MANUAL

INTERLOCKING SYSTEMS FOR SAFETY/RELIEF VALVES

DEP 80.46.30.11-Gen.

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DESIGN AND ENGINEERING PRACTICE

USED BY

COMPANIES OF THE ROYAL DUTCH/SHELL GROUP

PREFACE

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NOTE: In addition to DEP publications there are Standard Specifications and Draft DEPs for Development (DDDs). DDDs generally introduce new procedures or techniques that will probably need updating as further experience develops during their use. The above requirements for distribution and use of DEPs are also applicable to Standard Specifications and DDDs. Standard Specifications and DDDs will gradually be replaced by DEPs.

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1. INTRODUCTION

This DEP, which is a revision of an earlier publication of the same number dated December 1984, covers interlocking systems for fitting to isolating (block) valves installed upstream and/or downstream of safety/relief (S/R) valves.

This DEP should be used for designing interlocking systems for new construction projects where such mechanical interlocking systems have been specified. For the design of new units for an Operating Company that has operating experience with an interlocking system(s) differing from those described in this DEP, close contact with the Operating Company is required to make the new interlocking system compatible with the existing system(s).

Codes of safety and national and/or local regulations applicable to a location invariably stipulate that the required relief capacity shall always be available during plant operation. For installation of block valves on one side or both sides of S/R valves, dispensation has normally to be obtained from the authorities. This will usually be granted only if a reliable system is in place to ensure that adequate relief capacity is permanently available. One method of achieving this is by a mechanical interlocking system, the design of which is covered by this DEP. Other methods of achieving this are contained in DEP 80.45.10.10-Gen.

It should be noted that the need for block valves and locking systems is directly influenced by the operating and maintenance philosophies for the particular facility. DEP 80.45.10.10-Gen. provides guidance on the overall design of relief systems that minimise the necessity for such block valves based upon operations and maintenance philosophies.

1.2 DISTRIBUTION, INTENDED USE AND REGULATORY CONSIDERATIONS

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This DEP is intended for use in oil refineries, chemical plants, gas plants and, where applicable, in exploration and production facilities and supply/marketing installations.

If national and/or local regulations exist in which some of the requirements may be more stringent than in this DEP, the Contractor shall determine by careful scrutiny which of the requirements are the more stringent and which combination of requirements will be acceptable as regards safety, environmental, economic and legal aspects. In all cases the Contractor shall inform the Principal of any deviation from the requirements of this DEP which is considered to be necessary in order to comply with national and/or local regulations. The Principal may then negotiate with the Authorities concerned with the object of obtaining agreement to follow this DEP as closely as possible

1.3 DEFINITIONS

The **Contractor** is the party which carries out all or part of the design, engineering, procurement, construction, commissioning or management of a project or operation of a facility. The Principal may undertake all or part of the duties of the Contractor.

The **Manufacturer/Supplier** is the party which manufactures or supplies equipment and services to perform the duties specified by the Contractor.

The **Principal** is the party which initiates the project and ultimately pays for its design and construction. The Principal will generally specify the technical requirements. The Principal may also include an agent or consultant authorised to act for, and on behalf of, the Principal.

The word **shall** indicates a requirement.

The word **should** indicates a recommendation.

1.4 CROSS-REFERENCES

Where cross-references to other parts of this DEP are made, the referenced section number is shown in brackets. Other documents referenced by this DEP are listed in (4).

2. GENERAL

For the safety of personnel and plant equipment, the relief capacity of process equipment shall be fully maintained at all times when the plant is in operation or on stand-by under pressure. DEP 80.45.10.10-Gen. covers the overall selection of relief system configurations and recommends that, where operations and maintenance philosophies permit, no block valves are installed in relief systems. Where block valves are required, their use should be minimised, e.g. by siting a single block valve on a combined relief header from a processing train, where maintenance is carried out on a train basis (this block valve shall be locked open during operation of the train).

Where, for operational reasons, block valves are fitted upstream and/or downstream of S/R valves a system must be in place to ensure that the required relief capacity is always available.

One method of achieving this is by the installation of a proven interlocking system which makes it impossible to block off the operating S/R valve until other similar relief capacity has been connected to the system. Other methods are described in DEP 80.45.10.10-Gen. Where such an interlocking system is specified, the following provisions shall apply.

The block valve locks shall be of robust construction with materials which will withstand corrosion in the environment of application and shall be obtained from suppliers approved by the Principal.

The fully fabricated locks shall be secured to the block valves with a tamper-proof fixture, and shall be sealed without performing any hot work. The keys shall fit only the locks for which they are designed. The valve operating mechanism shall allow operation of the block valve only when the proper key(s) is (are) inserted in the lock.

All locks and keys shall be provided with unique identification numbers, reflecting the relevant S/R valve number. The selected lock and key type shall have sufficient space for a clear identification system.

3. INTERLOCKING SYSTEMS

Immediately after removal of an S/R valve (with an installed spare S/R valve in operation), another S/R valve or, if not available, a spool piece (**not** a blind flange) shall be installed in its place. The spool piece shall remain in place until re-installation of the S/R valve. For details of the spool piece, see (3.2.3).

NOTE: The reason for prohibiting the use of a blind flange is that if the block valve upstream of the blind flange were to be opened (which the interlocking system will definitely allow to be done) then the block valve upstream of the operating S/R valve could "legitimately" be closed, thereby eliminating the relief capacity (or, in the case of multiple S/R valves, reducing the relief capacity to below acceptable limits).

Two situations (discharge to atmosphere and discharge to flare), are described in (3.1) and (3.2), both of which are designed to allow the safe removal of an S/R valve for maintenance. A schematic layout of each is shown in Figures 1 and 2.

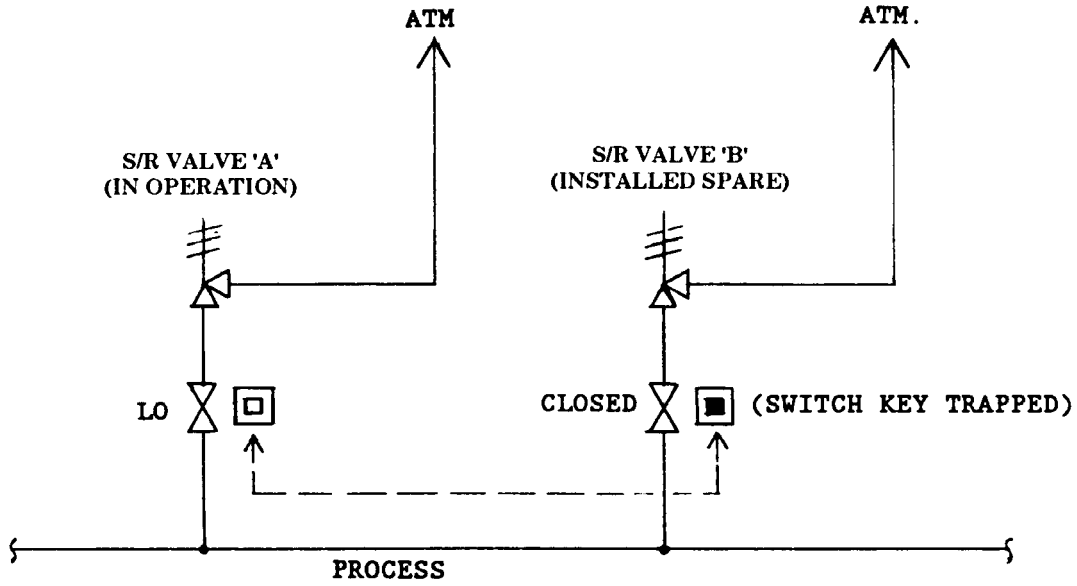
3.1 DISCHARGE TO ATMOSPHERE

Spared S/R valves discharging directly to atmosphere (via individual tail pipes) require block valves only in the inlet lines of the S/R valves. These block valves shall each be provided with a single lock, but with only one key in total.

During operation the key shall be trapped in the lock of the closed block valve of the installed spare S/R valve.

The key shall be retractable from the lock only by locking the block valve in the fully open position. Hence only one block valve can be in the closed position at any time.

Figure 1 Discharge to atmosphere



3.2 DISCHARGE TO FLARE

3.2.1 System description

Spared S/R valves discharging to a closed (flare) system require block valves in both the inlet and outlet lines of the S/R valves. The outlet block valves shall be provided with single locks, and the inlet block valves shall be provided with double locks.

Each S/R valve shall be provided with its unique key which fits both lock number 1 of the inlet block valve and the lock of the outlet block valve.

The key of the outlet block valve shall be retractable only by locking the outlet block valve in the fully open position.

The key of lock number 1 of the inlet block valve shall be retractable only when the switch key is inserted in lock number 2 of the same inlet block valve.

Each set of S/R valves shall be provided with one switch key which fits lock number 2 of all inlet block valves. This switch key shall be retractable only by locking the inlet block valve in the fully open position. This shall only be possible when the key of lock number 1 is inserted in the lock. During operation, only the inlet block valve of the installed spare S/R valve will be in the closed position (not locked). All other block valves will be locked in the fully open position. Putting the outlet block valve of the installed spare S/R valve (or its replacement spool piece) in the locked open position prevents pressure build-up in case the inlet block valve should leak.

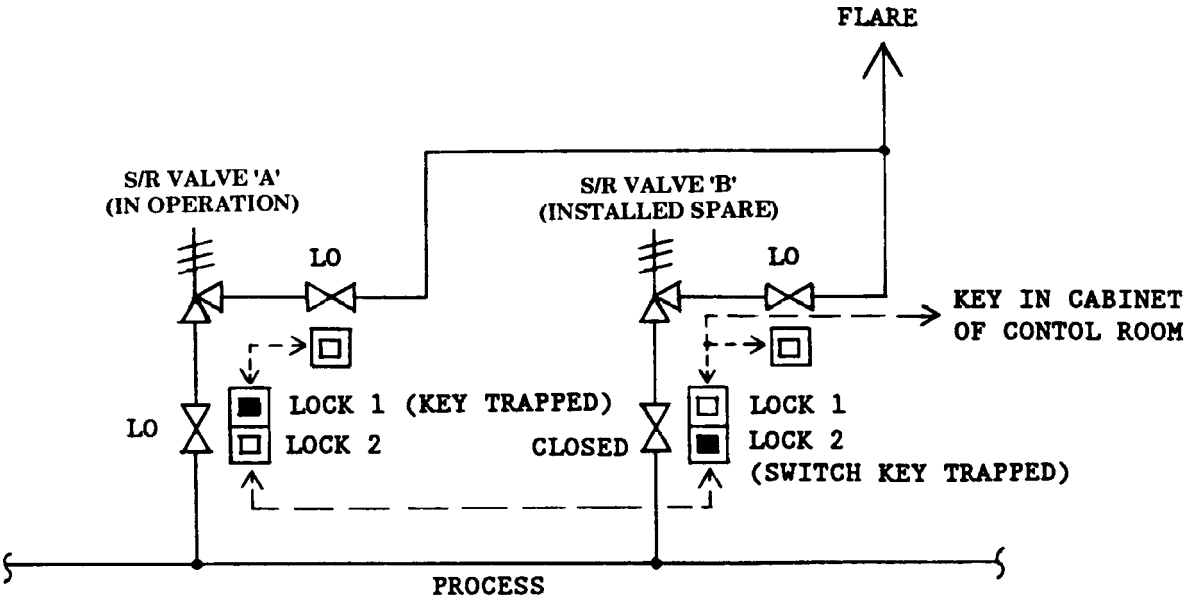
The keys of the locks of the block valves of the S/R valves in operation will be trapped in lock number 1 of the inlet block valves.

The switch key will be trapped in lock number 2 of the closed inlet block valve of the spare S/R valve.

Since the switch key is needed to unlock and close an inlet block valve, only one block valve can be in the closed position at any time.

The key of lock number 1 of the inlet block valve of the spare S/R valve shall be stored in a cabinet in the control room which shall only be accessible to authorized personnel. This cabinet shall clearly indicate the place for storing each individual interlocking key, thus providing a constant visual indication of all interlocking systems of the plant.

Figure 2 Discharge to flare


FLARE
S/R VALVE 'A'
(IN OPERATION)
S/R VALVE 'B'
(INSTALLED SPARE)
LO
LO
KEY IN CABINET
OF CONTOL ROOM
LO
LOCK 1 (KEY TRAPPED)
LOCK 2
CLOSED
LOCK 1
LOCK 2
(SWITCH KEY TRAPPED)
PROCESS

3.2.2 Removal procedure

If maintenance during operation is required on an S/R valve (S/R valve A) which discharges to a flare system, the following procedure shall apply:

- The key which fits the lock of the outlet block valve and lock number 1 of the inlet block valve of the installed spare S/R valve (S/R valve B) shall be collected from the authorized person in the control room.
- This key shall be inserted in lock number 1 of the inlet block valve of S/R valve B. The inlet block valve shall be opened and locked by retracting the switch key.
- The switch key shall be inserted in lock number 2 of the inlet block valve of S/R valve A. The inlet block valve shall be closed and the key from lock number 1 shall be retracted. This key shall then be inserted in the lock of the outlet block valve of S/R valve A and this block valve shall be closed.
- S/R valve A can now be removed for maintenance. Another S/R valve or, if one is not available, an open spool piece (3.2.3) shall be installed in place of S/R valve A. After this the outlet block valve shall be opened and locked by retracting the key. The key shall be returned to the control room.

S/R valve B is now in operation and S/R valve A has become the installed spare.

3.2.3 Spool piece details

The spool piece shall be made from schedule 80 pipe and elbows and shall be welded at both ends to blind flanges having the same size and rating as the S/R valve that the spool piece replaces. Each blind flange shall have been drilled at the connection point to suit the size of the spool piece pipe. The finished spool piece shall have the same build-in dimensions as the S/R valve it replaces. The size of the spool piece shall be as follows:

S/R valve size	Spool piece (pipe, elbows) Nominal diameter (inches)
1D2, 1E2, 1½F2	½
2H3	1
3K4	1½
4L6 and larger	2

4. REFERENCES

In this DEP, reference is made to the following publications:

NOTE: Unless specifically designated by date, the latest edition of each publication shall be used, together with any amendments/supplements/revisions thereto.

SHELL STANDARDS

Index to DEP publications and standard specifications	DEP 00.00.05.05-Gen.
Pressure relief and flare systems	DEP 80.45.10.10-Gen.