API PLAN 75

LEAKAGE CONTAINMENT VESSEL SYSTEM

Installation, Operation & Maintenance Instructions

John Crane Assembly Code:	
John Crane Order No.:	
Customer:	
Customer Order No.:	
Plant Owner/Site/Unit:	
Plant Item Numbers:	

This seal system 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 manufacturer from any liability or warranties.

For further information and your nearest John Crane facility, please contact one of the locations on the back of this manual.

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1. General

1.1 INTRODUCTION

This instruction manual is provided to familiarize the user with the system arrangement and its use. The instructions must be read and applied whenever work is done on the system, 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.

John Crane reserves the right to change the system and specifications described.

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

Where 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 liquid will determine the classification as long as a low pressure alarm is used.

Where appropriate this is attached.

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

These instructions are intended for use with the Plan 75 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.

Where 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 highlight 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 75 systems are commonly used with dual seal configurations to reduce the hazard potential from flammable, explosive, toxic or lethal process fluids. During normal operation, the process fluid will flow into the Plan 75 seal support system. 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.

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 process fluid.

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."

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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.

When seal systems are shipped first to a rotating equipment manufacturer, it is customary for them to be mounted on a skid by the rotating equipment manufacturer.

Seal systems and generally all auxiliary sealing products installed on rotating equipment skids should be packed in suitable crates or cases by the rotating equipment manufacturer to protect them from damage during shipment. All openings to the system are closed and sealed for shipping.

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.

- Seal systems should be stored 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 restoring.

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

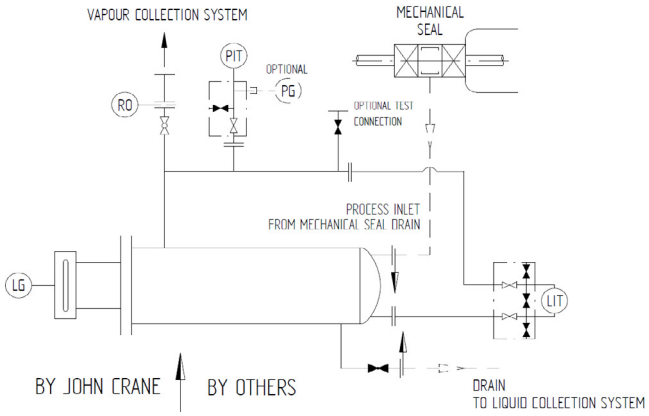
4.1 FUNCTION OF THE SYSTEM

The piping plan references used conform to API 682 (4th Edition).

Plan 75 works as follows. Leakage from the inner mechanical seal is restricted from escape by the containment seal and routed into the drain line of the seal. The drain line is connected to the collection reservoir of the Plan 75.

The collection reservoir accumulates any liquid, while vapour passes through into the vapour collection system.

- A level indicator is used to determine when the reservoir needs to be drained.
- The level transmitter enables the user to monitor the liquid leakage rate.
- An orifice in the outlet line of the collector restricts flow such that high leakage of the inner seal will cause a pressure increase and trigger the pressure transmitter to alarm at a pressure of 0,7 bar (10 psi) above the pressure of the vapour collection system.



4.2 RANGE OF APPLICATION

Plan 75 systems are designed to service mechanical seals by containing and redirecting hazardous process leakage; they must be operated within their performance limits.

The Plan 75 is rated to contain pressure from the process in the event of catastrophic damage to the inner mechanical seal. The Plan 75 should not be subject to pressures above the pressure rating indicated on the product nameplate.

The materials of construction and design of the Plan 75 will be designed to be compatible with the liquid phase and vapour phase process fluids being sealed by the machanical seal.

If the process or operating conditions are changed from those referenced in this manual, John Crane must be consulted to ensure the sealing system is safe.

If the rating of the equipment on which the system is installed exceeds the seal system Maximum Allowable Working Pressure (MAWP) a pressure relief valve, vented to a safe area, should be included. If a safe vent is not possible, the outlet connection should be piped down to grade and appropriate warnings erected adjacent to the valve.

4.3 INSTRUMENTATION AND FITTINGS

The system is usually supplied with the following:

- Flanged or threaded terminations to inter-connecting lines (Process inlet from mechanical seal, vapour collection system connection, and drain connection)
- Pressure transmitter(s) (with LCD)
- Level transmitter(s) (with LCD)
- Level gauge

And, upon request with the following possible options:

- Optional test connection (flanged or threaded)
- Pressure switch(s)
- Pressure gauge
- Level switch(s)
- Sun shades for instruments

5. Installation and assembly

See Section 8 for General Arrangement Drawing reference.

5.1 INSTALLATION POSITION

The location of the installation position is particularly important for the efficient operation of the system.

Please pay attention to the following points:

- Easy access to the equipment for operation and maintenance
- Easy access to drain plugs/valves and connections
- Sufficient room for removal of the system (see dimensions in the General Arrangement drawing, Section 8)
- Practical installation of all inter-connecting lines. (see Section 5.3)
- Visibility of Instrument transmitters/indicators

5.2 PREPARATIONS FOR INSTALLATION

Carry out the following steps prior to assembly:

- Examine system components for any damage caused during transport or storage
- Remove protection caps from pipes and connections
- Keep everything clean when assembling the system

5.3 ASSEMBLY

The system should be assembled using the Installation Drawing in Section 8 but considering the following.

- The system should be installed so that the process inlet connection is below the seal drain connection and a drain pipe/tube can be fitted flowing downwards from the seal drain connection to the process inlet connection.
- The system should be installed so that the restriction orifice on the line to the vapour collection system is below the drain on the gland plate of the mechanical seal.

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Connect the system to:

- appropriate vapour collection system to the system vapour collection system connection.
- seal drain line to the system process inlet connection
- liquid collection system to the system drain connection

Any welding of pressure components is strictly forbidden

When connecting the system to the seal and vapour collection system, the following recommendations must be applied:

- Piping or tubing to have a minimum bore of 0.5"/13.0 mm. (API 682 contains additional minimum requirements on pipe/tube sizing which should be considered where applicable)
- Stainless steel material
- Pipework bends should have a minimum radius of 5xD. There should be a maximum of 3 bends in total
- Maximum total length of piping or tubing 5.0 m/16.4 ft
- Lines are horizontal or continuously dropping to aid with flow. API 682 4th Edition states 40 mm slope per 240mm / 0.5" slope per ft pipe/tube run
- Do not include check valves

Install venting devices if self-venting is impractical.

5.4 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.

When fitted, the circulation pump should be operational before the primary equipment pump is started. Use a suitable controller for the start-up sequence.

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

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. Ensure all flange nuts/connections are tight.

B. Close the liquid collection system isolation valve.

C. Open the vapour collection system isolation valve.

D. Open the pressure gauge (if fitted), the pressure transmitter and the level transmitter isolating valves.

E. Check that all electrical instruments are correctly connected and in compliance with the area classification. **This should be carried out by a qualified electrician.**

F. Check that the pressure transmitter alarm set point is correctly adjusted to suit the duty: Alarm point is normally 0,7 bar (10 psi) above the pressure in the vapour collection system unless stated otherwise on system nameplate, drawing, or specification sheet. The instrument should be set to alarm on rising pressure.

G. Check that the level transmitter alarm set point is correctly adjusted to trigger when the liquid level reaches the high level marker on the level gauge.

H. Close instrument vent valves.

I. Check that any isolating valves in the circuit between the reservoir and the seals are locked fully open.

TABLE 1. Alarm Signals

Alarm Name	Instrument Set	Point Notes	Notes
Drain Alert (High Level Alert)	Level Indicating Transmitter (LIT) or Level Switch (LS)	If level rises above the high level mark on the level gauge	REQUIRED
High Pressure Alarm	Pressure Indicating Transmitter (PIT) or Pressure Switch (PS)	If pressure rises above the alarm point	REQUIRED

Before start-up, ensure that all personnel and assembly equipment have been moved to a safe distance and that any safety guards are refitted.

J. Start the machine.

K. Closely monitor the pressure and reservoir level in the Plan 75 as the equipment settles into a steady state for signs of unusual mechanical seal leakage

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6.2 DECOMMISSIONING

ATTENTION When the machine is stopped, the system pressure must be maintained until the machine itself is unpressurized.

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 leakage collection reservoir must be fully depressurized and drained.

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 system and removal of any dangerous gas remaining in the reservoir. Remember liquid 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 REGULAR MAINTENANCE CHECKS

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

- That the connections are leak-free
- Level in the leakage collection reservoir, ensuring it has not risen above the high level mark on the level gauge
- System pressure. Compare with the vapour collection system pressure.
- Any abnormal leakage rate from the outer seal
- Condition of alarm signals (see Section 7.3)
- There is no accumulation of dust on any part of the Plan 75. Remove any built-up dust as required

7.2 VESSEL DRAIN

In the course of normal running, the Plan 75 reservoir will collect process fluid that has leaked across the inboard seal. This fluid will need to be periodically drained whenever the reservoir is full.

- Vessel draining is required when the 'high level alert' is signalled by the level indicating transmitter, when the reservoir level rises above the 'high Level'line on the level gauge (see section 7.3). The drain procedure should be carried out before the completion of the following work shift from when the drain alert is triggered, and before the level rises above the top of the level gauge.
- Crack open the drain valve and release the fluid from the system into a safe container or leakage collection facility, until the level reaches the 'low level' line on the level gauge.
- The fluid in the vessel is process fluid from leakage across the inboard seal. Follow all safety precautions required when handling the process fluid, when handling the fluid in the Plan 75 reservoir.
- Record the frequency of draining the vessel. If the frequency increases, this is an indication that there has been a change in the condition of the mechanical seal. Close vent valve.

7.3 INDICATORS AND ALARMS

The instrumentation on the system has the specific purpose of monitoring the reservoir liquid level, tracking the pressure in the vapour collection system, and signalling eventual malfunction of the mechanical seals. Possible alarm signals indicating a malfunction are as shown in Table 2.

TABLE 2. Possible alarm signals indicating a malfunction

Effect	Instrument	Action	Cause
Rising pressure	Pressure Gauge (PG) or Pressure Indicating Transmitter (PIT)	A	D to F
High pressure alarm	Pressure Indicating Transmitter (PIT) or Pressure Switch (PS)	B	E or F
Rising level	Level Indicator (LG) or Level Indicating Transmitter (LG)	-	D
High level alert	Level Indicating Transmitter (LIT)	C	D

Actions	
A	Investigate cause and monitor to ensure pressure does not rise above safe limits
B	Shut down equipment to protect seal and prevent loss of containment
C	Drain the fluid in the vessel (see section 7.2)

Causes	
D	Leakage from the inboard seal (process side)
E	Abnormal working pressure of the machine or the vapour collection system
F	Abnormal/excessive leakage from the inboard seal (process side)

The signal from the pressure transmitter can be used either:

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

On critical items the alarm signal could be utilised as a trip function for the plant machinery.

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

John Crane must be consulted in the event of any abnormal malfunction of the sealing system. Excessive leakage rate, premature failure, high relative temperatures are all considered examples of abnormal malfunction.

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7.4 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

7.5 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 drained process liquid.

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

All flange joints should be checked for tightness and if necessary, the gaskets changed using replacements available from John Crane. If necessary, and prior to reconnecting the system should be flushed with a compatible liquid to remove any internal contamination.

Where required by code or local regulations the walls of pressurised vessels should be internally checked for corrosion damage. Where damage exceeds any corrosion allowance the vessels must be replaced.

7.6 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.

7.7 CONTAINMENT SEAL TEST

If a test connection is fitted, this can be used to test the containment seal as part of the installation process.

A. After the system is installed (see section 6) but before the pump is started, close the block valve on the line to the vapour collection line.

B. Open the block valve on the test connection.

C. Use a supply of nitrogen, regulated to no more than 1.7 bar (25 psi) to inject nitrogen into the Plan 75.

D. Use a liquid leakage detector and check for bubbles emerging from connections and from the containment seal area.

NOTE: A small number of bubbles from the containment seal area is acceptable. It does not indicate a poor seal. A continuous stream of bubbles indicates that the seal is damaged or installed incorrectly. Contact John Crane for additional guidance.

E. Once test is complete, close the block valve on the test connection and open the block valve on the line to the vapour collection system.

F. Disconnect the nitrogen supply from the test connection.

8. Accompanying Documents

- General Arrangement Drawing (Job Specific) or General Arrangement Drawing (Generic)
- Component supplier instructions
- Installation Drawing

9. Cold Environments

For environments with low ambient temperatures, winterisation features may be added to the Plan 75. These may include:

- Instruments may be supplied mounted in a heated enclosure. The heating element requires electrical connection as part of the installation and assembly procedure (see Section 5.4)
- Heat tracing and/or insulation may be required to maintain the temperature of the fluids in the Plan 75. This heat tracing and/or insulation may be supplied with the Plan 75, or may be applied on site as required.
- Care must be taken during commissioning and operation, that the Plan 75 is brought up to operating temperature before the machine is started, and the correct temperature is maintained throughout operation.

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