GR-2/GR-2 C IOM

PRESSURE VESSEL SEAL SUPPORT SYSTEM

Installation, Operation & Maintenance Instructions

1. General

1.1 INTRODUCTION

This Instruction Manual is provided to familiarise the user with GR-2/C system arrangement and its use. The instructions must be read and applied whenever work is done on GR-2/C system and must be available to the operating and maintenance personnel.

These instructions will help to avoid hazards 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 at any time. The following important terms and definitions are used in this document.

Barrier Liquid: a fluid supplied at a pressure above the pump seal chamber pressure. It is introduced between the two seals of a dual pressurised seal configuration to completely isolate the process liquid from the environment

Buffer Liquid: a fluid supplied at a pressure lower than the pump seal chamber pressure. It is used as a lubricant and/or to provide a process dilution in the containment chamber of a dual unpressurised seal configuration.

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. In a dual unpressurised seal, the most arduous liquid (process or buffer) will determine the classification. In the case of a dual pressurised seal the barrier liquid will define the hazard classification provided a low pressure alarm is fitted.

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 buffer 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 & 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 designed 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.

GR-2/C systems are used with dual seal configurations to reduce the hazard potential from flammable, explosive, toxic or lethal process fluids. The intermediate, protective barrier/buffer fluid, in certain failure modes, may risk being 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. The system is not suitable for running in the event of and uncontrolled fire.

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/barrier fluid and 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."

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 minimising 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.

Buffer/Barrier liquid recycling or disposal

Replacement of buffer/barrier liquid is required part of the normal maintenance operation. Recycling of liquid should be considered but if this is impractical because of contamination then an environmentally controlled form of disposal must be arranged.

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**.

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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. If any seals are broken or any connections are loose, then the system is assumed to be contaminated and shall be cleaned accordingly. After cleaning, all loose connections must be tightened to regain a good seal.

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 greater than >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 form 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.

Reservoirs which had already been fitted in plants must be transported in a vertical position. Protect the vessels against vibration, which can cause damage.

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

GR-2/C is comprised of a reservoir and a variety of instrumentation options.

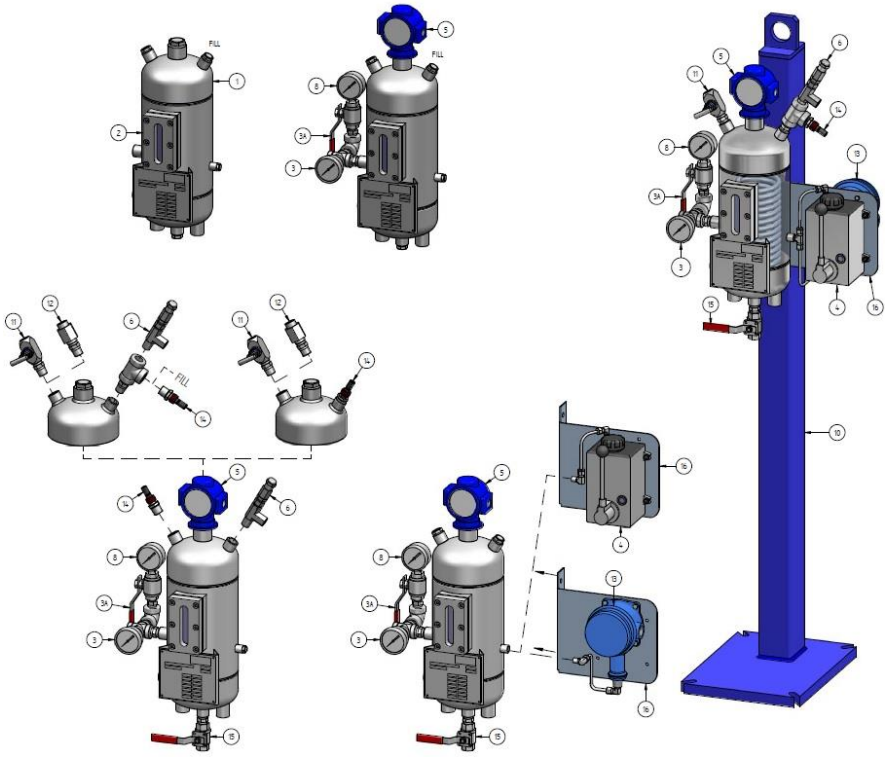
The system can be used to provide two different functions.

4.1 UNPRESSURISED SEAL ARRANGEMENT

In a dual unpressurised seal arrangement, two seals are used. The inboard seal operates in the process liquid at seal chamber pressure. Cooling and lubrication of this seal is achieved by using the pumped product. The outboard seal operates in a buffer liquid at a pressure lower than seal chamber pressure, typically atmospheric or low-pressure flare header pressure. Buffer liquid circulation via thermal siphoning and the pumping ring is essential to cool and lubricate the outboard seal. Leakage from the inboard seal is contained by the outboard seal and the reservoir system. The leakage is disposed of according to its vapour pressure. Vaporizing products are vented to flare or vapour recovery system, while condensing products can be routed to a sump or other approved drain. Various instrument configurations are available for monitoring seal performance.

4.2 PRESSURISED SEAL ARRANGEMENT

In a dual pressurized seal arrangement, two seals are used. Both seals operate on the reservoir barrier liquid, which is maintained at a pressure above seal chamber pressure. In addition to cooling and lubricating both seals, the barrier liquid serves to isolate the process from the atmosphere. Product emissions are effectively blocked as the differential pressure ensures that leakage will be barrier liquid across the inboard seal into process and across the outboard seal to the atmosphere. Various instrument configurations are available for monitoring seal performance.



Equipment Options			
1	Vessel	9	Fin tube air cooler (not shown)
2	Level gauge	10	Support stand
3	Temperature gauge	11	Nitrogen isolation valve
3A	PG isolation valve	12	Orifice union
4	Handpump refilling unit	13	Pressure switch
5	Level switch	14	Quick connector
6	Safety relief valve	15	Drain valve
7	Circulation pump (not shown)	16	Panel
8	Pressure gauge		

5. Function of the system

5.1 BUFFER/BARRIER FLUID CIRCULATION

Circulation is obtained through one or more of the following:

- A **thermal syphon effect** created by the difference in temperature between the reservoir supply and return pipes causing the liquid to recirculate between seal chamber and cooler.
- A **pumping ring** or **scroll** fitted to the seal producing forced circulation when rotating equipment is operating.
- A **circulation pump** (provided by John Crane upon request) installed in the connecting pipework, which may be required to achieve necessary cooling flowrate.

The thermosyphon effect is less powerful than a positive circulation and its use to generate circulation must be carefully evaluated.

5.2 HEAT DISSIPATION

Heat generated by the mechanical seals and/or positive heat soak from the process is transmitted to the buffer/barrier liquid. The heat is removed from the buffer/barrier fluid by:

- Internal cooling coil of the reservoir, circulation lines and the atmosphere.
- An air type heat exchanger installed in the circulation line (if cooling water is not available).
- Natural convection through the reservoir body and pipework.

Natural convection alone is less powerful than heat dissipation supported by a cooling coil/heat exchanger and its use must be carefully evaluated.

5.3 BARRIER PRESSURIZATION

The necessary pressure is obtained through a gas (normally nitrogen) applied to the fluid from a pressurised external source.

5.4 BUFFER/BARRIER LIQUID TOP UP

Periodic topping-up is required to replace buffer/barrier liquid consumed during normal operation.

Without the intended lubrication the seal face temperature will increase and may provide an ignition source in a potentially explosive environment. Equipment and system operation must ensure seal face lubrication is always available.

A refill alarm signal indicates the system must be topped up without delay, and before minimum operational level is reached, be recharged with fresh buffer/barrier fluid. Typical methods of topping-up are:

- Dedicated top-up handpump and storage reservoir permanently connected to the system reservoir, allowing topping-up without process shutdown.
- Mobile top-up trolley which can be used for topping up multiple systems by use of a hose and quick-connect coupling. This can also be carried out without process shutdown.
- Manual refilling.

For operator safety when using this method, the equipment should be shut down and depressurised before opening the fill connection. Additionally, the buffer/barrier fluid inside the reservoir shall be at ambient temperature.

5.5 RANGE OF APPLICATIONS

Buffer/barrier systems are designed to service mechanical seals by cooling, lubricating and pressurising (on dual pressurised seals); they must be operated within their performance limits.

The buffer/barrier fluid must be clean, with stable properties over the operating temperature and pressure conditions, and not constitute a hazard or introduce potential damage to the environment, and be compatible with the process fluid. It is advised **John Crane** is contacted for more detailed advice on buffer/barrier liquids and a formal approval sought.

Properties of buffer/barrier liquids may be the source of flammable or explosive hazards. A general guide of typical buffer/barrier liquids is given in the table below, however no change in liquid type should be undertaken without prior consultation with John Crane.

Buffer/Barrier Liquid
Mineral oils (maximum viscosity 20 cSt)
Water
Propylene Glycol
Water/Propylene Glycol mix

If the process or operating conditions are changed from those referenced in the GA drawing, 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 safer 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.

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6. Installation

- The reservoir shall be installed in a vertical position.
- Use the assembly bracket to fasten the reservoir to a suitable, stable point. A stand able to support the weight of a filled reservoir (typically 23 to 25 kg – 50 to 55 pounds) and sturdy enough to withstand wind force and normal vibration conditions can be supplied by John Crane upon request.
- Flowrate predictions are based on the interconnecting pipework assumptions. Therefore, the following recommendations should be applied:
  - Piping or tubing to have a minimum bore of ½" or 13 mm.
  - Pipework to be made of stainless steel.
  - Base of the vessel to be fitted minimum 500mm (20 inch) above the seal chamber centreline and within 500mm (20 inch) horizontal radius of it.
  - For unpressurised configuration, system to be mounted so that the normal level is minimum 1000mm (40 inch) above the seal chamber centreline.
  - It is recommended to use long, swept bends within the pipework. The supply and return pipework should have no more than 6 bends in total.
  - Total equivalent pipe length of the interconnecting piping should be less than 5 meters (16 foot).
  - Horizontal runs are to be avoided. Pipe runs should rise by at least 4° to allow bleed of any entrapped air back to the vent valve.
  - Seal chamber and mechanical seal loop must be fully vented upon initial filling.
  - Drain valve to be installed at the lowest point of the piping loop.
  - Flow indicators are discouraged without a circulation pump installed. However, if essential, only use low resistance designs.

A lower buffer/barrier flowrate will reduce the effective cooling and raise the buffer/barrier temperature. This may provide and ignition source in a potentially explosive atmosphere.

No welding allowed on components under pressure or structural parts.

Tolerated load on interface connection is 0. All pipes connecting to the Sealant system (to the pump, the drain and vent manifolds and the utilities) must be supported so that their weight is not on the reservoir connections.

Retained air or gas pockets will severely hinder flowrate and cause damage and overheating in the seal. Install venting devices if self-venting is impractical.

NOTE Due to the nature of the thermosyphonic flow and its relation to the system and seal design, it is not uncommon that the flow rate can differ between seemingly identical systems.

NOTE To assist in the promotion and maintenance of thermosyphonic flow, the warmer pipework leg can be lagged and/or trace heated.

The cooler connections (if required) must be adequately sealed, and the flowrate checked and adjusted to the value recommended. The following recommendations must be applied:

- Clean, cold and filtered coolant used.
- Isolating valves are lockable full-bore type and locked open.

6.1 CUSTOMER TERMINATIONS

All connections are ½" NPT. Connect the cooling coil terminations (GR-2C only) to the cooling circuit supply/return pipework. Refer to appropriate system GA drawing for termination details and locations.

6.2 ELECTRICAL CONNECTIONS

Only authorised 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 nameplate 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 guidance.
- 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 a potentially explosive areas, suitable protective devices should be added, following the pertinent rules.

6.3 DRAINING THE CIRCUIT

The system is fitted with a drain connection; however, it may also be preferable to install a drain valve (supplied by John Crane upon request) at the lowest point of the interconnecting pipework. Before any maintenance is undertaken, the system and pipework must be drained.

7. Commissioning

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

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

1. Close the drain connection, open the fill and any vent connections.
2. After flushing, using the fill connection, slowly fill the reservoir with the selected buffer/barrier liquid up to ¾ on the sight glass. Fill slowly to avoid aerating the fluid.
3. Carefully check that there is no leakage from any of the connections. In the event of a leak, tighten the threaded component. Should the leak persist, add Loctite/threading tape to seal the connection.
4. Completely vent all lines and the seal chamber. Refill the reservoir if required.

ATTENTION Follow the instructions above to ensure the seal is not running in dry conditions. It should be **avoided at all times** as this will damage the seal.

Dry running of seal faces will cause excessive temperatures, which may cause an explosive or flammable risk.

5. Open the instrument isolating valves and vent the instrument lines.
6. Adjust the pressure switch set point (if installed) to suit the duty. See reservoir nameplate for the correct alarm point.
   - Ensure low level switch (if installed) is correctly set to trigger low level alarm as needed.
7. Close the fill and, on dual pressurised arrangement, any vent connections.
8. Depending on configuration:

- **For dual pressurised arrangement:** Carefully apply the pressurised gas from a regulated supply until the correct operating pressure is reached.
- **For dual unpressurised arrangement:** Ensure that the vessel vent connection is routed to a safe area for any process leakage to be directed. For a vapourising process fluid, this is typically a vent/flare system.

NOTE Barrier liquid pressure must be maintained at all times while the process pressure is present in the equipment. The pressure source line must be open to ensure a constant barrier liquid pressure is achieved during normal operation.

Care should be exercised to ensure the Maximum Allowable Working Pressure is not exceeded during filling and pressurisation.

9. Check that any isolating valves in the circuit between the reservoir and the seal are locked fully open.
10. Check that all electrical instruments are correctly connected and in compliance with the area classification.

This should be carried out by a qualified electrician.

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

11. Open the cooling circuit (if installed) and circulate the required amount of coolant. The coolant flow must be present before any temperature is applied to the process equipment.
12. Start the machine.
13. Check the buffer/barrier liquid level and top-up if necessary, following the procedure in section **9.2**.
14. Check suitable flow circulation by measuring the buffer/barrier outlet line to confirm there is a suitable temperature rise above the inlet.
15. The coolant outlet temperature should be <50 °C (122 °F). If not, check that the coolant inlet temperature is low, and that the flowrate is correct.
16. The buffer/barrier settlement temperature when in service should typically be <80 °C (176 °F), measured at the reservoir. Some systems sealing hot process liquids may need to operate above this temperature; suitable warnings and protection must then be applied. Maximum system design temperature is shown on the GA drawing.

8. Running

8.1 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 of heat. Disconnection of any part of the system should not be undertaken without 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.

Periodic visual checking (at least every 48 hours) of the level/pressure within the system is recommended.

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

8.2 NAME AND DATA PLATE

A name and data plate is fitted to each system, giving identification and design limitations. Should you need further information or advice, **please contact your nearest John Crane regional office quoting the system code number**.

8.3 SIGNALS AND ALARMS

The standard instrumentation of the GR-1/C has the specific purpose of monitoring buffer/barrier liquid pressure and level changes. Additionally, logging the period between refills will give a guide to the seal condition. **Increasing frequency is an indication of seal wear**.

The optional temperature gauge is used to monitor changes in buffer/barrier liquid temperature. Tables presented below summarise the cause and effect for the various instrumentation readings. **Table 1** details the signals and alarms for a dual unpressurised arrangement. **Table 2** details the signals and alarms for a dual pressurised arrangement.

Actions

A	Recharge system with fresh buffer/barrier liquid
B	Drain system of excess buffer liquid
C	Shut down equipment to protect seal and prevent loss of containment
D	Investigate the cause of increased temperature

Causes

E	Leakage from the inboard seal (process side)
F	Leakage from the outboard seal (atmospheric side)
G	Leakage from a flange or joint
H	Process temperature rise
I	Inadequate cooling or flow of buffer/barrier circuit
J	Abnormally high process pressure
K	Buffer/Barrier fluid topped up above the high level line on the level gauge
L	Back pressure from the flare/vapour collection system
M	Loss of pressure supply

The signal from the pressure/level switches 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.

9. Maintenance

9.1 REGULAR MAINTENANCE

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

- That the connections are leak-free.
- Buffer/Barrier liquid level. Compare with Low Level and High Level marks on the level gauge.
- Buffer/Barrier pressure. Compare with the alarm pressure on the nameplate.
- Cooling water availability to the cooler/cooling coil (if fitted).
- Any abnormal leakage rate from the outer seal.
- Condition of alarm signals (see Section 8.3).
- There is no accumulation of dust on any part. Remove any built up dust as required.

Never allow the buffer/barrier level to drop down below the minimum mark on the vessel, otherwise the flow will be interrupted and cause damage and overheating of the mechanical seal which could provide an ignition source in a potentially explosive atmosphere.

In the circumstance where the system is used with a toxic or lethal process fluid or contaminant e.g., H2S, the buffer/barrier fluid must be periodically checked and replaced when contamination exceeds acceptable levels. Local regulations and legislation must be applied when determining these levels.

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TABLE 1. Possible Alarm Signals Indicating a Malfunction for dual unpressurised configuration			
Effect	**Instrument**	**Action**	**Cause**
Rising Pressure	Pressure Gauge (PG)	-	Excessive E, or L
Refill Alert (Low Level Alarm)	Low Level Switch (LLS)	A	F/G
Drain Alert (High Level Alert)	High Level Switch (HLS)	B	E or K
High Pressure Alarm	Pressure Switch (PS)	C	Excessive E, or L
Rising Temperature	Temperature Gauge (TG)	D	H to J

TABLE 2. Possible Alarm Signals Indicating a Malfunction for dual pressurised configuration			
Effect	**Instrument**	**Action**	**Cause**
Falling Pressure	Pressure Gauge (PG)	-	Excessive E/F/G, or M
Refill Alert (Low Level Alarm)	Low Level Switch (LLS)	A	E, F or G
High Shutdown Required Alarm (High Level Alarm)	High Level Switch (HLS)	C	J or K
Low Pressure Alarm	Pressure Switch (PS)	C	Excessive E/F/G, or M
Rising Temperature	Temperature Gauge (TG)	D	H to J

9.2 BUFFER/BARRIER TOP-UP

For unpressurised arrangement: In the case that the process fluid leakage transitions into a gas phase, this process is required to replenish lost buffer volume from the outboard seal. The system is typically sized to allow at least 28 days to pass between top-up intervals. Top-up is carried out by various methods (see section 5.4).

- Buffer/Barrier top-up is required when the 'refill alert' is signalled by the level switch when the buffer/barrier level drops below the 'Low Level' line on the level gauge. The top-up procedure should be carried out before the completion of the following work shift, from when the refill alert is triggered, and before the level falls to the bottom of the level gauge.
- Ensure the replenishment liquid is the correct specification, clean and free from contamination.

If buffer/barrier liquid systems need replenishment when in service, this should only be done with the fill systems that exclude air ingress and/or prevent gas leakage to the atmosphere.

- Using the fill connection, top-up the system with the selected buffer/barrier liquid using the top-up system chosen, until the level is just below the 'High Liquid Level' (HLL) line on the level gauge.
- Check the pressure in the buffer/barrier system. If it has risen above the recommended pressure, crack open the vent valve and reduce the pressure to the required value. Close vent valve.

9.3 BUFFER FLUID DRAIN

In the case that the process fluid leakage remains in the liquid phase, this process is required to release excessive buffer volume which has entered the reservoir through leakage from the inboard seal. The system is typically sized to allow at least 28 days to pass between drain intervals. Draining is carried out by various methods (see Section 4.1).

- Buffer draining is required when the 'drain alert' is signalled by the level switch, when the buffer level rises above the 'High Level' line on the level gauge. 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 buffer fluid from the system, into a safe container or leakage collection facility, until the level is just above the 'Low Liquid Level' (LLL) line on the level gauge.

The buffer will be continuously contaminated with process fluid from leakage across the inboard seal. Follow all safety precautions required when handling the process fluid, when handling the buffer fluid.

- Check the buffer fluid to determine if it has been sufficiently contaminated with process fluid to require replacement. See 9.4, buffer maintenance.

9.4 BUFFER/BARRIER FLUID MAINTENANCE

After first 100 operating hours, and after every subsequent 6 months:

- Change the buffer/barrier liquid.
- Check system and inter-connecting lines are clean and free of corrosion and deposits.

These maintenance intervals may need to be shortened if the operating conditions are extreme.

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9.5 BARRIER FLUID CONTAMINATION

If the system is subject to reverse leakage (process fluid leaks across the inboard seal into the circulating loop), normally due to inboard seal damage, the system should be stopped and decommissioned (see Section 10). The system should then be thoroughly cleaned to remove all contaminants. Caution should be taken to use the correct PPE, especially when GR-2/C is used with toxic or lethal process fluid. The contaminated barrier fluid should be disposed of in accordance with site policy and refilled with clean fluid as part of the system recommissioning process.

9.6 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

9.7 ANNUAL MAINTENANCE CHECKS

Disconnections shall be made by plant person in charge of authorisation.

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 buffer/barrier liquid.

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

All threaded joints should be checked for tightness. If necessary, and prior to refilling with fresh buffer/barrier fluid, 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.

9.8 COOLING COIL MAINTENANCE (GR-2C ONLY)

The cooling coil must be regularly checked to ensure that the cooling surface has not degraded or fouled. The cooling water side of a coil should be regularly back-flushed or cleaned at a frequency depending on the rate of scaling or quality of the water used. See local site regulations for guidance.

9.9 INSTRUMENT MAINTENANCE

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

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.

10. Decommissioning

ATTENTION When the machine is stopped, if GR-2/C is pressurised, system pressure must be maintained until the machine itself is unpressurised.

Work on the seal or GR-2/C system must only be carried out when the machine is stationary, secured against any unforeseen start-up and isolated from any connections to pressurisation sources.

Before carrying out any work on the seal or system, the buffer/barrier liquid must be fully depressurised 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 buffer/barrier 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 be carried out on the system after any maintenance and before operation on the equipment.

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
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