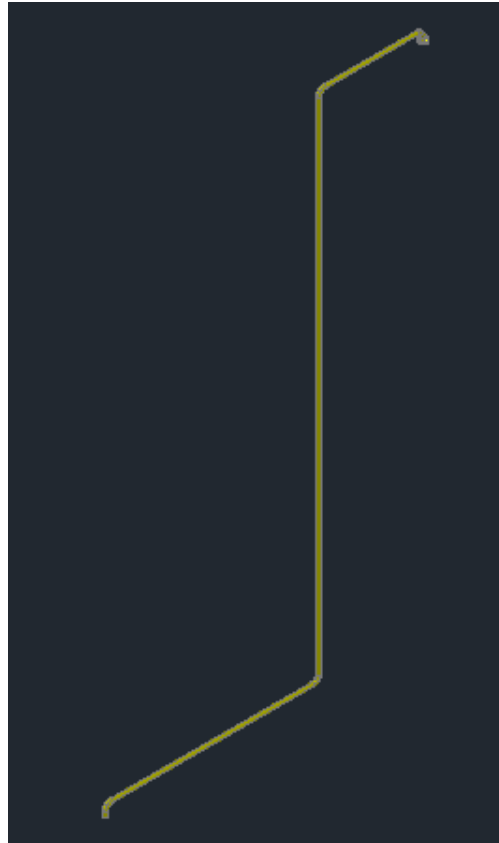
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	15.8M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	6"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	6	4"	ELL 90 LR, BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	6"x4"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	2	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	1	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
7	16	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
8	8	3/4"x33	BOLT SET, RF, 150 LB, STUD BOLT
9	2	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
10	1	6"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

PROJECT NAME:				Septian Andri Riswana			
DRAWN BY:				DRAWN BY:			
DATE:				DATE:			
JOB NUMBER:				JOB NUMBER:			
DRAWING NUMBER:				DRAWING NUMBER:			
LISE NO:				GS-10004		TYPE:	
JOB NUMBER:				N.T.S.		4 of 4	
JOB NUMBER:				4		0	

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Gambar 6.58 Lanjutan Piping isometric pipa 4"-GS-10004-CS150

6.2.18. Pipa 4"-GS-10006-CS150

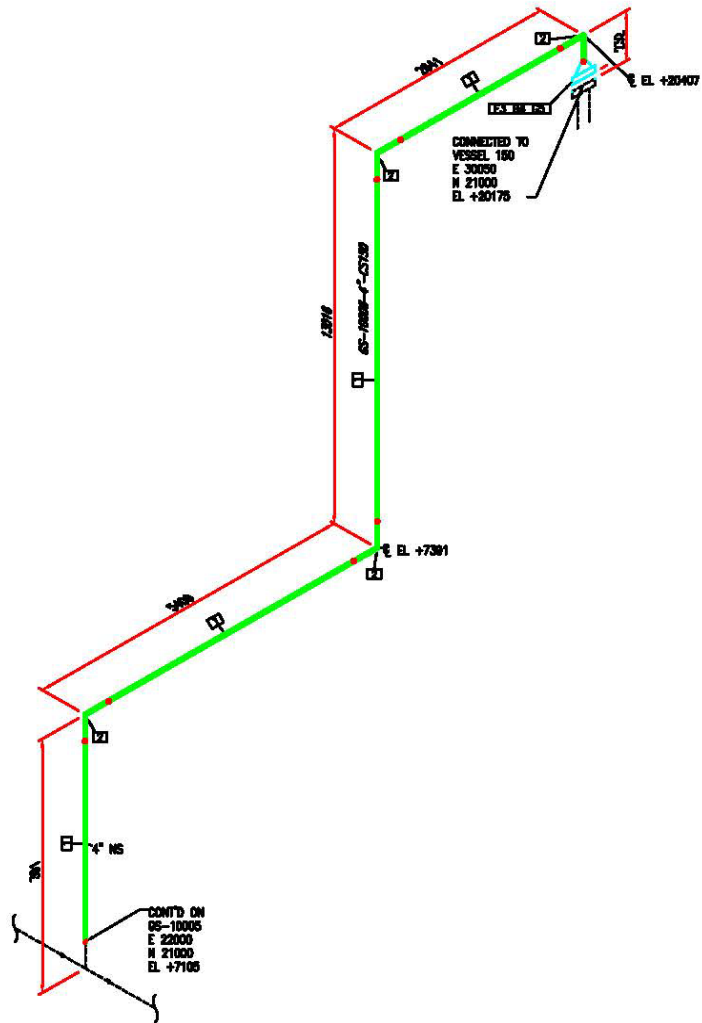


Gambar 6.59 Hasil pemodelan pipa 3D *line number* 4"-GS-10006-CS150

Pipa 4"-GS-10006-CS150 seperti Gambar 6.59 merupakan pipa yang menghubungkan antara N1 pada V-102 dengan jalur pipa 4"-GS-10005-CS 150 *to unit* 200. Adapun maksud dari nama jalur pipa 4"-GS-10006-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10006 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10006-CS150 dapat dilihat pada Gambar 6.60.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	20.3M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	4	4"	ELL 90 LR, DR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
4	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
5	1	4"	GASKET, SNG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

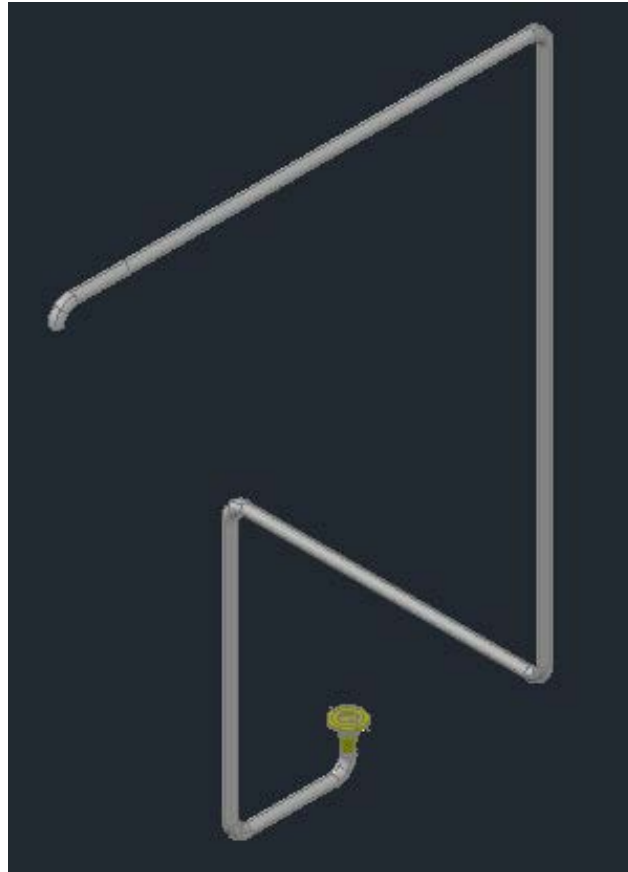
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					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
					INSULATION SPEC	
					INSULATION THK	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	

PROJECT NAME				Septian Andri Riswana			
TITLE							
DRAWING NUMBER				GS-10006			
DATE	ISSUE	BY	CHKD	DATE	ISSUE	BY	CHKD
JOB NUMBER				SCALE	CHG	REV	REQ
				N.T.S.	1	of 1	0

Gambar 6.60 Piping isometric pipa 4"-GS-10006-CS150

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6.2.19. Pipa 3"-WCS-10003-CS150

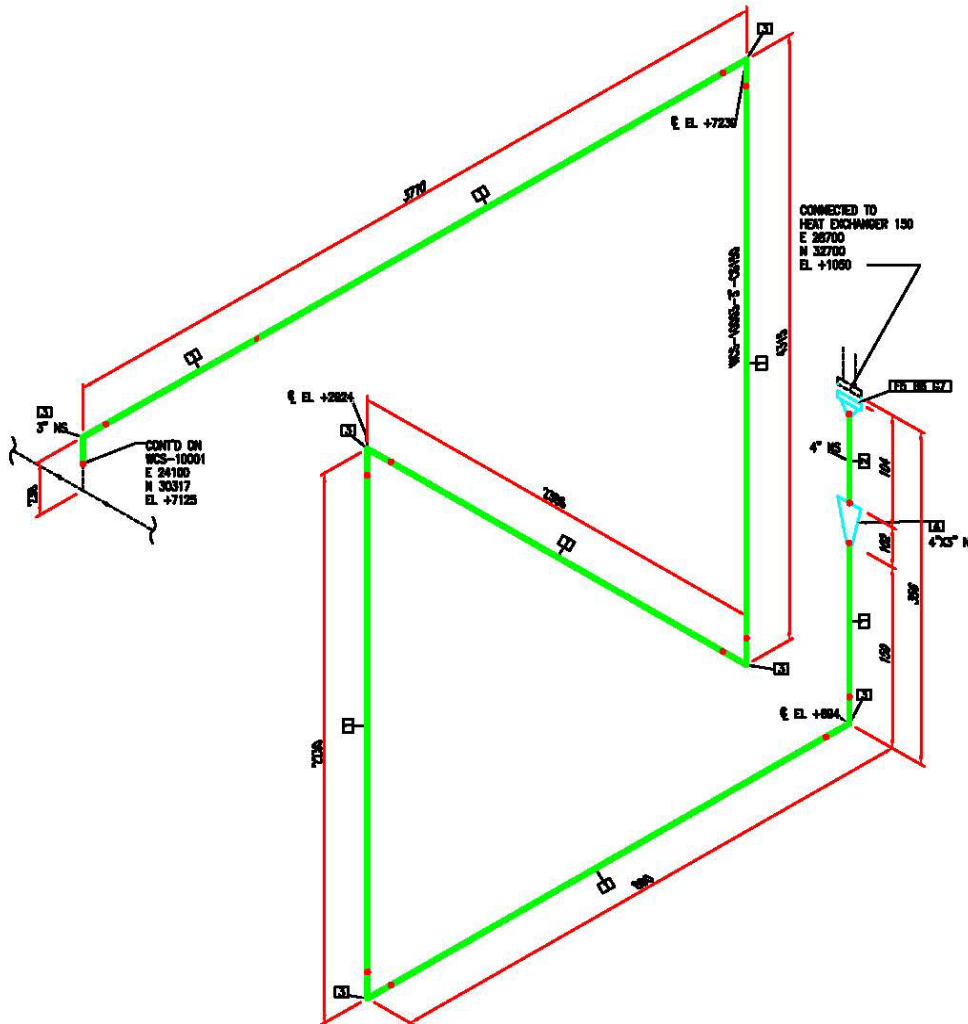


Gambar 6.61 Hasil pemodelan pipa 3D *line number* 3"-WCS-10003-CS150

Pipa 3"-WCS-10003-CS150 seperti Gambar 6.61 merupakan pipa yang menghubungkan antara N4 pada E-101 *from SN header*. Adapun maksud dari nama jalur pipa 3"-WCS-10003-CS150 adalah :

- 3" : *Size piping*
- WCS : *Service line code (Cooling Water Supply)*
- 10003 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 3"-WCS-10003-CS150 dapat dilihat pada Gambar 6.62.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	12.5M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	6	3"	ELL 90 LR, RF, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	4"x3"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	1	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
7	1	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

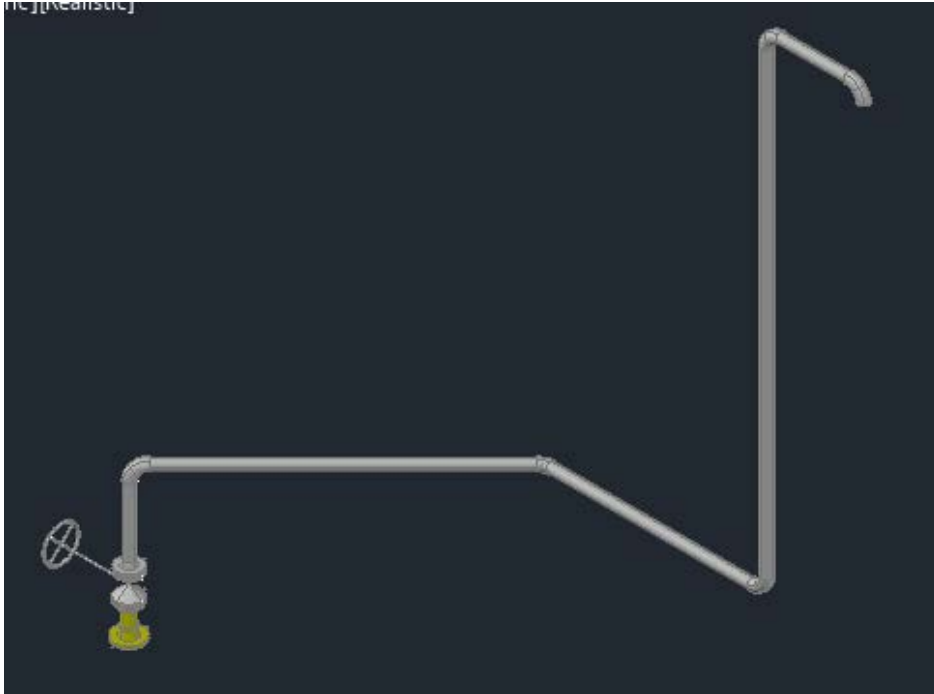
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK
		02/16/18				

PROJECT NAME				Septian Andri Riswana			
TITLE							
DRAWING NUMBER				WCS-10003			
DATE	WCS-10003	APPD	CHKD	TYPR			
JOB NUMBER		SCALE	QTY	REV	1	OF	1
		N.T.S.					0

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Gambar 6.62 Piping isometric pipa 3"-WCS-10003-CS150

6.2.20. Pipa 3"-WCR-10003-CS150

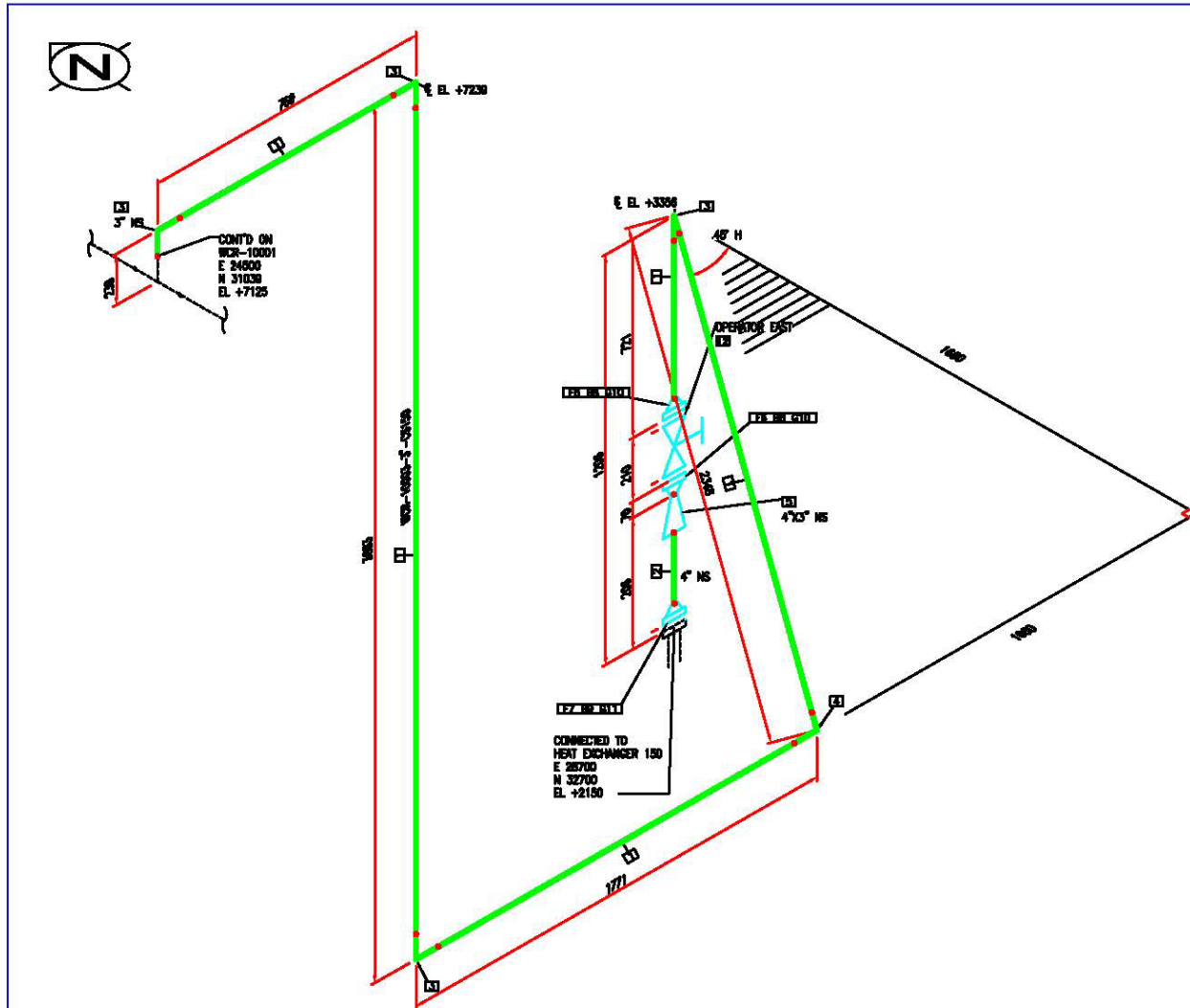


Gambar 6.63 Hasil pemodelan pipa 3D *line number* 3"-WCR-10003-CS150

Pipa 3"-WCR-10003-CS150 seperti Gambar 6.63 merupakan pipa yang menghubungkan antara N3 pada E-101 *from SN header*. Adapun maksud dari nama jalur pipa 3"-WCR-10003-CS150 adalah :

- 3" : *Size piping*
- WCR : *Service line code (Cooling Water Return)*
- 10003 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 3"-WCR-10003-CS150 dapat dilihat pada Gambar 6.64.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	0.0M	3"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	4	3"	ELL 90 LR, BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
4	1	3"	ELL 45 LR, BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
5	1	4x3"	REDUCER (CONC), BR, ASME B16.9, ASTM A234 OR WPB SMLS, SCH 40
6	2	3"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 OR WPB
7	1	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 OR WPB
8	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
9	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
10	2	3"	GASKET, SRG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	1	4"	GASKET, SRG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
12	1	3"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 OR WPB, HAND WHEEL

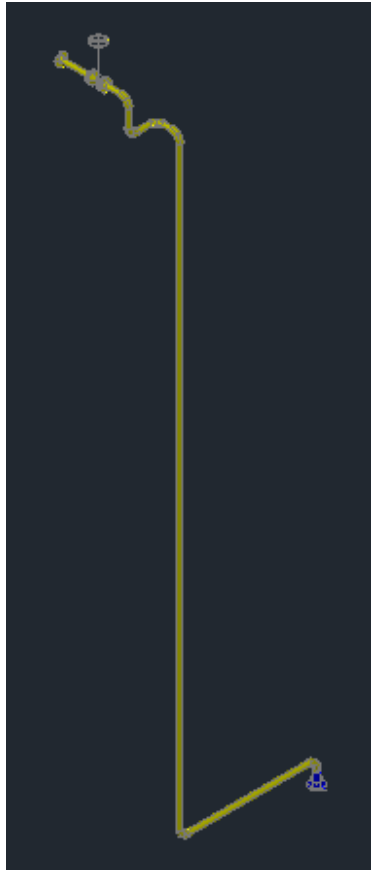
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					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
					INSULATION SPEC	
					INSULATION THK	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	

PROJECT NAME:	Septian Andri Riswana			
TITLE:				
DRAWING NUMBER:	WCR-10003			
DATE:	WCR-10003	APPR:	CHKD:	TYPD:
JOB NUMBER:		SCALE:	QTY:	REV:
		N.T.S.	1 of 1	0

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Gambar 6.64 Piping isometric pipa 3"-WCR-10003-CS150

6.2.21. Pipa 4"-GS-10003-CS150

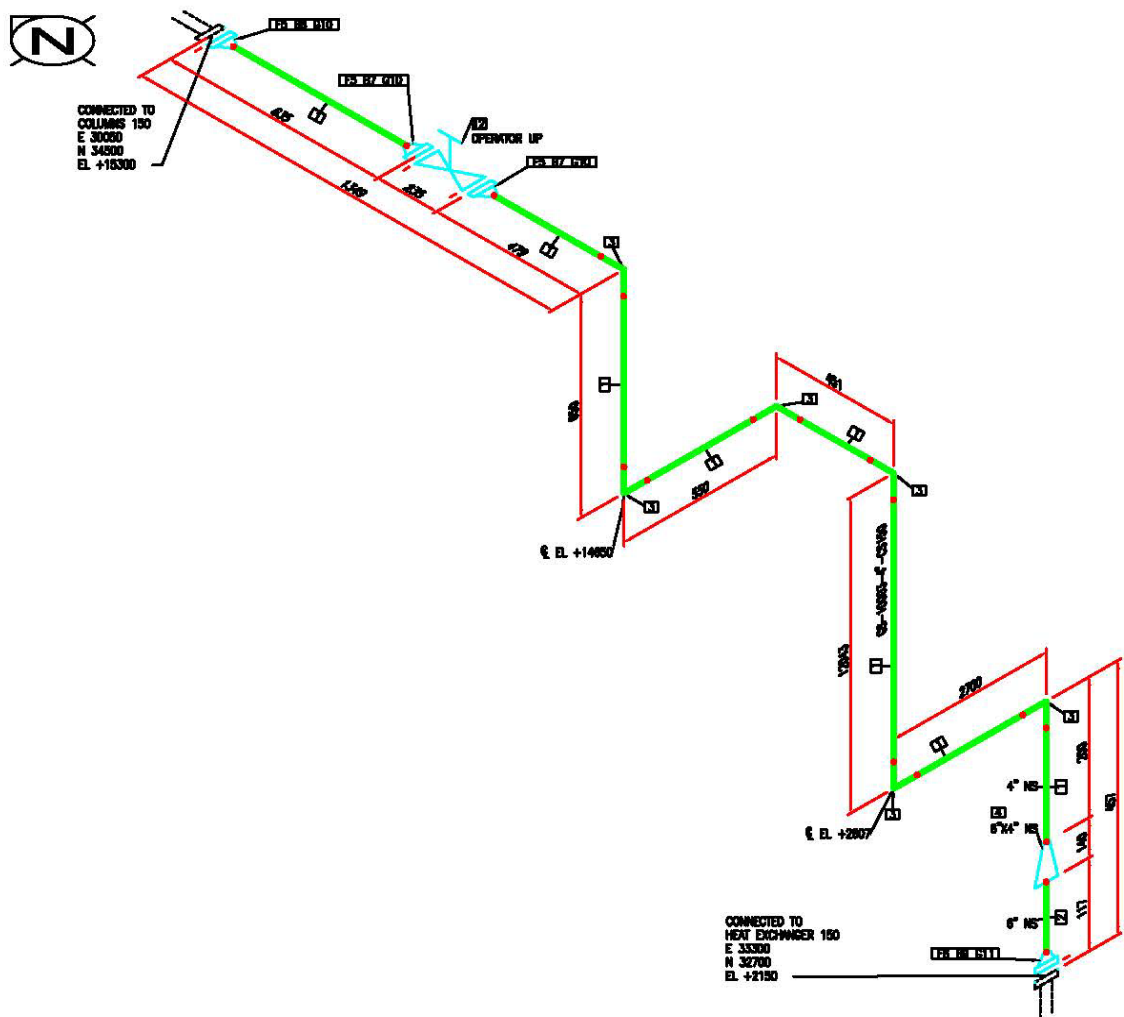


Gambar 6.65 Hasil pemodelan pipa 3D *line number* 4"-GS-10003-CS150

Pipa 4"-GS-10003-CS150 seperti Gambar 6.65 merupakan pipa yang menghubungkan antara N2 pada C-101 dengan N1 pada E-101. Adapun maksud dari nama jalur pipa 4"-GS-10003-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10003 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10003-CS150 dapat dilihat pada Gambar 6.66.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	15.7M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	0.1M	6"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
3	6	4"	ELL 90 LR, ER, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	6"x4"	REDUCER (CONC), ER, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	3	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	1	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
7	16	5/8"x20	BOLT SET, RF, 150 LB, STUD BOLT
8	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
9	8	3/4"x83	BOLT SET, RF, 150 LB, STUD BOLT
10	3	4"	GASKET, SRG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	1	6"	GASKET, SRG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
12	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

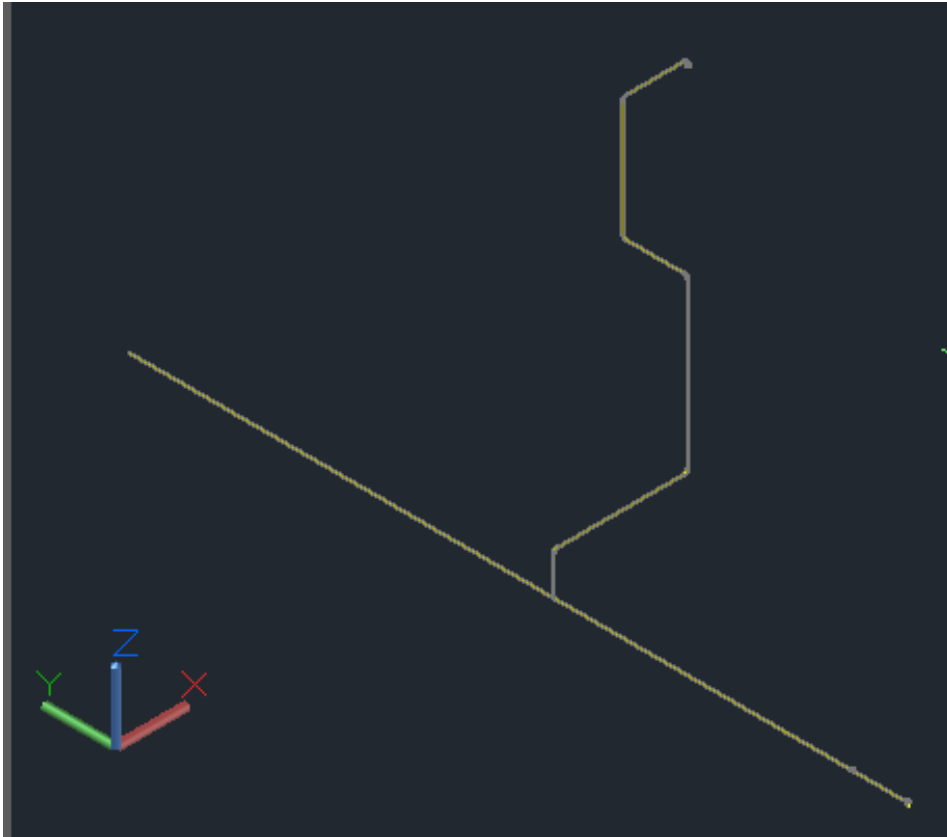
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					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana			
DATE:				
DRAWING NUMBER:	GS-10003			
DATE:	GS-10003	APPD:	CHKD:	TYPE:
JOB NUMBER:		SCALE:	QTY:	REV:
		N.T.S.	1 of 1	0

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Gambar 6.66 Piping isometric pipa 4"-GS-10003-CS150

6.2.22. Pipa 4"-GS-10005-CS150

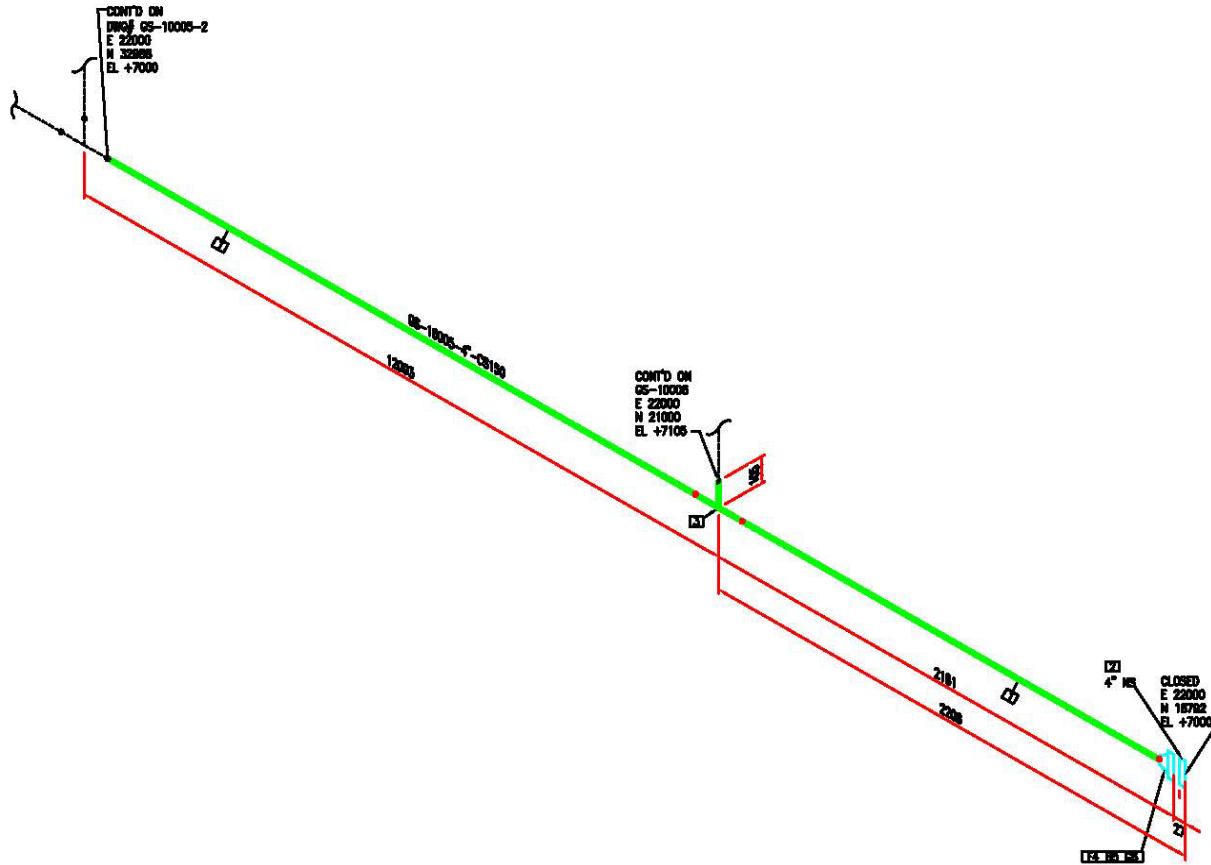


Gambar 6.67 Hasil pemodelan pipa 3D *line number* 4"-GS-10005-CS150

Pipa 4"-GS-10005-CS150 seperti Gambar 6.67 merupakan pipa yang menghubungkan antara N1 pada C-101 *to unit* 200. Adapun maksud dari nama jalur pipa 4"-GS-10005-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10005 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10005-CS150 dapat dilihat pada Gambar 6.68.



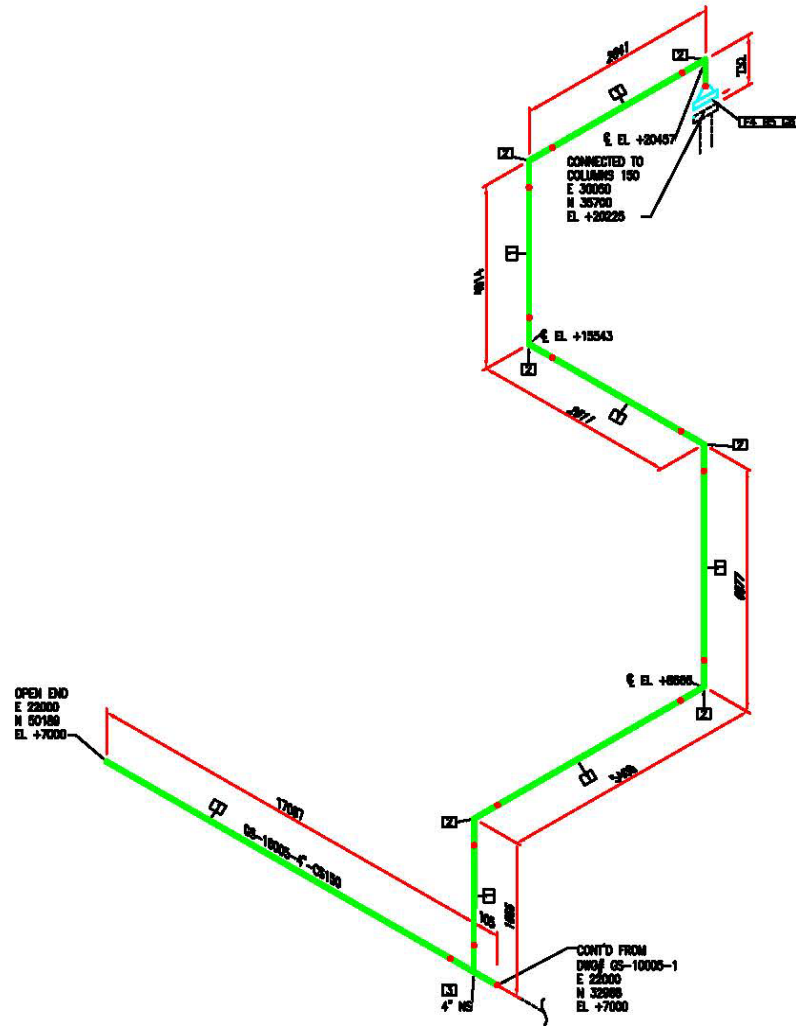
BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	13.0M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	1	4"	FLANGE BLND, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
3	1	4"	TEE, ENL, ASME B16.5, ASTM A234 GR WPB SMLS, SCH 40
4	1	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
5	8	5/8"x80	BOLT SET, RF, 150 LB, STUD BOLT
6	1	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

PROJECT NAME:	Septian Andri Riswana		
DATE:			
DRAWING NUMBER:	GS-10005-1		
DATE:	GS-10005	APPD:	TYPE:
JOB NUMBER:		NO. OF SHEETS:	TOTAL SHEETS:
		1	2
			0

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Gambar 6.68 Piping isometric pipa 4"-GS-10005-CS150



BILL OF MATERIALS

ID	QTY	NO	DESCRIPTION
1	30.4M	4"	PIPE, SEAMLESS, FE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	6	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	4"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
5	8	5/8"x70	BOLT SET, RF, 150 LB, STUD BOLT
6	1	4"	GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE

REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK
		02/16/18				

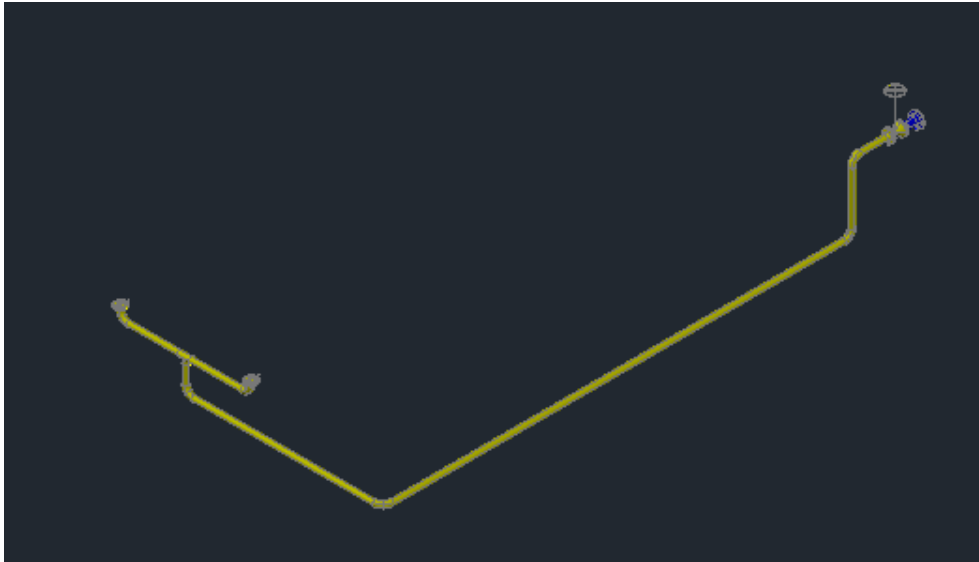
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PIPE SPEC	
MAX PRESSURE	
MAX TEMPERATURE	
P&ID DWG	
INSULATION SPEC	
INSULATION THK	

PROJECT NAME	Septian Andri Riswana		
DATE			
DRAWING NUMBER	GS-10005-2		
DATE	GS-10005		
JOB NUMBER			
	N.T.S.	2 of 2	0

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Gambar 6.68 Lanjutan *Piping isometric* pipa 4"-GS-10005-CS150

6.2.23. Pipa 4"-GS-10002-CS150

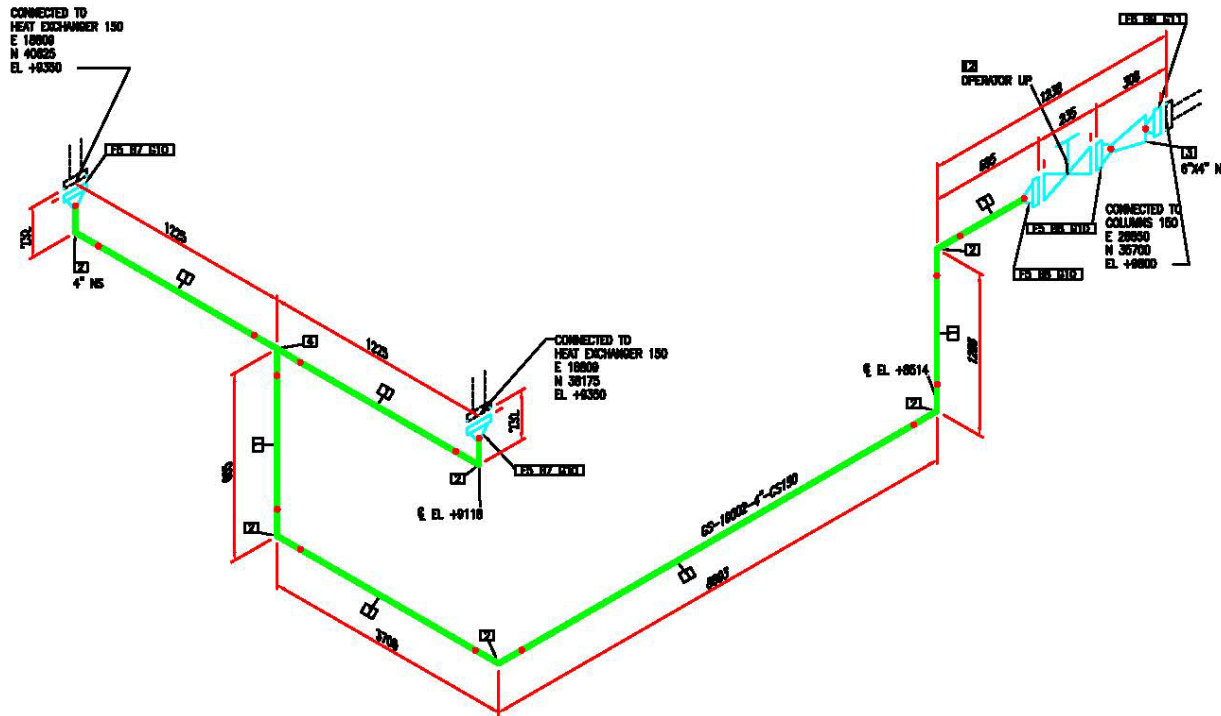


Gambar 6.69 Hasil pemodelan pipa 3D *line number* 4"-GS-10002-CS150

Pipa 4"-GS-10002-CS150 seperti Gambar 6.69 merupakan pipa yang menghubungkan antara N4 pada C-101 dengan N4 dan N3 pada E-102. Adapun maksud dari nama jalur pipa 4"-GS-10002-CS150 adalah :

- 4" : *Size piping*
- GS : *Service line code (Synthesis Gas)*
- 10002 : *Line number*
- CS150 : *Spec material (Carbon steel)*

Adapun hasil gambar *piping isometric* dari jalur pipa 4"-GS-10002-CS150 dapat dilihat pada Gambar 6.70.



BILL OF MATERIALS			
ID	QTY	NO	DESCRIPTION
1	15.7M	4"	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 GR B SMLS, SCH 40
2	6	4"	ELL 90 LR, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
3	1	6"X4"	REDUCER (CONC), BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
4	1	4"	TEE, BW, ASME B16.9, ASTM A234 GR WPB SMLS, SCH 40
5	4	4"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
6	1	6"	FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 GR WPB
7	16	5/8"X70	BOLT SET, RF, 150 LB, STUD BOLT
8	16	5/8"X80	BOLT SET, RF, 150 LB, STUD BOLT
9	8	3/4"X83	BOLT SET, RF, 150 LB, STUD BOLT
10	4	4"	GASKET, SRG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
11	1	6"	GASKET, SRG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE
12	1	4"	GATE VALVE, DOUBLE DISC, 150 LB, RF, ASME B16.10, ASTM A216 GR WPB, HAND WHEEL

					SERVICE	
					PIPE SPEC	
					MAX PRESSURE	
					MAX TEMPERATURE	
					P&ID DWG	
		02/16/18			INSULATION SPEC	
REV.	DESCRIPTION	DATE	DRAWN	CHKD	APPD	INSULATION THK

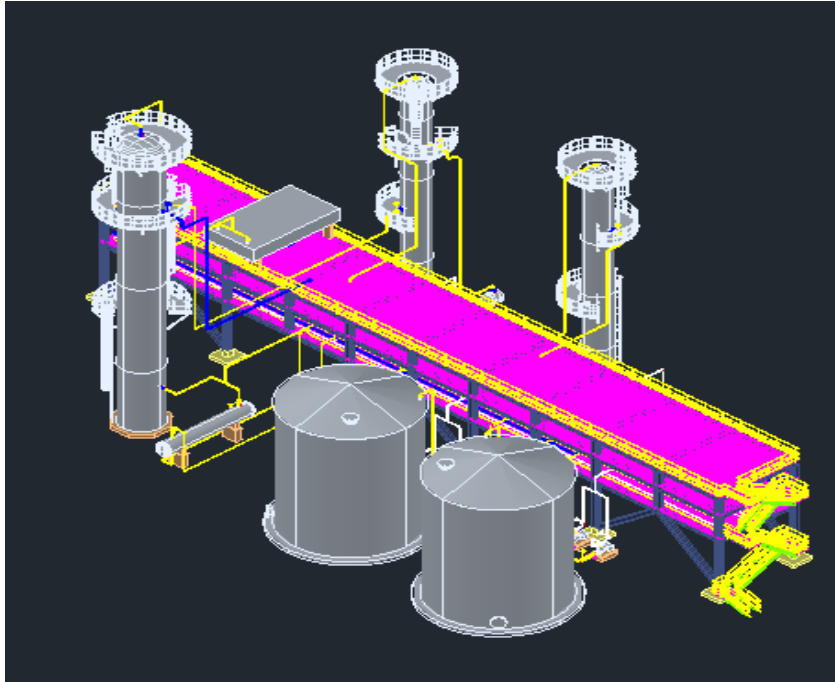
PROJECT NAME			
Septian Andri Riswana			
TITLE			
DRAWING NUMBER			
GS-10002			
LINE NO.	AREA	DATE	TYPE
GS-10002			
JOB NUMBER	SCALE	DATE	REV.
	N.T.S.	1 of 1	0

C:\Users\septianandriwana\Documents\Scriptan Andri Riswana\Isometric\Check_A2P\ndriass\Drawings\GS-10002.dwg

Gambar 6.70 Piping isometric pipa 4"-GS-10002-CS150

6.3. Hasil Pemodelan 3D *General Plant*

General plant merupakan hasil keseluruhan dari pemodelan ulang yang tampak dari pandangan *iso* seperti pada gambar 6.31.



Gambar 6.71 Hasil pemodelan 3D *general plant*

6.4. *Material Take Off / Bill of Material*

Material take off atau *Bill of material* merupakan report dari software AutoCAD Plant 3D yang memberikan informasi terkait komponen sistem perpipaan. *Bill of Material* memuat informasi berupa *Type* dan *Quantity*, *Description*, *Unit*, *Size*, *Standard* dan *Pressure class* komponen yang digunakan seperti pada Gambar

Bill of Material

Project: Septian Andri Riswana

PIPING DRAFTING TRAINING PLUS P.I.n.D
TRAINING COURSE

Quantity	Unit	Long Description	ND	Size	Spec	PN	Weight	Weight Unit
Type: Pipe, Seamless								
2031	mm	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 Gr B SMLS, Sch 40	0.75 in	3/4"	CS150		0.168162	KG
160435	mm	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 Gr B SMLS, Sch 40	2 in	2"	CS150		0.484487	KG
274230	mm	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 Gr B SMLS, Sch 40	3 in	3"	CS150		0.753797	KG
283785	mm	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 Gr B SMLS, Sch 40	4 in	4"	CS150		11.539025	KG
245235	mm	PIPE, SEAMLESS, PE, ASME B36.10, ASTM A106 Gr B SMLS, Sch 40	6 in	6"	CS150		9.619547	KG
Type: ELL 45 LR								
1		ELL 45 LR, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	3 in	3"	CS150		1.016057334663	KG
Type: ELL 90								
22		ELL 90, 3000 LB, SW, ASME B16.11, ASTM A105	2 in	2"	CS150	3000	1.615939399437	KG
Type: ELL 90 LR								
44		ELL 90 LR, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	3 in	3"	CS150		2.027578699083	KG
74		ELL 90 LR, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	4 in	4"	CS150		3.896398439626	KG
6		ELL 90 LR, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	6 in	6"	CS150		10.19686110859	KG
Type: REDUCER (CONC)								
7		REDUCER (CONC), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	3 in	3"x2"	CS150		0.997913453687	KG
5		REDUCER (CONC), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	4 in	4"x3"	CS150		1.596661525900	KG
7		REDUCER (CONC), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	6 in	6"x4"	CS150		3.896398439626	KG
Type: REDUCER (ECC)								
2		REDUCER (ECC), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	3 in	3"x2"	CS150		0.997913453687	KG
10		REDUCER (ECC), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	4 in	4"x3"	CS150		1.596661525900	KG
3		REDUCER (ECC), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	6 in	6"x4"	CS150		3.896398439626	KG
Type: FLANGE BLIND								
1		FLANGE BLIND, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	4 in	4"	CS150	150	7.711149414859	KG
2		FLANGE BLIND, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	6 in	6"	CS150	150	12.24711965889	KG

Gambar 6.72 Bill of material

Quantity	Unit	Long Description	ND	Size	Spec	PN	Weight	Weight Unit
Type: FLANGE SW								
20		FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	0.75 in	3/4"	CS150	150	0.907194048807	KG
22		FLANGE SW, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	2 in	2"	CS150	150	2.267985122017	KG
Type: FLANGE WN								
28		FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	3 in	3"	CS150	150	5.216365780640	KG
62		FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	4 in	4"	CS150	150	7.484350902658	KG
15		FLANGE WN, 150 LB, RF, ASME B16.5, ASTM A234 Gr WPB	6 in	6"	CS150	150	11.79352263449	KG
Type: CAP								
10		CAP, 3000 LB, SW, ASME B16.11, ASTM A105	0.75 in	3/4"	CS150	3000	0.170098884151	KG
Type: SOCKOLET								
4		SOCKOLET, 3000 LB, BWXSW, 9/16" LG, ASME B16.11, ASTM A105	3 in	3"x3/4"	CS150	3000	0.136079107321	KG
6		SOCKOLET, 3000 LB, BWXSW, 9/16" LG, ASME B16.11, ASTM A105	4 in	4"x3/4"	CS150	3000	0.136079107321	KG
Type: Tee								
2		TEE, 3000 LB, SW, ASME B16.11, ASTM A105	2 in	2"	CS150	3000	2.012836795790	KG
4		TEE, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	3 in	3"	CS150		3.819286945477	KG
10		TEE, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	4 in	4"	CS150		5.996552662614	KG
2		TEE, BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	6 in	6"	CS150		16.47917989657	KG
Type: Tee (red)								
7		TEE (RED), BW, ASME B16.9, ASTM A234 Gr WPB SMLS, Sch 40	6 in	6"x3"	CS150		15.99836705071	KG
Type: Bolt set								
20		BOLT SET, RF, 150 LB, STUD BOLT	0.75 in	3/4"	CS150	150	0.498956726843	KG
22		BOLT SET, RF, 150 LB, STUD BOLT	2 in	2"	CS150	150	0.757507030753	KG
28		BOLT SET, RF, 150 LB, STUD BOLT	3 in	3"	CS150	150	0.775650911730	KG
62		BOLT SET, RF, 150 LB, STUD BOLT	4 in	4"	CS150	150	1.555837793704	KG
15		BOLT SET, RF, 150 LB, STUD BOLT	6 in	6"	CS150	150	3.088995736187	KG
Type: Gasket, SWG								
20		GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE	0.75 in	3/4"	CS150	150	0.036287761952	KG
22		GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE	2 in	2"	CS150	150	0.108863285856	KG
28		GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE	3 in	3"	CS150	150	0.185974780005	KG
62		GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE	4 in	4"	CS150	150	0.317517917082	KG
15		GASKET, SWG, 1/8" THK, RF, 150 LB, ASME B16.20, CS/PTFE	6 in	6"	CS150	150	0.557924340016	KG

Gambar 6.72 Bill of material

Quantity	Unit	Long Description	ND	Size	Spec	PN	Weight	Weight Unit
Type: Socketweld								
40			0.75 in	3/4"	CS150			KG
72			2 in	2"	CS150			KG
Type: Check Valve								
4		Check Valve, Swing, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB	3 in	3"	CS150	150	26.99809489249	KG
Type: Gate Valve								
10		Gate Valve, Solid Wedge, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Whe	0.75 in	3/4"	CS150	150		KG
5		Gate Valve, Solid Wedge, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Whe	2 in	2"	CS150	150	15.87589585412	KG
7		Gate Valve, Double Disc, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Wheel	3 in	3"	CS150	150	33.99709697904	KG
15		Gate Valve, Double Disc, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Wheel	4 in	4"	CS150	150	52.00036287761	KG
3		Gate Valve, Double Disc, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Wheel	6 in	6"	CS150	150	87.99782273428	KG
Type: Globe Valve								
1		Globe Valve, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Wheel	2 in	2"	CS150	150	21.99945568357	KG
1		Globe Valve, 150 LB, RF, ASME B16.10, ASTM A216 Gr WPB, Hand Wheel	4 in	4"	CS150	150	59.99727841785	KG

6.5. Estimasi berat

6.5.1. Perhitungan Berat *equipment*

a) Shell :

Shell : Menggunakan data *Equipment C-101*

Diketahui : asumsi rating nozzle : 150#

Diameter : 2000 mm = 78,74 inch

Jari-Jari : 1000 mm = 39,37 inch

Panjang : 14000 mm = 45,93 ft

Asumsi : Suhu : 200 °F

CA : 0,125 inch

E : 1 (BW ASME B31.3 hal 232)

- MAWP dicari menggunakan tabel ASME B16.5 1A seperti gambar 6.33. Kemudian mengasumsikan data yang dibutuhkan :

TABLE 1A LIST OF MATERIAL SPECIFICATIONS

Material Group	Nominal Designation	Pressure-Temperature Rating Table	Applicable ASTM Specifications ¹		
			Forgings	Castings	Plates
1.1	C-Si C-Mn-Si	2-1.1	A 105 A 350 Gr. LF2	A 216 Gr. WCB	A 515 Gr. 70 A 516 Gr. 70 A 537 Cl. 1
1.2	C-Mn-Si 2½Ni 3½Ni	2-1.2	A 350 Gr. LF3	A 216 Gr. WCC A 352 Gr. LCC A 352 Gr. LC2 A 352 Gr. LC3	A 203 Gr. B A 203 Gr. E
1.3	C-Si C-Mn-Si 2½Ni 3½Ni	2-1.3		A 352 Gr. LCB	A 515 Gr. 65 A 516 Gr. 65 A 203 Gr. A A 203 Gr. D
1.4	C-Si C-Mn-Si	2-1.4	A 350 Gr. LF1 Cl. 1		A 515 Gr. 60 A 516 Gr. 60
1.5	C-½Mo	2-1.5	A 182 Gr. F1	A 217 Gr. WC1 A 352 Gr. LC1	A 204 Gr. A A 204 Gr. B
1.7	C-½Mo ½Cr-½Mo Ni-½Cr-½Mo ¾Ni-¾Cr-1Mo	2-1.7	A 182 Gr. F2	A 217 Gr. WC4 A 217 Gr. WC5	A 204 Gr. C
1.9	1Cr-½Mo 1½Cr-½Mo 1½Cr-½Mo-Si	2-1.9	A 182 Gr. F12 Cl. 2 A 182 Gr. F11 Cl. 2	A 217 Gr. WC6	A 387 Gr. 11 Cl. 2
1.10	2½Cr-1Mo	2-1.10	A 182 Gr. F22 Cl. 3	A 217 Gr. WC9	A 387 Gr. 22 Cl. 2
1.13	5Cr-½Mo	2-1.13	A 182 Gr. F5 A 182 Gr. F5a	A 217 Gr. C5	
1.14	9Cr-1Mo	2-1.14	A 182 Gr. F9	A 217 Gr. C12	
2.1	18Cr-8Ni	2-2.1	A 182 Gr. F304 A 182 Gr. F304H	A 351 Gr. CF3 A 351 Gr. CF8	A 240 Gr. 304 A 240 Gr. 304H
2.2	16Cr-12Ni-2Mo 18Cr-13Ni-3Mo 19Cr-10Ni-3Mo	2-2.2	A 182 Gr. F316 A 182 Gr. F316H	A 351 Gr. CF3M A 351 Gr. CF8M A 351 Gr. CG8M	A 240 Gr. 316 A 240 Gr. 316H A 240 Gr. 317
2.3	18Cr-8Ni 16Cr-12Ni-2Mo	2-2.3	A 182 Gr. F304L A 182 Gr. F316L		A 240 Gr. 304L A 240 Gr. 316L
2.4	18Cr-10Ni-Ti	2-2.4	A 182 Gr. F321 A 182 Gr. F321H		A 240 Gr. 321 A 240 Gr. 321H

Gambar 6.73 Tabel 1A ASME B16.5

Nominal designation : C-Si
 Proses : Plate
 Material : A 515 Gr 70
 Group Material : 1.1
 P-T Rating Table : 2-1.1

Kemudian untuk mencari MAWP digunakan P-T rating table ASME B16.5. Dengan menggunakan 2 data yaitu rating dan suhu lihat gambar 6.34.

**TABLES 2
PRESSURE-TEMPERATURE RATINGS FOR
GROUPS 1.1 THROUGH 3.16 MATERIALS**

TABLE 2-1.1 RATINGS FOR GROUP 1.1 MATERIALS

Nominal Designation	Forgings	Castings	Plates
C-Si	A 105 (1)	A 216 Gr. WCB (1)	A 515 Gr. 70 (1)
C-Mn-Si	A 350 Gr. LF2 (1)		A 516 Gr. 70 (1)(2) A 537 Cl. 1 (3)

NOTES:

- (1) Upon prolonged exposure to temperatures above 800°F, the carbide phase of steel may be converted to graphite. Permissible, but not recommended for prolonged use above 800°F.
- (2) Not to be used over 850°F.
- (3) Not to be used over 700°F.

WORKING PRESSURES BY CLASSES, psig							
Class Temp., °F	150	300	400	600	900	1500	2500
-20 to 100	285	740	990	1480	2220	3705	6170
200	260	675	900	1350	2025	3375	5625
300	230	655	875	1315	1970	3280	5470
400	200	635	845	1270	1900	3170	5280
500	170	600	800	1200	1795	2995	4990
600	140	550	730	1095	1640	2735	4560
650	125	535	715	1075	1610	2685	4475
700	110	535	710	1065	1600	2665	4440
750	95	505	670	1010	1510	2520	4200
800	80	410	550	825	1235	2060	3430
850	65	270	355	535	805	1340	2230
900	50	170	230	345	515	860	1430
950	35	105	140	205	310	515	860
1000	20	50	70	105	155	260	430

Gambar 6.74 Tabel 2-1.1 ASME B16.5

MAWP : 260 Psig

Setelah MAWP didapat kemudian menentukan tekanan operasi. Tekanan operasi dengan asumsi yaitu 200 psig. 200 psig < 260 psig berarti shell aman menggunakan asumsi tekanan operasi sebesar 200 psig.

- Untuk mencari SA (Allowable stress) bisa menggunakan tabel ASME B31.3 seperti gambar 6.35 dengan data material (plate) dan suhu seperti gambar 6.40.

SA : 23.1 ksi : 23100 psi (ASME B31.3 hal 185)

TABLE A-1 (CONT'D)
BASIC ALLOWABLE STRESSES IN TENSION FOR METALS¹
 Numbers in Parentheses Refer to Notes for Appendix A Tables; Specifications Are ASTM Unless Otherwise Indicated

Material	Spec. No.	P.No. or S.No. (5)	Grade	Notes	Min. Temp., °F (6)	Specified Min. Strength, ksi		Min. Temp. to 100	200	300
						Tensile	Yield			
Carbon Steel (Cont'd) Pipes and Tubes (2) (Cont'd)										
...	A 139	S-1	C	(tbl)	A	60	42	20.0	20.0	20.0
...	A 139	S-1	D	(tbl)	A	60	46			
...	API 5L	S-1	X42	(55)(77)	A	60	42			
...	A 301	S-1	Y42	...	A	60	42	20.0	20.0	20.0
...	A 301	S-1	Y48	...	A	62	48	20.6	19.7	18.7
...	API 5L	S-1	X46	(55)(77)	A	63	46	21.0	21.0	21.0
...	A 301	S-1	Y46	...	A	63	46	21.0	21.0	21.0
...	A 301	S-1	Y50	...	A	64	50	21.3	20.3	19.3
A 516 Gr. 65	A 671	1	CC65	(57)(67)	B	65	35	21.7	21.3	20.7
A 515 Gr. 65	A 671	1	CB65	}	A	65	35	21.7	21.3	20.7
A 515 Gr. 65	A 672	1	B65							
A 516 Gr. 65	A 672	1	C65							
...	A 139	S-1	E	(tbl)	A	66	52	22.0	22.0	22.0
...	API 5L	S-1	X52	(55)(77)	A	66	52	22.0	22.0	22.0
...	A 301	S-1	Y52	...	A	66	52	22.0	22.0	22.0
A 516 Gr. 70	A 671	1	CC70	(57)(67)	B	70	38	23.3	23.1	22.5
A 515 Gr. 70	A 671	1	CB70	}	A	70	38	23.3	23.1	22.5
A 515 Gr. 70	A 672	1	B70							
A 516 Gr. 70	A 672	1	C70	(57)(67)	B	70	40	23.3	23.3	23.3
...	A 106	1	C	(57)						
A 537 Cl. 1 (≤ 2½ in. thick)	A 671	1	CD70	}	D	70	50	23.3	23.3	22.9
A 537 Cl. 1 (≤ 2½ in. thick)	A 672	1	D70							
A 537 Cl. 1 (≤ 2½ in. thick)	A 691	1	CMSH70							
...	API 5L	S-1	X56	(51)(55)(71)(77)	A	71	56	23.7	23.7	23.7
...	A 301	S-1	Y56	(51)(55)(71)	A	71	56	23.7	23.7	23.7
A 299 (≤ 1 in. thick)	A 671	1	CK75	}	A	75	40	25.0	24.4	23.7
A 299 (≤ 1 in. thick)	A 672	1	N75							
A 299 (≤ 1 in. thick)	A 691	1	CMS75							
A 299 (≤ 1 in. thick)	A 671	1	CK75	}	A	75	42	25.0	25.0	24.8
A 299 (≤ 1 in. thick)	A 672	1	N75							
A 299 (≤ 1 in. thick)	A 691	1	CMS75							

(continued)

Gambar 6.75 Tabel A1 ASME B31.3

- *Wall thickness*

Tebal dari dinding *shell* bisa dicari menggunakan rumus 2.1 :

$$t = \frac{P_{MAWP} \times R}{S \times E - 0,4 \times P_{MAWP}} + CA$$

$$t = \frac{260 \text{ Psig} \times 39,37}{23100 \times 1 - 0,4 \times 260 \text{ Psig}} + 0,125$$

$$t = 0,5701 \text{ inch}$$

dibulatkan ke atas : 0,625 inch

Diameter : 78,74 inch dibulatkan ke atas : 84 inch

Dari dua data di atas yaitu tebal dan diameter maka bisa didapat berat shell dari table *weight shell and head pressure vessel handbook* (megyesy) seperti gambar 6.36. Maka didapat berat dari shell yaitu :

WEIGHT OF SHELLS & HEADS										
DIAM. VESSEL	WALL THICKNESS									
	5/8"					11/16"				
	SHELL		HEAD			SHELL		HEAD		
	I.S.	O.S.	ELLIP	F.&D.	HEMIS	I.S.	O.S.	ELLIP	F.&D.	HEMIS
12	84	76	58	40	55	93	83	64	44	61
14	97	89	70	50	73	108	98	79	55	81
16	111	103	87	61	95	122	112	95	67	105
18	124	116	101	74	119	137	127	113	83	132
20	137	129	121	86	146	152	142	133	97	162
22	151	143	138	101	176	166	156	154	113	194
24	164	156	161	121	208	181	171	177	133	230
26	177	169	180	138	243	196	186	198	151	269
28	191	183	201	156	281	211	201	221	171	311
30	204	196	228	175	322	225	215	251	195	355
32	218	210	257	201	365	240	230	283	221	403
34	231	223	288	223	411	255	245	317	245	454
36	244	236	326	245	460	269	259	353	270	508
38	258	250	355	275	512	284	274	390	302	565
40	271	263	391	300	566	299	289	430	330	625
42	284	276	428	327	623	313	303	471	360	688
48	324	316	552	421	811	357	347	607	458	895
54	364	356	691	526	1024	401	391	760	579	1129
60	404	396	846	643	1261	445	435	931	707	1390
66	444	436	1017	772	1523	489	479	1118	849	1677
72	484	476	1203	912	1810	533	523	1323	1003	1994
78	524	516	1405	1065	2121	577	567	1545	1171	2337
84	564	556	1622	1229	2458	621	611	1784	1352	2707
90	604	596	1855	1405	2818	665	655	2041	1545	3104
96	644	636	2104	1592	3204	710	700	2315	1751	3529
102	685	677	2368	1791	3614	754	744	2605	1970	3980
108	725	717	2648	2003	4049	798	788	2913	2203	4459
114	765	757	2944	2225	4509	842	832	3239	2448	4965
120	805	797	3213	2460	4993	886	876	3535	2706	5498
126	848	837	3578	2706	5502	930	920	3910	2977	6058
132	885	877	3980	2965	6036	974	964	4317	3261	6646
138	925	917	4325	3234	6595	1018	1008	4703	3557	7261
144	965	957	4720	3516	7178	1062	1052	5185	3868	7902

Gambar 6.76 Tabel weight of shells and head

Dengan I.S : 564 lb/ft

O.S : 556 lb/ft

Untuk mencari *weight shell* digunakan berat O.S karena yang digunakan adalah diameter luar. *Weight shell* bisa dicari menggunakan rumus 2.2.

- Weight shell : Panjang × tebal
: 45,93 ft x 556 lb
: 25537,08 lb
: 25537,08 lb x 0,454 Kg
: 11593,83432 Kg

Shell : Menggunakan data *Equipment T-101*

Diketahui : Diameter head : 9000 mm = 354,330 in

Panjang head : 10000 mm = 393,70 in

Asumsi : CA : 0,125 in

Material : Carbon Steel

: A 515 Gr 70

Suhu : 200 °F

SA : 23100 psi

ρ_{baja} : 7850 Kg/m³

ρ_{air} : 0,0361 lb/in³

- Tebal dinding tangki dicari menggunakan rumus 2.3 :

$$t = \frac{2,6 \times D \times (H-1) \times \rho_{air}}{SA} + CA$$

$$t = \frac{2,6 \times 354,330 \times (393,70 - 1) \times 0,0361}{23100} + CA$$

$$t = 0,690 \text{ in}$$

dibulatkan ke atas berdasarkan ketersediaan di pasaran lihat nilai pasar pada gambar 6.37.

Ukuran Tebal Dinding Shell & Head Standar :

- 1/4 = 0,25	- 7/8 = 0,875	- 1-1/2 = 1,5
- 5/16 = 0,3125	- 15/16 = 0,9375	- 1-9/16 = 1,5625
- 3/8 = 0,375	- 1 = 1,0	- 1-5/8 = 1,625
- 7/16 = 0,4375	- 1-1/16 = 1,0625	- 1-11/16 = 0,6875
- 1/2 = 0,5	- 1-1/8 = 1,125	- 1-3/4 = 1,75
- 9/16 = 0,5625	- 1-3/16 = 1,1875	- 1-13/16 = 1,8125
- 5/8 = 0,625	- 1-1/4 = 1,25	- 1-7/8 = 1,875
- 11/16 = 0,6875	- 1-5/16 = 1,3125	- 1-15/16 = 1,9375
- 3/4 = 0,75	- 1-3/8 = 1,375	- 2 = 2,0
- 13/16 = 0,8125	- 1-7/16 = 1,4375	- 2-1/4 = 2,25

Gambar 6.77 Ukuran tebal dinding *shell and head standard*

$$t = 0,75 \text{ in}$$

$$t = 19,05 \text{ mm}$$

$$t = 0,01905 \text{ m}$$

- Luas permukaan tangki bisa dicari menggunakan rumus 2.4 :

$$A = 2 \times \pi \times r \times z$$

$$A = 2 \times \pi \times 4,5 \text{ m} \times 10 \text{ m}$$

$$A = 282,6 \text{ m}^2$$

- Berat *shell* dicari menggunakan rumus 2.5 :

$$W = \rho_{baja} \times (A \times t) \times g$$

$$W = 7850 \text{ Kg/m}^3 \times (282,6 \text{ m}^2 \times 0,01905) \times 9,81 \text{ m/s}^2$$

$$W = 414577,57 \text{ N}$$

$$W = 42260,7105 \text{ Kg}$$

b) Head :

Head : Menggunakan data *Equipment C-101*

Diketahui : *Quantity* : 2 buah

Diameter head : 2000 mm = 78,74 inch

= 84 inch

Panjang head : 500 mm = 1,64 ft

Asumsi : MAWP (sama dengan shell) : 260 psig

Bentuk : ellipsoidal

CA : 0,125 in

- Untuk mencari berat head maka digunakan table yang sama dengan *shell* yaitu table *weight shell and head pressure vessel handbook* (megyesy). Untuk mencari berat head digunakan data bentuk, tebal, dan panjang head seperti gambar 6.38 yang menggunakan rumus 2.6.

$$t = \frac{P_{MAWP} \times D}{2 \times S \times E - 1,8 \times P_{MAWP}} + CA$$

$$t = \frac{260 \text{ psig} \times 78,74}{2 \times 23100 \times 1 - 1,8 \times 260 \text{ psig}} + 0,125$$

$$t = 0,572 \text{ inch}$$

dibulatkan ke atas : 0,625 inch

Diameter : 78,74 inch dibulatkan ke atas : 84 inch

WEIGHT OF SHELLS & HEADS										
DIAM. VESSEL	WALL THICKNESS									
	5/8"					11/16"				
	SHELL		HEAD			SHELL		HEAD		
	I.S.	O.S.	ELLIP	F.&D.	HEMIS	I.S.	O.S.	ELLIP	F.&D.	HEMIS
12	84	76	58	40	55	93	83	64	44	61
14	97	89	70	50	73	108	98	79	55	81
16	111	103	87	61	95	122	112	95	67	105
18	124	116	101	74	119	137	127	113	83	132
20	137	129	121	86	146	152	142	133	97	162
22	151	143	138	101	176	166	156	154	113	194
24	164	156	161	121	208	181	171	177	133	230
26	177	169	180	138	243	196	186	198	151	269
28	191	183	201	156	281	211	201	221	171	311
30	204	196	228	175	322	225	215	251	195	355
32	218	210	257	201	365	240	230	283	221	403
34	231	223	288	223	411	255	245	317	245	454
36	244	236	326	243	460	269	259	353	270	508
38	258	250	355	275	512	284	274	390	302	565
40	271	263	391	300	566	299	289	430	330	625
42	284	276	428	327	623	313	303	471	360	688
48	324	316	552	421	811	357	347	607	458	895
54	364	356	691	526	1024	401	391	760	579	1129
60	404	396	846	643	1261	445	435	931	707	1390
66	444	436	1017	772	1523	489	479	1118	849	1677
72	484	476	1203	912	1810	533	523	1323	1003	1994
78	524	516	1405	1065	2121	577	567	1545	1171	2337
84	564	556	1622	1229	2458	621	611	1784	1352	2707
90	604	596	1855	1405	2818	665	655	2041	1545	3104
96	644	636	2104	1592	3204	710	700	2315	1751	3529
102	685	677	2368	1791	3614	754	744	2605	1970	3980
108	725	717	2648	2003	4049	798	788	2913	2203	4459
114	765	757	2944	2225	4509	842	832	3239	2448	4965
120	805	797	3213	2460	4993	886	876	3535	2706	5498
126	848	837	3578	2706	5502	930	920	3910	2977	6058
132	885	877	3980	2965	6036	974	964	4317	3261	6646
138	925	917	4325	3234	6595	1018	1008	4703	3557	7261
144	965	957	4720	3516	7178	1062	1052	5185	3868	7902

Gambar 6.78 Tabel *weight of shells and head*

Weight : 1622 lb

: 736,388 Kg

- Weight total : 736,388 Kg × 2
: 1509,096 Kg

Head : Menggunakan data *Equipment T-101*

Diketahui : *Quantity* : 1 buah

Diameter head : 9000 mm = 29,52 ft

Panjang head : 1500 mm = 1,5 m

Asumsi : Bentuk : Cone

CA : 0,125 in

Sudut : 30°

Material : Carbon Steel

: A 515 Gr 70

Suhu : 200 °F

ρ_{baja} : 7850 Kg/m³

- Tebal *head* untuk tangki dicari menggunakan rumus 2.7 :

$$t = \frac{D}{400 \sin \theta} + CA$$

$$t = \frac{29,52}{400 \sin 30} + 0,125$$

$$t = 0,272 \text{ in}$$

dibulatkan ke atas berdasarkan ketersediaan di pasaran lihat nilai pasar pada gambar 6.37.

$$t = 0,3125 \text{ in}$$

$$t = 7,9375 \text{ mm}$$

$$t = 0,0079375 \text{ m}$$

- $s = \frac{\text{tinggi}}{\cos 30}$

$$s = \frac{1,5 \text{ m}}{\cos 30}$$

$$s = 1,732 \text{ m}$$

- $A = \pi \times r (r + s)$

$$A = \pi \times 4,5 \text{ m} (4,5 \text{ m} + 1,732 \text{ m})$$

$$A = 88,10 \text{ m}^2$$

- Berat dicari menggunakan rumus 2.5 :

$$W = \rho_{baja} \times (A \times \text{tinggi}) \times g$$

$$W = 7850 \text{ Kg/m}^3 \times (88,10 \text{ m}^2 \times 0,0079375) \times 9,81 \text{ m/s}^2$$

$$W = 53851,56 \text{ N}$$

$$W = 53851,56 \text{ N} \times \frac{1}{9,8 \text{ Kg}}$$

$$W = 5486,9384 \text{ Kg}$$

c) Plate : Menggunakan data *Equipment C-101*

Diketahui : Tinggi : 300 mm = 11,81 in

Diameter : 2500 mm = 98.42 in

Jari-jari : 1250 mm = 1,25 m

Asumsi : Material : Baja

ρ_{baja} : 7850 Kg/m³

Fluida : Air

ρ_{air} : 1000 Kg/m³

ρ_{air} : 0,0361 lb/in³

- Tebal dicari menggunakan rumus 2.10 :

$$t = \left(\frac{\sqrt{H \times G}}{215} \times D \right) + CA$$

$$t = \left(\frac{\sqrt{11,81 \times 0,0361}}{215} \times 98,425 \right) + 0,125$$

$$t = 0,423 \text{ in}$$

$$t = 10,74 \text{ mm}$$

$$t = 0,0107 \text{ m}$$

- Luas dicari menggunakan rumus 2.4 :

$$A = 2 \times \pi \times r \times z$$

$$A = 2 \times \pi \times 1,25 \times 0,3$$

$$A = 2,355 \text{ m}^2$$

- Berat dicari menggunakan rumus 2.5 :

$$W = \rho_{baja} \times (A \times t) \times g$$

$$W = 7850 \frac{\text{Kg}}{\text{m}^3} \times (2,355 \text{ m}^2 \times 0,0107 \text{ m}) \times 9,81 \text{ m/s}^2$$

$$W = 1940,49 \text{ N}$$

$$W = 199,06064 \text{ Kg}$$

d) Pondasi : Menggunakan data *Equipment C-101*

Diketahui : Diameter : 78,74 inch

Panjang pondasi : 5000 mm = 16,40 ft

Asumsi : MAWP : 260 psig

Weight O.S Shell : 556 lb/ft

- *Weight total* dicari menggunakan rumus 2.19 :

$$\text{Weight total} = \text{Panjang} \times \text{Weight O.S Shell}$$

$$= 16,40 \text{ lb} \times 556 \text{ lb/ft}$$

$$= 9118,4 \text{ lb}$$

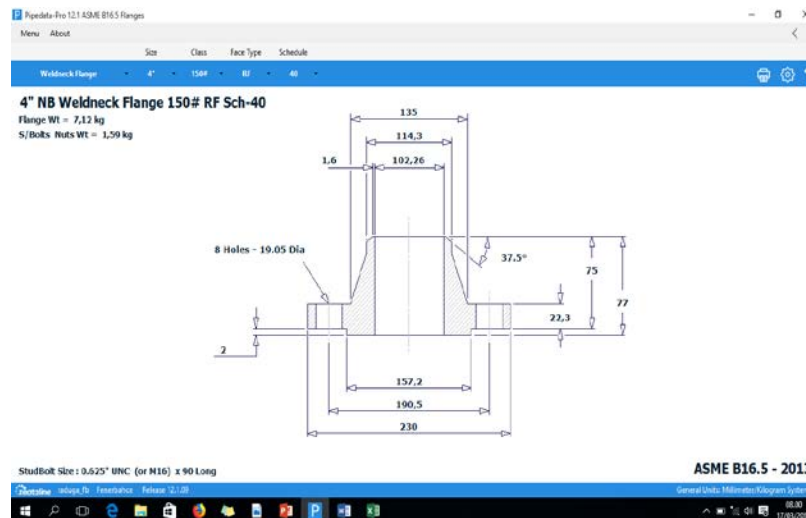
$$= 4139,75 \text{ Kg}$$

e) Nozzle : Menggunakan data *Equipment C-101*

Weight Nozzle dibagi menjadi 2 komponen yaitu flange dan pipa, beratnya bisa dicari menggunakan pipe data pro 12.1 seperti gambar 6.39 dan gambar 6.40.

Nozzle N1 :

- Flange

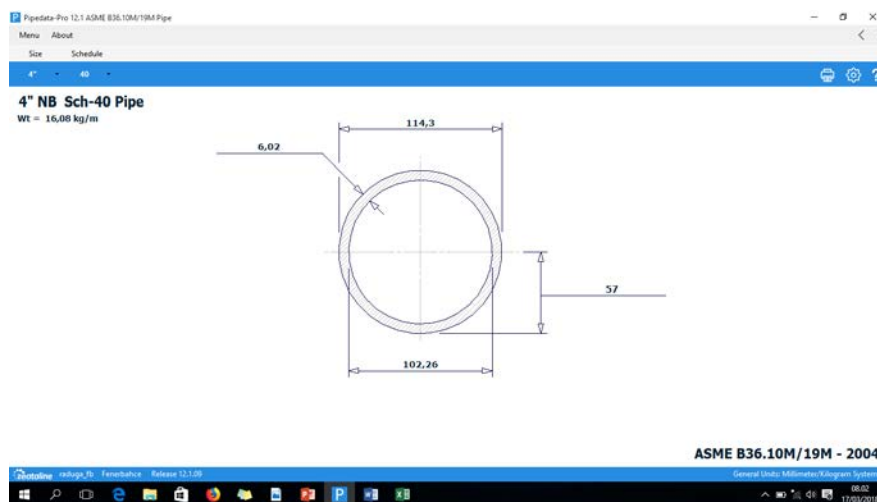


Gambar 6.79 *weight flange* menggunakan *pipe data pro 12.1*

Dari gambar 6.39 bisa dilihat data dari berat flange dan bolts nya yaitu totalnya adalah : 8,71 Kg

Panjang total dari flange adalah : 77 mm

- Pipa



Gambar 6.80 *weight pipa* menggunakan *pipe data pro 12.1*

Dari gambar 6.40 bisa dilihat data dari berat pipa dengan ukuran 4” dan schedule 40 yaitu : 16,08 Kg/m

- Panjang pipa keseluruhan bisa dicari menggunakan rumus 2.16 :

$$\begin{aligned}
 \text{Panjang dari pipa seluruhnya adalah} &= \text{Projection} - \text{panjang flange} \\
 &= 200 - 77 \\
 &= 123 \text{ mm} \\
 &= 0,123 \text{ m}
 \end{aligned}$$

- Berat pipa seluruhnya bisa dicari menggunakan rumus 2.17 :
 Berat pipa seluruhnya adalah $= \text{Panjang pipa} \times \text{berat pipa}$
 $= 0,123 \text{ m} \times 16,08 \text{ Kg/m}$
 $= 1,97 \text{ Kg}$

f) Tube Sheet

Diketahui	:	Diameter head	:	900 mm	= 0,9 m
		Tebal	:	100 mm	= 0,1 m
		Quantity	:	6 buah	
Asumsi	:	ρ_{baja}	:	7850 Kg/m ³	

- $A = \pi \times r \times r$
 $A = \pi \times 0,45 \text{ m} \times 0,45 \text{ m}$
 $A = 0,636 \text{ m}^2$
- Berat bisa dicari menggunakan rumus 2.5 :
 $W = \rho_{baja} \times (A \times t) \times g$
 $W = 7850 \text{ Kg/m}^3 \times (0,636 \text{ m}^2 \times 0,1) \times 9,81 \text{ m/s}^2$
 $W = 4897,74 \text{ N}$
 $W = 499,76 \text{ Kg}$
- Weight total = Quantity \times W
 $= 6 \times 499,76$
 $= 2998,56 \text{ Kg}$

g) Saddle : Menggunakan data *equipment* E-101

Diketahui : Diameter Vessel : 800 mm = 0,8 m

Quantity : 2 buah

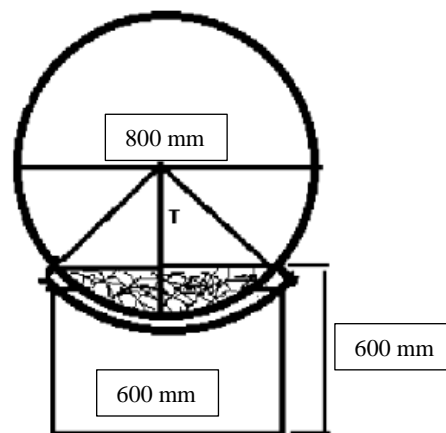
Panjang Saddle : 600 mm = 0,6 m

Jari-jari : 400 mm = 0,4 m

Tinggi : 600 mm = 0,6 m

Tebal : 0,3 m

Asumsi : ρ_{baja} : 7850 Kg/m³



Gambar 6.81 *Saddle*

- Luas 1/3 lingkaran bisa dicari menggunakan rumus 2.11 :

$$L = \frac{120}{360} \times \pi \times r^2$$

$$L = \frac{120}{360} \times \pi \times (0,4 \text{ m})^2$$

$$L = 0,167 \text{ m}^2$$

- Tinggi segitiga bisa dicari menggunakan rumus 2.12 :

$$T = \sqrt{jari - jari \text{ shell}^2 - \frac{1}{2} \text{panjang saddle}^2}$$

$$T = \sqrt{0,4^2 - 0,3^2}$$

$$T = 0,264 \text{ m}$$

- Luas segitiga bisa dicari menggunakan rumus 2.13 :

$$L\Delta = \frac{1}{2} \times \text{panjang saddle} \times \text{tinggi segitiga (T)}$$

$$L\Delta = \frac{1}{2} \times 0,6 \text{ m} \times 0,264 \text{ m}$$

$$L\Delta = 0,0792 \text{ m}^2$$

- Luas arsiran bisa dicari menggunakan rumus 2.14 :

$$L_{\text{arsiran}} = \text{Luas } 1/3 \text{ lingkaran} - \text{luas segitiga}$$

$$L_{\text{arsiran}} = 0,167 \text{ m}^2 - 0,0792 \text{ m}^2$$

$$L_{\text{arsiran}} = 0,0878 \text{ m}^2$$

- Luas permukaan saddle dan plat aus bisa dicari dengan rumus 2.15 :

$$A_{\text{saddle \& plat aus}} = L - L_{\text{arsiran}}$$

$$A_{\text{saddle \& plat aus}} = (\text{panjang saddle} \times \text{tinggi saddle}) - L_{\text{arsiran}}$$

$$A_{\text{saddle \& plat aus}} = (0,6 \text{ m} \times 0,6 \text{ m}) - 0,0878 \text{ m}^2$$

$$A_{\text{saddle \& plat aus}} = 0,2722 \text{ m}^2$$

- Berat saddle bisa dicari menggunakan rumus 2.5 :

$$W = 2 \times \rho \times (A \times t) \times g$$

$$W = 2 \times 7850 \text{ Kg/m}^3 \times (0,2722 \text{ m}^2 \times 0,3 \text{ m}) \times 9,81 \text{ m/s}^2$$

$$W = 12577,028 \text{ N}$$


$$W = 1282,061 \text{ Kg}$$

6.5.2. Hasil Perhitungan *Pipe Rack*

Hasil perhitungan untuk *pipe rack* dihitung berdasarkan berat dari material yang digunakan. Dalam material *pipe rack* yang digunakan yaitu *AISC* untuk *shape*

standard, HP untuk shape type, HP 14x117 untuk shape size, ASTM untuk Material standard pilihlah CONCRETE untuk Material code.

Berdasarkan spesifikasi *pipe rack* di atas di dapat berat untuk *member* yaitu 17,33 Kg/m seperti Gambar 6.. Sehingga bisa dihitung berat *structure pipe rack* yaitu :

Structural	
Long Descriptio...	Member HP14x117 x 5...
Material Code	CONCRETE
Material Standa...	ASTM
Class	Structure Member
Status	New
Weight	102.213207
Weight Unit	KG
Size	HP14x117
Comment	
Column ID	
Linear Weight	17.33
Linear Weight...	KG/M
Type	

Gambar 6.82 Spesifikasi member

Diketahui = *Material Code* = *Concrete*
 = *Standard* = *ASTM*
 = *Size* = *HP 14x117*
 = *Linear weight* = *17,33 Kg/m*
 = *Length total* = *692,6 m (gambar pipe rack)*

- $Weight\ member = Linear\ Weight \times Length\ total$
 $= 17,33\ Kg/m \times 692,6\ m$
 $= 12002,758\ Kg$

6.5.3. Total Berat *Equipment* dan komponen

Tabel 6.12 Berat total keseluruhan

No	Nama Equipment	Berat tiap Bagian Equipment (Kg)							Total berat (Kg)
		Shell	Head	Saddle	Nozzle	Tube sheet	Skirt	Plate	
1	C - 101	11593,83432	1509,096		464,0128		4139,7536	199,06064	17905,757
2	C - 103	26180,44572	3817,232		270,17115		7604,8632	357,28942	38230,001
3	E - 101	769,50276	58,566	1280,67666	55,2894	2997,90947			5161,9443
4	T - 101	42260,7105	5486,9384		569,76294			2480,6251	50798,037
5	T - 102	42260,7105	5486,9384		577,18294			2480,6251	50805,457
6	V - 101	1882,56094	300,548	2175,44453	31,70454				4390,258
7	V - 102	11593,83432	1509,096		464,0128		4099,36576	199,06064	17865,37
8	Komponen BOM								19343,649
9	Pipe rack								12002,758
Total									216503,23