

ATTACHMENT-III



Xinjiang Petroleum
Investigation Design and
Research Institute(Co.,Ltd.)

KPD-TAY Integrated Development Project Phase-II

PROC-FC/CB/PROJ-667/767321/2013

Project No.

FPA13013D

Document No.

F80-01-PRO-LST-05

Relief Load Summary

AS-BUILT

F0	25-08-2015	AS-BUILT	YZ	ZS	THZ	GJF
0	13-05-2014	Approved	YZ	ZS	THZ	GJF
B	10-04-2014	For Approval	YZ	ZS	THZ	GJF
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Xinjiang Petroleum
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KPD-TAY Integrated Development Project Phase-II

PROC-FC/CB/PROJ-667/767321/2013

Project No.

FPA13013D

Document No.

B45-01-PRO-LST-07

Relief Load Summary

AS-BUILT

F0	04-08-2015	As Built	ZJL	LGC	ZZY	GJF
0	10-02-2014	Approved	ZJL	LGC	ZZY	GJF
C	10-12-2013	For Approval	ZJL	LGC	ZZY	GJF
Rev.	Date	Description	Prepared by	Checked by	Reviewed by	Approved by

Relief Load Summary

 Xinjiang Petroleum Investigation Design and Research Institute (Co., Ltd.)		Project	KPD-TAY Integrated Development Project Phase-II PROC-FC/CB/PROJ-667/767321/2013					F0	04-Aug-2015	As Built		ZJL	LGC	LKY	GJF				
		Plant(or Unit) Name	Condensate Stabilization & LPG Recovery					0	10-Feb-2014	Approved		ZJL	LGC	LKY	GJF				
		Area	Unit 45/55/71/72					C	10-Dec-2013	Issued for Approval		ZJL	LGC	LKY	GJF				
		Design phase	As Built					Rev.	Date	Description	Squad check	Orig.By	Chk'd By	App'd By	F.App'd By				
Seq NO.	Source	Protected Equipment	P&ID No.	Destination	Relieving Status	Fluid	MW	Temp. F	Relief Load (lb/h)										Remarks
									CV failure	Tube Rupture	Closed outlet	Blocked in	Loss of medium	Cooling water failure	Power failure	Fire	Thermal relief	Design Flowrate	
CONDENSATE STABILIZATION - TRAIN 1																			
1	PSV-7101	V-7101	B71-01-PRO-DWG-02-01	Flare Head	G	Hydrocarbon gas	22.3	70			1935.6						4312		Overpressure
2	PSV-7102	F-7101A	B71-01-PRO-DWG-02-02	Flare Head	L	Condensate	95.91	95			27845						48466		Overpressure
3	PSV-7103	F-7101B	B71-01-PRO-DWG-02-02	Flare Head	L	Condensate	95.91	95			27845						48466		Overpressure
4	PSV-7104	F-7102	B71-01-PRO-DWG-02-02	Flare Head	L	Condensate	95.91	95			27845						48466		Overpressure
5	PSV-7105	C-7101	B71-01-PRO-DWG-02-03	Flare Head	G	Hydrocarbon gas	24.13	90			31060						36588		Overpressure
6	PSV-7106	E-7101 Tubeside	B71-01-PRO-DWG-02-03	Hot oil storage	L	Hot oil	118.5	430	33775								41649		Overpressure
7	PSV-7108	V-7102	B71-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	25.31	85			3990						4228		Overpressure
8	PSV-7109A	K-7102A	B71-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	25.31	243			3990						8961.9		Overpressure
9	PSV-7109B	K-7102B	B71-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	25.31	243			3990						8961.9		Overpressure
10	BDV-7104	C-7101	B71-01-PRO-DWG-02-03	Flare Head	G	Hydrocarbon gas	28.88	68.42							4505		4955.5		Blow Down (Peak flow)
LPG Recovery Unit - TRAIN 1																			
1	PSV-4500	E-4503	B45-01-PRO-DWG-02-01	Flare Head	G	Hydrocarbon gas	19.09	115			267640						293040		Overpressure
2	PSV-4502	V-4504	B45-01-PRO-DWG-02-02	Flare Head	G	Hydrocarbon gas	18.32	-45			239200						249610		Overpressure
3	PSV-4503	C-4501	B45-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	17.7	-105			208930						246970		Overpressure
4	PSV-4506	C-4502	B45-01-PRO-DWG-02-05	Flare Head	G	Hydrocarbon gas	22.3	-35			74560						99569		Overpressure
5	PSV-4507	E-4505 Tubeside	B45-01-PRO-DWG-02-05	Hot oil storage	L	Hot oil	50.01	218	35604.3								37855		Overpressure
6	PSV-4510	E-4506	B45-01-PRO-DWG-02-06	Flare Head	G	Hydrocarbon gas	22.3	-35			74560						99569		Overpressure
7	PSV-4512	E-4507Tubeside	B45-01-PRO-DWG-02-08	Hot oil storage	L	Hot oil	118	465	22071								25829		Overpressure
8	PSV-4513	V-4506	B45-01-PRO-DWG-02-09	Flare Head	G	Hydrocarbon gas	48.3	128					52139				79397		Overpressure
9	PSV-4514	P-4501A	B45-01-PRO-DWG-02-04	Flare Head	L	Liquid Hydrocarbon	24.5	-105								100	14497		Overpressure
10	PSV-4515	P-4501B	B45-01-PRO-DWG-02-04	Flare Head	L	Liquid Hydrocarbon	24.5	-105								100	14497		Overpressure
11	PSV-4516	P-4502A	B45-01-PRO-DWG-02-07	Flare Head	L	Liquid Hydrocarbon	25.5	-75								100	14517		Overpressure
12	PSV-4517	P-4502B	B45-01-PRO-DWG-02-07	Flare Head	L	Liquid Hydrocarbon	25.5	-75								100	14517		Overpressure
13	PSV-4518	P-4503A	B45-01-PRO-DWG-02-09	Flare Head	L	Liquid Hydrocarbon	48.3	130								100	10263		Overpressure
14	PSV-4519	P-4503B	B45-01-PRO-DWG-02-09	Flare Head	L	Liquid Hydrocarbon	48.3	130								100	10263		Overpressure
15	BDV-4500	V-4504	B45-01-PRO-DWG-02-02	Flare Head	G	Hydrocarbon gas	18.31	-46.58							8028		8830.8		Blow Down (Peak flow)
16	BDV-4506	C-4501	B45-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	17.69	-104							12580		13838.0		Blow Down (Peak flow)
17	BDV-4514	C-4502,V-4505	B45-01-PRO-DWG-02-07	Flare Head	G	Hydrocarbon gas	22.28	-31.86							22680		24948.0		Blow Down (Peak flow)
18	BDV-4519	C-4503,V-4506	B45-01-PRO-DWG-02-09	Flare Head	G	Hydrocarbon gas	45.56	130.4							26000		28600.0		Blow Down (Peak flow)
CONDENSATE STABILIZATION - TRAIN 2																			
1	PSV-7201	V-7201	B72-01-PRO-DWG-02-01	Flare Head	G	Hydrocarbon gas	22.3	70			1935.6						4312		Overpressure
2	PSV-7202	F-7201A	B72-01-PRO-DWG-02-02	Flare Head	L	Condensate	95.91	95			27845						48466		Overpressure
3	PSV-7203	F-7201B	B72-01-PRO-DWG-02-02	Flare Head	L	Condensate	95.91	95			27845						48466		Overpressure
4	PSV-7204	F-7202	B72-01-PRO-DWG-02-02	Flare Head	L	Condensate	95.91	95			27845						48466		Overpressure
5	PSV-7205	C-7201	B72-01-PRO-DWG-02-03	Flare Head	G	Hydrocarbon gas	24.13	90			31060						36588		Overpressure
6	PSV-7206	E-7201 Tubeside	B72-01-PRO-DWG-02-03	Hot oil storage	L	Hot oil	118.5	430	33775								41649		Overpressure
7	PSV-7208	V-7202	B72-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	25.31	85			3990						4228		Overpressure
8	PSV-7209A	K-7202A	B72-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	25.31	243			3990						8961.9		Overpressure
9	PSV-7209B	K-7202B	B72-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	25.31	243			3990						8961.9		Overpressure
10	BDV-7204	C-7201	B72-01-PRO-DWG-02-03	Flare Head	G	Hydrocarbon gas	28.88	68.42							4505		4955.5		Blow Down (Peak flow)
LPG Recovery Unit - TRAIN 2																			
1	PSV-5500	E-5503	B55-01-PRO-DWG-02-01	Flare Head	G	Hydrocarbon gas	19.09	115			267640						293040		Overpressure
2	PSV-5502	V-5504	B55-01-PRO-DWG-02-02	Flare Head	G	Hydrocarbon gas	18.32	-45			239200						249610		Overpressure
3	PSV-5503	C-5501	B55-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	17.7	-105			208930						246970		Overpressure
4	PSV-5506	C-5502	B55-01-PRO-DWG-02-05	Flare Head	G	Hydrocarbon gas	22.3	-35			74560						99569		Overpressure
5	PSV-5507	E-5505 Tubeside	B55-01-PRO-DWG-02-05	Hot oil storage	L	Hot oil	50.01	218	35604.3								37855		Overpressure
6	PSV-5510	E-5506	B55-01-PRO-DWG-02-06	Flare Head	G	Hydrocarbon gas	22.3	-35			74560						99569		Overpressure
7	PSV-5512	E-5507ubeside	B55-01-PRO-DWG-02-08	Hot oil storage	L	Hot oil	118	465	22071								25829		Overpressure
8	PSV-5513	V-5506	B55-01-PRO-DWG-02-09	Flare Head	G	Hydrocarbon gas	48.3	128					52139				79397		Overpressure
9	PSV-5514	P-5501A	B55-01-PRO-DWG-02-04	Flare Head	L	Liquid Hydrocarbon	24.5	-105								100	14497		Overpressure
10	PSV-5515	P-5501B	B55-01-PRO-DWG-02-04	Flare Head	L	Liquid Hydrocarbon	24.5	-105								100	14497		Overpressure
11	PSV-5516	P-5502A	B55-01-PRO-DWG-02-07	Flare Head	L	Liquid Hydrocarbon	25.5	-75								100	14517		Overpressure
12	PSV-5517	P-5502B	B55-01-PRO-DWG-02-07	Flare Head	L	Liquid Hydrocarbon	25.5	-75								100	14517		Overpressure
13	PSV-5518	P-5503A	B55-01-PRO-DWG-02-09	Flare Head	L	Liquid Hydrocarbon	48.3	130								100	10263		Overpressure
14	PSV-5519	P-5503B	B55-01-PRO-DWG-02-09	Flare Head	L	Liquid Hydrocarbon	48.3	130								100	10263		Overpressure
15	BDV-5500	V-5504	B55-01-PRO-DWG-02-02	Flare Head	G	Hydrocarbon gas	18.31	-46.5							8028		8830.8		Blow Down (Peak flow)
16	BDV-5506	C-5501	B55-01-PRO-DWG-02-04	Flare Head	G	Hydrocarbon gas	17.69	-104							12580		13838.0		Blow Down (Peak flow)
17	BDV-5514	C-5502,V-5505	B55-01-PRO-DWG-02-07	Flare Head	G	Hydrocarbon gas	22.28	-31.86							22680		24948.0		Blow Down (Peak flow)
18	BDV-5519	C-5503,V-5506	B55-01-PRO-DWG-02-09	Flare Head	G	Hydrocarbon gas	45.56	130.4							26000		28600.0		Blow Down (Peak flow)



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Document No.

A54-01-PRO-LST-08

Relief Load Summary

AS-BUILT

F0	13-08-2015	AS-BUILT	WJH	ZY	SQ	GJF
0	16-06-2014	Approved	WJH	ZY	SQ	GJF
C	07-11-2013	For Approval	WJH	ZY	SQ	GJF
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Relief Load Summary

AS-BUILT

F0	13-08-2015	AS-BUILT	WJH	ZY	SQ	GJF
0	16-06-2014	Approved	WJH	ZY	SQ	GJF
C	07-11-2013	For Approval	WJH	ZY	SQ	GJF
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  	SUPPLY AND COMMISSIONING OF DEHYDRATION UNITS CONTRACT N° PROC-FC / CB / PROJ-522 / 767349 / 2013 OGDCL- Oil & Gas Development Company Limited	Job No: 2307-12	Unit: 45/55	
		BELLELLI ENGINEERING S.p.A. Doc.No:		Rev.
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RELIEF AND BLOWDOWN REPORT

00	07/02/14	Issued for Comments	PM	SDO	AG		
Rev.	Date	Description	Prepared	Verified	Approved	Approved	Approved
Document Data			Bellelli Engineering S.p.A.		Contractor	Company	

 	SUPPLY AND COMMISSIONING OF DEHYDRATION UNITS		Job No: 2307-12	Unit: 45/55
	CONTRACT N° PROC-FC / CB / PROJ-522 / 767349 / 2013		BELLELLI ENGINEERING S.p.A. Doc.No:	Rev.
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Attachments:

Attachment 1 - RELIEF LOAD & BLOWDOWN SUMMARY

Attachment 2 - PSV INLET LINES SIZING

Attachment 3 - BLOWDOWN CALCULATIONS FOR EQUIPMENT

Attachment 4 - BLOWDOWN CALCULATIONS FOR MDMT

Attachment 5 - FLARE HEADER ANALYSIS

  	SUPPLY AND COMMISSIONING OF DEHYDRATION UNITS		Job No: 2307-12	Unit: 45/55
	CONTRACT N° PROC-FC / CB / PROJ-522 / 767349 / 2013 OGDCL- Oil & Gas Development Company Limited		BELLELLI ENGINEERING S.p.A. Doc.No:	Rev.
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1. ABBREVIATIONS

Bellelli	Bellelli Engineering S.p.A.
OGDCL	Oil & Gas Development Company Limited
B.L.	Battery Limit
MMSCFD	Millions of Standard Cubic Feet per Day
MMSCF	Millions of Standard Cubic Feet
USgal	US gallons
PSV	Pressure Relief Valve
PSE	Rupture Disk

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2. DESIGN AND REFERENCE DOCUMENTATION

The design of the Pressure Relieving and Depressuring System has been based on the following International Codes and Project Specifications and documentation:

- API RP-520 - Recommended Practice for the Design and Installation of Pressure Relieving Systems
- API RP-521 - Guide for Pressure Relief and Depressuring Systems
- API RP 526 - Flanged Steel Safety Relief Valves
- ASME Boiler & Pressure Vessel Code VIII/Div.1
- Piping & Instrument Diagrams, Bellelli doc. no. 2307-PU45-PR-DI-20005 / 2307-PU55-PR-DI-20006
- Layout drawing, Bellelli doc. no. 2307-PU45/55-ME-DW-30010
- Datasheet for PSV's and Rupture Disk, Bellelli doc. no. 2307-PU45/55-PR-DS-20025
- Design Basis, Bellelli doc. no. 2307-PU45/55-PR-PR-20001

3. FLARE SYSTEM

Both units 45 and 55 are connected to the flare system for disposal of relief and blowdown system streams originating from the high pressure source. The assumed flare header conditions at battery limit (BL-12) are below listed (refer also to Design Basis, Bellelli doc. no. 2307-PU45/55-PR-PR-20001):

Superimposed back pressure:	3	psig (constant/static)
	30	psig (variable/dynamic)
Built-up back pressure at PSV outlet:	max. 50	psig
Design pressure:	150	psig
Design temperature:	180	°F
Minimum Design Temperature:	-80	°F

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4. RELIEF SYSTEM BASE CONSIDERATIONS

The design of all relief equipment (safety valves and blowdown system) has been based on API RP 520/521.

In particular, the following main considerations and assumptions have been kept into account:

1. Maximum accumulated pressure on equipment design pressure:
 - Fire exposure cases: +21%
 - Other than fire exposure cases: +10%
2. Units 45 and 55 have been considered separate fire areas.
3. It is assumed that the entire area where the Package is installed is provided with adequate sewer system for liquid pools drainage and that prompt firefighting equipment/capability is available in the Plant (refer also to section 8. of the Design Basis, Bellelli doc. no. 2307-PU45/55-PR-PR-20001).
4. For the calculation of the external fire case on the vessels provided with thermal insulation, an insulation conductance lower than 4 Btu/(h ft²°F) has been considered. This requirement has been specified in the equipment relevant datasheets.
5. For the definition of the area and volume of the equipment exposed to external fire, an overdesign margin has been kept into account in order to keep into account of the associated piping lines.

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5. PRESSURE RELIEF VALVES INLET LINES

For the sizing of the Pressure Relief Valves inlet lines, the criteria described in API RP 520 and 521 have been followed. As a consequence, the inlet lines have been designed to keep the pressure losses from the connected vessel to the PSV lower than 3 percent of the set pressure.

The pressure loss has been calculated using the rated capacity of the PSV and based on the conditions corresponding to the sizing scenario. Refer also to the Datasheet for PSV's and Rupture disk, Bellelli doc. no. 2307-PU45/55-PR-DS-20025.

The piping segments lengths and fitting have been based on the Package general arrangement (Layout drawing, Bellelli doc. no. 2307-PU45/55-ME-DW-30010).

Refer to **Attachment 2 - PSV INLET LINES SIZING**.

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6. BLOWDOWN SYSTEM CALCULATION

The blowdown calculation and Flare Header sizing has been based on the relief loads and conditions indicated in the **Attachment 1 - RELIEF LOAD & BLOWDOWN SUMMARY**, and on the Flare conditions described at Section 2.

All the items connected to the Flare Header have been included in the analysis: the Pressure Relief Valves discharging to Flare, Rupture Disk PSE-4590/5590 and PSE-4591/5591, the Blowdown Valves BDV-4501/5501 and BDV-4502/5502.

6.1 Package Blowdown Calculation

For the design of the Blowdown Valves BDV-4501/5501 and BDV-4502/5502, relevant to the high pressure gas circuit, the Package blowdown flowrate has been calculated using the dedicated Blowdown Dynamic Utility in Aspen Hysys™ application and based on API RP 521 criteria.

Two different cases have been simulated:

- 1) Emergency depressurization during external fire case. This case is the sizing one for the Blowdown Valves BDV-4501/5501 and BDV-4502/5502 and provides the maximum discharge flowrate to the flare header.

The base calculation conditions are:

- Starting conditions: maximum operating pressure (1030 psig) and minimum operating temperature according to H&M balance for each equipment.
- Liquid level in the vessels: Normal Level value.
- Depressurization rate: to achieve 100 psig in 15 minutes (API RP 521).
- Equivalent depressurized volume defined in order to have the same geometrical volume and exposed area of each depressurized equipment item with associated piping.

The peak flowrates calculated by the Hysys Blowdown Dynamic Utility, for each single equipment, have been added up to determine the total maximum flowrate discharged during the Fire Case Emergency Depressurization by BDV-4501/5501 and BDV-4502/5502.

BDV-4501/5501 is designed to depressurize the following equipment:

E-4503/5503 tubes, V-4501/5501, F-4501/5501 A/B, V-4502/5502A and V-4502/5502B.

BDV-4502/5502 is designed to depressurize the following equipment:

V-4502/5502A, V-4502/5502B, F-4502/5502 A/B, E-4501/5501 tube/shell, E-4502/5502 A/B tube side, EA-4501/5501, V-4503/5503.

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2) Emergency depressurization at maximum operating pressure and minimum ambient temperature. This case simulation is necessary to determine the Minimum Design Temperatures of the Package high pressure gas circuit and of the Flare Header (refer also to Bellelli doc. no. 2307-PU45/55-PR-PR-20001).

The base calculation conditions are:

- Starting conditions: maximum operating pressure (1030 psig) and minimum ambient temperature (36 °F).
- No liquid level in the vessels (conservative condition since liquid thermal inertia is limiting the temperature decreasing).
- Final pressure: atmospheric.
- The RO-4503/5503 and RO-4504/5504 orifice sizes are the orifice sizes determined with the calculations described at point 5.1 and defined in Bellelli doc. no. 2307-PU45/55-IN-DS-40010 (datasheet for Flow meters and Restriction Orifice):
- Adiabatic conditions (more conservative as no heat input from the external environment is considered).

In adiabatic conditions, it is possible to simulate the depressurized equipment all together as an equivalent cylinder whose volume corresponds to the total geometrical volume of the single equipments and relevant piping.

Based on the calculation above described it has been verified that minimum expected walls temperature in the depressurized vessels and piping is higher than 30°F.

The minimum expected temperature in the Flare Header due to the gas pressure reduction through flow orifice 300/310-RO010 (downstream 300/310-BDV010) is about -75°F. According to this the Flare Header minimum design temperature is set to -80 °F.

Refer to **Attachment 3 - BLOWDOWN CALCULATIONS EQUIPMENT** and **Attachment 4 - BLOWDOWN CALCULATIONS MDMT** for the Hysys Blowdown Dynamic Utility simulation reports.

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6.2 Flare header and PSV's Discharge Lines

For the sizing of the Flare Header and of the Pressure Relief Valves discharge lines (tailpipes), the criteria described in API RP 520 and 521 have been followed.

The most significant discharge scenarios for a **single unit** have been analyzed using a dedicated application: *Aspen Flare System Analyzer TM*.

(For sake of clarity, the equipment items of reported the description below are referred to Unit 45. For items of Unit 55, the same tags can be read by modifying the first two number digits from 45 to 55 (e.g. from BDV-4501 to BDV-5501)

In order to develop the flare sizing in a conservative way, the calculation have been executed in adiabatic conditions.

The piping segments lengths and fitting have been based on the Package general arrangement (Layout drawing, Bellelli doc. no. 2307-PU45/55-ME-DW-30010).

Please refer to **Attachment 5 - FLARE HEADER ANALYSIS** for the output of the Flare System Analyzer.

The scenarios analyzed are the following:

a) Scenario Depressuring maxback P

Blowdown valves BDV-4501 and BDV-4502 are open during an external fire scenario. In addition, the maximum superimposed pressure (variable/dynamic) of 30 psig has been considered at the flare header battery limit.

This scenario provides the maximum build-up back pressure with the maximum massive flowrate in the flare header and it is therefore necessary to verify the total back pressure values at the pressure valves outlet.

The blowdown valves BDV-4501 and BDV-4502 have been assumed open to depressurize the high pressure gas circuit. Pressure relief valves PSV-4502, PSV-45003A/B, PSV-4504A/B, PSV-4005, PSV-4507 and PSV-4508 have not been included in the calculations of this scenario because, BDV-4501 and BDV-4502 are open, the vessels on the high pressure gas circuit have been depressurized and the relevant PSVs set pressure cannot be reached.

b) Scenario Depressuring minback P

Same conditions and considerations of scenario a) but considering the minimum superimposed pressure at the flare header battery limit considering a static back pressure of 3 psig plus a minimum built up pressure of 2 psig. So, minimum superimposed back pressure (variable/dynamic) at battery limit has been assumed 5 psig (19.7 psia).

This scenario provides the lowest build-up back pressure simultaneously with the maximum massive flowrate in the flare header, corresponding to the maximum volumetric flow rate.

 	SUPPLY AND COMMISSIONING OF DEHYDRATION UNITS		Job No: 2307-12	Unit: 45/55
	CONTRACT N° PROC-FC / CB / PROJ-522 / 767349 / 2013		BELLELLI ENGINEERING S.p.A. Doc.No:	Rev.
	OGDCL- Oil & Gas Development Company Limited		2307-PU45/55-PR-CA-20011	00
			Sheet / of	
Originator Company			10 / 10	
	BELLELLI ENGINEERING S.p.A.			

c) Scenario PSV-4502.

In this scenario only PSV-4502 is considered open and discharging at rated flow rate. The minimum superimposed backpressure has been considered at the Flare Header battery limit considering a static back pressure of 3 psig plus a minimum variable/dynamic pressure of 2 psig. So, minimum superimposed back pressure at battery limit has been assumed 5 psig (19.7 psia). This scenario provides the maximum volumetric flow rate in the PSV tail pipe and, therefore, is sizing for tail pipe itself.

d) Scenario PSV-4503 A/B.

Same considerations of scenario c) applied to PSV-4503 A/B.

e) Scenario PSV-4504 A/B.

Same considerations of scenario c) applied to PSV-4504 A/B.

f) Scenario PSV-4505.

Same considerations of scenario c) applied to PSV-4505.

g) Scenario PSV-4507.

Same considerations of scenario c) applied to PSV-4507.

h) Scenario PSV-4508.

Same considerations of scenario c) applied to PSV-4508.

i) Scenario PSE-4590.

Same considerations of scenario c) applied to PSE-4590.

j) Scenario PSE-4591.

Same considerations of scenario c) applied to PSE-4591.

Attachment 2 - PSV INLET LINES SIZING CALCULATION

Attachment 2 - PSV INLET LINE SIZING						
LINE SIZE & PRESSURE DROP CALCULATION						
CLIENT: ZEL-OGDCL			PROJECT: KPD-MOLECULAR SIEVE DEHYDRATION PACKAGE		DATE: 07.02.2014	
LOCATION: Pakistan			CASE: PSV inlet lines sizing		BY: PM	
					REV.: 00	
INPUT						
Pressure Relief Valve		PSV4502/5502	PSV4503/5503	PSV4504/5504	PSV4505/5505	PSV4507/5507
Drawing Ref.	P&ID	SH.2	SH.3	SH.4	SH.7	SH.5
from		V-4501/5501	F-4501/5501 A/B	T2-45-G-048049-E1X	V-4503	6"-45-G-075-E1X
Calculated Flowrate (note 6)	lb/h	9854	10893	19974	24678	9806
PSV Set Pressure	[psig]	1200	1200	1200	1200	1200
Max. allowable inlet line pressure drop	[psi]	36.0	36.0	36.0	36.0	36.0
Nominal or Internal diameter (N/I)		N	N	N	N	N
Diameter	[in]	3	3	4	3	3
Schedule (X to Standard) (Note 3)		STD	160	160	STD	160
Pipe roughness (X to default)	(Note 1) [in]	X	X	X	X	X
Phase (L, G, or M)		G	G	G	G	G
Liquid Flowrate RATED	[kg/h]					
Gas Flowrate RATED (note 7)	[kg/h]	6'442	6'456	10'078	16415	6317
RELIEVING Temperature	[°C]	176	176	179	218	191
RELIEVING Pressure	[bar(g)]	100.1	100.1	100.1	100.1	100.1
Molecular Weight	[kg/m3]	18.94	18.94	18.94	18.82	18.94
Gas Density (X to calculate)	[kg/m3]	51.146	51.146	50.831	46.929	50.513
Cp/Cv (X to default 1)		1.2	1.2	1.2	1.3	1.3
Gas Compressibility Factor Z (X to default 1)		0.99	0.99	0.99	0.98	0.97
Gas Visc. (X to default 0.025)	[cP]	0.014	0.014	0.014	0.019	0.018
Liquid / Mixed Phase Viscosity (Note 7)	[cP]					
Liquid Surface Tension	[dynes/cm]					
Erosion Constant (as per API RP 14E)	[ft ² /lb ^{1/2} /s]					
Maximum Velocity (Ceiling)	[ft/s]					
Minimum Velocity (Upper)	[ft/s]					
Maximum Allowable Rho * V ²	[lb/ft s ²]	17000	17000	17000	17000	17000
Minimum Rho * V ²	[lb/ft s ²]					
Maximum Allowable Rho * V ³	[lb/s ³]					
Minimum Rho * V ³	[lb/s ³]					
Maximum Allowable Specific Pressure Drop	[psi/100ft]					
FORMAL PROCESS DATA ANALYSIS		GAS OK	GAS OK	GAS OK	GAS OK	GAS OK
FORMAL PIPE DATA ANALYSIS		DIAM. OK SCHED. OK	DIAM. OK SCHED. OK	DIAM. OK SCHED. OK	DIAM. OK SCHED. OK	DIAM. OK SCHED. OK
Physical Length (Note 7)	[m]	10	13	10	20	10
Delta Elevation (Note 4)	[m]					
# of 45° Standard Elbows (L/D=16)						
# of 90° Standard Elbows (L/D=30)						
# of 90° Long Radius Elbows (L/D=16)		3	4	4	7	3
# of Tees: thru flow (L/D=20)		1	1	1	1	1
# of Tees: branch flow (L/D=60)			1	1		1
# of Valves - Check (L/D=100)						
# of Valves - Gate (L/D=8)						
Sudden Enlarg. Nom. Diam.	[in]					
Sudden Contr. Nom. Diam.	[in]	1	1	1.5	1.5	1.5
Pipe Sharp Edged Entrance (K=0.5)		1	1	1	1	1
Pipe Exit (K=1)						
Sum of other Equiv. Lengths (L/D) (Note 2)						
Sum of other K's						
Sum of other Pressure Drops	[bar]					
OUTPUT						
Flow Characteristic		Fully Turb.	Fully Turb.	Fully Turb.	Fully Turb.	Fully Turb.
Equivalent Length	[m]	15	23	23	33	19
Equivalent Length	[ft]	50	74	74	110	61
Total K (Note 5)		36.50	36.50	22.23	22.23	6.50
Mixed Phase Flow Density	[kg/m3]	-	-	-	-	-
Mixed Phase Flow Pattern		-	-	-	-	-
Gas Density	[kg/m3]	51.146	51.146	50.831	46.929	50.513
Gas Viscosity	[cP]	0.014	0.014	0.014	0.019	0.018
k (=Cp/Cv)		1.200	1.200	1.200	1.300	1.200
Z		0.990	0.990	0.990	0.980	0.970
Sonic Velocity	[m/s]	484.1	484.1	485.6	526.0	507.0
Mach number		0.015	0.021	0.019	0.022	0.020
Velocity	[m/s]	7.34	10.05	9.20	11.83	9.96
Rho * V ²	[lb/ft s ²]	24.07	32.97	30.17	38.81	32.67
Rho * V ³	[lb/s ³]	1'849	3'471	2'888	4'413	3'365
Frictional Pressure Drop per length	[psi/100ft]	1.35	3.08	1.84	2.31	2.98
Total Frictional Pressure Drop	[bar]	0.548	1.097	0.570	0.903	1.088
MAX AMM	[psi]	36.0	36.0	36.0	36.0	36.0

Note 1: Default value is 0.0018 in for Commercial Steel; for other materials see Table: ROUGHNESS OF PIPE MATERIAL (F5=ROUGHNESS).
 Note 2: For a collection of L/D values see Table: EQUIVALENT LENGTH OF VARIOUS VALVES AND FITTINGS (F5 + LENGTHS).
 Note 3: Available input values are: 5S, 10S, 10, 20, 30, 40, STD, 60, 80, XS, 100, 120, 140, 160, XXS.
 Note 4: Positive elevation is upward.
 Note 5: Based on velocity in main pipe.
 Note 6: refer to Datasheet for PSV's and Orifice Calculation, Belleli doc. no. 2307-PU45/55-PR-DS-20025, for the Pressure Relief Valves calculated flowrates.
 Note 7: Rated flowrate has been calculated assuming the installed orifice size as per API-RP-527 standard indication.

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 09:19:33 2014	
4				
5				
6	Depressuring - Dynamics: E-4503/5503 TUBE SIDE			
7				
8	Connections			
9				
10	Connections			
11	Inlet	E-4503Tube		
12	Vessel Volume (ft3)	36.07 *		
13	Liquid Volume (ft3)	0.0000 *		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	0.0000 *
16	Flat End Vessel Volume note 1 (ft3)	36.07	Cylindrical Area (ft2)	47.93
17	Height note 1 (ft)	5.070 *	Top Head Area (ft2)	7.114
18	Diameter note 1 (ft)	3.010 *	Bottom Head Area (ft2)	7.114
19	Metal Mass in Contact with Vapour (lb)	6173 *	Metal Mass in Contact with Liquid (lb)	---
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2)	---
24	C2	0.8200	Equation Units	Btu/hr
25	C3	0.3000 *		
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)	62.16	Insulation Density (lb/ft3)	17.48 *
29	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature (F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness (in)	0.8700 *	Vapour - Liquid C	0.1600
34	Metal Cp (Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density (lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity (Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness (in)	2.950 *	Vapour - Liquid m	0.3333
38	Insulation Cp (Btu/lb-F)	0.2150 *	Convection	Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
40	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
41	Valve Parameters			
42				
43	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area (in2)	2.716e-002 *		
45	Relief Pressure (psig)	7.000 *		
46	Full Open Pressure (psig)	10.00 *		
47	Vapour Back Pressure (psig)	3.000 *	Liquid Back Pressure (psig)	3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)	1030	Depressuring Time (seconds)	900.0
51	Time Step Size	---		
52	Vapour Outlet Solving Option	Calculate Cv	Final Pressure (psig)	100.0 *
53	Initial Cv Estimate (ft2)	1.886e-004 *	Solved Pressure (psig)	---
54	Results			
55				
56	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	92.98
57	Final Pressure (psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase (F)	89.52
58	Depressuring Time (seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F)	115.7
59	Vapour Cv (ft2)	1.886e-004 *	Valve Outlet Final Temperature - Liquid Phase (F)	47.02
60	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	47.02
61	Vessel Fluid Initial Temperature - Vapour Phase (F)	113.0	Inner Wall Initial Temperature - Liquid Phase (F)	113.3
62	Vessel Fluid Final Temperature - Vapour Phase (F)	92.98	Inner Wall Final Temperature - Liquid Phase (F)	107.3
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)	89.52	Inner Wall Minimum Temperature - Liquid Phase (F)	99.37
64	Valve Outlet Initial Temperature - Vapour Phase (F)	47.01	Initial Mass of Vapour (lb)	135.0
65	Valve Outlet Final Temperature - Vapour Phase (F)	86.40	Final Mass of Vapour (lb)	13.51
66	Valve Outlet Minimum Temperature - Vapour Phase (F)	37.04	Peak Vapour Flow Through Valve (lb/hr)	1260
67	Inner Wall Initial Temperature - Vapour Phase (F)	113.3	Initial Mass of Liquid (lb)	0.0000
68	Inner Wall Final Temperature - Vapour Phase (F)	107.3	Final Mass of Liquid (lb)	1.798e-029
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2ej

Date/Time: Thu Feb 06 09:19:33 2014

Depressuring - Dynamics: E-4503/5503 TUBE SIDE (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	107.3	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	113.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of E-4503/5503 tube side (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 10:14:17 2014	
4				
5				
6	Depressuring - Dynamics: V-4501/5501			
7				
8	Connections			
9				
10	Connections			
11	Inlet	V-4501		
12	Vessel Volume (ft3)	162.6 *		
13	Liquid Volume (ft3)	38.60 *		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	38.60 *
16	Flat End Vessel Volume note 1 (ft3)	162.6	Cylindrical Area (ft2)	192.5
17	Height note 1 (ft)	18.13 *	Top Head Area (ft2)	8.971
18	Diameter note 1 (ft)	3.380 *	Bottom Head Area (ft2)	8.971
19	Metal Mass in Contact with Vapour (lb)	8146 *	Metal Mass in Contact with Liquid (lb)	4072 *
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2)	---
24	C2	0.8200	Equation Units	Btu/hr
25	C3	0.3000 *		
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)	210.4	Insulation Density (lb/ft3)	17.48 *
29	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature (F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness (in)	1.100 *	Vapour - Liquid C	0.1600
34	Metal Cp (Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density (lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity (Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness (in)	3.000 *	Vapour - Liquid m	0.3333
38	Insulation Cp (Btu/lb-F)	0.2154 *	Convection	Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
40	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
41	Valve Parameters			
42				
43	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area (in2)	9.423e-002 *		
45	Relief Pressure (psig)	7.000 *		
46	Full Open Pressure (psig)	10.00 *		
47	Vapour Back Pressure (psig)	3.000 *	Liquid Back Pressure (psig)	3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)	1030	Depressuring Time (seconds)	900.0
51	Time Step Size	---		
52	Vapour Outlet Solving Option	Calculate Cv	Final Pressure (psig)	100.0 *
53	Initial Cv Estimate (ft2)	6.544e-004 *	Solved Pressure (psig)	100.1
54	Results			
55				
56	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	116.0
57	Final Pressure (psig)	100.1	Vessel Fluid Minimum Temperature - Liquid Phase (F)	111.3
58	Depressuring Time (seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F)	115.7
59	Vapour Cv (ft2)	6.544e-004 *	Valve Outlet Final Temperature - Liquid Phase (F)	115.7
60	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	115.7
61	Vessel Fluid Initial Temperature - Vapour Phase (F)	113.0	Inner Wall Initial Temperature - Liquid Phase (F)	113.3
62	Vessel Fluid Final Temperature - Vapour Phase (F)	116.0	Inner Wall Final Temperature - Liquid Phase (F)	114.0
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)	111.3	Inner Wall Minimum Temperature - Liquid Phase (F)	112.0
64	Valve Outlet Initial Temperature - Vapour Phase (F)	47.01	Initial Mass of Vapour (lb)	464.2
65	Valve Outlet Final Temperature - Vapour Phase (F)	109.9	Final Mass of Vapour (lb)	44.74
66	Valve Outlet Minimum Temperature - Vapour Phase (F)	47.01	Peak Vapour Flow Through Valve (lb/hr)	4373
67	Inner Wall Initial Temperature - Vapour Phase (F)	113.3	Initial Mass of Liquid (lb)	2397
68	Inner Wall Final Temperature - Vapour Phase (F)	113.2	Final Mass of Liquid (lb)	2393
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 10:14:17 2014

Depressuring - Dynamics: V-4501/5501 (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	113.1	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	113.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of V-4501/5501 (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 10:13:58 2014	
4				
5				
6	Depressuring - Dynamics: F-4501/5501 A/B			
7				
8	Connections			
9				
10	Connections			
11	Inlet	F-4501		
12	Vessel Volume (ft3)	322.9 *		
13	Liquid Volume (ft3)	59.45 *		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	59.45 *
16	Flat End Vessel Volume note 1 (ft3)	322.9	Cylindrical Area (ft2)	328.6
17	Height note 1 (ft)	26.62 *	Top Head Area (ft2)	12.13
18	Diameter note 1 (ft)	3.930 *	Bottom Head Area (ft2)	12.13
19	Metal Mass in Contact with Vapour (lb)	1.948e+004 *	Metal Mass in Contact with Liquid (lb)	3946 *
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2)	---
24	C2	0.8200	Equation Units	Btu/hr
25	C3	0.3000 *		
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)	352.9	Insulation Density (lb/ft3)	17.48 *
29	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature (F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness (in)	1.100 *	Vapour - Liquid C	0.1600
34	Metal Cp (Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density (lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity (Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness (in)	3.000 *	Vapour - Liquid m	0.3333
38	Insulation Cp (Btu/lb-F)	0.2154 *	Convection	Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
40	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
41	Valve Parameters			
42				
43	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area (in2)	0.1995 *		
45	Relief Pressure (psig)	7.000 *		
46	Full Open Pressure (psig)	10.00 *		
47	Vapour Back Pressure (psig)	3.000 *	Liquid Back Pressure (psig)	3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)	1030	Depressuring Time (seconds)	900.0
51	Time Step Size	---		
52	Vapour Outlet Solving Option	Calculate Cv	Final Pressure (psig)	100.0 *
53	Initial Cv Estimate (ft2)	1.385e-003 *	Solved Pressure (psig)	100.2
54	Results			
55				
56	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	111.0
57	Final Pressure (psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase (F)	108.4
58	Depressuring Time (seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F)	115.7
59	Vapour Cv (ft2)	1.385e-003 *	Valve Outlet Final Temperature - Liquid Phase (F)	115.7
60	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	115.7
61	Vessel Fluid Initial Temperature - Vapour Phase (F)	113.0	Inner Wall Initial Temperature - Liquid Phase (F)	113.3
62	Vessel Fluid Final Temperature - Vapour Phase (F)	111.0	Inner Wall Final Temperature - Liquid Phase (F)	109.8
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)	108.4	Inner Wall Minimum Temperature - Liquid Phase (F)	109.3
64	Valve Outlet Initial Temperature - Vapour Phase (F)	47.01	Initial Mass of Vapour (lb)	985.7
65	Valve Outlet Final Temperature - Vapour Phase (F)	104.8	Final Mass of Vapour (lb)	95.77
66	Valve Outlet Minimum Temperature - Vapour Phase (F)	47.01	Peak Vapour Flow Through Valve (lb/hr)	9258
67	Inner Wall Initial Temperature - Vapour Phase (F)	113.3	Initial Mass of Liquid (lb)	3691
68	Inner Wall Final Temperature - Vapour Phase (F)	112.8	Final Mass of Liquid (lb)	3686
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 10:13:58 2014

Depressuring - Dynamics: F-4501/5501 (continued)

Inner Wall Minimum Temperature - Vapour Phase (F)	112.8	Peak Liquid Flow Through Valve (lb/hr)	0.0000
Vessel Fluid Initial Temperature - Liquid Phase (F)	113.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of F-4501/5501 A/B (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 09:20:27 2014	
4				
5				
6	Depressuring - Dynamics: V-4502/5502 A <small>note 2</small>			
7				
8	Connections			
9				
10	Inlet	note 2	V-4502A	
11	Vessel Volume	(ft3)	1165 *	
12	Liquid Volume	(ft3)	0.0000	
13				
14	Vessel Orientation		Vertical	Initial Liquid Volume (ft3) 0.0000
15	Flat End Vessel Volume	note 1 (ft3)	1165	Cylindrical Area (ft2) 1055
16	Height	note 1 (ft)	75.96 *	Top Head Area (ft2) 15.34
17	Diameter	note 1 (ft)	4.420 *	Bottom Head Area (ft2) 15.34
18	Metal Mass in Contact with Vapour	(lb)	4.474e+005 *	Metal Mass in Contact with Liquid (lb) ---
19				
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1	(Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2) ---
24	C2		0.8200	Equation Units Btu/hr
25	C3		1.000 *	
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area	(ft2)	1085	Insulation Density (lb/ft3) 32.46
29	Recycle Efficiency of Vapour	(%)	100.00	Insulation Conductivity (Btu/hr-ft-F) 8.667e-002
30	Recycle Efficiency of Liquid Phase 1	(%)	100.00	Air - Outside C ---
31	Recycle Efficiency of Liquid Phase 2	(%)	100.00	Vapour - Wall C 0.7750
32	Ambient Temperature	(F)	118.0 *	Liquid - Wall C 0.7750
33	Metal Thickness	(in)	3.661 *	Vapour - Liquid C 0.1600
34	Metal Cp	(Btu/lb-F)	0.1218 *	Air - Outside m 0.2500
35	Metal Density	(lb/ft3)	498.4 *	Vapour - Wall m 0.2100
36	Metal Conductivity	(Btu/hr-ft-F)	86.67 *	Liquid - Wall m 0.2100
37	Insulation Thickness	(in)	0.0000 *	Vapour - Liquid m 0.3333
38	Insulation Cp	(Btu/lb-F)	0.1959	Convection Updated U
39	Inside Liq Phase	(Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F) 1.761
40	Inside Vap Phase	(Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F) 0.8806
41				
42	Valve Parameters			
43	Vapour Flow Equation		Relief	Liquid Flow Equation (No Flow)
44	Orifice Area	(in2)	0.8805 *	
45	Relief Pressure	(psig)	7.000 *	
46	Full Open Pressure	(psig)	10.00 *	
47	Vapour Back Pressure	(psig)	3.000 *	Liquid Back Pressure (psig) 3.000 *
48				
49	Operating Conditions			
50	Operating Pressure	(psig)	1030	Depressuring Time (seconds) 900.0
51	Time Step Size		---	
52	Vapour Outlet Solving Option		Calculate Cv	Final Pressure (psig) 100.0 *
53	Initial Cv Estimate	(ft2)	6.115e-003 *	Solved Pressure (psig) ---
54				
55	Results			
56	Initial Pressure	(psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F) 87.53
57	Final Pressure	(psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase (F) 78.46
58	Depressuring Time	(seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F) 115.3
59	Vapour Cv	(ft2)	6.115e-003 *	Valve Outlet Final Temperature - Liquid Phase (F) 46.51
60	Liquid Cv		---	Valve Outlet Minimum Temperature - Liquid Phase (F) 46.51
61	Vessel Fluid Initial Temperature - Vapour Phase	(F)	112.6	Inner Wall Initial Temperature - Liquid Phase (F) 113.1
62	Vessel Fluid Final Temperature - Vapour Phase	(F)	87.53	Inner Wall Final Temperature - Liquid Phase (F) 110.7
63	Vessel Fluid Minimum Temperature - Vapour Phase	(F)	78.46	Inner Wall Minimum Temperature - Liquid Phase (F) 91.89
64	Valve Outlet Initial Temperature - Vapour Phase	(F)	46.50	Initial Mass of Vapour (lb) 4366
65	Valve Outlet Final Temperature - Vapour Phase	(F)	80.81	Final Mass of Vapour (lb) 440.9
66	Valve Outlet Minimum Temperature - Vapour Phase	(F)	30.54	Peak Vapour Flow Through Valve (lb/hr) 4.089e+004
67	Inner Wall Initial Temperature - Vapour Phase	(F)	113.1	Initial Mass of Liquid (lb) 0.0000
68	Inner Wall Final Temperature - Vapour Phase	(F)	110.7	Final Mass of Liquid (lb) 1.885e-028
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 09:20:27 2014

Depressuring - Dynamics: V-4502/5502 A (continued) note 2

9	Inner Wall Minimum Temperature - Vapour Phase (F)	110.7	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	112.6		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of V-4502/5502 A (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY). For Molecular Sieve Dryer the considered volume is the volume of the tower without the volume of the sieves and ceramic ball.

Note 2: V-4502/5502 A is considering in operating mode (dehydration phase).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 09:20:06 2014	
4				
5				
6	Depressuring - Dynamics: F-4502/5502 A/B			
7				
8				
9	Connections			
10				
11	Inlet	F-4502		
12	Vessel Volume (ft3)	324.0 *		
13	Liquid Volume (ft3)	0.0000		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	0.0000
16	Flat End Vessel Volume note 1 (ft3)	324.0	Cylindrical Area (ft2)	278.1
17	Height note 1 (ft)	19.00 *	Top Head Area (ft2)	17.05
18	Diameter note 1 (ft)	4.660 *	Bottom Head Area (ft2)	17.05
19	Metal Mass in Contact with Vapour (lb)	2.342e+004 *	Metal Mass in Contact with Liquid (lb)	---
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2)	---
24	C2	0.8200	Equation Units	Btu/hr
25	C3	1.000 *		
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)	312.2	Insulation Density (lb/ft3)	32.46
29	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	8.667e-002
30	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature (F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness (in)	2.323 *	Vapour - Liquid C	0.1600
34	Metal Cp (Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density (lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity (Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness (in)	0.0000 *	Vapour - Liquid m	0.3333
38	Insulation Cp (Btu/lb-F)	0.1959	Convection	Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
40	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
41	Valve Parameters			
42				
43	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area (in2)	0.2431 *		
45	Relief Pressure (psig)	7.000 *		
46	Full Open Pressure (psig)	10.00 *		
47	Vapour Back Pressure (psig)	3.000 *	Liquid Back Pressure (psig)	3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)	1030	Depressuring Time (seconds)	900.0
51	Time Step Size	---		
52	Vapour Outlet Solving Option	Calculate Cv	Final Pressure (psig)	100.0 *
53	Initial Cv Estimate (ft2)	1.688e-003 *	Solved Pressure (psig)	---
54	Results			
55				
56	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	71.55
57	Final Pressure (psig)	100.1	Vessel Fluid Minimum Temperature - Liquid Phase (F)	61.71
58	Depressuring Time (seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F)	52.20
59	Vapour Cv (ft2)	1.688e-003 *	Valve Outlet Final Temperature - Liquid Phase (F)	52.21
60	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	52.20
61	Vessel Fluid Initial Temperature - Vapour Phase (F)	117.0	Inner Wall Initial Temperature - Liquid Phase (F)	117.1
62	Vessel Fluid Final Temperature - Vapour Phase (F)	71.55	Inner Wall Final Temperature - Liquid Phase (F)	110.4
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)	61.71	Inner Wall Minimum Temperature - Liquid Phase (F)	110.4
64	Valve Outlet Initial Temperature - Vapour Phase (F)	52.20	Initial Mass of Vapour (lb)	1199
65	Valve Outlet Final Temperature - Vapour Phase (F)	64.43	Final Mass of Vapour (lb)	126.5
66	Valve Outlet Minimum Temperature - Vapour Phase (F)	23.20	Peak Vapour Flow Through Valve (lb/hr)	1.119e+004
67	Inner Wall Initial Temperature - Vapour Phase (F)	117.1	Initial Mass of Liquid (lb)	0.0000
68	Inner Wall Final Temperature - Vapour Phase (F)	110.4	Final Mass of Liquid (lb)	0.0000
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 09:20:06 2014

Depressuring - Dynamics: F-4502/5502 (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	110.4	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	117.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of F-4501/5501 A/B (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA	Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)
2		Unit Set: NewUser2ej
3		Date/Time: Thu Feb 06 09:18:02 2014
4		
5		

Depressuring - Dynamics: E-4501/5501 SHELL

Connections

11	Inlet		E-4501Shell		
12	Vessel Volume	(ft3)	169.2 *		
13	Liquid Volume	(ft3)	0.0000		
14					
15	Vessel Orientation		Vertical	Initial Liquid Volume	(ft3) 0.0000
16	Flat End Vessel Volume	note 1 (ft3)	169.2	Cylindrical Area	(ft2) 267.6
17	Height	note 1 (ft)	33.67 *	Top Head Area	(ft2) 5.026
18	Diameter	note 1 (ft)	2.530 *	Bottom Head Area	(ft2) 5.026
19	Metal Mass in Contact with Vapour	(lb)	2.277e+004 *	Metal Mass in Contact with Liquid	(lb) ---

Heat Flux

20	Heat Flux				
21					
22	Operating Mode :	Fire API521			
23	C1	(Btu/hr-ft1.64)	2.100e+004 *	Wetted Area	(ft2) ---
24	C2		0.8200	Equation Units	Btu/hr
25	C3		0.3000 *		
26					
27	Heat Loss Model : Detailed				
28	Total Heat Transfer Area	(ft2)	277.6	Insulation Density	(lb/ft3) 17.48 *
29	Recycle Efficiency of Vapour	(%)	100.00	Insulation Conductivity	(Btu/hr-ft-F) 3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1	(%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2	(%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature	(F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness	(in)	1.181 *	Vapour - Liquid C	0.1600
34	Metal Cp	(Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density	(lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity	(Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness	(in)	3.937 *	Vapour - Liquid m	0.3333
38	Insulation Cp	(Btu/lb-F)	0.2150 *	Convection	Updated U
39	Inside Liq Phase	(Btu/hr-ft2-F)	---	Outside U	(Btu/hr-ft2-F) 1.761
40	Inside Vap Phase	(Btu/hr-ft2-F)	35.22	Vapour to Liquid	(Btu/hr-ft2-F) 0.8806

Valve Parameters

41	Valve Parameters				
42					
43	Vapour Flow Equation		Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area	(in2)	0.1269 *		
45	Relief Pressure	(psig)	7.000 *		
46	Full Open Pressure	(psig)	10.00 *		
47	Vapour Back Pressure	(psig)	3.000 *	Liquid Back Pressure	(psig) 3.000 *

Operating Conditions

48	Operating Conditions				
49					
50	Operating Pressure	(psig)	1030	Depressuring Time	(seconds) 900.0
51	Time Step Size		---		
52	Vapour Outlet Solving Option		Calculate Cv	Final Pressure	(psig) 100.0 *
53	Initial Cv Estimate	(ft2)	8.812e-004 *	Solved Pressure	(psig) ---

Results

54	Results				
55					
56	Initial Pressure	(psig)	1030	Vessel Fluid Final Temperature - Liquid Phase	(F) 91.56
57	Final Pressure	(psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase	(F) 85.51
58	Depressuring Time	(seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase	(F) 52.20
59	Vapour Cv	(ft2)	8.812e-004 *	Valve Outlet Final Temperature - Liquid Phase	(F) 52.21
60	Liquid Cv		---	Valve Outlet Minimum Temperature - Liquid Phase	(F) 52.20
61	Vessel Fluid Initial Temperature - Vapour Phase	(F)	117.0	Inner Wall Initial Temperature - Liquid Phase	(F) 117.1
62	Vessel Fluid Final Temperature - Vapour Phase	(F)	91.56	Inner Wall Final Temperature - Liquid Phase	(F) 110.7
63	Vessel Fluid Minimum Temperature - Vapour Phase	(F)	85.51	Inner Wall Minimum Temperature - Liquid Phase	(F) 110.7
64	Valve Outlet Initial Temperature - Vapour Phase	(F)	52.20	Initial Mass of Vapour	(lb) 626.2
65	Valve Outlet Final Temperature - Vapour Phase	(F)	84.95	Final Mass of Vapour	(lb) 63.54
66	Valve Outlet Minimum Temperature - Vapour Phase	(F)	36.96	Peak Vapour Flow Through Valve	(lb/hr) 5843
67	Inner Wall Initial Temperature - Vapour Phase	(F)	117.1	Initial Mass of Liquid	(lb) 0.0000
68	Inner Wall Final Temperature - Vapour Phase	(F)	110.7	Final Mass of Liquid	(lb) 0.0000



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 09:18:02 2014

Depressuring - Dynamics: E-4501/5501 SHELL (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	110.7	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	117.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of E-4501/5501 shell side (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 09:19:04 2014	
4				
5				
6	Depressuring - Dynamics: E-4502/5502 TUBES			
7				
8	Connections			
9				
10	Connections			
11	Inlet	E-4502Tube		
12	Vessel Volume (ft3)	9.307 *		
13	Liquid Volume (ft3)	0.0000		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	0.0000
16	Flat End Vessel Volume note 1 (ft3)	9.307	Cylindrical Area (ft2)	24.49
17	Height note 1 (ft)	5.130 *	Top Head Area (ft2)	1.814
18	Diameter note 1 (ft)	1.520 *	Bottom Head Area (ft2)	1.814
19	Metal Mass in Contact with Vapour (lb)	2094 *	Metal Mass in Contact with Liquid (lb)	---
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2)	---
24	C2	0.8200	Equation Units	Btu/hr
25	C3	0.3000 *		
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)	28.12	Insulation Density (lb/ft3)	17.48 *
29	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature (F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness (in)	0.9055 *	Vapour - Liquid C	0.1600
34	Metal Cp (Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density (lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity (Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness (in)	4.921 *	Vapour - Liquid m	0.3333
38	Insulation Cp (Btu/lb-F)	0.2150 *	Convection	Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
40	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
41	Valve Parameters			
42				
43	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area (in2)	6.971e-003 *		
45	Relief Pressure (psig)	7.000 *		
46	Full Open Pressure (psig)	10.00 *		
47	Vapour Back Pressure (psig)	3.000 *	Liquid Back Pressure (psig)	3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)	1030	Depressuring Time (seconds)	900.0
51	Time Step Size	---		
52	Vapour Outlet Solving Option	Calculate Cv	Final Pressure (psig)	100.0 *
53	Initial Cv Estimate (ft2)	4.841e-005 *	Solved Pressure (psig)	---
54	Results			
55				
56	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	101.4
57	Final Pressure (psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase (F)	97.49
58	Depressuring Time (seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F)	52.20
59	Vapour Cv (ft2)	4.841e-005 *	Valve Outlet Final Temperature - Liquid Phase (F)	52.21
60	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	52.20
61	Vessel Fluid Initial Temperature - Vapour Phase (F)	117.0	Inner Wall Initial Temperature - Liquid Phase (F)	117.1
62	Vessel Fluid Final Temperature - Vapour Phase (F)	101.4	Inner Wall Final Temperature - Liquid Phase (F)	112.6
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)	97.49	Inner Wall Minimum Temperature - Liquid Phase (F)	112.6
64	Valve Outlet Initial Temperature - Vapour Phase (F)	52.20	Initial Mass of Vapour (lb)	34.44
65	Valve Outlet Final Temperature - Vapour Phase (F)	95.03	Final Mass of Vapour (lb)	3.429
66	Valve Outlet Minimum Temperature - Vapour Phase (F)	43.08	Peak Vapour Flow Through Valve (lb/hr)	321.0
67	Inner Wall Initial Temperature - Vapour Phase (F)	117.1	Initial Mass of Liquid (lb)	0.0000
68	Inner Wall Final Temperature - Vapour Phase (F)	112.6	Final Mass of Liquid (lb)	0.0000
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2ej

Date/Time: Thu Feb 06 09:19:04 2014

Depressuring - Dynamics: E-4502/5502 TUBES (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	112.6	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	117.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of E-4502/5502 tube side (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 09:20:39 2014	
4				
5				
6	Depressuring - Dynamics: V-4502/5502 B note 2			
7				
8	Connections			
9				
10	Inlet	note 2	V-4502 B	
11	Vessel Volume (ft3)		1165 *	
12	Liquid Volume (ft3)		0.0000	
13				
14				
15	Vessel Orientation		Vertical	Initial Liquid Volume (ft3) 0.0000
16	Flat End Vessel Volume note 1 (ft3)		1165	Cylindrical Area (ft2) 1055
17	Height note 1 (ft)		75.96 *	Top Head Area (ft2) 15.34
18	Diameter note 1 (ft)		4.420 *	Bottom Head Area (ft2) 15.34
19	Metal Mass in Contact with Vapour (lb)		4.474e+005 *	Metal Mass in Contact with Liquid (lb) ---
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)		2.100e+004 *	Wetted Area (ft2) ---
24	C2		0.8200	Equation Units Btu/hr
25	C3		1.000 *	
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)		1085	Insulation Density (lb/ft3) 32.46
29	Recycle Efficiency of Vapour (%)		100.00	Insulation Conductivity (Btu/hr-ft-F) 8.667e-002
30	Recycle Efficiency of Liquid Phase 1 (%)		100.00	Air - Outside C ---
31	Recycle Efficiency of Liquid Phase 2 (%)		100.00	Vapour - Wall C 0.7750
32	Ambient Temperature (F)		118.0 *	Liquid - Wall C 0.7750
33	Metal Thickness (in)		3.661 *	Vapour - Liquid C 0.1600
34	Metal Cp (Btu/lb-F)		0.1218 *	Air - Outside m 0.2500
35	Metal Density (lb/ft3)		498.4 *	Vapour - Wall m 0.2100
36	Metal Conductivity (Btu/hr-ft-F)		86.67 *	Liquid - Wall m 0.2100
37	Insulation Thickness (in)		0.0000 *	Vapour - Liquid m 0.3333
38	Insulation Cp (Btu/lb-F)		0.1959	Convection Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)		---	Outside U (Btu/hr-ft2-F) 1.761
40	Inside Vap Phase (Btu/hr-ft2-F)		35.22	Vapour to Liquid (Btu/hr-ft2-F) 0.8806
41	Valve Parameters			
42				
43	Vapour Flow Equation		Relief	Liquid Flow Equation (No Flow)
44	Orifice Area (in2)		0.8752 *	
45	Relief Pressure (psig)		7.000 *	
46	Full Open Pressure (psig)		10.00 *	
47	Vapour Back Pressure (psig)		3.000 *	Liquid Back Pressure (psig) 3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)		1030	Depressuring Time (seconds) 900.0
51	Time Step Size		---	
52	Vapour Outlet Solving Option		Calculate Cv	Final Pressure (psig) 100.0 *
53	Initial Cv Estimate (ft2)		6.078e-003 *	Solved Pressure (psig) ---
54	Results			
55				
56	Initial Pressure (psig)		1030	Vessel Fluid Final Temperature - Liquid Phase (F) 91.47
57	Final Pressure (psig)		100.2	Vessel Fluid Minimum Temperature - Liquid Phase (F) 81.66
58	Depressuring Time (seconds)		900.0	Valve Outlet Initial Temperature - Liquid Phase (F) 52.20
59	Vapour Cv (ft2)		6.078e-003 *	Valve Outlet Final Temperature - Liquid Phase (F) 52.21
60	Liquid Cv		---	Valve Outlet Minimum Temperature - Liquid Phase (F) 52.20
61	Vessel Fluid Initial Temperature - Vapour Phase (F)		117.0	Inner Wall Initial Temperature - Liquid Phase (F) 117.1
62	Vessel Fluid Final Temperature - Vapour Phase (F)		91.47	Inner Wall Final Temperature - Liquid Phase (F) 114.6
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)		81.66	Inner Wall Minimum Temperature - Liquid Phase (F) 114.6
64	Valve Outlet Initial Temperature - Vapour Phase (F)		52.20	Initial Mass of Vapour (lb) 4312
65	Valve Outlet Final Temperature - Vapour Phase (F)		84.86	Final Mass of Vapour (lb) 437.6
66	Valve Outlet Minimum Temperature - Vapour Phase (F)		34.43	Peak Vapour Flow Through Valve (lb/hr) 4.030e+004
67	Inner Wall Initial Temperature - Vapour Phase (F)		117.1	Initial Mass of Liquid (lb) 0.0000
68	Inner Wall Final Temperature - Vapour Phase (F)		114.6	Final Mass of Liquid (lb) 0.0000
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 09:20:39 2014

Depressuring - Dynamics: V-4502/5502 B (continued) note 2

9	Inner Wall Minimum Temperature - Vapour Phase (F)	114.6	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	117.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of V-4502/5502 B (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY). For Molecular Sieve Dryer the considered volume is the volume of the tower without the volume of the sieves and ceramic ball.

Note 2: V-4502/5502 B is considering in regeneration mode (regeneration phase).

1	 BELLELLI ENGINEERING INT Burlington, MA USA	Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)
2		Unit Set: NewUser2ej
3		Date/Time: Thu Feb 06 09:18:48 2014
4		
5		

Depressuring - Dynamics: E-4501/5501 TUBE

Connections

11	Inlet		E-4501Tube		
12	Vessel Volume	(ft3)	55.46 *		
13	Liquid Volume	(ft3)	0.0000		
14					
15	Vessel Orientation		Vertical	Initial Liquid Volume	(ft3) 0.0000
16	Flat End Vessel Volume	note 1 (ft3)	55.46	Cylindrical Area	(ft2) 63.02
17	Height	note 1 (ft)	5.700 *	Top Head Area	(ft2) 9.730
18	Diameter	note 1 (ft)	3.520 *	Bottom Head Area	(ft2) 9.730
19	Metal Mass in Contact with Vapour	(lb)	1.389e+004 *	Metal Mass in Contact with Liquid	(lb) ---

Heat Flux

22	Operating Mode :	Fire API521			
23	C1	(Btu/hr-ft1.64)	2.100e+004 *	Wetted Area	(ft2) ---
24	C2		0.8200	Equation Units	Btu/hr
25	C3		0.3000 *		
26					
27	Heat Loss Model :	Detailed			
28	Total Heat Transfer Area	(ft2)	82.48	Insulation Density	(lb/ft3) 17.48 *
29	Recycle Efficiency of Vapour	(%)	100.00	Insulation Conductivity	(Btu/hr-ft-F) 3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1	(%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2	(%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature	(F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness	(in)	1.772 *	Vapour - Liquid C	0.1600
34	Metal Cp	(Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density	(lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity	(Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness	(in)	3.937 *	Vapour - Liquid m	0.3333
38	Insulation Cp	(Btu/lb-F)	0.2150 *	Convection	Updated U
39	Inside Liq Phase	(Btu/hr-ft2-F)	---	Outside U	(Btu/hr-ft2-F) 1.761
40	Inside Vap Phase	(Btu/hr-ft2-F)	35.22	Vapour to Liquid	(Btu/hr-ft2-F) 0.8806

Valve Parameters

43	Vapour Flow Equation		Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area	(in2)	3.879e-002 *		
45	Relief Pressure	(psig)	7.000 *		
46	Full Open Pressure	(psig)	10.00 *		
47	Vapour Back Pressure	(psig)	3.000 *	Liquid Back Pressure	(psig) 3.000 *

Operating Conditions

50	Operating Pressure	(psig)	1030	Depressuring Time	(seconds) 900.0
51	Time Step Size		---		
52	Vapour Outlet Solving Option		Calculate Cv	Final Pressure	(psig) 100.0 *
53	Initial Cv Estimate	(ft2)	2.694e-004 *	Solved Pressure	(psig) ---

Results

56	Initial Pressure	(psig)	1030	Vessel Fluid Final Temperature - Liquid Phase	(F) 154.7
57	Final Pressure	(psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase	(F) 147.6
58	Depressuring Time	(seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase	(F) 127.5
59	Vapour Cv	(ft2)	2.694e-004 *	Valve Outlet Final Temperature - Liquid Phase	(F) 127.5
60	Liquid Cv		---	Valve Outlet Minimum Temperature - Liquid Phase	(F) 127.5
61	Vessel Fluid Initial Temperature - Vapour Phase	(F)	178.0	Inner Wall Initial Temperature - Liquid Phase	(F) 176.2
62	Vessel Fluid Final Temperature - Vapour Phase	(F)	154.7	Inner Wall Final Temperature - Liquid Phase	(F) 172.5
63	Vessel Fluid Minimum Temperature - Vapour Phase	(F)	147.6	Inner Wall Minimum Temperature - Liquid Phase	(F) 172.5
64	Valve Outlet Initial Temperature - Vapour Phase	(F)	127.5	Initial Mass of Vapour	(lb) 176.5
65	Valve Outlet Final Temperature - Vapour Phase	(F)	149.4	Final Mass of Vapour	(lb) 18.56
66	Valve Outlet Minimum Temperature - Vapour Phase	(F)	109.5	Peak Vapour Flow Through Valve	(lb/hr) 1620
67	Inner Wall Initial Temperature - Vapour Phase	(F)	176.2	Initial Mass of Liquid	(lb) 0.0000
68	Inner Wall Final Temperature - Vapour Phase	(F)	172.5	Final Mass of Liquid	(lb) 0.0000



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 09:18:48 2014

Depressuring - Dynamics: E-4501/5501 TUBE (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	172.5	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	178.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of E-4501/5501 tube side (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: NewUser2ej	
3			Date/Time: Thu Feb 06 09:19:45 2014	
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6	Depressuring - Dynamics: EA-4501/5501			
7				
8				
9	Connections			
10				
11	Inlet	EA-4501		
12	Vessel Volume (ft3)	27.40 *		
13	Liquid Volume (ft3)	0.0000 *		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	0.0000 *
16	Flat End Vessel Volume note 1 (ft3)	27.40	Cylindrical Area (ft2)	37.66
17	Height note 1 (ft)	4.120 *	Top Head Area (ft2)	6.650
18	Diameter note 1 (ft)	2.910 *	Bottom Head Area (ft2)	6.650
19	Metal Mass in Contact with Vapour (lb)	8929 *	Metal Mass in Contact with Liquid (lb)	---
20	Heat Flux			
21				
22	Operating Mode : Fire API521			
23	C1 (Btu/hr-ft1.64)	2.100e+004 *	Wetted Area (ft2)	---
24	C2	0.8200	Equation Units	Btu/hr
25	C3	1.000 *		
26				
27	Heat Loss Model : Detailed			
28	Total Heat Transfer Area (ft2)	50.96	Insulation Density (lb/ft3)	32.46
29	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	8.667e-002
30	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature (F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness (in)	6.496e-002 *	Vapour - Liquid C	0.1600
34	Metal Cp (Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density (lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity (Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness (in)	0.0000 *	Vapour - Liquid m	0.3333
38	Insulation Cp (Btu/lb-F)	0.1959	Convection	Updated U
39	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
40	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
41				
42	Valve Parameters			
43	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area (in2)	1.972e-002 *		
45	Relief Pressure (psig)	7.000 *		
46	Full Open Pressure (psig)	10.00 *		
47	Vapour Back Pressure (psig)	3.000 *	Liquid Back Pressure (psig)	3.000 *
48				
49	Operating Conditions			
50	Operating Pressure (psig)	1030	Depressuring Time (seconds)	900.0
51	Time Step Size	---		
52	Vapour Outlet Solving Option	Calculate Cv	Final Pressure (psig)	100.0 *
53	Initial Cv Estimate (ft2)	1.369e-004 *	Solved Pressure (psig)	---
54				
55	Results			
56	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	130.0
57	Final Pressure (psig)	100.2	Vessel Fluid Minimum Temperature - Liquid Phase (F)	130.0
58	Depressuring Time (seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase (F)	148.6
59	Vapour Cv (ft2)	1.369e-004 *	Valve Outlet Final Temperature - Liquid Phase (F)	88.47
60	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	88.47
61	Vessel Fluid Initial Temperature - Vapour Phase (F)	146.0	Inner Wall Initial Temperature - Liquid Phase (F)	143.1
62	Vessel Fluid Final Temperature - Vapour Phase (F)	130.0	Inner Wall Final Temperature - Liquid Phase (F)	131.6
63	Vessel Fluid Minimum Temperature - Vapour Phase (F)	130.0	Inner Wall Minimum Temperature - Liquid Phase (F)	131.6
64	Valve Outlet Initial Temperature - Vapour Phase (F)	88.51	Initial Mass of Vapour (lb)	93.98
65	Valve Outlet Final Temperature - Vapour Phase (F)	124.2	Final Mass of Vapour (lb)	9.572
66	Valve Outlet Minimum Temperature - Vapour Phase (F)	84.51	Peak Vapour Flow Through Valve (lb/hr)	864.1
67	Inner Wall Initial Temperature - Vapour Phase (F)	143.1	Initial Mass of Liquid (lb)	0.0000
68	Inner Wall Final Temperature - Vapour Phase (F)	131.6	Final Mass of Liquid (lb)	5.638e-030
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 09:19:45 2014

Depressuring - Dynamics: EA-4501/5501 (continued)

Inner Wall Minimum Temperature - Vapour Phase (F)	131.6	Peak Liquid Flow Through Valve (lb/hr)	0.0000
Vessel Fluid Initial Temperature - Liquid Phase (F)	146.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of EA-4501/5501 (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA	Case Name:	03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2		Unit Set:	NewUser2ej	
3		Date/Time:	Thu Feb 06 10:14:35 2014	
4				
5				

Depressuring - Dynamics: V-4503/5503

Connections

11	Inlet		V-4503		
12	Vessel Volume	(ft3)	21.24 *		
13	Liquid Volume	(ft3)	4.470 *		
14					
15	Vessel Orientation		Vertical	Initial Liquid Volume	(ft3) 4.470 *
16	Flat End Vessel Volume	note 1 (ft3)	21.24	Cylindrical Area	(ft2) 60.68
17	Height	note 1 (ft)	13.80 *	Top Head Area	(ft2) 1.539
18	Diameter	note 1 (ft)	1.400 *	Bottom Head Area	(ft2) 1.539
19	Metal Mass in Contact with Vapour	(lb)	1365 *	Metal Mass in Contact with Liquid	(lb) 454.1 *

Heat Flux

22	Operating Mode :	Fire API521			
23	C1	(Btu/hr-ft.64)	2.100e+004 *	Wetted Area	(ft2) ---
24	C2		0.8200	Equation Units	Btu/hr
25	C3		1.000 *		
26					
27	Heat Loss Model :	Detailed			
28	Total Heat Transfer Area	(ft2)	63.76	Insulation Density	(lb/ft3) 17.48 *
29	Recycle Efficiency of Vapour	(%)	100.00	Insulation Conductivity	(Btu/hr-ft-F) 3.407e-002 *
30	Recycle Efficiency of Liquid Phase 1	(%)	100.00	Air - Outside C	---
31	Recycle Efficiency of Liquid Phase 2	(%)	100.00	Vapour - Wall C	0.7750
32	Ambient Temperature	(F)	118.0 *	Liquid - Wall C	0.7750
33	Metal Thickness	(in)	1.100 *	Vapour - Liquid C	0.1600
34	Metal Cp	(Btu/lb-F)	0.1218 *	Air - Outside m	0.2500
35	Metal Density	(lb/ft3)	498.4 *	Vapour - Wall m	0.2100
36	Metal Conductivity	(Btu/hr-ft-F)	86.67 *	Liquid - Wall m	0.2100
37	Insulation Thickness	(in)	0.0000 *	Vapour - Liquid m	0.3333
38	Insulation Cp	(Btu/lb-F)	0.2154 *	Convection	Updated U
39	Inside Liq Phase	(Btu/hr-ft2-F)	---	Outside U	(Btu/hr-ft2-F) 1.761
40	Inside Vap Phase	(Btu/hr-ft2-F)	35.22	Vapour to Liquid	(Btu/hr-ft2-F) 0.8806

Valve Parameters

43	Vapour Flow Equation		Relief	Liquid Flow Equation	(No Flow)
44	Orifice Area	(in2)	1.333e-002 *		
45	Relief Pressure	(psig)	7.000 *		
46	Full Open Pressure	(psig)	10.00 *		
47	Vapour Back Pressure	(psig)	3.000 *	Liquid Back Pressure	(psig) 3.000 *

Operating Conditions

50	Operating Pressure	(psig)	1030	Depressuring Time	(seconds) 900.0
51	Time Step Size		---		
52	Vapour Outlet Solving Option		Calculate Cv	Final Pressure	(psig) 100.0 *
53	Initial Cv Estimate	(ft2)	9.255e-005 *	Solved Pressure	(psig) 99.95

Results

56	Initial Pressure	(psig)	1030	Vessel Fluid Final Temperature - Liquid Phase	(F) 226.5
57	Final Pressure	(psig)	99.95	Vessel Fluid Minimum Temperature - Liquid Phase	(F) 145.9
58	Depressuring Time	(seconds)	900.0	Valve Outlet Initial Temperature - Liquid Phase	(F) 148.6
59	Vapour Cv	(ft2)	9.255e-005 *	Valve Outlet Final Temperature - Liquid Phase	(F) 148.6
60	Liquid Cv		---	Valve Outlet Minimum Temperature - Liquid Phase	(F) 148.6
61	Vessel Fluid Initial Temperature - Vapour Phase	(F)	146.0	Inner Wall Initial Temperature - Liquid Phase	(F) 143.1
62	Vessel Fluid Final Temperature - Vapour Phase	(F)	226.5	Inner Wall Final Temperature - Liquid Phase	(F) 216.0
63	Vessel Fluid Minimum Temperature - Vapour Phase	(F)	145.9	Inner Wall Minimum Temperature - Liquid Phase	(F) 143.1
64	Valve Outlet Initial Temperature - Vapour Phase	(F)	88.51	Initial Mass of Vapour	(lb) 57.52
65	Valve Outlet Final Temperature - Vapour Phase	(F)	221.6	Final Mass of Vapour	(lb) 4.939
66	Valve Outlet Minimum Temperature - Vapour Phase	(F)	88.47	Peak Vapour Flow Through Valve	(lb/hr) 584.0
67	Inner Wall Initial Temperature - Vapour Phase	(F)	143.1	Initial Mass of Liquid	(lb) 273.6
68	Inner Wall Final Temperature - Vapour Phase	(F)	151.6	Final Mass of Liquid	(lb) 271.6



BELLELLI ENGINEERING INT
Burlington, MA
USA

Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)

Unit Set: NewUser2eu

Date/Time: Thu Feb 06 10:14:35 2014

Depressuring - Dynamics: V-4503/5503 (continued)

9	Inner Wall Minimum Temperature - Vapour Phase (F)	143.1	Peak Liquid Flow Through Valve (lb/hr)	0.0000
10	Vessel Fluid Initial Temperature - Liquid Phase (F)	146.0		

NOTES:

Note 1: Equivalent cylinder ID and height with the same geometrical volume of V-4503/5503 (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: Field (psig)	
3			Date/Time: Thu Feb 06 10:57:33 2014	
4				
5				
6	Depressuring - Dynamics: MDMT-RO-4503/5503			
7				
8	Connections			
9				
10	Connections			
11	Inlet	STREAM MDMT-1		
12	Vessel Volume (ft3)	2850		
13	Liquid Volume (ft3)	0.0000		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	0.0000
16	Flat End Vessel Volume note 1 (ft3)	2850	Cylindrical Area (ft2)	1016
17	Height note 1 (ft)	28.83	Top Head Area (ft2)	98.85
18	Diameter note 1 (ft)	11.22	Bottom Head Area (ft2)	98.85
19	Metal Mass in Contact with Vapour (lb)	4.894e+005	Metal Mass in Contact with Liquid (lb)	---
20	Heat Flux			
21				
22	Operating Mode : Adiabatic			
23				
24	Heat Loss Model : Detailed			
25	Total Heat Transfer Area (ft2)	1214	Insulation Density (lb/ft3)	17.48
26	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	3.407e-002
27	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
28	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
29	Ambient Temperature (F)	36.00	Liquid - Wall C	0.7750
30	Metal Thickness (in)	3.661	Vapour - Liquid C	0.1600
31	Metal Cp (Btu/lb-F)	0.1218	Air - Outside m	0.2500
32	Metal Density (lb/ft3)	498.4	Vapour - Wall m	0.2100
33	Metal Conductivity (Btu/hr-ft-F)	86.67	Liquid - Wall m	0.2100
34	Insulation Thickness (in)	3.937	Vapour - Liquid m	0.3333
35	Insulation Cp (Btu/lb-F)	0.2150	Convection	Updated U
36	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
37	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
38				
39	Valve Parameters			
40	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
41	Orifice Area (in2)	2.220		
42	Relief Pressure (psig)	7.000		
43	Full Open Pressure (psig)	10.00		
44	Vapour Back Pressure (psig)	3.000	Liquid Back Pressure (psig)	3.000
45				
46	Operating Conditions			
47	Operating Pressure (psig)	1030	Depressuring Time (seconds)	3.600e+004
48	Time Step Size	---		
49	Vapour Outlet Solving Option	Calculate P	Final Pressure (psig)	7.000
50	Cv or Av (in2)	2.220		
51				
52	Results			
53	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	30.26
54	Final Pressure (psig)	7.000	Vessel Fluid Minimum Temperature - Liquid Phase (F)	-16.84
55	Depressuring Time (seconds)	3.600e+004	Valve Outlet Initial Temperature - Liquid Phase (F)	-66.17
56	Vapour Cv (ft2)	1.542e-002	Valve Outlet Final Temperature - Liquid Phase (F)	-59.70
57	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	-66.17
58	Vessel Fluid Initial Temperature - Vapour Phase (F)	36.00	Inner Wall Initial Temperature - Liquid Phase (F)	36.00
59	Vessel Fluid Final Temperature - Vapour Phase (F)	30.26	Inner Wall Final Temperature - Liquid Phase (F)	30.27
60	Vessel Fluid Minimum Temperature - Vapour Phase (F)	-16.84	Inner Wall Minimum Temperature - Liquid Phase (F)	29.52
61	Valve Outlet Initial Temperature - Vapour Phase (F)	-59.70	Initial Mass of Vapour (lb)	1.396e+004
62	Valve Outlet Final Temperature - Vapour Phase (F)	29.88	Final Mass of Vapour (lb)	255.0
63	Valve Outlet Minimum Temperature - Vapour Phase (F)	-75.45	Peak Vapour Flow Through Valve (lb/hr)	1.247e+005
64	Inner Wall Initial Temperature - Vapour Phase (F)	36.00	Initial Mass of Liquid (lb)	0.0000
65	Inner Wall Final Temperature - Vapour Phase (F)	30.27	Final Mass of Liquid (lb)	3.238e-028
66	Inner Wall Minimum Temperature - Vapour Phase (F)	30.04	Peak Liquid Flow Through Valve (lb/hr)	0.0000
67	Vessel Fluid Initial Temperature - Liquid Phase (F)	36.00		
68				
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	

1	 BELLELLI ENGINEERING INT Burlington, MA USA	Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)
2		Unit Set: Field (psig)
3		Date/Time: Thu Feb 06 10:57:33 2014
4		
5		

Depressuring - Dynamics: MDMT-RO-4503/5503 (continued)

NOTES

Note 1: Equivalent cylinder ID and height with the same geometrical volume of E-4503/5503 tube side, V-4501/5501, F-4501/5501 and V-4502/5502 A (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

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1	 BELLELLI ENGINEERING INT Burlington, MA USA		Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)	
2			Unit Set: Field (psig)	
3			Date/Time: Thu Feb 06 10:47:11 2014	
4				
5				
6	Depressuring - Dynamics: MDMT-RO-4504/5504			
7				
8	Connections			
9				
10	Connections			
11	Inlet	STREAM MDMT-2		
12	Vessel Volume (ft3)	2936		
13	Liquid Volume (ft3)	0.0000		
14				
15	Vessel Orientation	Vertical	Initial Liquid Volume (ft3)	0.0000
16	Flat End Vessel Volume note 1 (ft3)	2936	Cylindrical Area (ft2)	1027
17	Height note 1 (ft)	28.57	Top Head Area (ft2)	102.8
18	Diameter note 1 (ft)	11.44	Bottom Head Area (ft2)	102.8
19	Metal Mass in Contact with Vapour (lb)	5.265e+005	Metal Mass in Contact with Liquid (lb)	---
20	Heat Flux			
21				
22	Operating Mode : Adiabatic			
23				
24	Heat Loss Model : Detailed			
25	Total Heat Transfer Area (ft2)	1232	Insulation Density (lb/ft3)	17.48
26	Recycle Efficiency of Vapour (%)	100.00	Insulation Conductivity (Btu/hr-ft-F)	3.407e-002
27	Recycle Efficiency of Liquid Phase 1 (%)	100.00	Air - Outside C	---
28	Recycle Efficiency of Liquid Phase 2 (%)	100.00	Vapour - Wall C	0.7750
29	Ambient Temperature (F)	36.00	Liquid - Wall C	0.7750
30	Metal Thickness (in)	3.661	Vapour - Liquid C	0.1600
31	Metal Cp (Btu/lb-F)	0.1218	Air - Outside m	0.2500
32	Metal Density (lb/ft3)	498.4	Vapour - Wall m	0.2100
33	Metal Conductivity (Btu/hr-ft-F)	86.67	Liquid - Wall m	0.2100
34	Insulation Thickness (in)	3.937	Vapour - Liquid m	0.3333
35	Insulation Cp (Btu/lb-F)	0.2150	Convection	Updated U
36	Inside Liq Phase (Btu/hr-ft2-F)	---	Outside U (Btu/hr-ft2-F)	1.761
37	Inside Vap Phase (Btu/hr-ft2-F)	35.22	Vapour to Liquid (Btu/hr-ft2-F)	0.8806
38				
39	Valve Parameters			
40	Vapour Flow Equation	Relief	Liquid Flow Equation	(No Flow)
41	Orifice Area (in2)	2.220		
42	Relief Pressure (psig)	7.000		
43	Full Open Pressure (psig)	10.00		
44	Vapour Back Pressure (psig)	3.000	Liquid Back Pressure (psig)	3.000
45				
46	Operating Conditions			
47	Operating Pressure (psig)	1030	Depressuring Time (seconds)	3.600e+004
48	Time Step Size	---		
49	Vapour Outlet Solving Option	Calculate P	Final Pressure (psig)	7.000
50	Cv or Av (in2)	2.220		
51				
52	Results			
53	Initial Pressure (psig)	1030	Vessel Fluid Final Temperature - Liquid Phase (F)	30.34
54	Final Pressure (psig)	7.000	Vessel Fluid Minimum Temperature - Liquid Phase (F)	-15.18
55	Depressuring Time (seconds)	3.600e+004	Valve Outlet Initial Temperature - Liquid Phase (F)	-66.17
56	Vapour Cv (ft2)	1.542e-002	Valve Outlet Final Temperature - Liquid Phase (F)	-59.70
57	Liquid Cv	---	Valve Outlet Minimum Temperature - Liquid Phase (F)	-66.17
58	Vessel Fluid Initial Temperature - Vapour Phase (F)	36.00	Inner Wall Initial Temperature - Liquid Phase (F)	36.00
59	Vessel Fluid Final Temperature - Vapour Phase (F)	30.34	Inner Wall Final Temperature - Liquid Phase (F)	30.35
60	Vessel Fluid Minimum Temperature - Vapour Phase (F)	-15.18	Inner Wall Minimum Temperature - Liquid Phase (F)	29.95
61	Valve Outlet Initial Temperature - Vapour Phase (F)	-59.70	Initial Mass of Vapour (lb)	1.438e+004
62	Valve Outlet Final Temperature - Vapour Phase (F)	29.96	Final Mass of Vapour (lb)	258.8
63	Valve Outlet Minimum Temperature - Vapour Phase (F)	-74.95	Peak Vapour Flow Through Valve (lb/hr)	1.247e+005
64	Inner Wall Initial Temperature - Vapour Phase (F)	36.00	Initial Mass of Liquid (lb)	0.0000
65	Inner Wall Final Temperature - Vapour Phase (F)	30.35	Final Mass of Liquid (lb)	2.809e-028
66	Inner Wall Minimum Temperature - Vapour Phase (F)	30.12	Peak Liquid Flow Through Valve (lb/hr)	0.0000
67	Vessel Fluid Initial Temperature - Liquid Phase (F)	36.00		
68				
69	Aspen Technology Inc.		Aspen HYSYS Version 8.3 (29.0.0.8315)	

1	 BELLELLI ENGINEERING INT Burlington, MA USA	Case Name: 03_02_2014 DEPRESSURIZATION CALCS - (KPD)
2		Unit Set: Field (psig)
3		Date/Time: Thu Feb 06 10:47:11 2014
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Depressuring - Dynamics: MDMT-RO-4504/5504 (continued)

NOTES

Note 1: Equivalent cylinder ID and height with the same geometrical volume of E-4501/5501 shell side, E-4501/5501 tube side, E-4502/5502 tube side, F-4502/5502, V-4502/5502 B, V-4503/5503 and EA-4501/5501 (see section 6.1 of BLOWDOWN REPORT AND LOAD SUMMARY).

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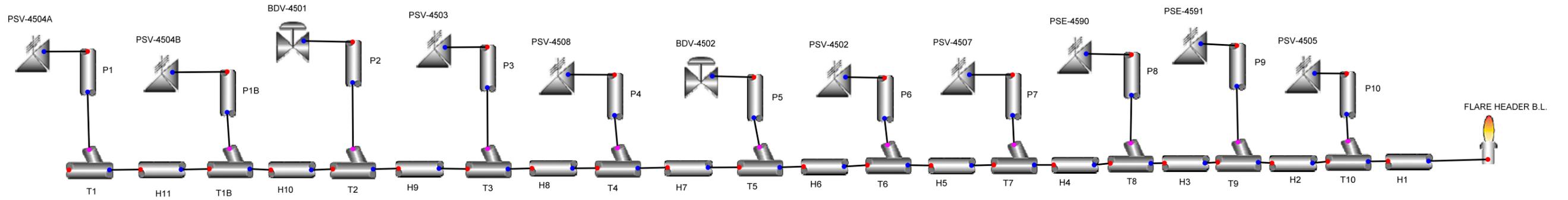
Aspen Flare System Analyzer

Version 28.0.0.24



User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : Blow-down network system
Label :

PFD



User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :

Network

Name	Location	Upstream Node	Downstream Node	Ignored	Tailpipe	Length (ft)
P1		PSV-4504A	T1	No	Yes	6.600
P2		BDV-4501	T2	No	Yes	6.560
P3		PSV-4503	T3	No	Yes	6.560
P4		PSV-4508	T4	No	Yes	6.560
P5		BDV-4502	T5	No	Yes	6.560
P6		PSV-4502	T6	No	Yes	6.560
P7		PSV-4507	T7	No	Yes	6.560
P8		PSE-4590	T8	No	Yes	6.560
P9		PSE-4591	T9	No	Yes	2.560
P10		PSV-4505	T10	No	Yes	6.560
H10		T1B	T2	No	No	8.200
H9		T2	T3	No	No	22.960
H8		T3	T4	No	No	7.550
H7		T4	T5	No	No	3.300
H6		T5	T6	No	No	19.360
H5		T6	T7	No	No	3.300
H4		T7	T8	No	No	7.000
H3		T8	T9	No	No	9.850
H2		T9	T10	No	No	20.340
H1		T10	FLARE HEADER B.L.	No	No	3.300
P1B		PSV-4504B	T1B	No	Yes	6.600
H11		T1	T1B	No	No	3.300

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :

Network

Name	Elevation Change (ft)	Material	Roughness (in)	Thermal Conductivity (Btu/hr-ft-F)	Nominal Diameter	Schedule	Internal Diameter (in)	Wall Thickness (in)
P1	0.000	Carbon Steel	0.00180	29.99	8 inch	40	7.981	0.322
P2	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
P3	0.000	Carbon Steel	0.00180	29.99	6 inch	80	5.761	0.432
P4	0.000	Carbon Steel	0.00180	29.99	6 inch	80	5.761	0.432
P5	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
P6	0.000	Carbon Steel	0.00180	29.99	6 inch	80	5.761	0.432
P7	0.000	Carbon Steel	0.00180	29.99	6 inch	80	5.761	0.432
P8	0.000	Carbon Steel	0.00180	29.99	10 inch	40	10.020	0.365
P9	0.000	Carbon Steel	0.00180	29.99	10 inch	40	10.020	0.365
P10	0.000	Carbon Steel	0.00180	29.99	8 inch	40	7.981	0.322
H10	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H9	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H8	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H7	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H6	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H5	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H4	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H3	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H2	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
H1	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375
P1B	0.000	Carbon Steel	0.00180	29.99	8 inch	40	7.981	0.322
H11	0.000	Carbon Steel	0.00180	29.99	12 inch	STD	12.000	0.375

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :

Fittings

Name	Location	Upstream Node	Downstream Node	Fitting List
P1		PSV-4504A	T1	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P2		BDV-4501	T2	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P3		PSV-4503	T3	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P4		PSV-4508	T4	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P5		BDV-4502	T5	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P6		PSV-4502	T6	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P7		PSV-4507	T7	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P8		PSE-4590	T8	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P9		PSE-4591	T9	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P10		PSV-4505	T10	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)
P1B		PSV-4504B	T1B	Elbow Butt-Welded 90 degree (r/d=1.5) Gate Valve (100% Open) Pipe Exit (Sharpe-Edged)

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring maxback P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P2	99938.0	5276.77	99938.0	0.99726	39.1	57.08521
P5	102514.0	5412.69	102514.0	1.10121	40.7	55.56558
H9	99938.0	5276.77	99938.0	0.21675	45.1	
H8	99938.0	5276.77	99938.0	0.07150	40.3	
H7	99938.0	5276.77	99938.0	0.03130	36.8	
H6	202452.0	10689.46	202452.0	0.90308	66.1	
H5	202452.0	10689.46	202452.0	0.15643	58.7	
H4	202452.0	10689.46	202452.0	0.33482	62.1	
H3	202452.0	10689.46	202452.0	0.47746	63.9	
H2	202452.0	10689.46	202452.0	1.00858	67.5	
H1	202452.0	10689.46	202452.0	0.16678	59.9	

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring maxback P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
P2	57.08521	48.32	175.862	0.136	6216	2.188e+007
P5	55.56558	56.46	188.480	0.144	6834	2.285e+007
H9	55.26038	48.17	181.693	0.140	6422	2.188e+007
H8	55.02249	48.15	182.482	0.141	6450	2.188e+007
H7	54.92980	48.15	182.791	0.141	6461	2.188e+007
H6	51.26307	52.07	400.302	0.307	28663	4.472e+007
H5	50.25900	51.99	408.327	0.313	29238	4.472e+007
H4	50.00100	51.97	410.442	0.315	29389	4.472e+007
H3	49.56358	51.94	414.077	0.318	29649	4.472e+007
H2	48.98213	51.89	419.009	0.322	30003	4.472e+007
H1	47.86678	51.80	428.806	0.329	30704	4.472e+007

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring maxback P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P2	56.08795	48.28	179.002	0.138	6327	2.188e+007
P5	54.46437	56.37	192.305	0.147	6972	2.285e+007
H9	55.04364	48.20	182.412	0.141	6448	2.188e+007
H8	54.95099	48.19	182.721	0.141	6458	2.188e+007
H7	54.89851	48.19	182.896	0.141	6465	2.188e+007
H6	50.35999	51.99	407.506	0.313	29179	4.472e+007
H5	50.10258	51.97	409.607	0.314	29329	4.472e+007
H4	49.66618	51.94	413.218	0.317	29588	4.472e+007
H3	49.08612	51.89	418.118	0.321	29939	4.472e+007
H2	47.97355	51.80	427.848	0.328	30635	4.472e+007
H1	47.70000	51.78	430.310	0.330	30812	4.472e+007

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring maxback P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P2	Single Phase/Single Phase	0.97341	0.02386	0.00000	0.93699	0.01325
P5	Single Phase/Single Phase	1.07139	0.02982	0.00000	1.03467	0.01325
H9	Single Phase/Single Phase	0.21129	0.00546	0.00000	0.00000	0.01325
H8	Single Phase/Single Phase	0.06969	0.00181	0.00000	0.00000	0.01325
H7	Single Phase/Single Phase	0.03050	0.00079	0.00000	0.00000	0.01325
H6	Single Phase/Single Phase	0.79213	0.11094	0.00000	0.00000	0.01311
H5	Single Phase/Single Phase	0.13673	0.01970	0.00000	0.00000	0.01311
H4	Single Phase/Single Phase	0.29205	0.04276	0.00000	0.00000	0.01311
H3	Single Phase/Single Phase	0.41521	0.06225	0.00000	0.00000	0.01311
H2	Single Phase/Single Phase	0.87243	0.13615	0.00000	0.00000	0.01311
H1	Single Phase/Single Phase	0.14361	0.02317	0.00000	0.00000	0.01311

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : Depressuring maxback P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P2	4870647	0.000e+000				
P5	4928816	0.000e+000				
H9	4871227	0.000e+000				
H8	4871319	0.000e+000				
H7	4871365	0.000e+000				
H6	9804927	0.000e+000				
H5	9804988	0.000e+000				
H4	9805526	0.000e+000				
H3	9806305	0.000e+000				
H2	9808242	0.000e+000				
H1	9808105	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : Depressuring maxback P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P2			108.54	6.560
P5			108.56	6.560
H9			22.96	22.960
H8			7.55	7.550
H7			3.30	3.300
H6			19.36	19.360
H5			3.30	3.300
H4			7.00	7.000
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring min back P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
H1	202452.0	10689.46	202452.0	1.42267	85.0	
H2	202452.0	10689.46	202452.0	4.21209	85.0	
H3	202452.0	10689.46	202452.0	1.39645	80.3	
H4	202452.0	10689.46	202452.0	0.87656	77.2	
H5	202452.0	10689.46	202452.0	0.38601	73.0	
H6	202452.0	10689.46	202452.0	2.04290	79.6	
H7	99938.0	5276.77	99938.0	0.04767	45.8	
H8	99938.0	5276.77	99938.0	0.10869	49.4	
H9	99938.0	5276.77	99938.0	0.32809	54.1	
P5	102514.0	5412.69	102514.0	1.69521	50.1	37.87701
P2	99938.0	5276.77	99938.0	1.46018	47.5	40.43449

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring min back P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
H1	21.12267	49.68	973.591	0.746	69713	4.472e+007
H2	25.68241	50.03	800.456	0.614	57315	4.472e+007
H3	27.32267	50.16	752.315	0.577	53868	4.472e+007
H4	28.42038	50.25	723.201	0.555	51784	4.472e+007
H5	29.01475	50.30	708.356	0.543	50721	4.472e+007
H6	31.25978	50.48	657.379	0.504	47071	4.472e+007
H7	37.26896	46.77	269.783	0.208	9536	2.188e+007
H8	37.40940	46.79	268.767	0.207	9500	2.188e+007
H9	37.76911	46.82	266.200	0.205	9409	2.188e+007
P5	37.87701	55.08	276.833	0.212	10037	2.285e+007
P2	40.43449	47.03	248.605	0.192	8787	2.188e+007

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring min back P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
H1	19.70000	49.56	1044.003	0.800	74754	4.472e+007
H2	21.47032	49.69	957.803	0.734	68582	4.472e+007
H3	25.92622	50.05	792.915	0.608	56775	4.472e+007
H4	27.54383	50.18	746.262	0.572	53435	4.472e+007
H5	28.62874	50.26	717.927	0.551	51406	4.472e+007
H6	29.21687	50.31	703.446	0.539	50369	4.472e+007
H7	37.22129	46.76	270.129	0.208	9548	2.188e+007
H8	37.30071	46.77	269.552	0.208	9528	2.188e+007
H9	37.44103	46.78	268.539	0.207	9492	2.188e+007
P5	36.18179	54.94	289.837	0.222	10509	2.285e+007
P2	38.97431	46.90	257.946	0.199	9117	2.188e+007

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring min back P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
H1	Single Phase/Single Phase	0.33597	1.08669	0.00000	0.00000	0.01311
H2	Single Phase/Single Phase	1.78448	2.42761	0.00000	0.00000	0.01311
H3	Single Phase/Single Phase	0.77016	0.62629	0.00000	0.00000	0.01311
H4	Single Phase/Single Phase	0.52085	0.35571	0.00000	0.00000	0.01311
H5	Single Phase/Single Phase	0.23840	0.14761	0.00000	0.00000	0.01311
H6	Single Phase/Single Phase	1.33246	0.71045	0.00000	0.00000	0.01311
H7	Single Phase/Single Phase	0.04503	0.00264	0.00000	0.00000	0.01325
H8	Single Phase/Single Phase	0.10272	0.00597	0.00000	0.00000	0.01325
H9	Single Phase/Single Phase	0.31029	0.01780	0.00000	0.00000	0.01325
P5	Single Phase/Single Phase	1.59370	0.10151	0.00000	1.59278	0.01325
P2	Single Phase/Single Phase	1.38911	0.07106	0.00000	1.37193	0.01325

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : Depressuring min back P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
H1	9855847	0.000e+000				
H2	9919297	0.000e+000				
H3	9842611	0.000e+000				
H4	9836442	0.000e+000				
H5	9833353	0.000e+000				
H6	9842318	0.000e+000				
H7	4882885	0.000e+000				
H8	4882820	0.000e+000				
H9	4882735	0.000e+000				
P5	4942382	0.000e+000				
P2	4882897	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : Depressuring min back P

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
H1			3.30	3.300
H2			20.34	20.340
H3			9.85	9.850
H4			7.00	7.000
H5			3.30	3.300
H6			19.36	19.360
H7			3.30	3.300
H8			7.55	7.550
H9			22.96	22.960
P5			108.57	6.560
P2			108.54	6.560

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4502

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P6	14202.0	749.73	14202.0	1.94058	46.8	21.53674
H5	14202.0	749.73	14202.0	0.00300	13.1	
H4	14202.0	749.73	14202.0	0.00636	16.4	
H3	14202.0	749.73	14202.0	0.00896	17.9	
H2	14202.0	749.73	14202.0	0.01851	21.0	
H1	14202.0	749.73	14202.0	0.00301	13.1	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4502

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
P6	21.53674	310.92	441.281	0.281	9617	5.090e+006
H5	19.74709	310.86	110.926	0.071	557	5.090e+006
H4	19.74228	310.86	110.953	0.071	557	5.090e+006
H3	19.73410	310.86	110.999	0.071	558	5.090e+006
H2	19.72333	310.86	111.059	0.071	558	5.090e+006
H1	19.70301	310.86	111.174	0.071	558	5.090e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4502

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P6	19.59616	310.83	484.988	0.309	10570	5.090e+006
H5	19.74409	310.84	110.942	0.071	557	5.090e+006
H4	19.73591	310.84	110.988	0.071	557	5.090e+006
H3	19.72514	310.84	111.049	0.071	558	5.090e+006
H2	19.70482	310.84	111.164	0.071	558	5.090e+006
H1	19.70000	310.84	111.191	0.071	559	5.090e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4502

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P6	Single Phase/Single Phase	1.73501	0.20556	0.00000	1.67838	0.01579
H5	Single Phase/Single Phase	0.00298	0.00002	0.00000	0.00000	0.01502
H4	Single Phase/Single Phase	0.00632	0.00004	0.00000	0.00000	0.01502
H3	Single Phase/Single Phase	0.00890	0.00005	0.00000	0.00000	0.01502
H2	Single Phase/Single Phase	0.01840	0.00011	0.00000	0.00000	0.01502
H1	Single Phase/Single Phase	0.00299	0.00002	0.00000	0.00000	0.01502

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSV4502

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P6	1037144	0.000e+000				
H5	496820	0.000e+000				
H4	496820	0.000e+000				
H3	496820	0.000e+000				
H2	496821	0.000e+000				
H1	496821	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4502

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P6			48.55	6.560
H5			3.30	3.300
H4			7.00	7.000
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4503

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P3	14233.0	751.37	14233.0	1.94591	46.8	21.57484
H8	14233.0	751.37	14233.0	0.00688	16.7	
H7	14233.0	751.37	14233.0	0.00301	13.1	
H6	14233.0	751.37	14233.0	0.01766	20.8	
H5	14233.0	751.37	14233.0	0.00301	13.1	
H4	14233.0	751.37	14233.0	0.00639	16.4	
H3	14233.0	751.37	14233.0	0.00900	17.9	
H2	14233.0	751.37	14233.0	0.01859	21.1	
H1	14233.0	751.37	14233.0	0.00302	13.2	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4503

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s ²)	Upstream Enthalpy Flow (btu/hr)
P3	21.57484	310.92	441.466	0.281	9642	5.101e+006
H8	19.78027	310.86	110.982	0.071	559	5.101e+006
H7	19.77158	310.86	111.031	0.071	559	5.101e+006
H6	19.76676	310.86	111.058	0.071	559	5.101e+006
H5	19.74728	310.86	111.167	0.071	560	5.101e+006
H4	19.74245	310.86	111.194	0.071	560	5.101e+006
H3	19.73425	310.86	111.241	0.071	560	5.101e+006
H2	19.72343	310.86	111.302	0.071	560	5.101e+006
H1	19.70302	310.86	111.417	0.071	561	5.101e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4503

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s ²)	Downstream Enthalpy Flow (btu/hr)
P3	19.62893	310.84	485.238	0.309	10598	5.101e+006
H8	19.77339	310.84	111.020	0.071	559	5.101e+006
H7	19.76857	310.84	111.047	0.071	559	5.101e+006
H6	19.74910	310.84	111.157	0.071	560	5.101e+006
H5	19.74427	310.84	111.184	0.071	560	5.101e+006
H4	19.73606	310.84	111.230	0.071	560	5.101e+006
H3	19.72525	310.84	111.291	0.071	560	5.101e+006
H2	19.70484	310.84	111.407	0.071	561	5.101e+006
H1	19.70000	310.84	111.434	0.071	561	5.101e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4503

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P3	Single Phase/Single Phase	1.73959	0.20632	0.00000	1.68301	0.01579
H8	Single Phase/Single Phase	0.00684	0.00004	0.00000	0.00000	0.01502
H7	Single Phase/Single Phase	0.00299	0.00002	0.00000	0.00000	0.01502
H6	Single Phase/Single Phase	0.01755	0.00011	0.00000	0.00000	0.01502
H5	Single Phase/Single Phase	0.00299	0.00002	0.00000	0.00000	0.01502
H4	Single Phase/Single Phase	0.00635	0.00004	0.00000	0.00000	0.01502
H3	Single Phase/Single Phase	0.00894	0.00006	0.00000	0.00000	0.01502
H2	Single Phase/Single Phase	0.01848	0.00011	0.00000	0.00000	0.01502
H1	Single Phase/Single Phase	0.00300	0.00002	0.00000	0.00000	0.01502

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4503

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P3	1039419	0.000e+000				
H8	497908	0.000e+000				
H7	497908	0.000e+000				
H6	497908	0.000e+000				
H5	497908	0.000e+000				
H4	497908	0.000e+000				
H3	497908	0.000e+000				
H2	497909	0.000e+000				
H1	497909	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4503

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P3			48.56	6.560
H8			7.55	7.550
H7			3.30	3.300
H6			19.36	19.360
H5			3.30	3.300
H4			7.00	7.000
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSV4504

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P1	22218.0	1172.90	22218.0	1.09130	44.9	22.66332
H10	44436.0	2345.80	44436.0	0.06757	47.1	
H9	44436.0	2345.80	44436.0	0.19070	51.8	
H8	44436.0	2345.80	44436.0	0.06320	47.1	
H7	44436.0	2345.80	44436.0	0.02772	43.5	
H6	44436.0	2345.80	44436.0	0.16366	51.4	
H5	44436.0	2345.80	44436.0	0.02807	43.8	
H4	44436.0	2345.80	44436.0	0.05976	47.1	
H3	44436.0	2345.80	44436.0	0.08451	48.7	
H2	44436.0	2345.80	44436.0	0.17598	52.1	
H1	44436.0	2345.80	44436.0	0.02875	44.3	
P1B	22218.0	1172.90	22218.0	1.10643	45.2	22.40357
H11	22218.0	1172.90	22218.0	0.00656	23.3	

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSV4504

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
P1	22.66332	316.56	344.328	0.219	6117	8.035e+006
H10	20.75112	316.50	332.692	0.211	5229	1.607e+007
H9	20.66608	316.50	334.062	0.212	5250	1.607e+007
H8	20.45771	316.49	337.465	0.214	5304	1.607e+007
H7	20.37677	316.49	338.805	0.215	5325	1.607e+007
H6	20.33127	316.49	339.564	0.216	5337	1.607e+007
H5	20.14966	316.48	342.625	0.217	5385	1.607e+007
H4	20.10359	316.48	343.410	0.218	5397	1.607e+007
H3	20.02577	316.48	344.745	0.219	5418	1.607e+007
H2	19.92309	316.48	346.522	0.220	5446	1.607e+007
H1	19.72875	316.47	349.935	0.222	5500	1.607e+007
P1B	22.40357	316.56	348.321	0.221	6188	8.035e+006
H11	21.52136	316.53	160.392	0.102	1260	8.035e+006

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSV4504

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P1	21.57202	316.53	361.750	0.230	6426	8.035e+006
H10	20.68355	316.50	333.779	0.212	5246	1.607e+007
H9	20.47538	316.50	337.173	0.214	5299	1.607e+007
H8	20.39451	316.50	338.511	0.215	5320	1.607e+007
H7	20.34905	316.49	339.267	0.215	5332	1.607e+007
H6	20.16761	316.49	342.320	0.217	5380	1.607e+007
H5	20.12159	316.49	343.103	0.218	5392	1.607e+007
H4	20.04384	316.48	344.434	0.219	5413	1.607e+007
H3	19.94126	316.48	346.206	0.220	5441	1.607e+007
H2	19.74711	316.47	349.610	0.222	5495	1.607e+007
H1	19.70000	316.47	350.446	0.222	5508	1.607e+007
P1B	21.29714	316.52	366.420	0.233	6509	8.035e+006
H11	21.51480	316.53	160.441	0.102	1261	8.035e+006

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSV4504

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P1	Single Phase/Single Phase	1.02451	0.06679	0.00000	0.98491	0.01488
H10	Single Phase/Single Phase	0.06388	0.00369	0.00000	0.00000	0.01378
H9	Single Phase/Single Phase	0.18015	0.01055	0.00000	0.00000	0.01378
H8	Single Phase/Single Phase	0.05966	0.00355	0.00000	0.00000	0.01378
H7	Single Phase/Single Phase	0.02616	0.00157	0.00000	0.00000	0.01378
H6	Single Phase/Single Phase	0.15431	0.00935	0.00000	0.00000	0.01378
H5	Single Phase/Single Phase	0.02645	0.00162	0.00000	0.00000	0.01378
H4	Single Phase/Single Phase	0.05628	0.00347	0.00000	0.00000	0.01378
H3	Single Phase/Single Phase	0.07955	0.00496	0.00000	0.00000	0.01378
H2	Single Phase/Single Phase	0.16551	0.01048	0.00000	0.00000	0.01378
H1	Single Phase/Single Phase	0.02702	0.00173	0.00000	0.00000	0.01378
P1B	Single Phase/Single Phase	1.03704	0.06939	0.00000	0.99856	0.01488
H11	Single Phase/Single Phase	0.00648	0.00008	0.00000	0.00000	0.01443

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4504

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P1	1162934	0.000e+000				
H10	1546025	0.000e+000				
H9	1546062	0.000e+000				
H8	1546039	0.000e+000				
H7	1546039	0.000e+000				
H6	1546069	0.000e+000				
H5	1546050	0.000e+000				
H4	1546056	0.000e+000				
H3	1546063	0.000e+000				
H2	1546094	0.000e+000				
H1	1546070	0.000e+000				
P1B	1162981	0.000e+000				
H11	772992	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4504

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P1			67.70	6.600
H10			8.20	8.200
H9			22.96	22.960
H8			7.55	7.550
H7			3.30	3.300
H6			19.36	19.360
H5			3.30	3.300
H4			7.00	7.000
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300
P1B			67.70	6.600
H11			3.30	3.300

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4505

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P10	36188.0	1910.70	36188.0	3.73230	61.2	23.60928
H1	36188.0	1910.70	36188.0	0.02099	40.1	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4505

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s ²)	Upstream Enthalpy Flow (btu/hr)
P10	23.60928	395.13	593.188	0.362	17164	1.479e+007
H1	19.72099	395.03	314.122	0.192	4020	1.479e+007

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4505

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P10	19.87698	395.01	704.571	0.430	20387	1.479e+007
H1	19.70000	395.00	314.457	0.192	4025	1.479e+007

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4505

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P10	Single Phase/Single Phase	3.03662	0.69568	0.00000	3.37594	0.01463
H1	Single Phase/Single Phase	0.02006	0.00092	0.00000	0.00000	0.01400

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4505

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P10	1773788	0.000e+000				
H1	1171079	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4505

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P10			68.70	6.560
H1			3.30	3.300

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4507

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P7	13926.0	735.05	13926.0	1.94087	46.8	21.53240
H4	13926.0	735.05	13926.0	0.00639	16.4	
H3	13926.0	735.05	13926.0	0.00900	17.9	
H2	13926.0	735.05	13926.0	0.01860	21.1	
H1	13926.0	735.05	13926.0	0.00302	13.2	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4507

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
P7	21.53240	341.44	449.962	0.282	9616	5.240e+006
H4	19.74244	341.39	113.111	0.071	557	5.240e+006
H3	19.73424	341.39	113.158	0.071	557	5.240e+006
H2	19.72343	341.39	113.220	0.071	558	5.240e+006
H1	19.70302	341.39	113.337	0.071	558	5.240e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4507

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P7	19.59153	341.32	494.542	0.310	10568	5.240e+006
H4	19.73605	341.32	113.147	0.071	557	5.240e+006
H3	19.72524	341.32	113.209	0.071	558	5.240e+006
H2	19.70483	341.32	113.327	0.071	558	5.240e+006
H1	19.70000	341.32	113.354	0.071	558	5.240e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4507

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P7	Single Phase/Single Phase	1.73525	0.20561	0.00000	1.67818	0.01582
H4	Single Phase/Single Phase	0.00635	0.00004	0.00000	0.00000	0.01509
H3	Single Phase/Single Phase	0.00894	0.00005	0.00000	0.00000	0.01509
H2	Single Phase/Single Phase	0.01848	0.00011	0.00000	0.00000	0.01509
H1	Single Phase/Single Phase	0.00300	0.00002	0.00000	0.00000	0.01509

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4507

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P7	988905	0.000e+000				
H4	473710	0.000e+000				
H3	473710	0.000e+000				
H2	473710	0.000e+000				
H1	473710	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4507

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P7			48.47	6.560
H4			7.00	7.000
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4508

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P4	14105.0	744.50	14105.0	1.96403	46.9	21.58365
H7	14105.0	744.50	14105.0	0.00304	13.2	
H6	14105.0	744.50	14105.0	0.01785	21.0	
H5	14105.0	744.50	14105.0	0.00304	13.3	
H4	14105.0	744.50	14105.0	0.00646	16.6	
H3	14105.0	744.50	14105.0	0.00910	18.0	
H2	14105.0	744.50	14105.0	0.01880	21.2	
H1	14105.0	744.50	14105.0	0.00305	13.3	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4508

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s ²)	Upstream Enthalpy Flow (btu/hr)
P4	21.58365	331.38	448.927	0.283	9717	5.223e+006
H7	19.77234	331.33	112.948	0.071	563	5.223e+006
H6	19.76747	331.33	112.976	0.071	564	5.223e+006
H5	19.74779	331.33	113.089	0.071	564	5.223e+006
H4	19.74291	331.33	113.117	0.071	564	5.223e+006
H3	19.73461	331.33	113.164	0.071	565	5.223e+006
H2	19.72368	331.33	113.227	0.071	565	5.223e+006
H1	19.70305	331.33	113.346	0.071	565	5.223e+006

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4508

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s ²)	Downstream Enthalpy Flow (btu/hr)
P4	19.61962	331.27	493.872	0.311	10690	5.223e+006
H7	19.76930	331.28	112.966	0.071	564	5.223e+006
H6	19.74962	331.27	113.078	0.071	564	5.223e+006
H5	19.74474	331.27	113.106	0.071	564	5.223e+006
H4	19.73645	331.27	113.154	0.071	564	5.223e+006
H3	19.72552	331.27	113.216	0.071	565	5.223e+006
H2	19.70489	331.27	113.335	0.071	565	5.223e+006
H1	19.70000	331.27	113.363	0.071	566	5.223e+006

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSV4508

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P4	Single Phase/Single Phase	1.75408	0.20996	0.00000	1.69842	0.01580
H7	Single Phase/Single Phase	0.00302	0.00002	0.00000	0.00000	0.01506
H6	Single Phase/Single Phase	0.01774	0.00011	0.00000	0.00000	0.01506
H5	Single Phase/Single Phase	0.00303	0.00002	0.00000	0.00000	0.01506
H4	Single Phase/Single Phase	0.00642	0.00004	0.00000	0.00000	0.01506
H3	Single Phase/Single Phase	0.00904	0.00006	0.00000	0.00000	0.01506
H2	Single Phase/Single Phase	0.01868	0.00012	0.00000	0.00000	0.01506
H1	Single Phase/Single Phase	0.00303	0.00002	0.00000	0.00000	0.01506

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4508

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P4	1011088	0.000e+000				
H7	484315	0.000e+000				
H6	484315	0.000e+000				
H5	484315	0.000e+000				
H4	484315	0.000e+000				
H3	484315	0.000e+000				
H2	484316	0.000e+000				
H1	484316	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSV4508

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P4			48.51	6.560
H7			3.30	3.300
H6			19.36	19.360
H5			3.30	3.300
H4			7.00	7.000
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4590

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P8	2993606.0	166172.04	2993606.0	6.03078	0.0	28.98136
H3	2993606.0	166172.04	2993606.0	0.35640	0.0	
H2	2993606.0	166172.04	2993606.0	0.73595	0.0	
H1	2993606.0	166172.04	2993606.0	0.11940	0.0	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4590

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
P8	28.98136	102.36	24.406	0.004	37061	-2.387e+009
H3	21.02841	102.38	17.017	0.003	18017	-2.387e+009
H2	20.61368	102.39	17.017	0.003	18017	-2.387e+009
H1	19.81940	102.39	17.017	0.003	18017	-2.387e+009

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4590

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P8	22.95058	102.38	24.406	0.004	37062	-2.387e+009
H3	20.67201	102.39	17.017	0.003	18017	-2.387e+009
H2	19.87773	102.39	17.017	0.003	18017	-2.387e+009
H1	19.70000	102.39	17.017	0.003	18017	-2.387e+009

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4590

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P8	Single Phase/Single Phase	6.03078	0.00000	0.00000	5.43167	0.01907
H3	Single Phase/Single Phase	0.35640	0.00000	0.00000	0.00000	0.01861
H2	Single Phase/Single Phase	0.73595	0.00000	0.00000	0.00000	0.01861
H1	Single Phase/Single Phase	0.11940	0.00000	0.00000	0.00000	0.01861

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4590

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P8	2847536	0.000e+000				
H3	2378037	0.000e+000				
H2	2378077	0.000e+000				
H1	2378110	0.000e+000				

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4590

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P8			66.03	6.560
H3			9.85	9.850
H2			20.34	20.340
H1			3.30	3.300

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4591

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Mass Flow (lb/hr)	Molar Flow (lbmole/hr)	Rated Mass Flow (lb/hr)	Static Pressure Drop (psi)	Noise (dB)	Static Source Back Pressure (psia)
P9	3162044.0	12425.56	3162044.0	10.92834	11.6	36.06059
H2	3162044.0	12425.56	3162044.0	1.38346	11.3	
H1	3162044.0	12425.56	3162044.0	0.22446	3.2	

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4591

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Upstream Static Pressure (psia)	Upstream Temperature (F)	Upstream Velocity (ft/s)	Upstream Mach No.	Upstream Rho V2 (lb/ft/s2)	Upstream Enthalpy Flow (btu/hr)
P9	36.06059	562.21	44.596	0.022	71532	8.372e+008
H2	21.42059	562.23	31.112	0.016	34794	8.372e+008
H1	19.92446	562.23	31.113	0.016	34796	8.372e+008

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4591

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Downstream Static Pressure (psia)	Downstream Temperature (F)	Downstream Velocity (ft/s)	Downstream Mach No.	Downstream Rho V2 (lb/ft/s2)	Downstream Enthalpy Flow (btu/hr)
P9	25.13225	562.23	44.615	0.022	71563	8.372e+008
H2	20.03713	562.23	31.113	0.016	34796	8.372e+008
H1	19.70000	562.23	31.114	0.016	34796	8.372e+008

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4591

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Flow Regime	Static Pipe Friction Loss (psi)	Static Pipe Accel. Loss (psi)	Static Pipe Elevation Loss (psi)	Static Pipe Fittings Loss (psi)	Friction Factor
P9	Single Phase/Single Phase	10.92834	0.00000	0.00000	10.48584	0.01869
H2	Single Phase/Single Phase	1.38346	0.00000	0.00000	0.00000	0.01811
H1	Single Phase/Single Phase	0.22446	0.00000	0.00000	0.00000	0.01811

User Name : BEI
Job Code : 2703-Kunnar Pasaki
Project : GAS DEHYDRATION UNIT
Description :
Scenario : PSE4591

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Reynolds Number	Duty (Btu/hr)	Overall HTC (Btu/h/ft ² /F)	External Convective HTC (Btu/h/ft ² /F)	External Radiative HTC (Btu/h/ft ² /F)	Internal HTC (Btu/h/ft ² /F)
P9	8534552	0.000e+000				
H2	7128498	0.000e+000				
H1	7128698	0.000e+000				

User Name : BEI
 Job Code : 2703-Kunnar Pasaki
 Project : GAS DEHYDRATION UNIT
 Description :
 Scenario : PSE4591

Pressure/Flow Summary(Velocities Based Upon Nominal Flows)

Name	Wall Temperature (F)	External Temperature (F)	Equivalent Length (ft)	Physical Length (ft)
P9			63.22	2.560
H2			20.34	20.340
H1			3.30	3.300