Line Blinding for Offshore Applications

Line blinding or the placing of a solid steel gasketed plate between two flanges in a pipeline is a well established maintenance and safety procedure in the oil, gas, onshore and refining industries. The plate completely covers the bore, and is capable of withstanding the maximum pressure of the pipe with no leakage beyond the plate. Absolute closure or positive flow shut-off is thereby achieved.

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Fig. 1 – Cam-Sets installed in a tank farm in UAE

Fig. 2– Cam-Sets installed in Hydrotreating plant in Brasil

The main uses of spectacle blinds or line blind valves are in the refinery, tank farms, loading terminals or on offshore platforms. Given the flammable or explosive nature of the media here, maintenance can only be safely carried out if the line is absolutely closed off. It is still a commonly held belief that the use of isolation valves is sufficient to create positive flow shut-off. Unfortunately, valves can and do leak.

Valves can and do leak!

It is worth repeating it several times - valves do leak. In fact they leak by design. The standards that cover seat leakage for control valves (ANSI/FCI /70-2 1976(R1982)) allow 27 bubbles per minute or 4 ml per minute for a 6 inch (DN150) valve. Likewise the API standard – 598 for metal seated valves allows for 12 drops per minute for liquids and 24 bubbles per minute for gas tests. The leakage rates outlined above do not seem too extreme at first glance. However, many valves do not even meet these standards (API 598 – Class VI). The tragic consequence for the hydrocarbon industry ranges from cross contamination and pollution to fires and explosions that can lead to plant damage and personnel injury.

With such a clear cut situation, one would imagine that line blinds would be used in almost every area where toxic or flammable media needs to be isolated for maintenance or emergency circumstances. This is often not the case and for good reason. Ask any maintenance team what their least preferred job in the refinery is and often the reply is changing blinding plates. The reasons are numerous – for a 6 inch line three or four men require up to six hours (please see Figure 3 below);

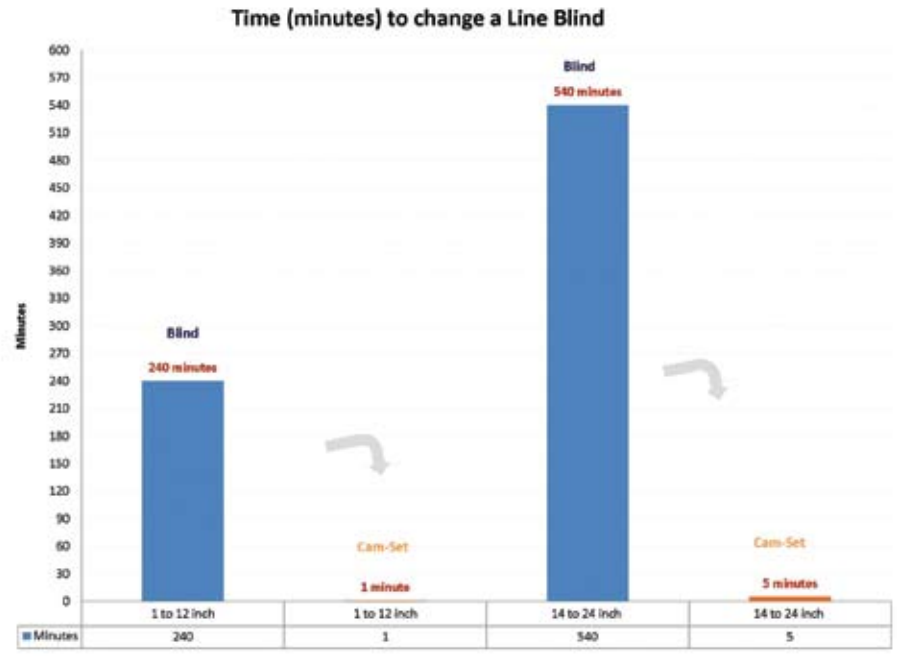


Fig. 3– Line blind time change table

the pipeline needs to be spread using cheater bars (which incidentally can cause damage to the pipeline and dent storage tanks); the plate is heavy and tricky to remove and in some cases noxious or dangerous media are still in the line.

Line blinding systems come of age

In 1975 Fetterolf Corporation introduced the first jacking bolt free line blinding system the "Cam-Set" that removed many of the listed disadvantages of line blinding. The Cam-Set is a valve assembly that incorporates a spectacle blind and a mechanism to change its position from open to close or vice versa without removing bolts, spreading the line, or using special equipment (e.g. a crane). It can be operated by one person from one side of the valve and changed in less than 60 seconds.

Suddenly, the ability to ensure plant and personnel safety in a quick and convenient way had arrived – but at a cost. Over the past 35 years the cost has come down dramatically; the valve has been substantially developed (with high temperature and pressure versions as well as a diverse set of sealing mechanisms suitable for different media), and it has become a standard requirement in many refinery and petrochemical applications.

Line Blind Standards

The valve industry often refers to line blinding systems as line blind valves. It is of course not completely correct. Line blinds can only be operated once the line has been depressurised, and in no way modulate the process flow. It is a line block system that should be used in a symbiotic combination with an isolation valve. This poses some problems as to what standards should apply to its design and manufacture. In the end a manufacturer of a high quality and safety oriented line blinding system must apply many of the standards listed in Figure 5 depending on the application. The thickness of the spectacle plate for the refining industry is defined in API 590 (ASME 16.48) and is a good standard for other industries also. The ASME Boiler and Pressure Vessel Code (Section 8) outline the applicable materials as well as rules for construction. The tensile bolting area of the line blind should be equal to or greater than the tensile bolting area used in the flanges for example. Likewise bolt diameter should increase with size and they should be tack welded to avoid inadvertent removal. A good inspection and test standard is API 598. For specific industries there are further useful standards such as NACE MR 0175 for applications or media that normally results in stress corrosion or sulphide related material cracking. Last but not least ASTM F 1020-86 outlines line blind requirements for marine applications (aboard ships, tankers and merchant vessels).

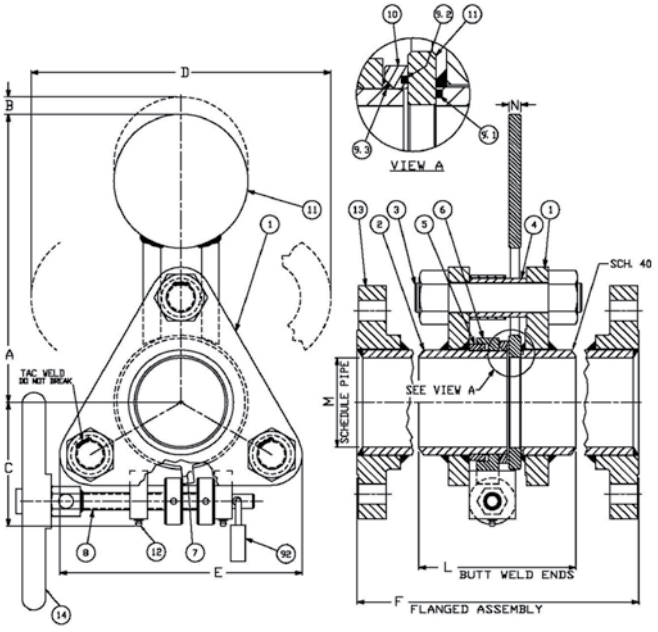


Fig. 4– Cam-Set design drawing

particular. These include:

- High pressure applications (some with delta P of 900 bar plus)
- Offshore safety procedures
- Corrosive salt sea atmosphere
- Entrained solids in media (sand, weld slag and pipe scaling)
- Ease of operation
- Operator abuse

Offshore Line Blind Challenges

Applications on Offshore oil rigs, and FPSO vessels pose special problems for valves in general and line blinds in particular.

The majority of line blinds sold into the chemical and refinery industries are in the ASME 150# to ASME 300# range which if manufactured according to the

ASME Standard	Description
B16.5	Pipe flanges and flanged fittings
B16.34	Valves - flanged, threaded and welding end
B31.1	Power piping
ASTM F 1020-86	Line Blind Valves for Marine Applications

ASME B&PV Code	Description (Boiler & Pressure Vessel Code)
Section 2	Material
Section 8	Rules for construction of pressure vessels
Section 9	Welding and brazing qualifications

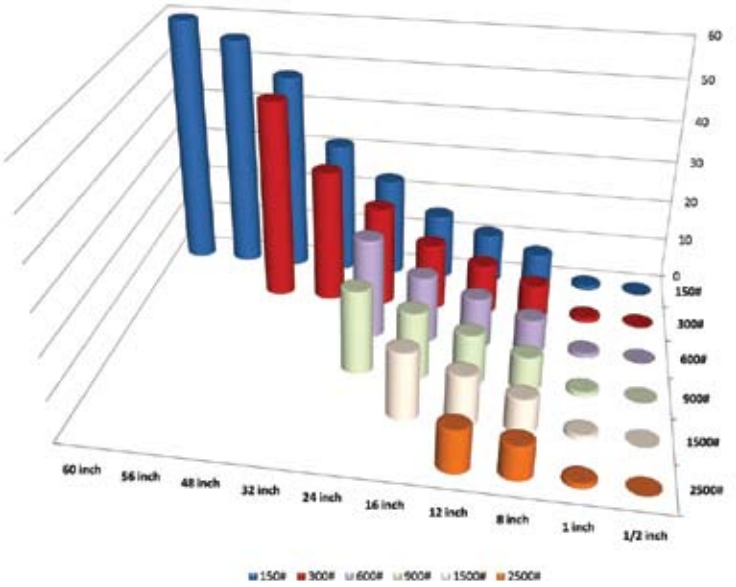
API Standard	Description
API 590 (now ASME 16.48)	Steel Line Blanks for Refining
API 598	Valve inspection and testing
API 2217	Guidelines for confined space work in the Petroleum Industry

Other	Description
ISO 9001:2000	Quality management system
NACE MR 0175	Sulphide stress cracking and stress corrosion

Fig. 5– Engineering Standards for line blind systems

Fig. 6 – 20 inch ASME 600# Offshore Cam-Set – Gulf of Mexico

Fig. 7. **Cam- Set Size and Pressure Class**



ASME BP&V Code can be delivered in sizes up to 60 inches (DN 1500). As soon as the pressure class increases the available size of line blind decreases quickly as illustrated in Figure 7.

At the higher end of the range we have supplied ASME 2500# line blinds to 10 inches (DN 250) for a FPSO operating in the Gulf of Mexico. Eight to 20 inch ASME 600# line blind systems are far more common in this area however.

Even in the 600# range other problems arise that we do not see on-shore. Corrosion issues due to the salt sea atmosphere can be largely eliminated by applying a Sermetel coating or epoxy paint to the body, using Monel stems, stainless steel bolting and brass hand wheels.

Ease of operation is particularly important offshore due to stormy or changeable weather conditions. For this reason older style line blinding systems that use multiple jacking bolts are too time consuming and difficult to operate on oil rigs. The Cam-Set in comparison is a cinch to operate - turn the hand wheel and swing the plate.

Safety is at a premium on offshore vessels and rigs. Pressure surges need to be kept under tight control and changeover with safety relief valve or rupture disc combinations for example are installed in expensive materials (such as Titanium as shown in Figure 8 below) and high pressure classes. The line blind is equally important for rig safety but often does not fall into the same critical on board valve category.

Even if your line blind system provider has managed to offer you a product that meets all of the standards, operates quickly, conveniently and safely - in an off-shore environment other factors such as operator habits come into play. Cheater bars are commonly used with such force that stems, hand wheels or actuators can easily break. In some cases incorrect operation can lead to valve body deflection and ultimate seal failure. As most valve suppliers seldom meet the end users, they consider this to be valve abuse, when it is just a fact of life when operating on an offshore rig or FPSO.

Figure 9 shows a Cam-Set actuator arm that has been modified to take

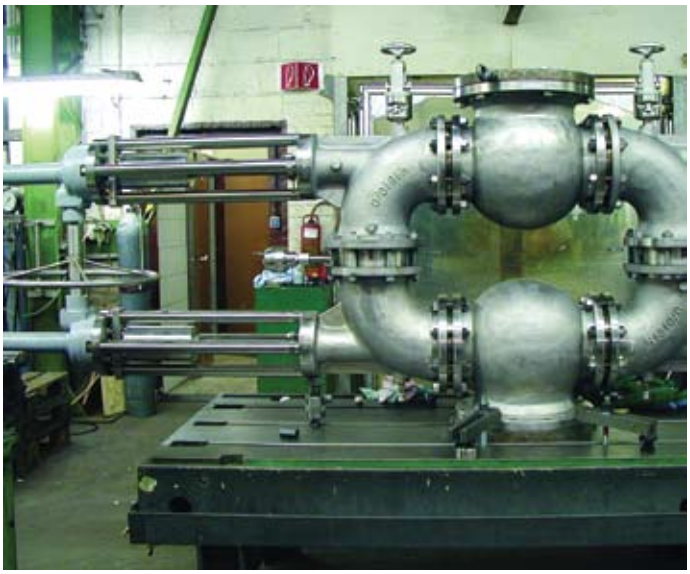


Fig. 8 – Offshore tandem changeover valve with rupture discs

Fig. 9 – Offshore Cam-Set Actuator arm

Typical offshore applications	Size Inches	Size DN	Pressure Class
Combustible gas line	3	75	600#
Main gas line (In)	24	600	150#
Main gas line (Out)	24	600	150#
Main gas line drain branch	2	50	150#
Oil recovery line (from main gas line)	2	50	150#
Oil recovery line (second line)	4	100	300#
Oil water line	2	50	300#
Drain line (MTGB)	2	50	600#
Condensate line	4	100	600#
Condensate drain line	1	25	600#
Outlet line	14	350	150#

Fig. 10 – Typical offshore line blind applications

the full load of an operator applying his full body weight with a cheater bar on the hand wheel of a Cam-Set. Other offshore developments include body reinforcements, stem covers, and special sealing rings.

SchuF Fetterolf has recently installed 200 special offshore design Cam-Set line blinds in the Gulf of Mexico in the Kumalobzap oil field and continues to refine its design. The company design department has come full circle – from making an easy to use line blind design, to ensuring the safest blinding system, to high pressure variants, and back to end user operation specific customisation. Whatever line blind system you choose to use, always remember – Valves leak downstream. Line blind systems do not.

About the author

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