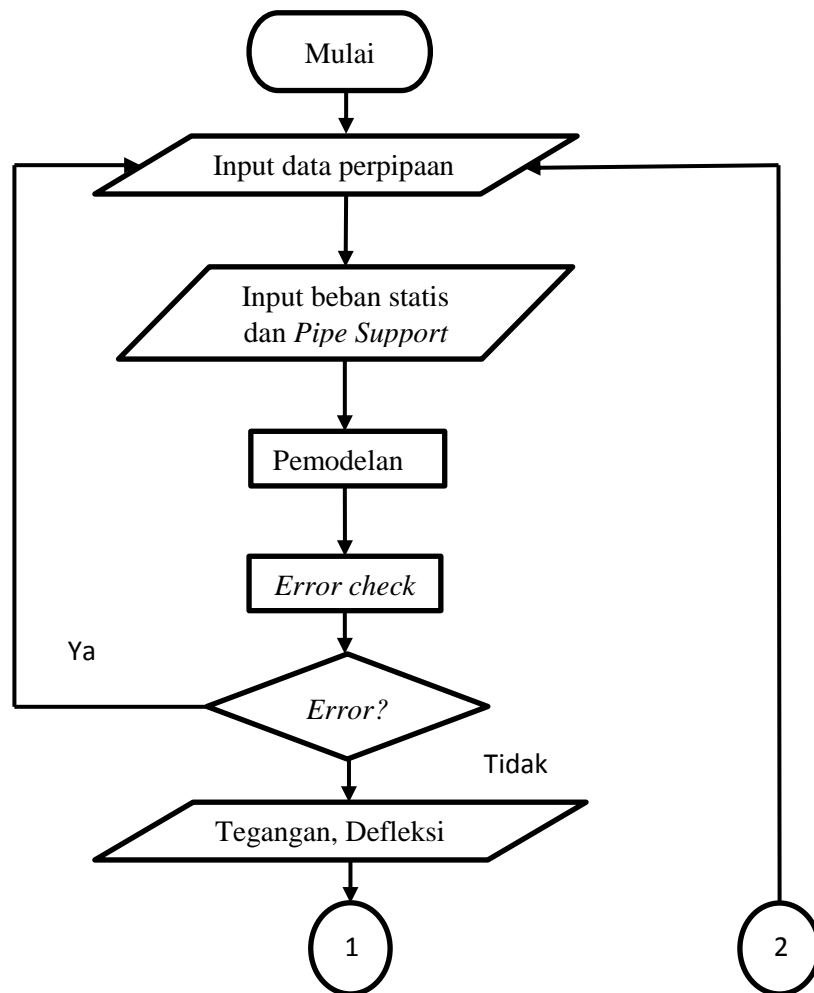


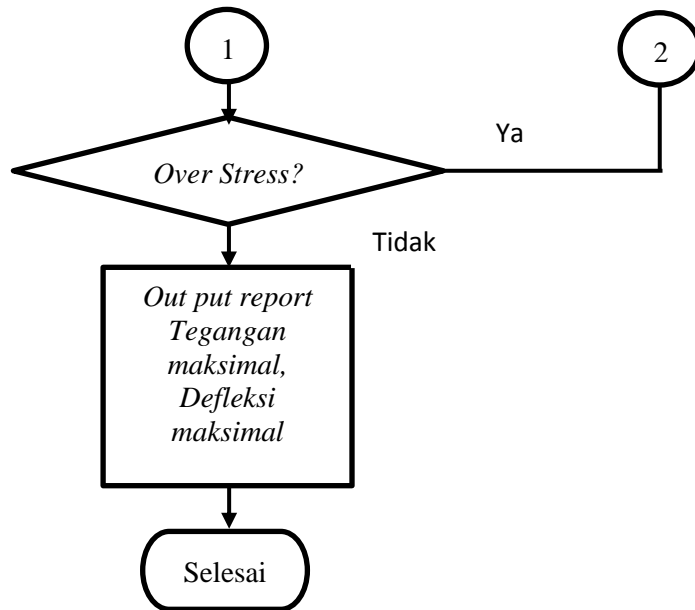
## BAB IV METODOLOGI

### 4.1. Diagram Alir Pemodelan dan Tegangan

Langkah-langkah proses pemodelan sampai pemeriksaan tegangan pada jalur pipa 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV* Cilacap secara umum dapat dilihat pada diagram alir sebagaimana ditunjukkan pada Gambar 4.1



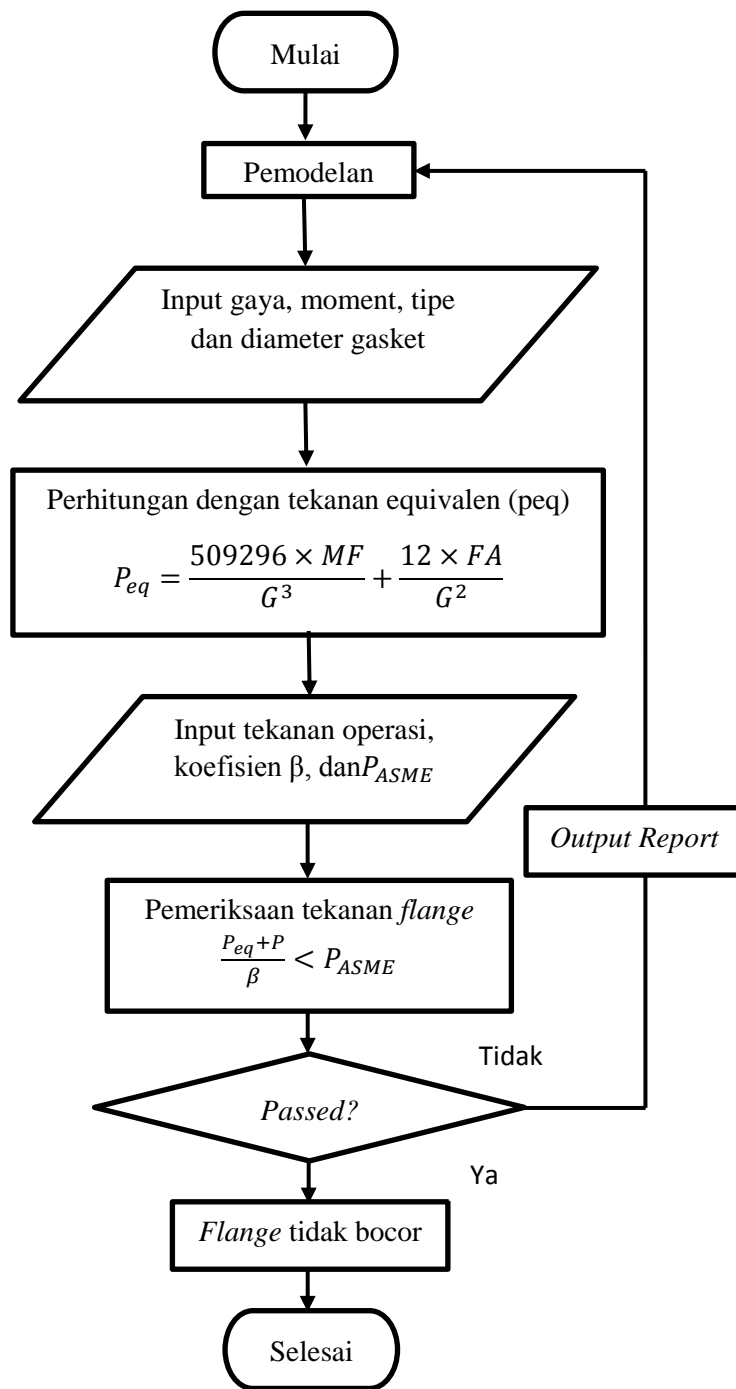
**Gambar 4.1** Diagram Alir Tegangan dan Defleksi



**Gambar 4.1** Diagram Alir Tegangan dan Defleksi (lanjutan)

#### **4.2. Diagram Alir Pemeriksaan Kebocoran *Flange***

Langkah-langkah proses pemodelan hingga pemeriksaan kebocoran *flange* pada jalur pipa 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV* Cilacap secara umum dapat dilihat pada diagram alir yang ditunjukkan pada Gambar 4.2



**Gambar 4.2** Diagram Alir Pemeriksaan Kebocoran *Flange*

### **4.3. Penggunaan Software dan Alat Bantu Lainnya**

Pendesainan jalur pipa 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV* Cilacap menggunakan *software* dan alat bantu sebagai berikut:

1. Caesar II 2013 (*software* utama untuk pemodelan)
2. *PipeData-PRO* 12.1 (sebagai *software* bantuan, untuk melihat komponen perpipaan menurut *rating standard* dan *code*)
3. *Uconer* (sebagai alat bantu konversi satuan)

### **4.4. Standard dan code yang Digunakan**

*Standard* yang digunakan untuk menganalisa tegangan pada jalur pipa 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV* Cilacap adalah:

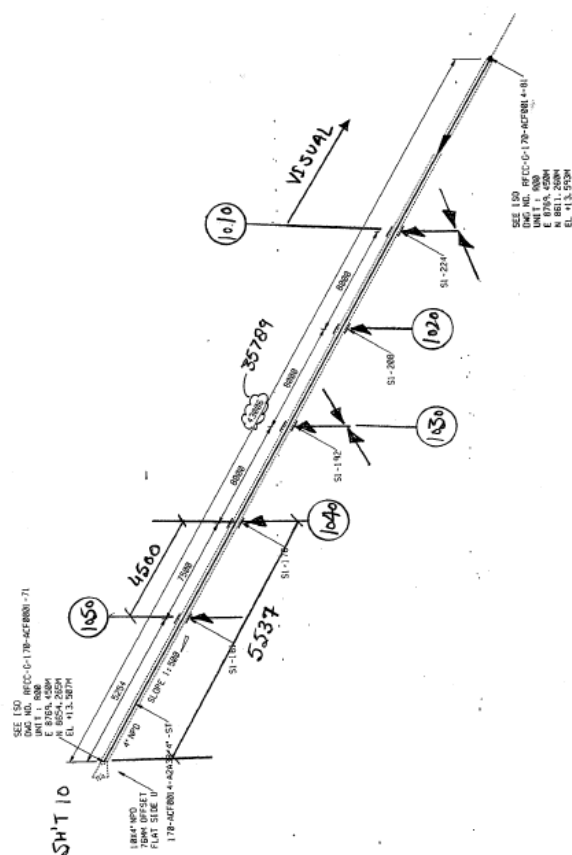
1. ASME B31.3-2014 *Process Piping*
2. ASME B16.5-2013 *Pipe Flange dan Flange Fittings*

### **4.5. Data Pemodelan**

Sebelum melakukan analisa tegangan pipa, sistem perpipaan harus dimodelkan dulu. Data yang dibutuhkan untuk memodelkan jalur pipa 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV* Cilacap sebagai berikut:

1. Gambar Isometri

Gambar isometri adalah gambar konstruksi dari sebuah sistem perpipaan suatu seluruh *plan* perusahaan atau sebagaian dari sistem perpipaan yang dimiliki suatu *plan* perusahaan tersebut. Gambar isometri juga memuat informasi dari jalur rancangan sistem perpipaan.



SEE LSO  
 DRAWING NO. 170-ACF0014-AZAJR-18-01-01  
 UNIT 1000  
 E 878A 450M  
 EL. 113.520M

NOTE

(a) "L": LIQUID; "V": GAS OR VAPOR; "L": LIQUID  
 (b) SPECIFIED SG, SH, EG AND EN, WHEN UNLISTED MATERIAL IS USED.

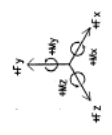
OPERATION AND DESIGN			SERVICE FLUID(S)			REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY		
OPERATING	0.30	37.				
DESIGN	3.50	250				
STEAM OUT						
UPSET						
<b>HYDRO 6-67</b>						
UNITS : PRESS. kg/cm <sup>2</sup> G. L. TEMP. °C DEG.C. D. DENSITY ( kg/m <sup>3</sup> )						
NPS / PIPE O.D. (in.)	4"					
WALL THK. (mm)	6.9188					
FLANGE RATING (lb)	150#					
CORR. ALLOW. (mm)	3					
BASE TEMP. (DEG.C)	18°C					
MATERIAL	AL6067B					
THERMAL EXPAN. (mm/m)						
INSUL. DENSITY (kg/ft <sup>3</sup> )						
INSUL. TYPE/THK. (mm)						
SH 10 <sup>3</sup> (kg/mm <sup>2</sup> )						
SC 10 <sup>3</sup> (kg/mm <sup>2</sup> )						
EN X 10 <sup>3</sup> (kg/mm <sup>2</sup> )						
EG X 10 <sup>3</sup> (kg/mm <sup>2</sup> )						
REV.	DATE	DESCRIPTION	PRE'D	CHK'D		

**PERTAMINA PT. PERTAMINA (Persero)**  
**PT. ADHI KARYA (Persero) Tbk**  
**GS EAC GS Engineering & Construction**  
 PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING  
 (RFCC) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA  
**PIPING STRESS ANALYSIS**  
 LINE NO. 170-ACF0014-AZAJR-18-01-ST  
 PAID NO.  
 DWG NO. RFCC-G-170-ACF0014-B5  
 PROJECT NO. 101830  
 ANALYSIS NO. 170-015  
 REV. 1/1

SYMBOL & LEGEND	
	TWO-DIRECTIONAL RESTRAINTS
	ONE-DIRECTIONAL RESTRAINTS
	RESTRAINTS W/GAP
	RESTRAINTS W/GAP SPRING SUPPORT
	ANCHOR
	HOLD DOWN
	EXPANSION JOINT
	SNUBBER

Gambar 4.3 Gambar isometric 11

NOTE

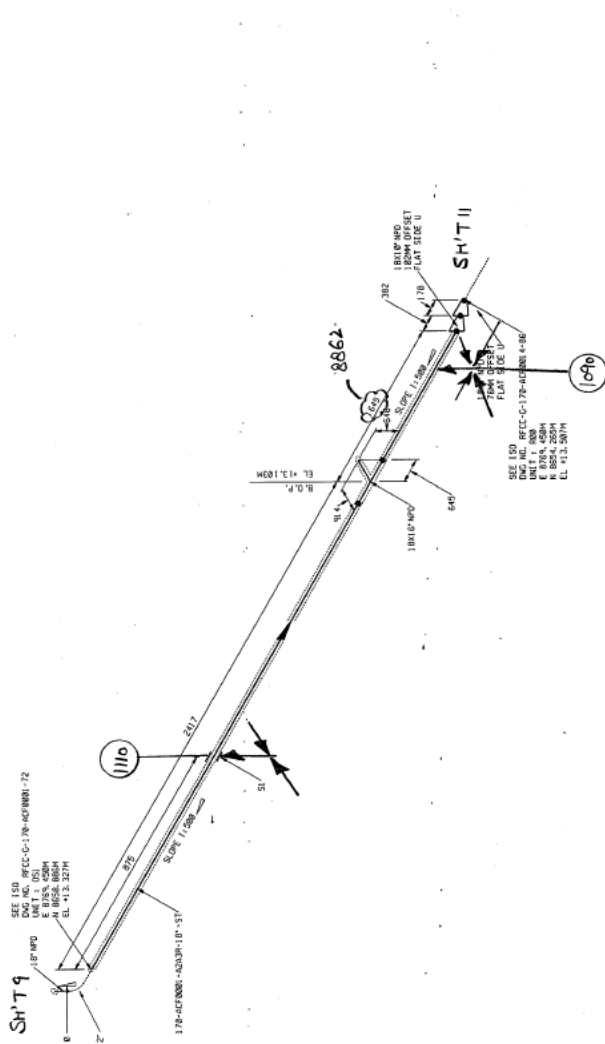


(c) "LV" : LIQUID-VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (d) SPECIFIED SG, SH, EG AND EN, WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN			SERVICE FLUID(G)		REMARK
MEDIA	PRESS.	TEMP.	PHASE	DENSITY	
OPERATING	0.30	37			
DESIGN	3.50	250			
STEAM IN/OUT					
UPSET					
<b>HYDRO G-07</b>					
UNITS : PRESS.4 kg/cm <sup>2</sup> g.j.; TEMP.1 DEG.C ; DENSITY 1 kg/m <sup>3</sup>					
NPS PIPE O.D. (mm)					
WALL THK. (mm)					
FLANGE RATING (LB)					
CORR. ALLOW. (mm)					
BASE TEMP. (DEG.C)					
MATERIAL					
THEMAL EXPAN. (mm/m)					
INSUL. DENSITY (kg/m <sup>3</sup> )					
INSUL. TYPE/THK. (mm)					
SH. wt (kg/m)					
SG wt (kg/m <sup>3</sup> )					
EN X 10 <sup>10</sup> (kg/m <sup>2</sup> )					
EG X 10 <sup>10</sup> (kg/m <sup>2</sup> )					
REV.	DATE	DESCRIPTION	PRE'D	CHK'D	

THE SAME AS PREVIOUS SHEET

**PERTAMINA PT. PERTAMINA (Persero)**  
**PT. ADHI KARYA (Persero) Tbk**  
**GS Engineering & Construction**  
**GSEAC**  
 PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING  
 (RCC) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA  
**PIPING STRESS ANALYSIS**  
 LINE NO. 170-ACF0001-A2A3R-18"-ST  
 170-PP-101  
 DWG NO. RFGC-G-170-ACF0001-71  
 PROJECT NO. 101830  
 ANALYSIS NO. 170-00/S  
 REV. 10/11  
 FILE NAME.



SYMBOL & LEGEND		ANCHOR	HOLD DOWN	EXPANSION JOINT	SNUBBER
	TWO-DIRECTIONAL RESTRAINTS		RESTRAINTS W/GAP		SPRING SUPPORT
	ONE-DIRECTIONAL RESTRAINTS		RESTRAINTS		ANCHOR

Gambar 4.4 Gambar isometric 10

NOTE

(G) "LV" : LIQUID-VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (D) SPECIFIED SO, SH, EG AND EN WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN

MODES	ANALYSIS CASE		SERVICE FLUID(G)		REMARK
	OPERATING	DESIGN	PHASE	DENSITY	
OPERATING	0.30	37			
DESIGN	3.50	250			
STEAM DOT					
UPSET					

HYDRO C-07

UNITS : PRESS. : kg/cm<sup>2</sup> g ; T. TEMP. : DEG.C ; D. DENSITY : kg/m<sup>3</sup>

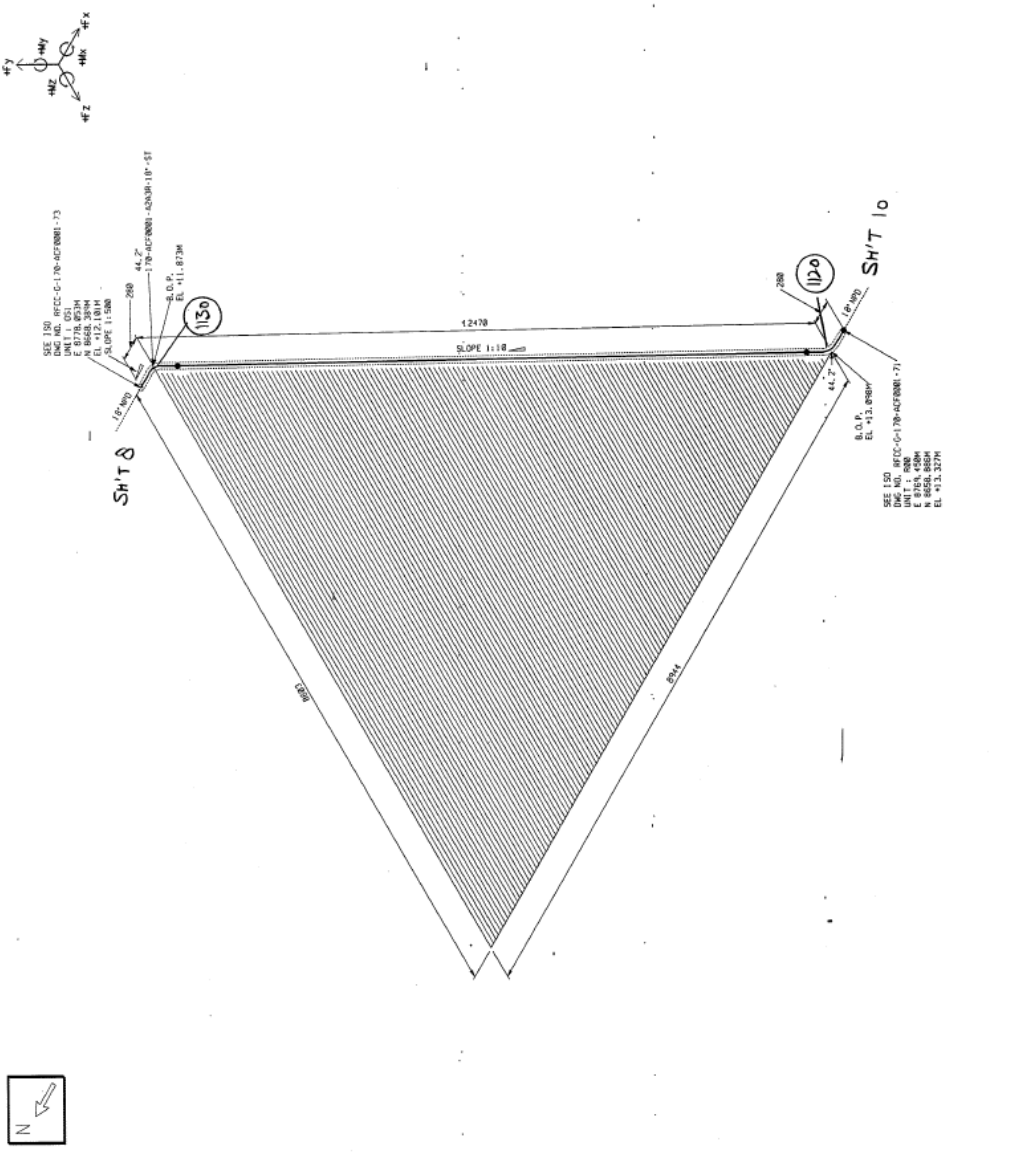
WPS / PIPE O.D. (mm)	
WALL THK. (mm)	
FLANGE RATING (lb)	
CORR. ALLOW. (mm)	
BASE TEMP. (DEG.C)	
MATERIAL	
THEORETICAL EXPAN. (mm/hr)	
INSUL. DENSITY (kg/m <sup>3</sup> )	
INSUL. TYPE/THK. (mm)	
Sh (kg/mm <sup>2</sup> )	
Sc (kg/mm <sup>2</sup> )	
En x 10 <sup>3</sup> (kg/mm <sup>2</sup> )	
Ec x 10 <sup>3</sup> (kg/mm <sup>2</sup> )	

THE SAME AS PREVIOUS SHEET

REV.	DATE	DESCRIPTION	PRE'D	CHK'D

**PERTAMINA PT. PERTAMINA (Persero)**  
**PT. ADHI KARYA (Persero) Tbk**  
**GS Engineering & Construction**  
**GS E&C**  
 PROJECT TITLE : CILICAP RESID FLUID CATALYTIC CRACKING  
 THPCCT PROJECT  
 CILICAP, CENTRAL JAVA, INDONESIA

**PIPING STRESS ANALYSIS**  
 LINE NO. 170-ACF0001-AZADR-18"-ST  
 PAID NO. 170-PI-161  
 DMC NO. RECC-C-170-ACF0001-72  
 PROJECT NO. 101830  
 ANALYSIS NO. 170-00/5  
 FILE NAME. 9/11



Gambar 4.5 Gambar isometric 9

NOTE



(a) "LV" = LIQUID-VAPOR "G" = GAS OR VAPOR "L" = LIQUID  
 (b) SPECIFIED SG, SH, EG AND EN, WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN

ANALYSIS CASE		SERVICE FLUID(G)		REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY
OPERATING	0.30	37		
DESIGN	3.50	250		
STEAM OUT				
UPSET				

HYDRO 6-07

UNITS : PRESS. kg/cm<sup>2</sup> G. J. TEMP. °C. DENS. kg/m<sup>3</sup>

WALL THK. (mm)	FLANGE RATING (lb)	CDR. ALLOW. (mm)	BASE TEMP. (DEG.C)	MATERIAL	THERMAL EXPAN. (mm/m)	INSUL. DENSITY (kg/m <sup>3</sup> )	INSUL. TYPE/THK. (mm)	SH (lb)	Sc (lb)	EN X 10 <sup>4</sup> (lb)	Ec X 10 <sup>4</sup> (lb)

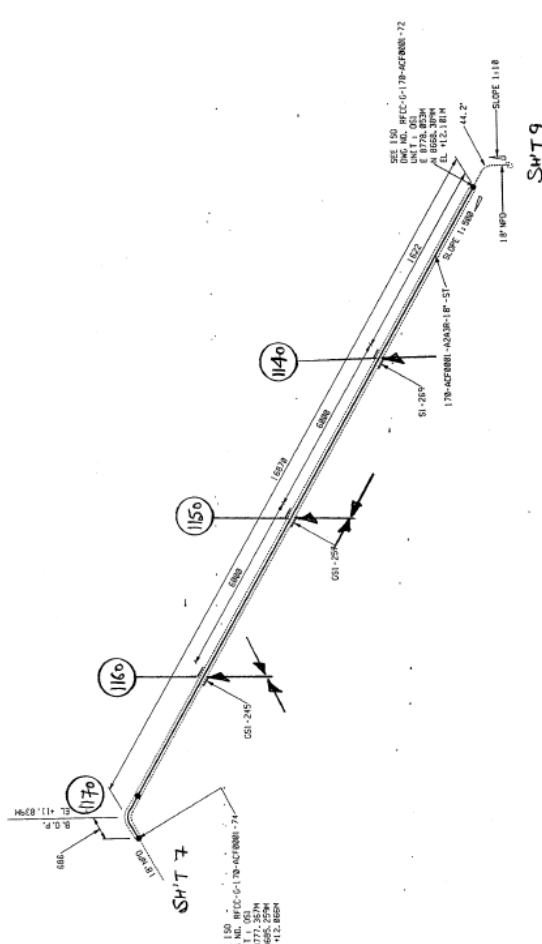
THE SAME AS PREVIOUS SHEET

PERTAMINA PT. PERTAMINA (Persero)  
 PT. ADHI KARYA (Persero) Tbk  
 GS Engineering & Construction  
 PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING (FREC) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA

PIPING STRESS ANALYSIS

LINE NO.	170-ACF0001-A2A3R-18"-ST	PAID NO.	170-PI-161
ONG NO.	RFCC-G-170-ACF0001-73	PROJECT NO.	101830
ANALYSIS NO.	170-0015	REV.	8/11

FILE NAME :



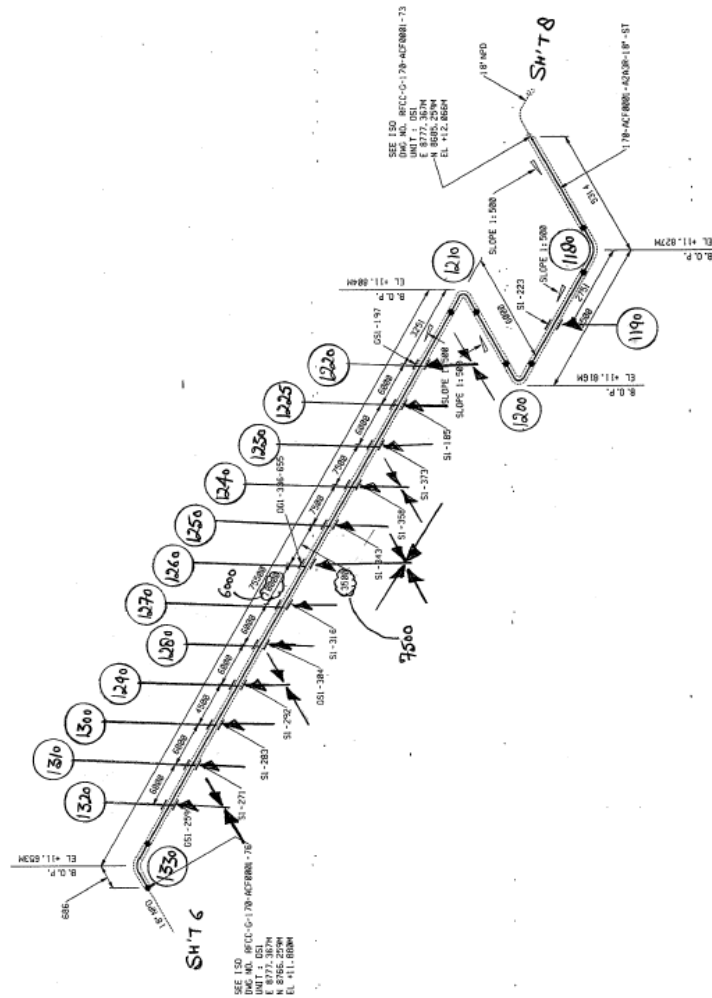
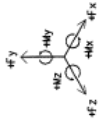
SYMBOL & LEGEND

SYMBOL	RESTRAINTS	RESTRAINTS	RESTRAINTS W/GAP	ANCHOR	HOLD DOWN	EXPANSION JOINT	SNUBBER

Gambar 4.6 Gambar isometric 8



NOTE



(a) "LV" : LIQUID-VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (b) SPECIFIED Sp, Sh, Eo and Em WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN

MODES	ANALYSIS CASE		SERVICE FLUID(C)		REMARK
	PRESS.	TEMP.	PHASE	DENSITY	
OPERATING	0.30	37.			
DESIGN	3.50	250			
STEAM OUT					
UPSET					

HYDRO 6-07

UNITS : PRESS. kg/cm<sup>2</sup> g, TEMP. DEG. C, DENSITY kg/m<sup>3</sup>

WPS/PIPE D.D. (JIS)	
WALL THK. (mm)	
FLANGE RATING (LB)	
CORR. ALLOW. (mm)	
BASE TEMP. (DEG-C)	
MATERIAL	THE SAME AS PREVIOUS SHEET
THERMAL EXPAN. (mm/m)	
INSUL. DENSITY (kg/m <sup>3</sup> )	
INSUL. TYPE/THK. (mm)	S.O.C.
Sh (a)	(kg/mm <sup>2</sup> )
Sc (a)	(kg/mm <sup>2</sup> )
Eh x 10 <sup>3</sup> (a)	(kg/mm <sup>2</sup> )
Ec x 10 <sup>3</sup> (a)	(kg/mm <sup>2</sup> )

REV.	DATE	DESCRIPTION	PRE'D	CHK'D

PERTAMINA PT. PERTAMINA (Persero)

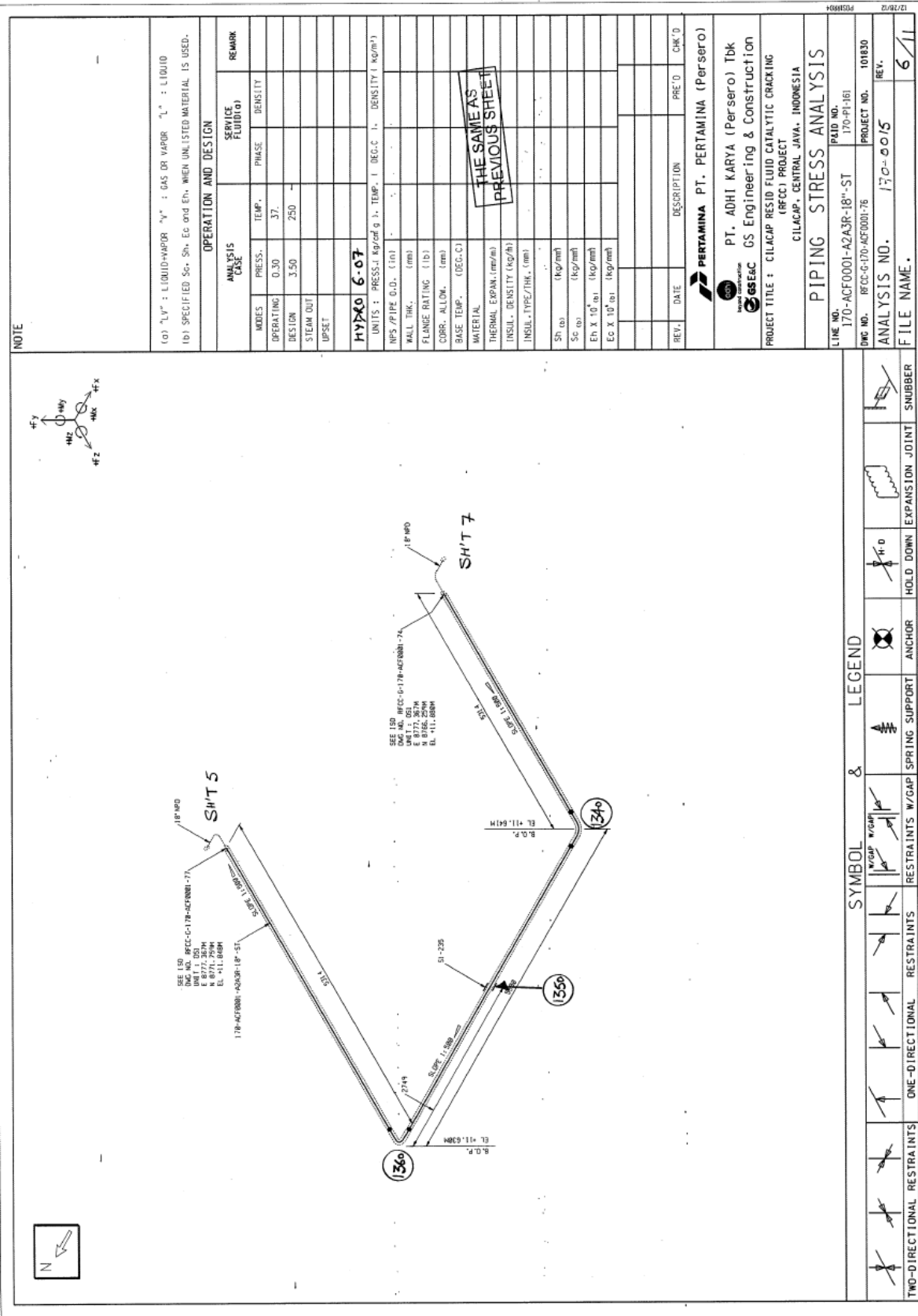
PT. ADHI KARYA (Persero) Tbk  
 GS Engineering & Construction  
 PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING  
 (RFCC) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA

PIPING STRESS ANALYSIS

LINE NO.	170-ACF0001-AZASR-18"-ST	FEED NO.	170-PI-181
DMG NO.	RFCC-G-170-ACF0001-74	PROJECT NO.	101830
ANALYSIS NO.	170-005	REV.	7/1
FILE NAME.			

SYMBOL & LEGEND	
	TWO-DIRECTIONAL RESTRAINTS
	ONE-DIRECTIONAL RESTRAINTS
	RESTRAINTS W/GAP
	SPRING SUPPORT
	ANCHOR
	HOLD DOWN
	EXPANSION JOINT
	SNUBBER

Gambar 4.7 Gambar isometric 7



**NOTE**

(1) "LV" : LIQUID-VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (2) SPECIFIED Se, Sn, Ec and Em, WHEN UNLISTED MATERIAL IS USED.

**OPERATION AND DESIGN**

ANALYSIS CASE		SERVICE FLUID (2)		REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY
OPERATING	0.30	37.		
DESIGN	3.50	250		
STEAM OUT				
UPSET				

**HYDRO 6-07**

UNITS : PRESS. (kg/cm<sup>2</sup> g.), TEMP. ( DEG.C ), DENSITY ( kg/m<sup>3</sup> )

NPS / PIPE O.D. (in) :  
 WALL THK. (mm) :  
 FLANGE RATING (lb) :  
 CORR. ALLOW. (mm) :  
 BASE TEMP. (DEG.C) :  
 MATERIAL :  
 THERMAL EXPAN. (mm/m) :  
 INSUL. DENSITY (kg/m<sup>3</sup>) :  
 INSUL. TYPE/THK. (mm) :  
 S<sub>1</sub> (psi) (kg/mm<sup>2</sup>) :  
 S<sub>2</sub> (psi) (kg/mm<sup>2</sup>) :  
 E<sub>H</sub> X 10<sup>6</sup> (psi) (kg/mm<sup>2</sup>) :  
 E<sub>C</sub> X 10<sup>6</sup> (psi) (kg/mm<sup>2</sup>) :

**THE SAME AS PREVIOUS SHEET**

REV.	DATE	DESCRIPTION	PRE'D	CHK'D

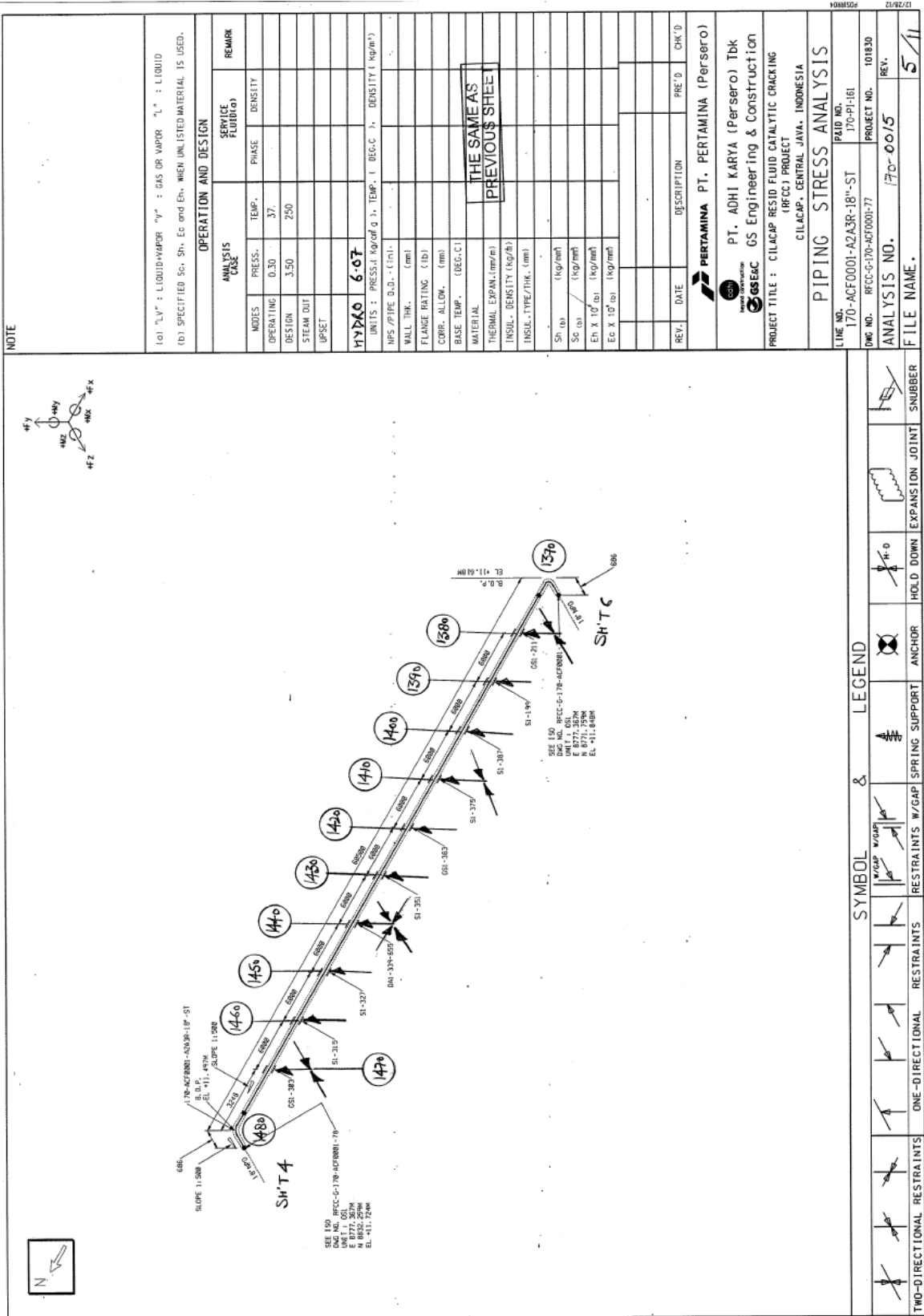
**PERTAMINA PT. PERTAMINA (Persero)**

**PT. ADHI KARYA (Persero) Tbk**  
**GS Engineering & Construction**  
 PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING (RFCC) PROJECT  
 CILACAP - CENTRAL JAVA - INDONESIA

**PIPING STRESS ANALYSIS**

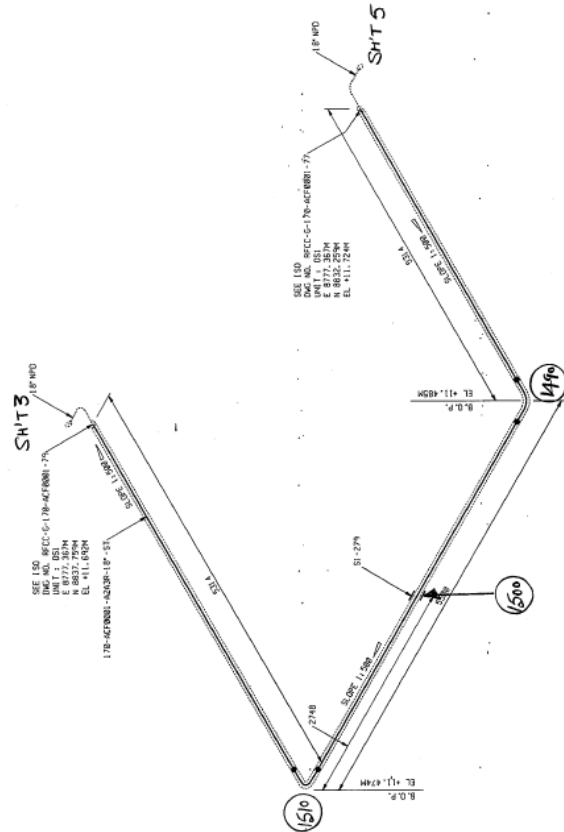
LINE NO. 170-ACF0001-A2A3R-18"-ST PAID NO. 170-PI-161  
 DWG NO. RFCC-G-170-ACF0001-76 PROJECT NO. 101830  
 ANALYSIS NO. 170-0015 REV.  
 FILE NAME. 6/11

Gambar 4.8 Gambar isometric 6



Gambar 4.9 Gambar isometri5

NOTE



(a) "LV" : LIQUID/VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (b) SPECIFIED SO, SH, EC AND EN, WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN

ANALYSIS CASE		SERVICE FLUID (g)		REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY
OPERATING	0.30	37		
DESIGN	3.50	250		
STEAM OUT				
UPSET				

UNITS : PRESS. : kg/cm<sup>2</sup> g ; TEMP. : DEG.C ; DENSITY : kg/m<sup>3</sup>

HYDRO 6.07

NPS / PIPE O.D. (in)	
WALL THK. (mm)	
FLANGE RATING (LB)	
CORR. ALLOW. (mm)	
BASE TEMP. (DEG.C)	
MATERIAL	
THERMAL EXPAN. (mm/m)	
INSUL. DENSITY (kg/m <sup>3</sup> )	
INSUL. TYPE/THK. (mm)	
Sh (b) (kg/mm <sup>2</sup> )	
Sc (b) (kg/mm)	
Ed x 10 <sup>-6</sup> (b) (kg/mm)	
Ec x 10 <sup>-6</sup> (b) (kg/mm)	

THE SAME AS PREVIOUS SHEET

REV. DATE DESCRIPTION PRE'D CHK'D

**PERTAMINA PT. PERTAMINA (Persero)**

**PT. ADHI KARYA (Persero) Tbk**  
**GS Engineering & Construction**  
 (BFCC) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA

PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING (BFCC) PROJECT

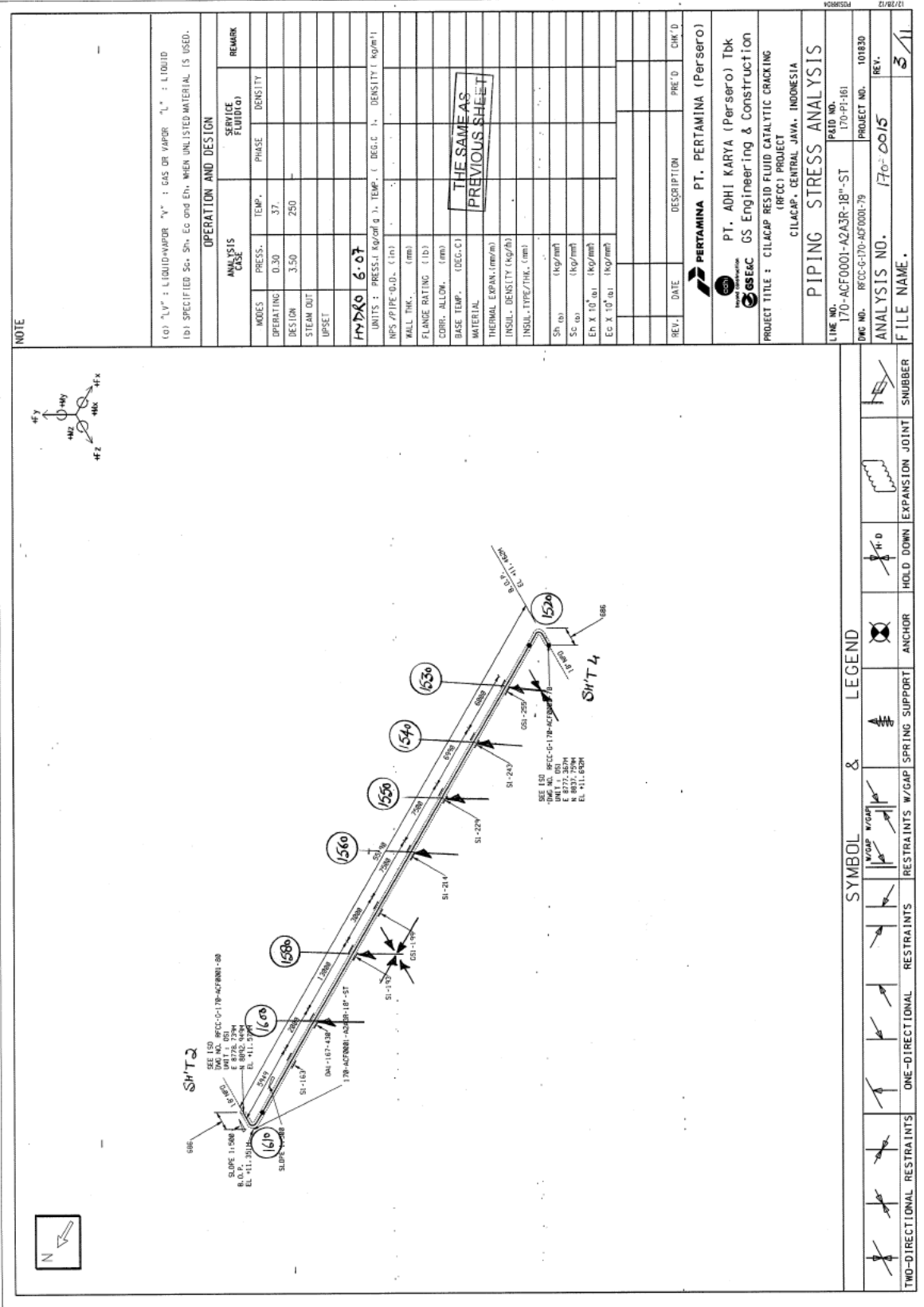
PIPING STRESS ANALYSIS

LINE NO.	170-ACF0001-A2A3R-18"-ST	PAID NO.	170-P1-61
DOC NO.	BFCC-G-170-ACF0001-78	PROJECT NO.	101830
ANALYSIS NO.	170-0015	REV.	4/1
FILE NAME.			

SYMBOL & LEGEND

	TWO-DIRECTIONAL RESTRAINTS		ONE-DIRECTIONAL RESTRAINTS		RESTRAINTS W/GAP		SPRING SUPPORT		ANCHOR		HOLD DOWN		EXPANSION JOINT		SNUBBER
--	----------------------------	--	----------------------------	--	------------------	--	----------------	--	--------	--	-----------	--	-----------------	--	---------

Gambar 4.10 Gambar isometric 4



NOTE

(G) "LV" : LIQUID/VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (B) SPECIFIED Sp, Sh, Ec and Eh, WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN		SERVICE FLUID(S)		REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY
OPERATING	0.30	37		
DESIGN	3.50	250		
STEAM OUT				
UPSET				
<b>HYDRO 6.07</b>				
UNITS : PRESS. I Kg/cm <sup>2</sup> G, TEMP. I DEG.C I, DENSITY I kg/m <sup>3</sup>				
WPS. PIPE O.D.	(in)			
WALL THK.	(mm)			
FLANGE RATING	(lb)			
CORR. ALLOW.	(mm)			
BASE TEMP.	(DEG.C)			
<b>THE SAME AS PREVIOUS SHEET</b>				
MATERIAL				
THERMAL EXPAN. (mm/m)				
INSUL. DENSITY (kg/m <sup>3</sup> )				
INSUL. TYPE/THK. (mm)				
Sh (a)	(kg/mm <sup>2</sup> )			
Sc (a)	(kg/mm <sup>2</sup> )			
Eh x 10 <sup>-6</sup> (a)	(kg/mm <sup>2</sup> )			
Ec x 10 <sup>-6</sup> (a)	(kg/mm <sup>2</sup> )			
REV.	DATE	DESCRIPTION	PRE'D	CHK'D

**PERTAMINA PT. PERTAMINA (Persero)**

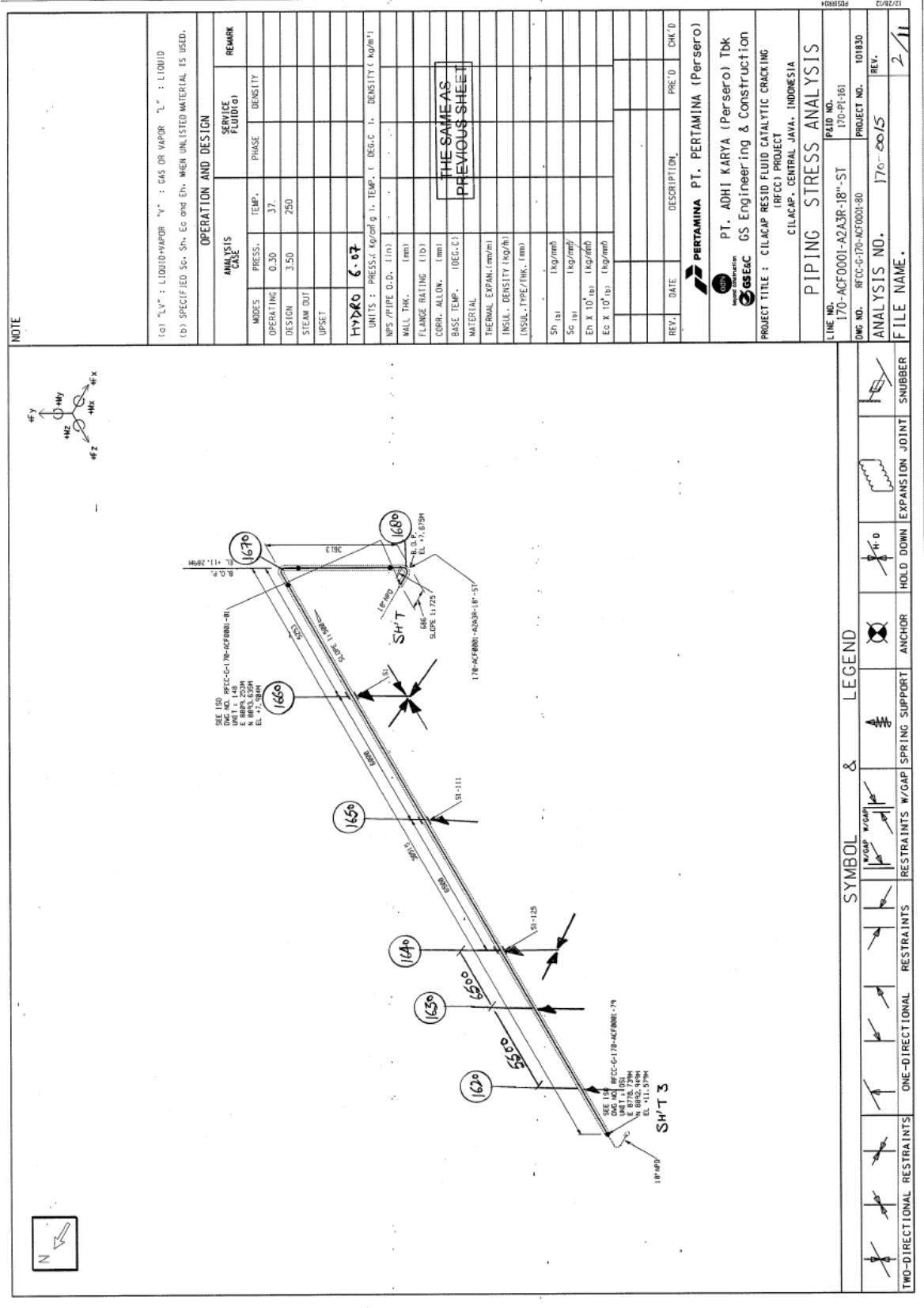
**PT. ADHI KARYA (Persero) Tbk**  
**GS Engineering & Construction**

**PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING (RFCC) PROJECT**  
 CILACAP, CENTRAL JAVA, INDONESIA

**PIPING STRESS ANALYSIS**

LINE NO. 170-ACF0001-A2A3R-18"-ST PAID NO. 170-PI-161  
 DMC NO. RFCC-G-170-ACF0001-79 PROJECT NO. 101830  
 ANALYSIS NO. 170-0015 REV. 3/1  
 FILE NAME.

Gambar 4.11 Gambar isometric 3



NOTE

(G) "LV" : LIQUID+VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (D) SPECIFIED SG, SH, EG AND EN, WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN

ANALYSIS CASE		SERVICE FLUID (G)		REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY
OPERATING	0.30	37		
DESIGN	3.50	250		
STEAM OUT				
UPSET				

Hydro 6.07

UNITS : PRESS. <math>kg/cm^2(g)</math>, TEMP. ( DEG.C ), DENSITY (  $kg/m^3$  )

NPS / PIPE O.D. (in)

WALL THK. (mm)

FLANGE RATING (L/D)

CORR. ALLIN. (mm)

BASE TEMP. (DEG.C)

MATERIAL

THERMAL EXPAN. (mm/m)

INSUL. DENSITY (kg/m<sup>3</sup>)

INSUL. TYPE/THK. (mm)

SH (a) (kg/mm<sup>2</sup>)

SG (a) (kg/cm<sup>3</sup>)

En X 10 (a) (kg/mm<sup>2</sup>)

Ec X 10 (a) (kg/mm<sup>2</sup>)

REV. DATE DESCRIPTION PRE. D. CHK. D.

**PERTAMINA PT. PERTAMINA (Persero)**

**PT. ADHI KARYA (Persero) Tbk**

**GS&SEC GS Engineering & Construction**

PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING (RFCC) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA

**PIPING STRESS ANALYSIS**

LINE NO. 170-ACF0001-A2A3R-18"-ST PAID NO. 170-PI-161  
 DWG NO. RFCC-G-170-ACF0001-80 PROJECT NO. 101930  
 ANALYSIS NO. 170-0015 REV. 2/11  
 FILE NAME.

Gambar 4.12 Gambar isometric 2

NOTE  
**NOZZLE (780) IS OK AS PER VENDOR PRINT**

(1) "LV" : LIQUID+VAPOR "V" : GAS OR VAPOR "L" : LIQUID  
 (2) SPECIFIED Ss, Ss, Etc and Etc, WHEN UNLISTED MATERIAL IS USED.

OPERATION AND DESIGN

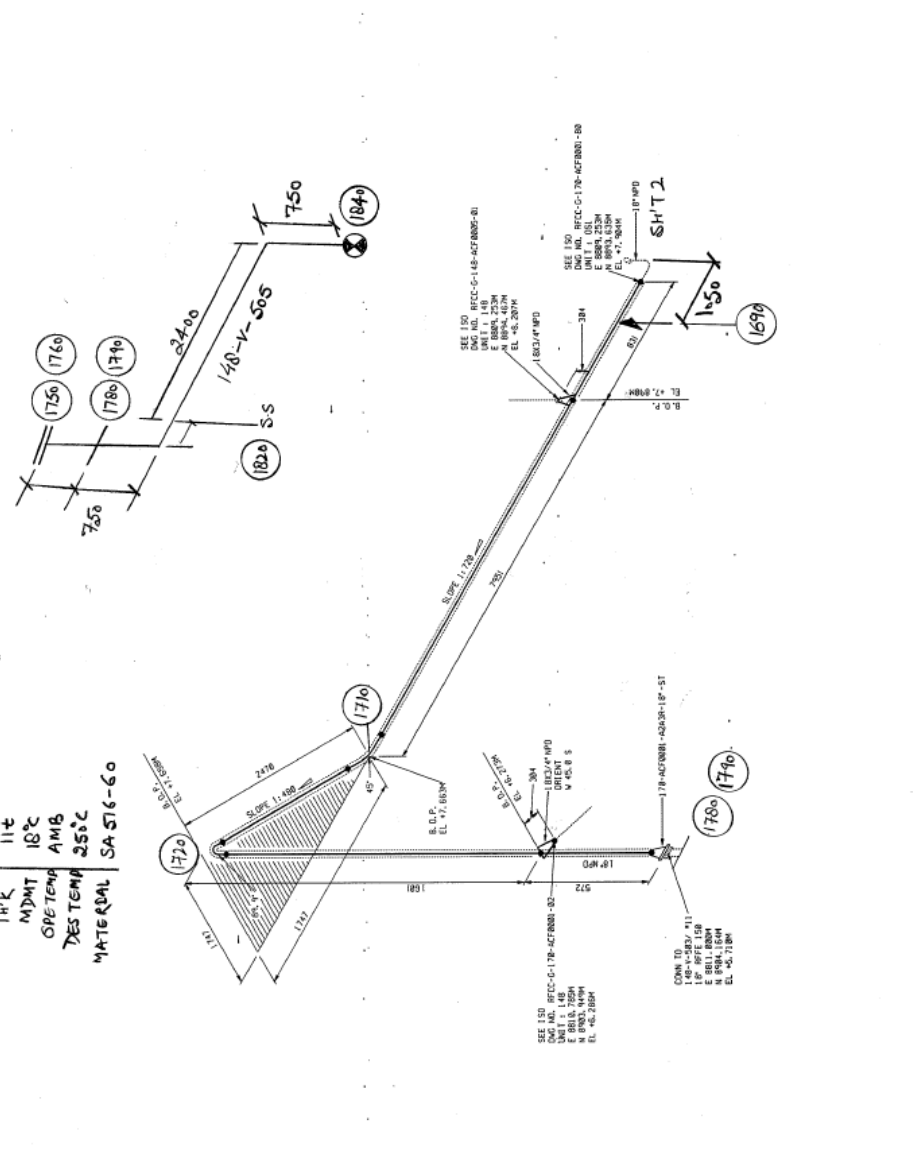
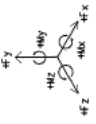
ANALYSIS CASE		SERVICE FLEUID(C)		REMARK
MODES	PRESS.	TEMP.	PHASE	DENSITY
OPERATING	0.30	37		
DESIGN	3.50	250		
STEAM OUT				
UPSET				
HYDRO 6.07				
UNITS : PRESS. (kg/cm <sup>2</sup> g), TEMP. ( DEG.C ), DENSITY ( kg/m <sup>3</sup> )				
NPS / PIPE O.D. (in)	18			
WALL THK. (mm)	9.525			
FLANGE RATING (1b)	150#			
CORR. ALLOW. (mm)	3			
BASE TEMP. (DEG.C)	18°C			
MATERIAL	A672Gr60			
TERMINAL EXPAN. (mm/m)				
INSUL. DENSITY (kg/m <sup>3</sup> )				
INSUL. TYPE/THK. (mm)				
SH (lb)	(kg/mm)			
SC (lb)	(kg/mm)			
EL X 10 <sup>3</sup> (ft)	(kg/mm)			
EL X 10 <sup>3</sup> (m)	(kg/mm)			
REV.	DATE	DESCRIPTION	PRE'D	CHK'D

**PERTAMINA PT. PERTAMINA (Persero)**  
**PT. ADHI KARYA (Persero) Tbk**  
**GS Engineering & Construction**

PROJECT TITLE : CILACAP RESID FLUID CATALYTIC CRACKING  
 (RCCCT) PROJECT  
 CILACAP, CENTRAL JAVA, INDONESIA

PIPING STRESS ANALYSIS

LINE NO.	170-ACF0001-A2A3R-18"-ST	FIELD NO.	170-P1-161
DMG NO.	RFC-CG-170-ACF0001-01	PROJECT NO.	101830
ANALYSIS NO.	170-0015	REV.	1/11
FILE NAME.			



<b>148-V-50S</b>	
I.D	150 mm
C.A	3 mm
THK	11t
MDMT	18°C
OPERTMP	AMB
DES TEMP	250°C
MATERIAL	SA 516-60

SYMBOL & LEGEND

SYMBOL	RESTRAINTS	RESTRAINTS	RESTRAINTS	W/GAP	RESTRAINTS	ANCHOR	HOLD DOWN	EXPANSION JOINT	SNUBBER

Gambar 4.13 Gambar isometric 1

## 2. *Load Case*

Pada jalur 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV Cilacap* terdapat 26 load case yang dibebankan yaitu:

- L1 (HYD) WW+HP
- L2 (OPE) W+T1+PI
- L3 (OPE) W+T2+P1
- L4 (OPE) W+T1+PI+U1
- L5 (OPE) W+T1+P1-U1
- L6 (OPE) W+T1+P1+U2
- L7 (OPE) W+T1+P1-U2
- L8 (OPE) W+T1+P1+U3
- L9 (OPE) W+T1+P1-U3
- L10 (SUS) W+PI
- L11= L4-L2 (OCC)
- L12= L5-L2 (OCC)
- L13= L6-L2 (OCC)
- L14= L7-L2(OCC)
- L15= L8-L2 (OCC)
- L16= L9-L2 (OCC)
- L17= L11+L10 (OCC)
- L18= L12+L10 (OCC)
- L19= L13+L10 (OCC)
- L20= L14+L10 (OCC)
- L21= L15+L10 (OCC)
- L22= L16+L10 (OCC)
- L23= L2-L10(EXP)
- L24= L3-L10(EXP)
- L25= L2+L3(OPE)
- L26= L11+L12+L13+L14+L15+16 (OCC)

Berikut adalah penjelasan faktor *load case* yang ada pada jakur pipa 170-ACF0001-A2A3R-18"-ST RFCC di PT Pertamina (Persero) *Refinery Unit IV Cilacap*:

### 1. *Elementarry Load Case*

<i>Weight with contents</i>	(WW)
<i>Hydro pressure</i>	(HP)
<i>Pressure in design condition</i>	(P1)
<i>Thermal in design condition</i>	(T1)
<i>Pipe acceleration along X direction due to the earthquake</i>	(U1)



*Pipe acceleration along Y direction due to the earthquake (U2)*

*Pipe acceleration along Z direction due to the earthquake (U3)*

2. *Caesar II Load Case*

- *Case Hydrostatic Test Stress an Loads on Support and Equipment*

L1 (HYD) WW+HP

- *Design Condition:*

*Case for Load on support*

L2 (OPE) W+T1+PI

L3 (OPE) W+T2+P1

L4 (OPE) W+T1+PI+U1

L5 (OPE) W+T1+P1-U1

L6 (OPE) W+T1+P1+U2

L7 (OPE) W+T1+P1-U2

L8 (OPE) W+T1+P1+U3

L9 (OPE) W+T1+P1-U3

L25= L2+L3(OPE)

*Case for thermal stress*

L23= L2-L10(EXP)

L24= L3-L10(EXP)

*Case for sustained stress*

L10 (SUS) W+PI

*Case for occational stress:*

L11= L4-L2 (OCC)

L12= L5-L2 (OCC)

L13= L6-L2 (OCC)

L14= L7-L2(OCC)

L15= L8-L2 (OCC)

L16= L9-L2 (OCC)

L17= L11+L10 (OCC)

L18= L12+L10 (OCC)

L19= L13+L10 (OCC)

L20= L14+L10 (OCC)

L21= L15+L10 (OCC)

L22= L16+L10 (OCC)

L26= L11+L12+L13+L14+L15+16 (OCC)