# API PLAN 72

SEAL SYSTEMS

Installation, Operation & Maintenance Instructions

## 1. General

### 1.1 INTRODUCTION

Plan 72 may only be installed, commissioned and maintained by an authorized plant machinery specialist, paying close attention to these instructions and all other relevant regulations. Failure to do this relieves the manufactures from any liability or warranties.

This instruction manual is provided to familiarize the user with the Plan 72 arrangement and its use. The instructions must be read and applied whenever work is done on the Plan 72 and must be available to the operating and maintenance personnel.

These instructions will help to avoid danger and increase reliability. They should be used with the appropriate mechanical seal instruction manual.

The following important terms and definitions are used in this document.

### 1.2 EUROPEAN AND/OR UK DECLARATION OF INCORPORATION (MACHINERY DIRECTIVE 2006/42/EC, AND UK SI 2008 NO. 1597)

If appropriate this is attached.

### 1.3 EUROPEAN AND/OR UK DECLARATION OF CONFORMITY (PRESSURE EQUIPMENT DIRECTIVE 2014/68/EU, AND UK SI 2016 NO. 1105)

In assessing the hazard classification for the European or UK pressure equipment directive/regulations the process fluid, the coil volume and the design pressure will define the hazard classification.

If appropriate this is attached.

### 1.4 EUROPEAN AND/OR UK DECLARATION OF CONFORMITY (ATEX 2014/34/EU, AND EQUIPMENT AND UK SI 2016 NO. 1107)

These instructions are intended for use with the system operating in Equipment Group II, category 2GD and 3GD.

The Declaration covers the complete seal and system and the Maximum Surface temperature is recorded in the Mechanical Seal instruction manual.

If appropriate this is attached.

## 2. Safety and environment

The safety notes refer to the system supplied. They can never be exclusive, and must be used in connection with the relevant safety regulations for the machine, auxiliary equipment, plant and sealed product.

### 2.1 WARNING SYMBOLS

The following symbols are used in this instruction manual to highligh information of particular importance:

**Danger - Mandatory instructions designed to prevent personal injury or extensive damage.**

**Warning of electric current.**

**ATTENTION** Special instructions or information to avoid damage to the system or its surroundings.

**NOTE** Information for easy installation and efficient operation.

**Environmental note**

Compliance is required with any additional warning signs affixed to the system.

### 2.2 SAFETY INSTRUCTIONS

**ATTENTION**

Every working practice that compromises personal safety is to be avoided. All safety requirements in this document must be strictly adhered to.

In the event of an operating problem, the machinery must be switched off immediately and made safe! Problems must be solved promptly.

Ensure suitable protective clothing is used when maintaining the system.

Plan 72 systems are commonly used with dual seal configurations to reduce the hazard potential from flammable, explosive, toxic or lethal process fluids. The intermediate, protective buffer gas region will be contaminated by the process fluid. During any maintenance operation operators must thus assume they will be exposed to the liquid or gaseous properties of the process fluid and have suitable protective gloves, clothing, respirators and equipment.

Particular note must be taken of the relevant guidelines for the electrical installations.

A slight leakage will occur during normal seal operation. Depending on the duty, this leakage can appear as a gas, a liquid or a solid. In case of a worn or defective seal the leakage will increase. The leakage may be hazardous or toxic, and a safe collection system is required.

Surface temperatures above 60°C/140°F should be protected against accidental contact.

The equipment sealed by this seal system must be operated within its recommended design limits.

Compounds containing PTFE, fluorocarbons and perfluoroelastomers should never be burnt as the fumes and residues are highly toxic. If this accidentally occurs protective equipment should be worn as hydrofluoric acid may be present.

Additional equipment/flanges/joint seals used within the system are to be rated for the appropriate electrical and pressure requirements and are to be chemically compatible with the buffer gas and process fluid.

- During venting or draining of the buffer region it should be piped to a vent or reservoir where it can be safely contained or disposed.
- All above according to the local legislation.
- For further information and safe operating limits contact John Crane
- All periodical maintenance checks have to be in accordance with local legislation and rules.

All welding or cutting operations are forbidden without permission from John Crane.

If you are in any doubt please contact your local John Crane office for further information before proceeding.

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## 2.3 ENVIRONMENTAL ASPECTS

### 2.3.1 COMPANY POLICY EXTRACT

"It is the policy of John Crane to manage its business activities in an environmentally responsible manner, comply with all relevant laws and regulations, prevent pollution, and continually improve its environmental performance, certification to the latest issue of ISO 14001 ensures compliance."

John Crane adopts the '**Design For the Environment**' **(DFE)** principle in making this product. Using this product will benefit the environment **directly** by:

- **Reducing waste** of precious resources through decreasing the risk of leakage and minimizing energy consumption.
- **Preventing pollution** through controlling harmful emissions to the atmosphere and ground contamination.
- **Preserving valuable materials** through the use of high quality durable materials.

### 2.3.2 RECYCLING

### PRODUCT REFURBISHMENT

This product has been designed for long life.

### DISPOSAL

When the product is considered to be beyond economical repair and potential reuse, it should be disposed of by **environmentally beneficial** means. The product can be disassembled with ease.

### SCRAPPED COMPONENTS

These should be handled with extra care due to possible contamination. They should be **recycled** through **local** industrial recycling plants.

### PACKAGING

All packaging materials used are made from **recyclable**, environmentally friendly materials.

When in doubt or for further information and advice on this subject, please consult **John Crane**.

## 3. Transportation and storage

Transport and store the system where possible in its original packaging.

It is necessary to protect and preserve the integrity of the equipment between shipment and installation/start-up at site. This is particularly important when extended periods of storage are envisaged.

Plan 72 systems may be shipped first to the rotating equipment vendor to be mounted on the rotating equipment baseplate complete with the connecting pipework. In this event follow the instructions as given in the rotating equipment IOM.

Plan 72 systems, which are to be mounted off the rotating equipment baseplate, shall be shipped directly to site and shall be packed in suitable crates or cases to protect them from damage during shipment. All openings to the system are closed and sealed for shipping. In this event follow the following instructions.

On arrival at site and before unloading for storage, a visual inspection of the crate/case should be carried out for signs of damage during shipment. In the event of any damage the crate/case must be opened, and the contents thoroughly examined for signs of equipment damage. All bolts and threaded connections should be checked for signs that they have come loose during transport. If any seals are broken, then the system is assumed to be contaminated and shall be cleaned accordingly. All loose connections or bolts should be correctly tightened to eliminate any loosening which has occurred during transportation or as part of the cleaning process.

If the parts are considered acceptable with no visual signs of damage, the crate/case should be properly closed again prior to storage.

After checking for shipment damage, the following recommendations should be undertaken to prevent deterioration arising from long term storage.

- Plan 72 system should be replaced in their original packaging and if possible, the crate/case should be stored away from direct sunlight, in a well-ventilated building with a hard floor.
- Temperature control is not normally necessary, but large temperature fluctuations (>40°C/72°F) should be avoided.
- If stored outdoors, it is recommended that the crate/case be placed on square timber bearers resting on a concrete or similar hard surface.
- The crate/case must then be wrapped with waterproof tarpaulin to prevent ingress of water and dirt.
- Loose components or accessories in the case should be stored as above, after proper itemisation.
- A weekly visual external inspection of the protection and preservation should be undertaken, and any deficiencies noticed should be corrected without delay.
- The system must be stored far from backwater to avoid the MIC phenomenon (microbial corrosion).

**NOTE** Should water, condensation, sand, dirt or other contaminant enter the system, through package/ tarpaulin damage or improperly positioned covers, the cause of the problem must be eliminated and the equipment thoroughly dried and cleaned before re-storing.

If used system parts are to be transported to the manufacturer or a third party they have to be cleaned, decontaminated and require safe handling instructions externally attached.

**ATTENTION** The system normally does not require any preservatives; it is resistant against most environmental conditions.

Ensure preservatives and cleaning agents do not affect the elastomers.

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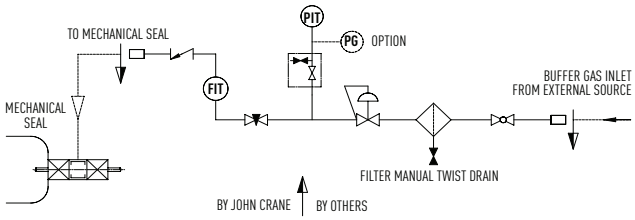
## 4. Description of the system

### 4.1 FUNCTION OF THE SYSTEM

Plan 72 systems are used on unpressurized containment seals and can be used in conjunction with a piping plan 75 or 76.

The buffer gas, normally dry nitrogen, is constantly supplied to the seal inter-space from a reliable source at a pressure less than seal chamber pressure. In normal operation the buffer gas pressure should not exceed 0.7 bar/10 psi.

The panel includes a coalescing filter to ensure that the final buffer gas supply to the seal is free of particulates and moisture. Seal operating pressure is set by adjusting the control panel regulator in conjunction with the system pressure transmitter LCD read-out (and/or pressure gauge if fitted). The orifice (or needle valve) is used to regulate the flow. Gas flows are visually monitored using the panel mounted flow transmitter and pressure transmitter to provide a common signal indicating either excess gas consumption or loss of gas supply pressure. The pressure alarm is normally set at the piping plan 75 or 76 alarm point or at least 0.4 bar (5 psi) above the normal flare pressure.




### 4.2 INSTRUMENTATION AND FITTINGS

The system is usually supplied with the following:

- Buffer gas supply inlet (flanged or threaded)
- Panel outlet to seal (flanged or threaded)
- Pressure indicating transmitter (PIT)
- Flow indicating transmitter (FIT)

And, upon request with the following options:

- Pressure gauge (PG)
- Pressure switch (PS) instead of a PIT
- Flow Indicator (FI) instead of FIT

## 5. Installation and assembly

### 5.1 BEFORE INSTALLATION

Prior to installation ensure that internally all connecting pipe work has been thoroughly cleaned. Remove protection caps from pipes and connections. Check all fittings/connections for damage replacing if necessary.

### 5.2 PANEL MOUNTING

Refer to the appropriate arrangement drawing for mounting details.

It is recommended that piping between the pressure control panel and the seal should be kept below 2 meters/72 inches wherever possible. If this length is exceeded consideration should be given to increased frictional losses and if necessary allowances must be made when setting the seal pressure.

**It is advisable to install a vent connection in the interconnecting pipe work close to the seal chamber.**

With the gas supply isolated, connect the buffer gas supply piping to the inlet connection on the control panel and connect the panel outlet connection to the seal chamber. Do not open gas supply at this time.

### 5.3 ELECTRICAL CONNECTIONS

**Only authorized and qualified personnel are permitted to carry out work on electrical systems. International and local safety regulations must be followed in all cases.**

Before connecting cables, check the electrical data on the name plate matches the available power supply and complies with the area hazard classification.

Refer to the diagrams in the terminal housing and the supplier's instruction manual for wiring instructions. Connect the electrical component using flexible conduit or armoured cable to assist removal of the component for maintenance purposes.

If passive switching elements are installed in potentially explosive areas you should add suitable protective devices, following the pertinent rules.

### 5.4 LEAK CHECK

During transit, tube fittings may work loose, check all fittings/ connections for tightness. First checking that the buffer gas supply pressure is within the limits of the control panel slowly open the buffer gas supply line isolation valves allowing the control panel to pressurize.

Using a suitable leak testing liquid check all joints and if necessary rectify any leaks found.

## 6. Commissioning and Decommissioning

### 6.1 COMMISSIONING

Before starting the machine (pump or mixer) carry out the following operations:

**ATTENTION** Before commencing the start-up procedure, review and become familiar with all the available instructions concerning the equipment, especially the safety warnings.

A. Set the buffer pressure to the 'operating pressure' on the nameplate pressure below the seal chamber pressure, (typically not exceeding 0.7 bar/10 psi by adjusting the regulator valve until the correct pressure is shown on the pressure transmitter (or pressure gauge if fitted). Turning the regulator adjuster clockwise increases pressure and counter-clockwise decreases pressure.

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B. Purge the system of air by cracking open the vent connection (if fitted) or by carefully cracking open the fitting at the seal and allowing buffer gas to escape. After 10-15 seconds flow retighten the vent/fitting.

C. Adjust the needle valve (acting as adjustable orifice) to reduce the gas flow but maintaining the required pressure.

D. Recheck the operating pressure on the pressure gauge (if fitted) or pressure transmitter LCD and fine tune if necessary.

E. Check that the pressure transmitter and flow transmitter set points are correctly adjusted to suit the duty: Refer to Table 1 below.

**TABLE 1. Alarm Signals**

| Alarm Name | Instrument | Set Point | Notes |
|---|---|---|---|
| Low Pressure /Shutdown Required | Pressure Indicating Transmitter (PIT) | If buffer pressure drops below the operating pressure on the nameplate* | REQUIRED |
| Low Flow Alert | Flow Indicating Transmitter (FIT) | If buffer gas flow drops significantly below normal values | REQUIRED |
| High Flow Alert | Flow Indicating Transmitter (FIT) | If buffer gas flow rises significantly above normal values | RECOMMENDED |

*The pressure alarm may be set at the piping plan 75 or 76 alarm point, or at least 0.4 bar/5 psi above the normal flare pressure.

**NOTE** Flow alarms are recommended as indicators of significant deviations from normal running conditions. Setting these alarms may require some initial running of the pump to establish the range of normal flow rates.

F. Start the machine.

G. During initial start-up it is recommended that the gas pressure/flow is regularly monitored for correct operation. Fine tune pressure setting if necessary.

### 6.2 NORMAL RUNNING

The equipment shall be kept clean and free from debris to allow ease of access and reading of the instrumentation. Care should be taken to prevent damage to the system from accidental knocks and/or exposure to excessive sources or heat. Disconnection of any part of the system should not be undertaken without the appropriate authorisation and until all pressure has been completely discharged and system allowed to cool. All joints broken for maintenance should be plugged off to prevent ingress of dirt.

During normal operation the only attention required is to monitor the buffer gas flow. Periodic visual checking (at least every 48 hours) of the pressure/flow within the system is recommended

### 6.3 DECOMMISSIONING

**Work on the seal or system must only be carried out when the machine is stationary, and secured against any unforeseen start-up. Isolation from connections to pressurization sources must be carried out.**

Before carrying out any work on the seal or system, the equipment must be shut down and the buffer region must be fully depressurized. Once this has been done the buffer gas supply to the panel can be isolated. **Do not isolate the buffer gas supply before the pump is made safe**. Once the buffer gas supply is isolated carefully vent any residual pressure from the panel and interconnecting pipe work and drain of any liquids before carrying out any maintenance.

If the pump/panel is to be removed cover any open tubing fittings/ connections to prevent contamination.

**If the equipment has been used on toxic or hazardous fluids, ensure all precautions are taken to avoid personnel hazards such as correct decontamination when draining the buffer system and removal of any dangerous gas remaining in the reservoir. Remember fluid is often trapped during draining.**

**NOTE** It is recommended that a pressure test is carried out on the system after any repair and before operation on the equipment.

## 7. Maintenance

### 7.1 ROUTINE MAINTENANCE

Check the following as part of regular site walk-around checks for trouble-free operation:

- Check the condition of the coalescing filter element for contamination (see Section 7.2).
- Buffer pressure. Compare with the operating pressure on the nameplate.
- Buffer flow. Compare with the normal flow rate observed.
- Condition of alarm signals (see Section 7.3)

### 7.2 FILTER

It is recommended that the element is checked after the first month of operation and if no contamination is detected thereafter at 6 monthly intervals.

Irrespective of visual condition it is recommended that the filter element is replaced annually.

**The filter bowl is pressurized and no attempt should be made to remove it until the buffer gas supply has been isolated and all residual pressure in the system safely vented.**

### 7.3 SIGNALS AND ALARMS

A sudden or noticeably steady increase in the gas consumption should be considered abnormal and may indicate a failing seal. The instrumentation on the system has the specific purpose of signalling eventual malfunction of the mechanical seals. Possible alarm signals indicating a malfunction are as shown in Table 2.

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| TABLE 2. Possible alarm signals indicating a malfunction | | | |
|---|---|---|---|
| **Effect** | **Instrument** | **Action** | **Cause** |
| Rising pressure | Pressure Gauge (PG) or Pressure Indicating Transmitter (PIT) | A | D |
| Falling Pressure | Pressure Gauge (PG) or Pressure Indicating Transmitter (PIT) | A | E to H |
| Low Pressure/ Shutdown Required | Pressure Indicating Transmitter (PIT) | B | G |
| Falling Flow | Flow Indicating Transmitter (FIT) | C | D, G or H |
| Rising Flow | Flow Indicating Transmitter (FIT) | A | E or F |
| Low Flow Alert | Flow Indicating Transmitter (FIT) | C | D, G or H |
| High Flow Alert | Flow Indicating Transmitter (FIT) | B | E or F |

| **Actions** | |
|---|---|
| A | Investigate cause, and monitor to ensure values do not breach safe limits |
| B | Shut down machine to prevent damage or loss of containment |
| C | Check coalescing filter and gas supply |

| **Causes** | |
|---|---|
| D | Excessive leakage across the inboard seal |
| E | Excessive leakage across the outboard seal |
| F | Pipe work/joint failure |
| G | Drop in the buffer gas supply pressure/flow |
| H | Blockage of the coalescing filter |

The signal from the pressure transmitter can be used either:

- LOCALLY (with a Klaxon and/or beacon)
- REMOTELY (in the control room)

Consult the specific instrument manufacturers manual should there be a malfunction.

If necessary, for safety or the process the alarm signals could be used as a trip function

### 7.4 INSTRUMENT MAINTENANCE

All instruments require regular calibration, following local processes and regulations. See the supplier's instruction manual for and additional instructions for maintenance of electrical instruments.

### 7.5 SPARE PARTS

Spare parts must conform to the established technical specifications of the manufacturer. This is guaranteed with John Crane spare parts.

You are advised to stock the most important wear parts on site.

The following data is necessary for spare part orders:

- John Crane code/part number
- John Crane order/ref no.
- Part description
- Quantity

### 7.6 ANNUAL MAINTENANCE CHECKS

Disconnection shall be made by plant person in charge of authorization.

Before any maintenance operation the system pressure must be fully discharged, and the equipment allowed to cool to ambient temperature. A suitable container should be available to contain any liquid drained from the buffer system.

All parts requiring maintenance must be thoroughly decontaminated prior to any work commencing.

All joints should be checked for tightness and signs of buffer gas leakage. If present, all flange joints should be checked for tightness and, if necessary, gaskets changed using replacements available from John Crane.

## 8. Accompanying Documents

Installation Drawing (job specific) or Typical Drawing and Operational Data Sheet.

A name and data plate is fitted to each gas control panel.
It contains references and part numbers which must be quoted in any communication.

**For replacement parts please contact your local John Crane office, quoting the system code number.**

## 9. Cold Environments

For environments with low ambient temperatures, winterisation features may be added to the Plan 72. These may include:

- The panel may be supplied mounted in a heated enclosure. The heating element requires electrical connection as part of the installation and assembly procedure (see Section 6.2)
- Heat tracing and/or insulation may be required to maintain the temperature of the gas in the Plan 72. This heat tracing and/ or insulation may be supplied with the Plan 72 panel, or may be applied on site as required. Heat tracing and/or insulation should be applied around all pipework and components, leaving room to read instruments and operative valves.
- Care must be taken during commissioning and operation, that the Plan 72 is brought up to operating temperature before the machine is started, and the correct temperature is maintained throughout operation.

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**North America**
United States of America
Tel: 1-847-967-2400

**Europe**
United Kingdom
Tel: 44-1753-224000

**Latin America**
Brazil
Tel: 55-11-3371-2500

**Middle East & Africa**
United Arab Emirates
Tel: 971-481-27800

**Asia Pacific**
Singapore
Tel: 65-6518-1800