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What is the applicable relief scenarios for Pig Launcher/Receiver in crude oil service?

[Majid Abdolkarimi](#)

Process Lead Engineer at EIED



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[Priyanka Ferrao](#)

at

Hi Majid,

Priyanka

What i have observed in past projects is a fire case PSV on the launcher/ receiver. 1x100% should suffice as this is an intermittent operation.
What do you mean by 'medium' crude oil service?

Also as an extension of your question - in a recent project we have provided a portable launcher/ receiver. Client believes that the fire case PSV on the launcher/ receiver may not be required, it being an intermittent operation plus the portability of the equipment.

Any comments/ experience on why or why not we should provide a PSV.

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[Majid Abdolkarimi](#)

Process Lead Engineer at EIED

Majid

Hi Priyanka,

I think that fire case can not be applicable to Launcher/Receiver, because relieving temperature due to high design pressure of pipeline, is higher than metal melting temperature, it means that before relieving fluid, it is possible to melt the metal.

As you know pipeline design pressure and consequently PSV set pressure is depend on upstream pump's shut off pressure or surge effect, therefore for crude oil, relieving temperature can be higher than metal melting temperature.

Other important issue for crude oil is high heat of vaporization that intensifies the above effect.

Medium crude oil is crude oil with API gravity of 20 to 30.

Regards
Majid

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**Mojtaba Habibi**

Process Engineer at Petroleum Engineering and Development Company (PEDEC)
Top Contributor

Mojtaba

In my view fire case is a credible scenario for both pig launcher and pig receiver and PSVs are going to be a necessary part of a complete protection system based on requirements of Code (i.e. ASME). Depends on mode of operation, pig launcher/receiver can contain gas, liquid or combination of both. If there is liquid inside, then this helps to protect the pig launcher/receiver and buy time such that other protective facilities which are considered for fire protection can be used. If there is gas inside then PSV may or may not protect the pig launcher/receiver against fire. Then additional safeguards as recommended by API 521 may be considered.

I have discussed this concern with Mr. Joe Wong the experienced process engineer, earlier. I would like to share his viewpoints:

"[Joe Wong] : You just imagine a gas filled vessel being heated external. The internal pressure will increase and simultaneously the wall temperature also increase. Poor heat transfer between gas and wall will result wall temperature increase much faster than the gas temperature and vessel will fail eventually. Regardless of jet fire or pool fire, the vessel still fail. Of course jet fire will result it fail quicker than pool fire. Just a matter of time.

You must understand that any material will lose their strength when it expose to high heat input (internal or external) and failed eventually. We are providing necessary measures to buy time so that it if sufficient time for evacuation and arrival of external aid.

Those a PSV will not protect gas filled vessel from external fire but it partially delay (buy a little bit of time) the failure of vessel.

But we shall focus on other measures such as

- emergency depressurization system
- high SIL instrumented protective system
- fire proofing system
- high firewater spray density

These measures will definitely helps to delay the failure of the material / system."

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**Rashesh Shah**

Chief Process Engineer, CEng MIChemE at PetroVietnam Technical (M&C) Services Corporation

Rashesh

I have an opinion, If the pig launcher and receiver are isolated with double block and bleed valves and if the strict operating procedures with key interlock in the valves are placed than we assume that the pi launcher is practically empty (nitrogen inside) and there is no sustainable pool fire and hence no PSV is required (if the pig launchers barrels are pipeline spec.). this need to be discussed with the client. The other way is reduced the set pressure of PSV if design pressure is too high than operating. that will give you reasonable relieving temperature.

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**Saeid R. Mofrad**

Principal Process Engineer at Petrofac (P.E.)
Top Contributor

As rightly mentioned by Mojtaba, relief valve may not protect the pig trap when it is gas filled (process gas or nitrogen). However, considering different possible modes of operation, relief valve is usually required.

If pig trap is not in fire zone, relief valve requirement due to fire may be waived, however, other causes of overpressure should be taken into consideration. I remember a pig trap in produced water service where there was no source of hydrocarbon around (no fire zone) where we provided thermal relief valve only.

The only point which makes me a bit reluctant about providing relief valve on pig traps is that most of the times they are not designed according to pressure vessel design code (ASME VIII) where protection against overpressure is a mandatory!

Dear Rashesh, reducing the relief valve set pressure does not prevent a gas filled system's metal from being melted down due to overheating in fire scenario as the reason of failure is not hot gas inside the system. It is fire!

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S M Kumar
Process Design Consultant
Top Contributor

S M

Fire or Thermal Relief is the usual case for Pig Launcher/Receiver PSV sizing. The PSV there is not sized blocked outlet etc!

in a fire case, PSV does not protect due to increasing metal wall temperature with falling ability to hold pressure - be it a vessel or pig launcher.

Even in a vessel with liquid, flames engulfing the unwetted metal on top (the space occupied by vapour) can weaken the metal.

Though this knowledge is NOW known and appreciated, in earlier days PSV was considered adequate. Subsequent failures and analysis lead to addition of blowdown valves. BDVs are common in the upstream O&G industry only. Not so common and widely used in the downstream refinery/ petrochemical plants.

Pig Launchers/ Receivers are usually kept isolated depressurized at atmospheric pressure - either filled with N2 or HC gas, practice varies from client to client + H2S level in process stream.

PSVs are required only if it is designed and bought/sold to ASME code. Same pig launchers/ receivers to pipeline code do not require PSVs as hinted by Rashesh and indirectly suggested by Saeid. It helps in the beginning of the project to agree with the client to source the launchers and receivers to pipeline spec and get rid of PSV.

Thus the real reason PSVs are on the launcher/ receivers are to "Meet" code requirements. Otherwise Certifying/Inspection/Insurance persons will not approve the design. An eye wash. It is not uncommon in countries like Canada to give a PSV at the outlet of the Centrifugal pump whose outlet is fully designed for shut-off head just to meet the Inspector's demand. The PSV can be for zero flow or min size.

Priyanka: Portable launcher/ receivers are used in a manned operation and are removed as soon as their use is over. Here the protection is by procedures, as in the case "LO"/"LC" valves, where the protection is assumed to be provided by procedure.

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Vagif Gafarov
Sr. Process Engineer at KBR

Vagif

I also remember my colleague from a local EPC also considered surge flow for the relieving scenario at the pig receiver, though I'm not sure how credible is that - they increased the flowrate in the pipeline and found that the surge pressure exceeded the design pressure of the pig receiver.

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S M Kumar
Process Design Consultant
Top Contributor

S M

General practice is to have the same design pressure for upstream piping and the Pig Launcher; size the PSV upstream of Pig Launcher to handle all non-fire case demands including compressor blocked outlet.

If surge pressure exceeds the design pressure, then it is a wrong design; the design pressure should have considered the surge pressure. Not only the Pig Launcher but the upstream piping also has to handle the surge pressure.

If the Pig Launcher was derated (that is its design pressure is lower than that of upstream piping), then it is a bad design. It is not protected against a stuck pig scenario.

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Vagif Gafarov
Sr. Process Engineer at KBR

Vagif

Well, for that case the issue with the surge pressure arose after they decided to increase flow rate though the pipeline (condensate) and found that the surge pressure at the pig receiver (not launcher) is greater its design pressure as well as pipeline pressure

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Alireza Ranjbarmehr
Senior Concept/Process Engineer at Wood Group- CCC (Oman Branch)

Alireza

In upstream and wellhead cases, It is quite required to take a look at pigging philosophies in plant. frequency of normal pigging is important.

In most cases on condensate or oil pig receivers, There is one thermal relief.
Fire case (if applicable) PRV is normally located on downstream vessel or pipeline and not the receiver and launcher itself as these two are sealed and kept in atmospheric condition.
If number of wells, flow line and trunk lines are available in the system then HIPPS failure, transient and also steady state surge analysis must be taken in to place for PRV govern scenario.
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Saeid R. Mofrad
Principal Process Engineer at Petrofac (P.E.)
Top Contributor

Kumar,

I agree with you that pipeline and pig trap should have the same design pressure however, having protection against surge (like what has been discussed in http://www.linkedin.com/groups/Surge-drum-sizing-level-control-3822450.S.117051598?qid=c1d97f5c-97c8-4c0f-aeb9-a13fa321774d&trk=group_search_item_list-0-b-ttl&goback=%2Egmr_3822450%2Eanp_3822450_1352725369533_1 for instance) is not wrong. In fact, in a very recent project anti surge relief valve was provided on pipeline when FEED designer could not manage to avoid surge and it was not feasible to increase the design pressure to handle the surge pressure.

Vagif,

If there is a surge problem, protection should be provided on pipeline (upstream of first isolation valve) which will protect entire system. Providing the pig trap with anti surge relief valve does not make sense to me as pig trap will be isolated from the pipeline in major part of its life, offering no pipeline protection.

Alireza,

For fire case (if applicable at all, see Kumar's post above), installing a relief valve on pipeline does not protect pig trap as it will be isolated from the pipeline in major part of its life. Fire is not certainly applicable to pipeline.

Any protection device against HIPPS failure, surge or other pipeline transient analysis should be located on pipeline (upstream of first isolation valve) not on pig trap.

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👍 Alireza Ranjbarmehr likes this



Vagif Gafarov
Sr. Process Engineer at KBR

Vagif

Thank you Saeid for your always valuable comments, I see you point - actually I cannot recall the exact location of the PSV as it was not the project where I was directly involved.

all the best,
Vagif

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Alireza Ranjbarmehr
Senior Concept/Process Engineer at Wood Group- CCC (Oman Branch)

Alireza

Dear Saeid
Agreed, I did not mean the fire PRV (if applicable) on the pipeline. for the rest also I meant the pipeline PRV, not the pig itself. Thanks for clarification.

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S M Kumar
Process Design Consultant
Top Contributor

S M

Saeid:

1. My point was pipeline and pig trap should have the same rating. Pipeline PSV takes care of all demands including surge. Pig trap PSV is only for fire/thermal.

2. Not including surge in design pressure and providing surge relief valve is done - but not an ideal design.

We design to avoid a PSV lift say by designing a (a) centrifugal pump outlet to shut-off head (b) Compressor suction to settle-out and (c) turbine driven centrifugal compressor discharge to surge pressure at 105% speed. If you are unable to (it was ignored or not considered initially), you can provide a PSV.

If a settle-out is missed out, the PSV on suction drum will protect but will lift off every time the compressor is tripped. In a centrifugal compressor, say normal operating pressure = 70 units. PAH@ 77 PAHH@ 84 and Surge pressure at 105 units. You can design the discharge to 105 and provide a PSV set at 105 units and be sure PSV will not lift-off. You can design the discharge at 90 units and provide a PSV set at 90.

Some companies consider PSV lift-off as a serious event and may shut-off the plant to investigate. In that case, the business loss is high.

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