Specification & Calculation Sheet

DOCUMENT NO.	180760-R2-P-054-2-S-0002
PROJECT NAME	Yeosu No. 2 Complex Project
ITEM NO.	Pressure Safety Valve
COMPANY NAME	LG Chem, Ltd.
SITE LOCATION	Yeosu, Korea
CONTRACTOR NAME	GS E&C
PROJECT NO.	180760
PURCHASE ORDER NO.	180760-R2-GS-PO-P-054-2
VENDOR NAME	Jokwang I.L.I

Action	Code	Description
☐	1	Approved without comment, Vendor to submit "FINAL"
☐	2	Approved with comment, Vendor to amend and **submit "FOR FINAL"**
☐	3	Vendor to amend and **re-submit** "**FOR APPROVAL**"
☐	4	Not Reviewed/Considered unacceptable Quality, Vendor to **re- submit** "FOR APPROVAL"

2	23.FEB.21	FINAL	S.W.PARK	M.J.LEE	J.H.LEEM
1	22.JAN.21	FOR FINAL	S.W.PARK	M.J.LEE	J.H.LEEM
0	16.JUL.20	FOR FINAL	S.W.PARK	J.G.YOON	J.H.LEEM
A	03 MAR. 20	FOR APPROVAL	S.W.PARK	J.G.YOON	S.C.KIM
REV.	DATE	DESCRIPTION	PREP'D	CHK'D	APP'D

Pressure Safety & Relief Valve Specification and Calculation Sheet

JOKWANG I.L.I ® Since 1968

Sheet No.	1 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

P&ID No.	1	H530-R2-PID-1011	
Tag No.	2	R2-PSV-1029/1030	
Service Line	3	E-1 08A/B 2ND STAGE FEED/EFFULENT EXCHANGER #2-1 TUBE SIDE E-1 09A/B 2ND STAGE FEED/EFFULENT EXCHANGER #2-2 TUBE SIDE	
Model No.	4	JSV-FF100	
Quantity	5	2	

Calculation

Calculation of Area

$$A1 = 13160 * W1 * (\sqrt{ZT/M})/(C*Kd*(P*1.1+101.325)*Kb*Kc)$$

$$= 13160*19856*(\sqrt{0.952*465.4/26.10})/(331.04*0.831*(4844*1.1+101.325)*1*1)$$

$$= \underline{720.775029} \text{ mm}^2$$

TYPE

Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

CONN.

Size. Inlet / Outlet	11	3"X4"
Inlet. Rating / Facing	12	ASME CL.600 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

Body (Base)	14	SA217 C5
Bonnet	15	SA217 C5
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	Graphite
Spring	20	Inconel X-750
Bellows	21	None

Calculation of Capacity

$$W = A*C*Kd*(P*1.1+101.325)*Kb*Kc/(13160*\sqrt{ZT/M})$$

$$= 834.19*331.04*0.831*(4844*1.1+101.325)*1*1/(13160*\sqrt{0.952*465.4/26.10})$$

$$= \underline{22980} \text{ kg/h}$$

BASIS

Approved by	22	KGS UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520
Fire	26	No
Sizing Basis	27	Thermal Expansion
Rupture Disk	28	No

SERVICE CONDITION

Fluid / State	29	HC / GAS	W	Valve Capacity	22980 kg/h
Mol. Weight / Specific Gravity	30	26.10	W1	Required Capacity	19856 kg/h
Compressibility Factor	31	0.952	P	Set Pressure	4844 KPag
Ratio of Specific Heat	32	1.140	A1	Calculated Area	720.775029 mm²
Viscosity	33	0.017 cP	A	Selected Area	834.19 mm²
Operating / Relieving Temp.	34	192.36 / 192.4 ℃	Kd	Coefficient of Discharge	0.831
Design Min. / Design Max. Temp.	35	-18/319 ℃	C	Coefficient base on Ratio of Specific Heat	331.04
Operating / Set Pressure	36	3.677 / 4.844 MPag	T	Kelvin Temperature	465.4 K
Design Pressure / C.D.T.P	37	4.844 / 4.815 MPag	M	Molecular Weight	26.10
Back Pressure — Superimposed - Constant	38	0.029 MPag	Z	Compressibility Factor	0.952
Back Pressure — Superimposed - Variable	39	- MPag	Kb	Correction Factor Due to Back Pressure	1
Back Pressure — Built-up	40	0.081 MPag	Kc	Correction Factor for a rupture disk	1
Back Pressure — Total	41	0.11 MPag			
Allowable Overpressure	42	10 %			
Closing Pressure / Blowdown(%)	43	Min. 4.50492 MPag / 7%			

Remarks

*Remark
Service Requirement : NACE MR0103
Painting : P-5
- Operating Pressure : 37.5 kg/㎠g
- Setting Pressure : 49.4 kg/㎠g
- Design Pressure : 49.4 kg/㎠g
- Constant Back Pressure : 0.3 kg/㎠g
- Variable Back Pressure : kg/㎠g
- Built-up Back Pressure : 0.83 kg/㎠g
- Required Capacity : 19856 kg/hr
- Valve Capacity : 22980 kg/hr

SIZING & SELECTION

Required Capacity	44	19856 kg/h
Valve Actual Capacity	45	22980 kg/h
Calculated Orifice Area	46	720.775029 mm²
Selected Orifice Area	47	834.19 mm²
Orifice Dia.(mm)	48	J(32.6)
		-
		-

ETC

Paint System & Color	49	See Remark
Test Gag	50	Yes
Bug screen	51	No

Ref. No : SLO200334-20-642257   JOKWANG I.L.I CO.,LTD.   No.TTIPCF500-2

Pressure Safety & Relief Valve Specification and Calculation Sheet			
Sheet No.	2 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

P&ID No.	1	H530-R2-PID-1 031	
Tag No.	2	R2-PSV-1311/1312	
Service Line	3	C-1 01A/B-E2A (LUBE OIL COOLER) PLATE SIDE	
Model No.	4	JSV-FF100	
Quantity	5	2	

TYPE

Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

CONN.

Size. Inlet / Outlet	11	3/4"X1"
Inlet. Rating / Facing	12	ASME CL.150 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

Body (Base)	14	SA216 WCB
Bonnet	15	SA216 WCB
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	PTFE
Spring	20	316 SS
Bellows	21	None

BASIS

Approved by	22	UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520-Certification
Fire	26	No
Sizing Basis	27	Thermal Expansion
Rupture Disk	28	No

SERVICE CONDITION

Fluid / State	29	CW / LIQUID
Mol. Weight / Specific Gravity	30	0.981
Compressibility Factor	31	-
Ratio of Specific Heat	32	-
Viscosity	33	0.437 cP
Operating / Relieving Temp.	34	36 / 64.4 ℃
Design Min. / Design Max. Temp.	35	-18/65 ℃
Operating / Set Pressure	36	0.539 / 1.029 MPag
Design Pressure / C.D.T.P	37	1.029 / 1.029 MPag
Back Pressure — Superimposed - Constant	38	- MPag
Back Pressure — Superimposed - Variable	39	- MPag
Back Pressure — Built-up	40	0.009 MPag
Back Pressure — Total	41	0.009 MPag
Allowable Overpressure	42	10 %
Closing Pressure / Blowdown(%)	43	Min. 0.87464 MPag / 15.0009%

SIZING & SELECTION

Required Capacity	44	0.012 m3/h
Valve Actual Capacity	45	12.6 m3/h
Calculated Orifice Area	46	0.126515 ㎟
Selected Orifice Area	47	132.9 ㎟
Orifice Dia.(mm)	48	D1(13)
		-
		-

ETC

Paint System & Color	49	See Remark
Test Gag	50	Yes
Bug screen	51	No

Calculation

Calculation of Area

$$A1 = 11.78 \cdot W1 \cdot (\sqrt{G/(P1-Pb)})/(Kd \cdot Kb \cdot Kc \cdot Kv)$$

$$= 11.78 \cdot 0.2 \cdot \sqrt{(0.981/(1131.9-9))}/(0.615 \cdot 1 \cdot 1 \cdot 0.895)$$

$$= \underline{\mathbf{0.126515}} \ ㎟$$

Calculation of Capacity

$$W = A \cdot Kd \cdot Kb \cdot Kc \cdot Kv/(11.78 \cdot \sqrt{(G/(P1-Pb))})$$

$$= 132.9 \cdot 0.615 \cdot 1 \cdot 1 \cdot 0.895/(11.78 \cdot \sqrt{(0.981/(1131.9-9))})$$

$$= 210.10 \ ℓ/min$$
$$= \mathbf{12.6} \ m3/h$$

W	Valve Capacity	210.10 ℓ/min
W1	Required Capacity	0.2 ℓ/min
P	Set Pressure	1029 KPag
A1	Calculated Area	0.126515 ㎟
A	Selected Area	132.9 ㎟
Kd	Coefficient of Discharge	0.615
G	Specific Gravity	0.981
Pb	Back Pressure	9 KPag
Kb	Correction Factor Due to Back Pressure	1
Kc	Correction Factor for a rupture disk	1
Kv	Correction Factor due to Viscosity	0.895
P1	Set Pressure plus Overpressure	1131.9 KPag

Remarks

*Remark
- Operating Pressure : 5.5 kg/㎠g
- Setting Pressure : 10.5 kg/㎠g
- Design Pressure : 10.5 kg/㎠g
- Built-up Back Pressure : 0.1 kg/㎠g
- Required Capacity : 12 kg/h
- Valve Capacity : 7357.5 kg/h

	Pressure Safety & Relief Valve Specification and Calculation Sheet			
JOKWANG I.L.I ® Since 1968	Sheet No.	3 of 11	Rev . No	1
	Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
	Project No.			
	Date	2021-01-22	By	S.W.PARK
	Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

P&ID No.	1	H530-R2-PID-3026	
Tag No.	2	R2-PSV-3261A/B	
Service Line	3	E-31 5 (Benzene Product Cooler) SS	
Model No.	4	JSV-FF100	**Calculation**
Quantity	5	2	

TYPE

Nozzle Type	6	Full Nozzle	Calculation of Area
Design Type	7	Conventional	
Bonnet Type	8	Close	$A1 = 13160 \cdot W1 \cdot (\sqrt{ZT/M})/(C \cdot Kd \cdot (P \cdot 1.21 + 101.325) \cdot Kb \cdot Kc)$
Lever Type	9	None	
Cap Type	10	Screwed	

CONN.

Size. Inlet / Outlet	11	1"X2"	$= 13160 \cdot 2045 \cdot (\sqrt{0.785 \cdot 476.1/78.12})/(333.86 \cdot 0.831 \cdot (1176 \cdot 1.21 + 101.325) \cdot 1 \cdot 1)$
Inlet. Rating / Facing	12	ASME CL.150 RF	
Outlet. Rating / Facing	13	ASME CL.150 RF	

MATERIALS

Body (Base)	14	SA216 WCB	$= \underline{\textbf{139.193968}}$ ㎟
Bonnet	15	SA216 WCB	
Seat	16	316 SS-st.	
Disc	17	316 SS-st.	Calculation of Capacity
Guide	18	316 SS	
Gasket (Bonnet)	19	PTFE	
Spring	20	316 SS	$W = A \cdot C \cdot Kd \cdot (P \cdot 1.21 + 101.325) \cdot Kb \cdot Kc/(13160 \cdot \sqrt{(ZT/M)})$
Bellows	21	None	

BASIS

Approved by	22	KGS UV STAMP	$= 188.39 \cdot 333.86 \cdot 0.831 \cdot (1176 \cdot 1.21 + 101.325) \cdot 1 \cdot 1/(13160 \cdot \sqrt{(0.785 \cdot 476.1/78.12)})$
Comply with NACE	23	No	
EN 10204	24	No	
Code	25	API RP 520	$= \underline{\textbf{2768}}$ kg/h
Fire	26	Yes	
Sizing Basis	27	Fire Case	

Rupture Disk	28	No	W	Valve Capacity	2768 kg/h

SERVICE CONDITION

Fluid / State	29	Hydrocarbon(HC) / GAS	W1	Required Capacity	2045 kg/h
Mol. Weight / Specific Gravity	30	78.12	P	Set Pressure	1176 KPag
Compressibility Factor	31	0.785	A1	Calculated Area	139.193968 ㎟
Ratio of Specific Heat	32	1.167	A	Selected Area	188.39 ㎟
Viscosity	33	0.018 cP	Kd	Coefficient of Discharge	0.831
Operating / Relieving Temp.	34	108 / 203.1 ℃	C	Coefficient base on Ratio of Specific Heat	333.86
Design Min. / Design Max. Temp.	35	150 ℃	T	Kelvin Temperature	476.1 K
Operating / Set Pressure	36	0.715 / 1.176 MPag	M	Molecular Weight	78.12
Design Pressure / C.D.T.P	37	1.176 / 1.15847 MPag	Z	Compressibility Factor	0.785
Back Pressure — Superimposed - Constant	38	0.029 MPag	Kb	Correction Factor Due to Back Pressure	1
Back Pressure — Superimposed - Variable	39	- MPag	Kc	Correction Factor for a rupture disk	1
Back Pressure — Built-up	40	0.029 MPag		**Remarks**	
Back Pressure — Total	41	0.058 MPag			
Allowable Overpressure	42	21 %		*Paint Color(*)	
Closing Pressure / Blowdown(%)	43	Min. 1.09368 MPag / 7%		Painting : P-5 (RAL 9006 Silver)	

SIZING & SELECTION

Required Capacity	44	2045 kg/h	*Remark
Valve Actual Capacity	45	2768 kg/h	- Operating Pressure : 7.3 kg/㎠g
Calculated Orifice Area	46	139.193968 ㎟	- Setting Pressure : 12.0 kg/㎠g
Selected Orifice Area	47	188.39 ㎟	- Design Pressure : 12.0 kg/㎠g
Orifice Dia.(mm)	48	E1(15.5)	- Constant Back Pressure : 0.3 kg/㎠g
		-	- Built-up Back Pressure : 0.3 kg/㎠g
		-	

ETC

Paint System & Color	49	See Remark
Test Gag	50	Yes
Bug screen	51	No

Ref. No : SLO200334-40-642284   JOKWANG I.L.I CO.,LTD.   No.TTIPCF500-2

JOKWANG I.L.I (Since 1968)

Pressure Safety & Relief Valve Specification and Calculation Sheet

Sheet No.	4 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

P&ID No.	1	H530-R2-PID-3037	
Tag No.	2	R2-PSV-3371	
Service Line	3	HP Cold drain to W-302-D6 (Cold Drains Vaporizer)	
Model No.	4	JSV-FF100	
Quantity	5	1	

Calculation

TYPE

Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

Calculation of Area

$$A1 = 11.78*W1*(\sqrt{G/(P1-Pb)})/(Kd*Kb*Kc*Kv)$$

$$= 11.78*0.933333*\sqrt{(0.449/(6526.3-9))}/(0.615*1*1*0.969)$$

$$= \underline{\mathbf{0.153134}} \text{ mm}^2$$

CONN.

Size. Inlet / Outlet	11	3/4"X1"
Inlet. Rating / Facing	12	ASME CL.600 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

Body (Base)	14	SA351 CF8M
Bonnet	15	SA351 CF8M
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	PcTFE
Spring	20	316 SS
Bellows	21	None

Calculation of Capacity

$$W = A*Kd*Kb*Kc*Kv/(11.78*\sqrt{(G/(P1-Pb))})$$

$$= 132.9*0.615*1*1*0.969/(11.78*\sqrt{(0.449/(6526.3-9))})$$

$$= 810.00 \text{ ℓ/min}$$
$$= \mathbf{48.6} \text{ m3/h}$$

BASIS

Approved by	22	KGS UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520-Certification
Fire	26	No
Sizing Basis	27	Thermal Expansion
Rupture Disk	28	No

SERVICE CONDITION

Fluid / State	29	Hydrocarbon(HC) / LIQUID	W1	Required Capacity	0.933333 ℓ/min
Mol. Weight / Specific Gravity	30	0.449	P	Set Pressure	5933 KPag
Compressibility Factor	31	-	A1	Calculated Area	0.153134 mm²
Ratio of Specific Heat	32	-	A	Selected Area	132.9 mm²
Viscosity	33	0.120 cP	Kd	Coefficient of Discharge	0.615
Operating / Relieving Temp.	34	-148 / 60 ℃	G	Specific Gravity	0.449
Design Min. / Design Max. Temp.	35	-196/66 ℃	Pb	Back Pressure	9 KPag
Operating / Set Pressure	36	4.873 / 5.933 MPag	Kb	Correction Factor Due to Back Pressure	1
Design Pressure / C.D.T.P	37	5.933 / 5.933 MPag	Kc	Correction Factor for a rupture disk	1
Back Pressure — Superimposed - Constant	38	- MPag	Kv	Correction Factor due to Viscosity	0.969
Back Pressure — Superimposed - Variable	39	- MPag	P1	Set Pressure plus Overpressure	6526.3 KPag
Back Pressure — Built-up	40	0.009 MPag			
Back Pressure — Total	41	0.009 MPag			

W	Valve Capacity	810.00 ℓ/min

Allowable Overpressure	42	10 %
Closing Pressure / Blowdown(%)	43	Min. 5.04305 MPag / 15%

Remarks

*Remark
Service Requirement : Cryogenic Service

- Operating Pressure : 49.7 kg/cm²g
- Setting Pressure : 60.5 kg/cm²g
- Design Pressure : 60.5 kg/cm²g
- Built-up Back Pressure : 0.1 kg/cm²g
- Required Capacity : 24.695 kg/h
- Valve Capacity : 22539.8 kg/h

SIZING & SELECTION

Required Capacity	44	0.056 m3/h
Valve Actual Capacity	45	48.6 m3/h
Calculated Orifice Area	46	0.153134 mm²
Selected Orifice Area	47	132.9 mm²
Orifice Dia.(mm)	48	D1(13)
		-
		-

ETC

Paint System & Color	49	None
Test Gag	50	Yes
Bug screen	51	No

Ref. No : SLO200334-50-642287   JOKWANG I.L.I CO.,LTD.   No.TTIPCF500-2

	Pressure Safety & Relief Valve Specification and Calculation Sheet			
JOKWANG I.L.I ® Since 1968	Sheet No.	5 of 11	Rev . No	1
	Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
	Project No.			
	Date	2021-01-22	By	S.W.PARK
	Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL	P&ID No.	1	H530-R2-PID-3037		
	Tag No.	2	R2-PSV-3372		
	Service Line	3	LP Cold drain to W-302-D6 (Cold Drains Vaporizer)		
	Model No.	4	JSV-FF100	**Calculation**	
	Quantity	5	1		
TYPE	Nozzle Type	6	Full Nozzle	Calculation of Area	
	Design Type	7	Conventional		
	Bonnet Type	8	Close	A1 = 11.78*W1*(√G/(P1-Pb))/(Kd*Kb*Kc*Kv)	
	Lever Type	9	None		
	Cap Type	10	Screwed		
CONN.	Size. Inlet / Outlet	11	3/4"X1"	= 11.78*0.933333*√(0.449/(1617-9))/ (0.615*1*1*0.969)	
	Inlet. Rating / Facing	12	ASME CL.150 RF		
	Outlet. Rating / Facing	13	ASME CL.150 RF		
MATERIALS	Body (Base)	14	SA351 CF8M	= **0.308293** ㎜²	
	Bonnet	15	SA351 CF8M		
	Seat	16	316 SS-st.		
	Disc	17	316 SS-st.	Calculation of Capacity	
	Guide	18	316 SS		
	Gasket (Bonnet)	19	PTFE	W = A*Kd*Kb*Kc*Kv/(11.78*√(G/(P1-Pb)))	
	Spring	20	316 SS		
	Bellows	21	None	= 132.9*0.615*1*1*0.969/(11.78*√(0.449/(1617-9)))	
BASIS	Approved by	22	KGS UV STAMP		
	Comply with NACE	23	No		
	EN 10204	24	No	= 402.30 ℓ/min	
	Code	25	API RP 520-Certification	= **24.1** m3/h	
	Fire	26	No		
	Sizing Basis	27	Thermal Expansion		
	Rupture Disk	28	No	W	Valve Capacity	402.30 ℓ/min

SERVICE CONDITION	Fluid / State	29	Hydrocarbon(HC) / LIQUID	W1	Required Capacity	0.933333 ℓ/min
	Mol. Weight / Specific Gravity	30	0.449	P	Set Pressure	1470 KPag
	Compressibility Factor	31	-	A1	Calculated Area	0.308293 ㎜²
	Ratio of Specific Heat	32	-	A	Selected Area	132.9 ㎜²
	Viscosity	33	0.12 cP	Kd	Coefficient of Discharge	0.615
	Operating / Relieving Temp.	34	-148 / 60 ℃	G	Specific Gravity	0.449
	Design Min. / Design Max. Temp.	35	-196/66 ℃	Pb	Back Pressure	9 KPag
	Operating / Set Pressure	36	0.588 / 1.47 MPag	Kb	Correction Factor Due to Back Pressure	1
	Design Pressure / C.D.T.P	37	1.47 / 1.47 MPag	Kc	Correction Factor for a rupture disk	1
	Back Pressure — Superimposed - Constant	38	- MPag	Kv	Correction Factor due to Viscosity	0.969
	Back Pressure — Superimposed - Variable	39	- MPag	P1	Set Pressure plus Overpressure	1617 KPag
	Back Pressure — Built-up	40	0.009 MPag	**Remarks**		
	Back Pressure — Total	41	0.009 MPag			
	Allowable Overpressure	42	10 %	*Remark Service Requirement : Cryogenic Service		
	Closing Pressure / Blowdown(%)	43	Min. 1.2495 MPag / 15%			

SIZING & SELECTION	Required Capacity	44	0.056 m3/h
	Valve Actual Capacity	45	24.1 m3/h
	Calculated Orifice Area	46	0.308293 ㎜²
	Selected Orifice Area	47	132.9 ㎜²
	Orifice Dia.(mm)	48	D1(13)
			-
			-

- Operating Pressure : 6 kg/㎠g
- Setting Pressure : 15 kg/㎠g
- Design Pressure : 15 kg/㎠g
- Constant Back Pressure : kg/㎠g
- Variable Back Pressure : kg/㎠g
- Built-up Back Pressure : 0.1 kg/㎠g
- Required Capacity : 24.695 kg/h
- Valve Capacity : 9833.1 kg/h

ETC	Paint System & Color	49	None
	Test Gag	50	Yes
	Bug screen	51	No

Ref. No : SLO200334-60-642288   JOKWANG I.L.I CO.,LTD.   No.TTIPCF500-2

Pressure Safety & Relief Valve Specification and Calculation Sheet			
Sheet No.	6 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

P&ID No.	1	H530-R2-PID-3037	
Tag No.	2	R2-PSV-3373A/B	
Service Line	3	W-302-D6 (Cold Drains Vaporizer)	
Model No.	4	JSV-FF100	
Quantity	5	2	

Calculation

TYPE

Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

Calculation of Area

$$A_1 = 13160 \cdot W_1 \cdot (\sqrt{ZT/M})/(C \cdot K_d \cdot (P \cdot 1.21 + 101.325) \cdot K_b \cdot K_c)$$

$$= 13160 \cdot 387 \cdot (\sqrt{0.849 \cdot 475.7/91.55})/(228.08 \cdot 0.831 \cdot (588 \cdot 1.21 + 101.325) \cdot 1 \cdot 1)$$

$$= \underline{\mathbf{69.43581}} \text{ mm}^2$$

CONN.

Size. Inlet / Outlet	11	1"X2"
Inlet. Rating / Facing	12	ASME CL.150 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

Body (Base)	14	SA351 CF8M
Bonnet	15	SA351 CF8M
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	PcTFE
Spring	20	316 SS
Bellows	21	None

Calculation of Capacity

$$W = A \cdot C \cdot K_d \cdot (P \cdot 1.21 + 101.325) \cdot K_b \cdot K_c/(13160 \cdot \sqrt{ZT/M})$$

$$= 132.9 \cdot 228.08 \cdot 0.831 \cdot (588 \cdot 1.21 + 101.325) \cdot 1 \cdot 1/(13160 \cdot \sqrt{0.849 \cdot 475.7/91.55})$$

$$= \underline{\mathbf{741}} \text{ kg/h}$$

BASIS

Approved by	22	KGS UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520
Fire	26	Yes
Sizing Basis	27	Fire Case
Rupture Disk	28	No

SERVICE CONDITION

Fluid / State	29	Hydrocarbon(HC) / GAS
Mol. Weight / Specific Gravity	30	91.55
Compressibility Factor	31	0.849
Ratio of Specific Heat	32	0.449
Viscosity	33	0.017 cP
Operating / Relieving Temp.	34	40 / 202.7 ℃
Design Min. / Design Max. Temp.	35	-166/200 ℃
Operating / Set Pressure	36	0.101 / 0.588 MPag
Design Pressure / C.D.T.P	37	0.588 / 0.559 MPag
Back Pressure — Superimposed - Constant	38	0.029 MPag
Back Pressure — Superimposed - Variable	39	- MPag
Back Pressure — Built-up	40	0.024 MPag
Back Pressure — Total	41	0.053 MPag
Allowable Overpressure	42	21 %
Closing Pressure / Blowdown(%)	43	Min. 0.54684 MPag / 7%

		Valve / factor	Value
W	Valve Capacity		741 kg/h
W1	Required Capacity		387 kg/h
P	Set Pressure		588 KPag
A1	Calculated Area		69.43581 mm²
A	Selected Area		132.9 mm²
Kd	Coefficient of Discharge		0.831
C	Coefficient base on Ratio of Specific Heat		228.08
T	Kelvin Temperature		475.7 K
M	Molecular Weight		91.55
Z	Compressibility Factor		0.849
Kb	Correction Factor Due to Back Pressure		1
Kc	Correction Factor for a rupture disk		1

Remarks

*Remark
?
- Required Capacity : 387 kg/h
- Valve Capacity : 682 kg/h

SIZING & SELECTION

Required Capacity	44	387 kg/h
Valve Actual Capacity	45	741 kg/h
Calculated Orifice Area	46	69.43581 mm²
Selected Orifice Area	47	132.9 mm²
Orifice Dia.(mm)	48	D1(13)
		-
		-

ETC

Paint System & Color	49	None
Test Gag	50	Yes
Bug screen	51	No

JOKWANG I.L.I

Pressure Safety & Relief Valve Specification and Calculation Sheet

Sheet No.	7 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

P&ID No.	1	H530-R2-PID-3040	
Tag No.	2	R2-PSV-3402/3403	
Service Line	3	C-301A/B-E1 (Oil Cooler) TS	
Model No.	4	JSV-FF100	
Quantity	5	2	

Calculation

TYPE

Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

CONN.

Size. Inlet / Outlet	11	3/4"X1"
Inlet. Rating / Facing	12	ASME CL.150 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

Body (Base)	14	SA216 WCB
Bonnet	15	SA216 WCB
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	PTFE
Spring	20	316 SS
Bellows	21	None

BASIS

Approved by	22	UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520-Certification
Fire	26	No
Sizing Basis	27	Thermal Expansion
Rupture Disk	28	No

Calculation of Area

$$A1 = 11.78*W1*(\sqrt{G/(P1-Pb)})/(Kd*Kb*Kc*Kv)$$

$$= 11.78*0.2*\sqrt{(0.986/(1131.9-9))}/(0.615*1*1*0.886)$$

$$= \underline{\textbf{0.128125}} \text{ mm}^2$$

Calculation of Capacity

$$W = A*Kd*Kb*Kc*Kv/(11.78*\sqrt{(G/(P1-Pb))})$$

$$= 132.9*0.615*1*1*0.886/(11.78*\sqrt{(0.986/(1131.9-9))})$$

$$= 207.50 \text{ } \ell/min$$
$$= \textbf{12.5} \text{ m3/h}$$

SERVICE CONDITION

Fluid / State	29	CW / LIQUID	W1	Required Capacity	0.2 ℓ/min
Mol. Weight / Specific Gravity	30	0.986	P	Set Pressure	1029 KPag
Compressibility Factor	31	-	A1	Calculated Area	0.128125 mm²
Ratio of Specific Heat	32	-	A	Selected Area	132.9 mm²
Viscosity	33	0.504 cP	Kd	Coefficient of Discharge	0.615
Operating / Relieving Temp.	34	38 / 55 ℃	G	Specific Gravity	0.986
Design Min. / Design Max. Temp.	35	-18/65 ℃	Pb	Back Pressure	9 KPag
Operating / Set Pressure	36	0.49 / 1.029 MPag	Kb	Correction Factor Due to Back Pressure	1
Design Pressure / C.D.T.P	37	1.029 / 1.029 MPag	Kc	Correction Factor for a rupture disk	1
Back Pressure — Superimposed - Constant	38	- MPag	Kv	Correction Factor due to Viscosity	0.886
Back Pressure — Superimposed - Variable	39	- MPag	P1	Set Pressure plus Overpressure	1131.9 KPag
Back Pressure — Built-up	40	0.009 MPag			
Back Pressure — Total	41	0.009 MPag			

W	Valve Capacity	207.50 ℓ/min

Allowable Overpressure	42	10 %
Closing Pressure / Blowdown(%)	43	Min. 0.87465 MPag / 14.9999%

Remarks

*Remark
- Operating Pressure : 5.0 kg/cm²g
- Setting Pressure : 10.5 kg/cm²g
- Design Pressure : 10.5 kg/cm²g
- Constant Back Pressure : kg/cm²g
- Variable Back Pressure : kg/cm²g
- Built-up Back Pressure : 0.1 kg/cm²g
- RequiredCapacity : 0.6902 kg/h
- Valve Capacity : 6803.4 kg/h

SIZING & SELECTION

Required Capacity	44	0.012 m3/h
Valve Actual Capacity	45	12.5 m3/h
Calculated Orifice Area	46	0.128125 mm²
Selected Orifice Area	47	132.9 mm²
Orifice Dia.(mm)	48	D1(13)
		-
		-

ETC

Paint System & Color	49	See Remark
Test Gag	50	Yes
Bug screen	51	No

Ref. No : SLO200334-80-642297   JOKWANG I.L.I CO.,LTD.   No.TTIPCF500-2

JOKWANG I.L.I

Pressure Safety & Relief Valve Specification and Calculation Sheet

Sheet No.	8 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

		No.	
P&ID No.		1	H530-R2-PID-3040
Tag No.		2	R2-PSV-3404/3405
Service Line		3	C-302A/B-E2A (LUBE OIL COOLER) PLATE SIDE
Model No.		4	JSV-FF100
Quantity		5	2

TYPE

Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

CONN.

Size. Inlet / Outlet	11	3/4"X1"
Inlet. Rating / Facing	12	ASME CL.150 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

Body (Base)	14	SA216 WCB
Bonnet	15	SA216 WCB
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	PTFE
Spring	20	316 SS
Bellows	21	None

BASIS

Approved by	22	UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520-Certification
Fire	26	No
Sizing Basis	27	Thermal Expansion
Rupture Disk	28	No

SERVICE CONDITION

Fluid / State	29	CW / LIQUID
Mol. Weight / Specific Gravity	30	0.981
Compressibility Factor	31	-
Ratio of Specific Heat	32	-
Viscosity	33	0.437 cP
Operating / Relieving Temp.	34	36 / 64.4 ℃
Design Min. / Design Max. Temp.	35	65 ℃
Operating / Set Pressure	36	0.539 / 1.029 MPag
Design Pressure / C.D.T.P	37	1.029 / 1.029 MPag
Back Pressure — Superimposed - Constant	38	- MPag
Back Pressure — Superimposed - Variable	39	- MPag
Back Pressure — Built-up	40	0.009 MPag
Back Pressure — Total	41	0.009 MPag
Allowable Overpressure	42	10 %
Closing Pressure / Blowdown(%)	43	Min. 0.87465 MPag / 14.9999%

SIZING & SELECTION

Required Capacity	44	0.0007 m3/h
Valve Actual Capacity	45	5.3 m3/h
Calculated Orifice Area	46	0.017567 ㎟
Selected Orifice Area	47	132.9 ㎟
Orifice Dia.(mm)	48	D1(13)
		-
		-

ETC

Paint System & Color	49	See Remark
Test Gag	50	Yes
Bug screen	51	No

Calculation

Calculation of Area

$$A1 = 11.78 \times W1 \times (\sqrt{G/(P1-Pb)})/(Kd \times Kb \times Kc \times Kv)$$

$$= 11.78 \times 0.011667 \times \sqrt{0.981/(1131.9-9)}/(0.615 \times 1 \times 1 \times 0.376)$$

$$= \underline{\mathbf{0.017567}} \ ㎟$$

Calculation of Capacity

$$W = A \times Kd \times Kb \times Kc \times Kv/(11.78 \times \sqrt{(G/(P1-Pb))})$$

$$= 132.9 \times 0.615 \times 1 \times 1 \times 0.376/(11.78 \times \sqrt{(0.981/(1131.9-9))})$$

$$= 88.30 \ ℓ/min$$
$$= \mathbf{5.3} \ m3/h$$

W	Valve Capacity	88.30 ℓ/min
W1	Required Capacity	0.011667 ℓ/min
P	Set Pressure	1029 KPag
A1	Calculated Area	0.017567 ㎟
A	Selected Area	132.9 ㎟
Kd	Coefficient of Discharge	0.615
G	Specific Gravity	0.981
Pb	Back Pressure	9 KPag
Kb	Correction Factor Due to Back Pressure	1
Kc	Correction Factor for a rupture disk	1
Kv	Correction Factor due to Viscosity	0.376
P1	Set Pressure plus Overpressure	1131.9 KPag

Remarks

*Remark
- Operating Pressure : 5.5 kg/㎠g
- Setting Pressure : 10.5 kg/㎠g
- Design Pressure : 10.5 kg/㎠g
- Constant Back Pressure : kg/㎠g
- Variable Back Pressure : kg/㎠g
- Built-up Back Pressure : 0.1 kg/㎠g
- RequiredCapacity : 11.772 kg/h
- Valve Capacity : 294.3 kg/h

JOKWANG I.L.I

Pressure Safety & Relief Valve Specification and Calculation Sheet

Sheet No.	9 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL	P&ID No.	1	H530-R2-PID-3040
	Tag No.	2	R2-PSV-3406/3407
	Service Line	3	C-301A/B CYLINDER
	Model No.	4	JSV-FF100
	Quantity	5	2

Calculation

Calculation of Area

TYPE	Nozzle Type	6	Full Nozzle
	Design Type	7	Conventional
	Bonnet Type	8	Close
	Lever Type	9	None
	Cap Type	10	Screwed

$$A1 = 11.78 \cdot W1 \cdot (\sqrt{G/(P1-Pb)})/(Kd \cdot Kb \cdot Kc \cdot Kv)$$

CONN.	Size. Inlet / Outlet	11	3/4"X1"
	Inlet. Rating / Facing	12	ASME CL.150 RF
	Outlet. Rating / Facing	13	ASME CL.150 RF

$$= 11.78 \cdot 0.016667 \cdot \sqrt{(0.969/(1131.9-9))}/(0.615 \cdot 1 \cdot 1 \cdot 0.556)$$

MATERIALS	Body (Base)	14	SA216 WCB
	Bonnet	15	SA216 WCB
	Seat	16	316 SS-st.

$$= \underline{\textbf{0.016867}} \; \text{mm}^2$$

	Disc	17	316 SS-st.
	Guide	18	316 SS
	Gasket (Bonnet)	19	PTFE
	Spring	20	316 SS
	Bellows	21	None

Calculation of Capacity

$$W = A \cdot Kd \cdot Kb \cdot Kc \cdot Kv/(11.78 \cdot \sqrt{(G/(P1-Pb))})$$

BASIS	Approved by	22	UV STAMP
	Comply with NACE	23	No
	EN 10204	24	No
	Code	25	API RP 520-Certification
	Fire	26	No
	Sizing Basis	27	Thermal Expansion

$$= 132.9 \cdot 0.615 \cdot 1 \cdot 1 \cdot 0.556/(11.78 \cdot \sqrt{(0.969/(1131.9-9))})$$

$$= 131.30 \; \ell/min$$
$$= \textbf{7.9} \; m3/h$$

	Rupture Disk	28	No

		Value
W	Valve Capacity	131.30 ℓ/min
W1	Required Capacity	0.016667 ℓ/min
P	Set Pressure	1029 KPag
A1	Calculated Area	0.016867 mm²
A	Selected Area	132.9 mm²
Kd	Coefficient of Discharge	0.615
G	Specific Gravity	0.969
Pb	Back Pressure	9 KPag
Kb	Correction Factor Due to Back Pressure	1
Kc	Correction Factor for a rupture disk	1
Kv	Correction Factor due to Viscosity	0.556
P1	Set Pressure plus Overpressure	1131.9 KPag

SERVICE CONDITION	Fluid / State	29	CW / LIQUID
	Mol. Weight / Specific Gravity	30	0.969
	Compressibility Factor	31	-
	Ratio of Specific Heat	32	-
	Viscosity	33	0.331 cP
	Operating / Relieving Temp.	34	35 / 85.7 ℃
	Design Min. / Design Max. Temp.	35	65 ℃
	Operating / Set Pressure	36	0.539 / 1.029 MPag
	Design Pressure / C.D.T.P	37	1.029 / 1.029 MPag
	Back Pressure — Superimposed - Constant	38	- MPag
	Back Pressure — Superimposed - Variable	39	- MPag
	Back Pressure — Built-up	40	0.009 MPag
	Back Pressure — Total	41	0.009 MPag
	Allowable Overpressure	42	10 %
	Closing Pressure / Blowdown(%)	43	Min. 0.87465 MPag / 14.9999%

Remarks

*Remark
- Operating Pressure : 5.5 kg/㎠g
- Setting Pressure : 10.5 kg/㎠g
- Design Pressure : 10.5 kg/㎠g
- Built-up Back Pressure : 0.1 kg/㎠g
- Required Capacity : 0.969 kg/h
- Valve Capacity : 775.2 kg/h

SIZING & SELECTION	Required Capacity	44	0.001 m3/h
	Valve Actual Capacity	45	7.9 m3/h
	Calculated Orifice Area	46	0.016867 mm²
	Selected Orifice Area	47	132.9 mm²
	Orifice Dia.(mm)	48	D1(13)
			-
			-

ETC	Paint System & Color	49	See Remark
	Test Gag	50	Yes
	Bug screen	51	No

Pressure Safety & Relief Valve Specification and Calculation Sheet

JOKWANG I.L.I (Since 1968)

Sheet No.	10 of 11	Rev . No	1
Project Name	Yeosu No.2 Complex Project(R2) 2nd PO		
Project No.			
Date	2021-01-22	By	S.W.PARK
Checked	M.J.LEE	Approved	J.H.LEEM

GENERAL

		No	
P&ID No.	1	H530-R2-PID-3037
Tag No.	2	R2-PSV-3756A/B
Service Line	3	W-302-E (Cold Box)
Model No.	4	JSV-FF100
Quantity	5	2

TYPE

	No	
Nozzle Type	6	Full Nozzle
Design Type	7	Conventional
Bonnet Type	8	Close
Lever Type	9	None
Cap Type	10	Screwed

CONN.

	No	
Size. Inlet / Outlet	11	3/4"X1"
Inlet. Rating / Facing	12	ASME CL.600 RF
Outlet. Rating / Facing	13	ASME CL.150 RF

MATERIALS

	No	
Body (Base)	14	SA351 CF8M
Bonnet	15	SA351 CF8M
Seat	16	316 SS-st.
Disc	17	316 SS-st.
Guide	18	316 SS
Gasket (Bonnet)	19	PcTFE
Spring	20	316 SS
Bellows	21	None

BASIS

	No	
Approved by	22	KGS UV STAMP
Comply with NACE	23	No
EN 10204	24	No
Code	25	API RP 520
Fire	26	Yes
Sizing Basis	27	Fire Case
Rupture Disk	28	No

SERVICE CONDITION

	No	
Fluid / State	29	Hydrocarbon (HC) / GAS
Mol. Weight / Specific Gravity	30	3.2
Compressibility Factor	31	1.008
Ratio of Specific Heat	32	1.4
Viscosity	33	0.008 cP
Operating / Relieving Temp.	34	42 / -137 ℃
Design Min. / Design Max. Temp.	35	-196 / 66 ℃
Operating / Set Pressure	36	4.942 / 5.933 MPag
Design Pressure / C.D.T.P	37	5.933 / 5.9036 MPag
Back Pressure — Superimposed - Constant	38	0.0294 MPag
Back Pressure — Superimposed - Variable	39	- MPag
Back Pressure — Built-up	40	0.0217 MPag
Back Pressure — Total	41	0.0511 MPag
Allowable Overpressure	42	21 %
Closing Pressure / Blowdown(%)	43	Min. 5.51769 MPag / 7%

SIZING & SELECTION

	No	
Required Capacity	44	574 kg/h
Valve Actual Capacity	45	1775 kg/h
Calculated Orifice Area	46	22.952062 ㎟
Selected Orifice Area	47	70.97 ㎟
Orifice Dia.(mm)	48	D(9.5)
		-
		-

ETC

	No	
Paint System & Color	49	See Remark
Test Gag	50	Yes
Bug screen	51	No

Calculation

Calculation of Area

$$A_1 = 13160 \cdot W_1 \cdot (\sqrt{ZT/M})/(C \cdot K_d \cdot (P \cdot 1.21 + 101.325) \cdot K_b \cdot K_c)$$

$$= 13160 \cdot 574 \cdot (\sqrt{1.008 \cdot 136/3.2})/(356.06 \cdot 0.831 \cdot (5933 \cdot 1.21 + 101.325) \cdot 1 \cdot 1)$$

$$= \underline{\mathbf{22.952062}} \ \text{㎟}$$

Calculation of Capacity

$$W = A \cdot C \cdot K_d \cdot (P \cdot 1.21 + 101.325) \cdot K_b \cdot K_c/(13160 \cdot \sqrt{ZT/M})$$

$$= 70.97 \cdot 356.06 \cdot 0.831 \cdot (5933 \cdot 1.21 + 101.325) \cdot 1 \cdot 1/(13160 \cdot \sqrt{1.008 \cdot 136/3.2})$$

$$= \underline{\mathbf{1775}} \ \text{kg/h}$$

W	Valve Capacity	1775 kg/h
W1	Required Capacity	574 kg/h
P	Set Pressure	5933 KPag
A1	Calculated Area	22.952062 ㎟
A	Selected Area	70.97 ㎟
Kd	Coefficient of Discharge	0.831
C	Coefficient base on Ratio of Specific Heat	356.06
T	Kelvin Temperature	136 K
M	Molecular Weight	3.2
Z	Compressibility Factor	1.008
Kb	Correction Factor Due to Back Pressure	1
Kc	Correction Factor for a rupture disk	1

Remarks

*Remark
Service Requirement : Cryogenic

- Operating Pressure : 50.4 kgf/㎠g
- Setting Pressure : 60.5 kgf/㎠g
- Design Pressure : 60.5 kgf/㎠g
- Constant Back Pressure : 0.3 kgf/㎠g
- Built-up Back Pressure : 0.222 kgf/㎠g

Ref. No : SLO200334-110-642732   JOKWANG I.L.I CO.,LTD.   No.TTIPCF500-2