Flare header load summary

Rev.	Description	Date	Made by	Chd.	Appd.
0	First issue	08-OCT-2010	HEHE	LOJ	ST
1	General revision	19-NOV-2011	HELR	LOJ	ST
2	USV-2482 revised	08-JUN-2016	LM	KSBL	ST

Contents

1 General

A summary of the various safety and vent valves is shown in Table 1. Please see the respective instrument data sheets for further details. The data given in Table 1 shall be verified during detailed engineering.

1.1 Back pressure.

Flammable gases will be disposed to the flare system, when pressure exceeds the back-pressure of the flare system.

Back-pressure bar g, superimposed: 1.5

2 Causes of release to flare header

2.1 General remarks

Release to flare may be expected during plant start-up, plant shut-down or during an upset when the plant is not in balance or when part of the plant is shut down or tripped.
In case the methanol synthesis is not able to consume the gas available, it will be flared upstream that section.

In case of a trip of either the complete plant or plant section, some release to flare will occur due to depressurisation of some sections.

In case of fire, release to flare may occur due to manual activation of trip, due to manually controlled depressurisation or due to release through safety valves .
Release through the safety valves may also occur as a result of the other contingencies considered for the safety valves, for instance blocked outlet, gas break-through, etc.

2.2 Plant start-up and shut-down

When the reforming section is started up or shut down, the desulphurisation section and reforming section may operate at different capacities. This will result in flaring of excess natural gas from the vent valve, PV-1045, downstream of the desulphurisation section or PV-2073, downstream the saturator.

Throughout the start-up sequence of the reforming unit and until the reformed gas can be sent to the methanol synthesis, reformed gas will be flared from the vent valve, PV-2481, downstream of Final Separator, D 2005,
During start-up of the methanol synthesis, the purge gas from the synthesis section will be sent to flare via, PV-2536, until stable operation has been obtained and the gas can be sent to the fuel gas header.

The plant sections may be shut-down in the opposite sequence of the start-up resulting in the feed gas to the plant section being temporarily flared.

2.3 Plant trip

If the plant trips the reforming section and the methanol synthesis will be depressurised automatically by discharging the gas to the flare. The other sections will remain under pressure until it is decided to depressurise these sections.

In case of trip of the methanol synthesis section, the reforming section will continue operation and the excess reformed gas will be released via vent valve, PV-2481, to flare.

2.4 PSV contingencies

Please refer to Table 1 for a description of the PSV contingencies considered.
In case of fire, release to the flare system through safety valves will occur only if the equipment heated by the fire is isolated and the temperature increase causes the system pressure to increase to the relief pressure of the safety valves. It would be expected that the plant is tripped and the system pressure decreased through the vent valves discharging to the flare system.

3 Quantities released to flare header

All valves discharging to flare header are listed in Table 1.

Discharging flows and conditions are given to the extent known during basic design. This information must be confirmed and completed during detailed design when the sizes of the valves installed are known. For a typical composition of the relief stream reference is made to HTAS doc ‘Stream Tables’, for each source of relief a reference number to stream tables is indicated.

The flow given below must therefore only be considered preliminary.

3.1 Desulphurization section

During start-up the desulphurization section is heated by natural gas which is discharged to flare via PV-1045 or PV-2073. For continuous discharge to the flare header, maximum flow through the valves should be considered. In case of Trip of Tubular Reformer the desulphurization section stays under pressure. There will be no discharge to flare unless the operator opens PV-1045 manually.

3.2 Reforming section

In case of Trip of Tubular Reformer the reforming section will be depressurised by venting reformed gas to the flare header through USV-2482, at the outlet of Final Separator D 2005. The initial release will be as indicated in table 1, but the flow rate will decrease as the pressure decrease.

In case of trip or stop of the downstream units the excess reformed gas from the reforming section has to be vented to the flare header through, PV-2481. This situation will persist until the downstream unit is re-started or the reforming section capacity is reduced.

The release source accounting for the maximum process gas flow is located downstream the Steam Superheater E 2021 (PSV-2354, PSV-2355, PSV-2356, PSV-2357, PSV-2358, PSV-2359 and PSV-2360). This release will be design giving for the flare system.

3.3 Methanol synthesis

During start up the purge gas is vented to the flare through PV-2536 or PV-3166.
In case of Trip of Methanol Synthesis the synthesis may manually be depressurised by venting through PV-3166 to the flare header.

3.4 Simultaneity

For design of the flare header system, simultaneous flaring from various flaring points must be considered.

The desulphurization, the reforming section, and downstream sections are directly connected. It is thus not possible to flare the maximum capacity from the desulphurization section simultaneously with flaring of the maximum capacity from the downstream sections. Power failure at different consumers may result in simultaneous flaring. Loss of cooling water supply to different consumers may result in simultaneous flaring.

The scenarios mention above for simulations flaring has been evaluated and the conclusion is that none of the cases gives a larger flow than the one given in paragraph 3.2.

Table 1 - Summary of safety and vent valves discharging to flare

PID	Tag No.	Fluid	Contingency	Flow rate (kg/hr)	MW (g/mole)	T (°C)	LHV (kJ/Nm³)	HHV (kJ/Nm³)	Reference stream no.[1]
P01	PSV-1008 / PSV-1009	Natural gas	Inadvertent valve opening of PV-1006	2000	16.74	40	34496	38260	2005
P01	PSV-1013 / PSV-1014	Natural gas	Inadvertent valve opening of PV-1011	27700	16.74	35	34496	38260	7005
P01	PSV-1015	Natural gas	Fire around D 1001	800	16.74	85	34496	38260	2000
P04	PSV-1031	Process gas	Fire around R 1001	1200	16.54	410	33834	37542	2030
P04	PSV-1038	Process gas	Fire around R 1002 1	1200	16.54	410	33834	37542	2040
P04	PSV-1043	Process gas	Fire around R 1002 2	1200	16.54	410	33834	37542	2040
P04	PV-1045	Process gas	Valve failure at normal operating pressure/start-up	63000	16.54	365	33834	37542	2040
P07	PSV-6053	Steam + natural gas	Fire around D 6001	3800	13.14	283	7350	8900	2200
P09	PV-2073	Process gas	Valve failure at normal operating pressure/start-up	165300	17.47	262	13565	16226	2090
P09	PSV-2078	Recycle gas from C 2002	Inadvertent valve opening of FV-2079	1500	11.44	48	10367	11751	3000
P17	PSV-2354 / PSV-2355 / PSV-2356 / PSV-2357 / PSV-2358 / PSV-2359 / PSV-2360 /	Reformed gas	Blocked outlet	510000	13.14	360	7350	8900	2200
P19	PV-2406	Reformed gas	Valve failure at normal operating pressure/trip of downstream units	222400	13.17	165	7350	8900	2200

[1] Please refer to HTAS doc ”Stream tables” for composition

PID	Tag No.	Fluid	Contingency	Flow rate (kg/hr)	MW (g/mole)	T (°C)	LHV (kJ/Nm³)	HHV (kJ/Nm³)	Reference stream no.[1]
P21	PV-2481	Reformed gas	Valve failure at normal operating pressure/trip of methanol synthesis	282200	11.44	48	10367	11751	3000
P21	USV-2482	Reformed gas	Reformer Trip	29700	11.44	48	10367	11751	3000
P22	HV-3011	Synthesis gas	Small purge (short duration)	4000	11.44	48	10367	11751	3000
P22	PSV-3021	Synthesis gas	Fire around R 3001 1/2/3	5600	9.81	120	10426	12029	3110
P27	PSV-3163	Synthesis gas	Fire around D 3001	19000	9.37	100	10441	12132	3190
P27	PV-3166	Recycle gas	Valve failure at normal operating pressure/start-up	51000	11.4	48	10441	12132	3190
P27	HV-3166	Recycle gas	Maximum flow	51000	11.4	48	10441	12132	3190
P27	PSV-3173 / PSV-3174	Purge gas	Inadvertent valve opening of FV-3169	41800	9.37	48	10441	12132	3190
P28	PSV-3196 / PSV-3197 / PSV-3206	Purge gas	Gas breakthrough from LV-3161	66900	9.37	48	9598	10975	3340
P30	PSV-5058 / PSV-5059 / PSV-5060 / PSV-5061	Methanol vapour	Reflux failure	118800	29.92	116	22076	25549	5030
P32	PV-5109	Off-gas	Maximum case	2400	43.59	48	20664	23009	5145
P34	PSV-5179 / PSV-5180	Methanol vapour	Fire around T 5002	5200	29.08	121	22077	25554	5240
P38	PSV-5250 / PSV-5251 / PSV-5261	Methanol vapour	Reflux failure	100200	27.1	141	16524	19619	5430
P40	HV-5338	Methanol vapour	Manual vent on D 5003	220	32.04	101	28473	32389	5500
P42	PSV-5384	Methanol vapour	Fire around X 5001 A	5900	32.04	174	28474	32390	5370

[1] Please refer to HTAS doc ”Stream tables” for composition

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P42	PSV-5386	Methanol vapour	Fire around X 5001 B	5900	32.04	174	28473	32390	5370
U01	PV-2536 B	Purge gas	Trip of purge gas fuel	31800	10.64	47	10509	12189	3350
U17	PSV-2604 / PSV-2605	Hydrogen	Inadvertent valve opening of PV-2608	4000	9.37	48	10441	12132	3310

[1] Please refer to HTAS doc "Stream tables" for composition