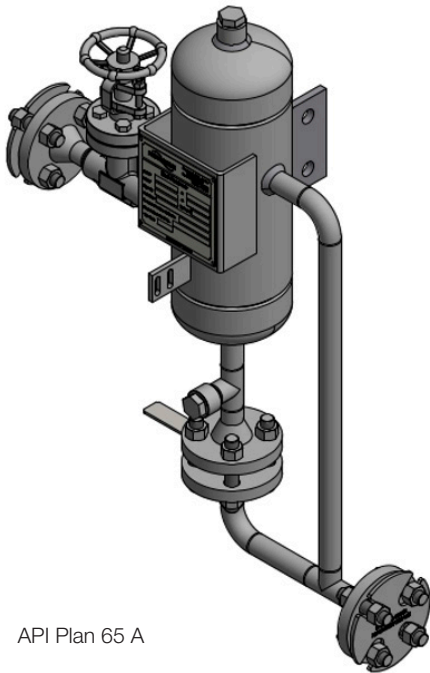


Standard Plan 65 A/B for API and General Industry Markets

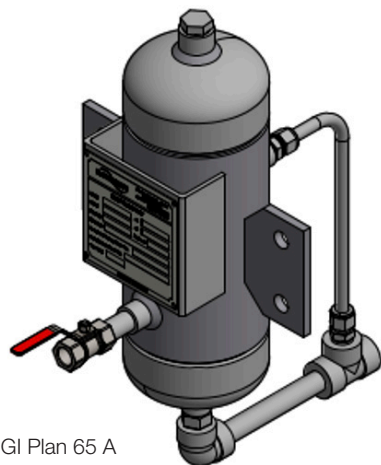




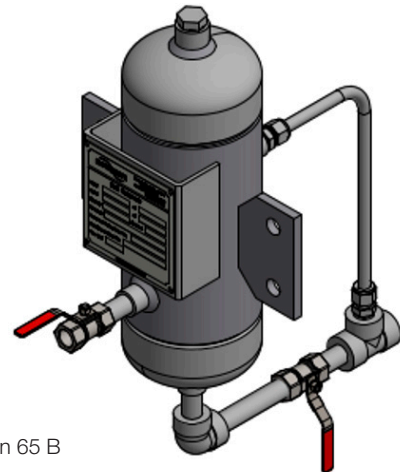
API Plan 65 A



API Plan 65 B



GI Plan 65 A



GI Plan 65 B

CONTENTS

1	Introduction	4
1.1	About this manual	4
1.2	How to use this manual	4
1.3	Other supplied documentation	4
1.4	Conformity with norms and directives	4
1.5	Use of alerts and icons	5
2	Safety	6
2.1	Plan 65A/B hazards	6
2.2	General safety	6
2.3	Trained and qualified personnel	7
2.4	Personal protective equipment (PPE)	7
3	Environmental Considerations	8
3.1	Disposing of waste products	8
3.2	End-of-life equipment	8
4	Description	9
4.1	Purpose of Plan 65A/B	9
4.2	P & ID and connections	10
4.3	Parts	10
4.4	Identifying the product (nameplate)	11
5	Preservation, Packing, Transport and Storage Requirements	12
5.1	Preservation	12
5.1.1	Mechanical preservation instructions	12
5.1.2	De-preservation	12
5.2	Packing	12
5.3	Transportation and storage requirements	13
6	Installation	14
6.1	Introduction	14
6.2	Installation requirements	14
6.2.1	Safety considerations	14
6.2.2	Interconnecting pipes (all Plan 65A/B systems)	15
6.3	Installation procedure	15
7	Operation	17
7.1	Set up system	17
7.2	Start up system	18
7.3	Monitor system	19
7.4	Shut down system	19
8	Maintenance	21
8.1	Introduction	21
8.2	Periodic maintenance tables	21
8.3	Repair work	22
9	Troubleshooting	23
10	Spare Parts	24
11	Appendix	25
11.1	System logbook	25
11.2	GA drawings	26
11.3	Vendor documentation	27

1 Introduction

1.1 About this manual

This manual (which is intended for operating, maintenance, and supervisory personnel) provides information on installing, operating, and maintaining the API Plan 65A/B system.

1.2 How to use this manual

Only trained and qualified personnel should use this manual. Refer to section 2.3. Inexperienced personnel should only work on this system under the supervision of a qualified person.

Before using this manual, make sure you have fully read and understood the safety section. If you are new to the system, pay particular attention to section 4, which describes the system in detail.

When maintaining the system, always make sure you follow the maintenance procedures. Pay particular attention to the alerts and icons.

The Plan 65 A and B and its internal components may only be used for its main purposes as described in this manual. No adjustments can be made without the approval of Flowserve.

Changes, modifications, repairs or use under conditions deviating from the design specifications without prior permission of Flowserve will make the declaration of conformity and the nameplate invalid.

1.3 Other supplied documentation

The appendix contains the General Arrangement drawings (called GA drawings) and documentation on the vendor parts. The instructions in this manual sometimes refer to the vendor documentation. If a reference is made to the vendor documentation, you must follow the instructions in that documentation as well.

1.4 Conformity with norms and directives


The information in this manual conforms to the following norms and directives (if applicable):


- ASME VIII-1
- ATEX Directive 2014/34/EU
- PED 2014/68/EU
- CSA-B51


1.5 Use of alerts and icons


This manual uses “Notes”, “Cautions”, “Warnings”, and “Dangers” to alert you of important information and dangerous situations. These alerts (from the least severe to the most severe) are:

NOTE: “Notes” inform you of important additional information.


 **CAUTION:** *The equipment, product or surrounding area can be damaged if the “caution” is not obeyed.*

 **WARNING:** *Personnel can be (seriously) injured, or the equipment can be seriously damaged if the “warning” is not obeyed.*

 **DANGER:** *Personnel can be seriously injured (resulting in death) if the “danger” is not obeyed.*

 **DANGER:** *Dangers or Warnings that refer to the use of the system in potentially explosive atmosphere – in accordance with the ATEX Directive 2014/34/EU.*

The above icons are the general icons that are used for “Cautions”, “Warnings” and “Dangers”. More specific icons are also used, depending on the type of hazard. Refer to the following example:

 **WARNING – HIGH PRESSURE:** *The Plan 65A/B can burst if it is over pressurized. NEVER exceed max. design parameters.*

2 Safety

2.1 Plan 65 A/B hazards

The following hazards can be present in the Plan 65 A/B system:

- High pressure
- Explosion
- Dangerous chemicals/media
- Temperature (hot or cold surfaces)

If the Plan 65 A/B system has any external leaks, you must stop the system immediately and have the leak repaired by qualified personnel.

2.2 General safety

When installing, operating and maintaining the system, pay particular attention to safety:

- Obey all applicable safety laws and regulations.
- Obey all Plant regulations.
- Make sure that only trained and qualified personnel work on the system. Refer to section 2.3.
- Read and understand each part of this manual.
- Follow the installation, maintenance and operating procedures exactly.
- Wear the relevant personal protective equipment (PPE). Refer to section 2.4.
- Never work alone.

- Make sure that adequate safety equipment is installed in and around the work area: first aid kits, safety showers (if applicable), fire extinguishers, escape routes, shut off valves, etc.
- Make sure that personnel are fully trained on how to use the safety equipment. A qualified first aid specialist must always be available for each shift.
- Read the plant requirements for handling hazardous materials.
- Check MSDS for relevant information.

This equipment has not been designed to withstand any external forces and moments, unless otherwise stated on the drawing, such as:

- Forces and moments resulting from wind loading
- Forces and moments resulting from snow and ice
- Forces and moments resulting from earthquakes
- Forces resulting from rapid fluctuations in pressure
- Forces resulting from vibrations
- Excessive forces during transport should be avoided

These forces and moments shall be brought to a minimum during (re)installation and operation.

2.3 Trained and qualified personnel

Qualified personnel are people who have been authorized by those responsible for the safety of the Plant to perform the necessary work, and who can recognize and avoid possible dangers. The following aspects determine the qualification of personnel:

- Appropriate training
- Relevant experience
- Knowledge of relevant standards and specifications
- Knowledge of accident prevention regulations
- Knowledge of plant regulations and operating conditions

2.4 Personal protective equipment (PPE)

The Plan 65A/B are often used for applications containing high-pressure, hot or cold surfaces, sharp edges, dangerous and/or toxic chemicals. When operating or maintaining this system, make sure you wear the appropriate PPE: protective clothing, gloves, safety glasses, etc.

Always follow local regulations regarding PPE.

If one (or more) of the below icons is shown in the work place, the equipment must be worn at all time.



When operating outside, PPE also to be worn to prevent slipping, tripping and/or falling.

3 Environmental Considerations

⚠ CAUTION: *You are required by law to dispose of waste products and end of life equipment, according to local regulations.*

3.1 Disposing of waste products

Any waste products resulting from the use or maintenance of the Plan 65A/B must be disposed of, to a suitable disposal point, according to local environment laws and regulations.

3.2 End-of-life equipment

STOP **WARNING – DANGER CHEMICALS:** *Dangerous chemical might be released during removal of the system. Wear PPE. Follow all safety regulations and Plant regulations.*

STOP **WARNING – HIGH PRESSURE:** *High pressure might be stored in the system. Before removing or re-installing the system, make sure the entire system has been de-pressurized (and drained if required).*

NOTE: End-of-life equipment must be disposed of according to local environment laws and regulations.

4 Description

4.1 Purpose of Plan 65A/B

Even in normal operation mode, a mechanical seal will always show some leakage to atmosphere.

Depending on the vapor pressure of the product sealed, the leakage can migrate to atmosphere in 2 phases;

- Liquid phase (nonvolatile product)
- Vapor phase (volatile product)

65A/B should be used only with product that stays at liquid phase.

The leakage detector has two functions:

1. Controlled disposal of mechanical seal leakage:

The leakage from the mechanical seal shall be disposed of by means of piping from the mechanical seal drain connection through the leakage detector to a drain.

2. Monitor the condition of the mechanical seal: (for Plan 65 A).

Plan 65 A is a seal leakage detection piping plan normally used with Arrangement 1 seals in services where seal leakage is expected to be mostly liquid (not gas).

Piping is connected to the seal drain connection in the gland plate and directs any seal leakage through a reservoir and then through an orifice, causing the level to rise. A level transmitter or level switch is installed to activate an alarm once the liquid has reached the maximum level in the reservoir, then the mechanical seal is leaking excessively and needs to be replaced. A connection at the top side of the reservoir will allow excessive leakage to be effectively drained.

Monitor the condition of the mechanical seal: (for Plan 65 B).

Plan 65B is a seal leakage detection piping plan normally used with Arrangement 1 seals in services where seal leakage is expected to be mostly liquid (not gas).

Piping is connected to the seal drain connection in the gland plate and directs any seal leakage through a reservoir, causing the level to rise. A level transmitter or level switch is installed to activate an alarm once the liquid has reached the maximum level in the reservoir. The reservoir must then be emptied by opening the block valve. When the interval of emptying the reservoir becomes too short, the mechanical seal is leaking excessively and needs to be replaced. A connection at the top side of the reservoir will allow excessive leakage to be effectively drained.

4.2 P & ID with connections

In each Plan 65 A/B drawing a P&ID is included, showing the components and piping flow.

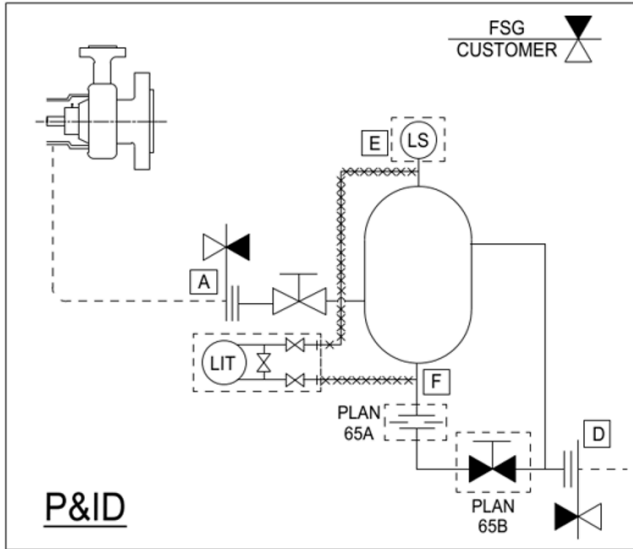


Figure 1: Typical schematic overview

- Connection table for API Plan 65 A/B

Connections Table				
NO.	CONNECTION	SW TYPE (S06)	BW TYPE (B06)	NPT TYPE (N00)
A	FROM SEAL	0.75 in. 600# RF (BLINDED)	0.75 in. 600# RF (BLINDED)	0.75 in. NPT
D	DRAIN	0.75 in. 600# RF (BLINDED)	0.75 in. 600# RF (BLINDED)	0.75 in. NPT
E	LEVEL MEASUREMENT CONNECTION	0.75 in. NPT (PLUGGED)	0.75 in. NPT (PLUGGED)	0.75 in. NPT (PLUGGED)
F	LEVEL TRANSMITTER CONNECTION	0.75 in. NPT (PLUGGED)	0.75 in. NPT (PLUGGED)	0.75 in. NPT (PLUGGED)

- Connection table for General Industry Plan 65 A/B

Connections		
NO.	NAME	SIZE
A	FROM SEAL	0.50 in. FNPT
D	DRAIN	0.50 in. FNPT
E	LEVEL MEASUREMENT CONNECTION	0.75 in. NPT (PLUGGED)

For General Industry Plan 65 A/B, differential pressure transmitter (also connection F) is not applicable.

4.3 Parts

Standard parts for Plan 65 A (API and GI)

Number	Part	Function
1	Block Valve Inlet	Used for closing off the inlet line for maintenance of Plan 65A
2	Orifice	To restrict excessive seal leakage
2	Reservoir	To collect seal leakage and used for monitoring the mechanical seal

Standard parts for Plan 65 B (API and GI)

Number	Part	Function
1	Block Valve Inlet	Used for closing off the inlet line for maintenance of Plan 65B
2	Block Valve Bypass	Normally closed. Used to drain Plan 65B for maintenance
4	Reservoir	To collect seal leakage and used for monitoring the mechanical seal.

Optional Items

Number	Part	Function
1	Level Switch (LS)	Used for pressure alarm and monitoring the level (for API+GI)
2	Differential Pressure Transmitter (LIT)	Used for pressure alarm and monitoring the level (for API)
3	Guided Wave Radar Transmitter (GWR)	Used for pressure alarm and monitoring the level (for API and GI)

Refer to the P&ID in appendix for applicable instruments.

4.4 Identifying the product (nameplate)

The nameplate is, as per Flowserve standard, shown in the GA drawing.

This nameplate provides the necessary information regarding the system.



Figure 2: Example of typical nameplate

For information on the nameplate, see the attachments in “Chapter 11.2. Appendix”.

5 Preservation, Packing, Transport and Storage requirements

5.1 Preservation

5.1.1 Mechanical preservation instructions

Equipment should not be sealed in a way that it/ will obstruct inspection. Access for normal inspection and preservation maintenance shall be provided. Internal surfaces of pressure vessels, piping systems and similar equipment shall be dried and cleaned of surface corrosion and foreign material.

Flange facings shall be sealed with an oil resistant rubber gasket and covered with a steel cap or water resistant plywood binding, tightened with minimum 4 hot dipped galvanized or SS316L bolts. All threaded openings shall be provided with steel caps or solid-shank steel plugs of metallurgy equal to the metallurgy of the component being capped or plugged.

Heat exchangers, piping and valves shall be thoroughly cleaned and dried after manufacturing and testing, prior to application of preservatives.

For equipment where water is used for cleaning or pressure testing, the water shall have antifreeze medium added unless the water is completely drained off. This also applies if the ambient temperature is below 4°C during any of these operations.

Internal surfaces fully consisting of corrosion resistant materials shall not be preserved unless stated other.

All valves to be in closed position, except for ball valves which shall be in open position.

5.1.2 De-preservation

For de-preservation the threaded opening caps and flange cover need to be removed prior to commissioning. During hook up it is mandatory to keep these covers/ plugs in place for as long as possible to prevent contamination.

5.2 Packing

Package size and weights shall be as small as possible but maximum restricted to the following dimensions:

- 1,200 [mm] length
- 800 [mm] width
- 900 [mm] height
- 50 kg gross weight

All equipment to be carefully lifted inside a timber box.

To prevent damage during transport all equipment needs to be properly secured inside their timber package with suitable bolting, straps or wooden supports.

5.3 Transportation and storage requirements

Transport and storage criteria	Requirements
Transportation	The system must be transported and stored in the unopened, original shipping box. Instructions on the shipping box shall be followed.
Suspect damaged during transportation	Systems that have been dropped, or have been subjected to heavy impacts during transport, must not be installed. The Flowserve representative shall be contacted.
Warehouse requirements	The warehouse must be dry and dust free. The system should not be exposed to: large temperature fluctuations, high humidity, or radiation
Long-term storage	After a storage period of 1 year, the system must be inspected for its “as new” properties. This applies particularly to the instrumentation.
Preserving installed systems	The preserving medium must not damage the installed system, for example by fouling or attacking the components and mechanical seal. If you are not sure which preserving medium to use, contact Flowserve AMSS for preserving procedure.

6 Installation

6.1 Introduction


Before installing the system, make sure you have read and understood the Installation requirements in this section. If you have any questions regarding the installation of your system, contact your local Flowserve representative.

6.2 Installation requirements

6.2.1 Safety considerations

Position the Plan 65A/B as close to the seal as possible. Make sure there is sufficient room for:

- Evacuation of the Plant in case of an emergency (do not block walkways and emergency exits).
- Safe operation and maintenance of the system.

 ***DANGER – RISK OF EXPLOSION: If the system is being installed in a hazardous area, there could be an explosion risk. Make sure all instrumentation has the adequate explosion protection.***

If the system is being installed in a confined area, make sure there is adequate ventilation.

Adequate ventilation is required for:

- Safely operating the plan 65A/B

The following points shall be taken into account during installation of the sealing system:

- Operating and design parameters shall never be exceeded;
- Provide suitable ventilation in the operating area;
- Never exceed the nozzle loads of the tie in points;
- Torque valves (if applicable) of the tie in points to be checked after installation and after start up;
- Possible misalignment of the sealing system due to temperature fluctuations shall be taken into account;

6.2.2 Interconnecting pipes (all Plan 65A/B systems)

Pay particular attention to the following points:

- Minimize the number of restrictions (for example, limit the number of fittings).
- Unless otherwise specified:
 - For API the pipe size shall be 0.75 in. and schedule shall be the same as the system piping (or as per specification).
 - For GI tube/pipe size shall be 0.50 in. and schedule shall be the same as the system piping (or as per specification).
- The pipes must be clean and free of burrs.
- The total pipe length and number of bends shall be kept to a minimum.
- Use smooth, large radius bends; do not use elbows, tees, etc.
- Pipe runs should be sloped continuously up or down
- For threaded connections, do not use Teflon tape but Engineering Loctite 577.

NOTE: If isolation valves are part of the interconnecting piping, these valves shall be full bore and “locked open” during operation.

6.3 Installation procedure

Use this procedure to install or reinstall the system.

Procedure

1. Before installing the system, inspect all components for damage, dirt or contamination. If any of the components are damaged, it shall be reported to the Flowserve representative. Clean/flush the sealing system prior to installation.
2. Determine the installed position of the system. Refer to the Installation requirements.



WARNING – CRUSH HAZARD: Possible injury and/or trapped limbs. Take care to avoid being trapped or crushed between heavy, moving objects.



WARNING – SLIPPING, FALLING HAZARD: When monitoring equipment is mounted too high in the sealing system, end user to provide suitable precautions for better readout (landing, borders, stairs etc.).

3. Use suitable lifting equipment together with the available lifting lugs on the Plan 65A/B, to position the Plan 65A/B system as close as possible to the mechanical seal. Make sure you leave sufficient room for operation and maintenance purposes.



WARNING – CRUSH/ IMPACT HAZARD BY FALLING OBJECTS: Possible injury and/or trapped limbs. Never walk under a suspended load! Use suitable lifting equipment!

4. The leakage detector shall be mounted in the upright position as the detector relies on gravity feed of leakage from the mechanical seal to the detector and the alarms to function properly; the leakage detector shall always be installed below the level of the seal assembly.
5. (IF APPLICABLE) Mount the system at the desired location using bolts through the holes in the mounting plate of the reservoir. Mounting location may vary with each installation but keep piping length from panel to seal to a minimum. The following connections should be made according point 7:
6. Manufacture the interconnecting piping according to the Installation requirements. Refer to section 6.2.2.

NOTE: Not all of the connections in the following step may apply to your system (some are optional). Also the names used in this procedure may vary slightly to the names in the GA drawings.

Refer to the GA drawing(s) in the appendix for full details. In case of doubt, contact the Flowserve representative.

7. Make the following connections:

- From seal to the plan 65A/B system: Piping from the mechanical seal to the plan 65A/B inlet connection.
- From the plan 65A/ B outlet to a drain collector: Connect the plan 65A/B outlet to a suitable drain/ disposal point. Always follow local regulations for the disposal of the medium from the plan 65A/B.
- Electrical connections: Wire the electrical connections for instrumentation according to the applicable instrument and plant requirements; Refer to the vendor documentation in the appendix for more information.

NOTE: For locations of the connections, refer to the connections table on GA Drawing in appendix.

NOTE: Always check the functionality of every instrument/ electrical equipment prior to start-up.



DANGER – RISK OF EXPLOSION: Static electricity can build up and ignite flammable vapors

Make sure the installation and its components are correctly grounded to prevent the risk of explosion.

8. Sign the System Logbook in the appendix to verify that the installation has been completed according to this procedure.

7 Operation

7.1 Set up system

Use this procedure if:

- The system is being set up for the first time, or
- The plan 65A/B system has been completely depressurized.

Procedure

1. The flange covers provided for shipping only, should be removed.
2. Make sure the block bleed valve(s) to the instrumentation is(are) open (if applicable).
3. Make sure that the block valve is in Locked open position (only during maintenance the block valve to be closed).

STOP **WARNING – HIGH PRESSURE: The Plan 65A/B can burst if it is over pressurized. Never block the overflow pipe or exceed system design parameters.**

4. Check all connections for leakage (with for instance a leakage spray) and rectify where necessary.
5. Use valve positions:
 - a. Valve 1 shall be left open during operation and may be closed only for maintenance of the piping plan. (applicable for Plan 65A/B).
 - b. Valve 2 shall normally be closed during operation although it may be opened periodically to allow collected leakage to be drained. (only applicable for Plan 65 B).

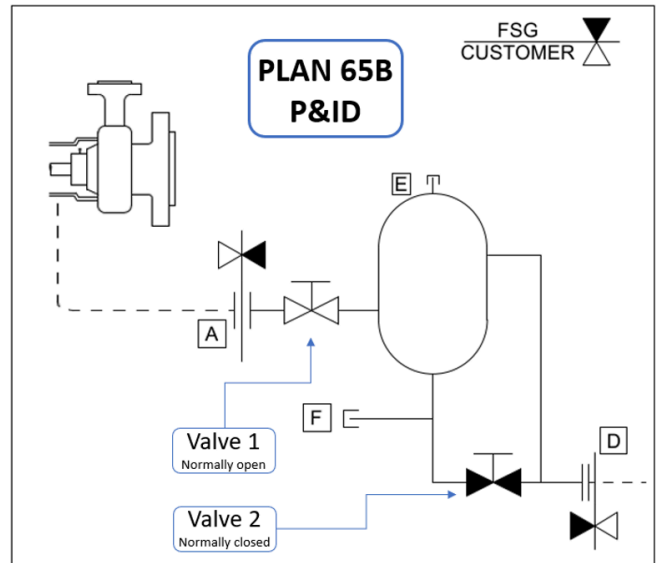


Figure 3: Plan 65 B typical installation with valve positions

7.2 Start up system

Use this procedure to start the system.

⚠ DANGER – RISK OF EXPLOSION: Always make sure that the design parameters (MAWP and MAWT) of the sealing system shall never be exceeded as stated on the nameplate. In case of possibility of exceeding the above, your local Flowserve representative shall be contacted. Operation may not start/ continue if the above is not met.

Procedure

1. Before starting up the system, inspect all components for damage, dirt or contamination. If any of the components are damaged, it shall be reported to the Flowserve representative. Clean/flush the sealing system prior to installation.
2. Main equipment (pump) can be started.
3. Monitor the system for correct operation. Also, refer to the periodic maintenance tables in section 8.2.

Make sure:

- There are no leaks
- There is no heavy vibration in the system

7.3 Monitor system

Xe **DANGER – RISK OF EXPLOSION:** *When operating in a hazardous area, always make sure that the sealing system is continuously monitored by sensors (for Pressure, Temperature and/ or Flow) which measure and signal during operation.*

Xe **DANGER – RISK OF EXPLOSION:** *Always make sure that the design parameters (MAWP and MAWT) of the sealing system shall never be exceeded as stated on the nameplate. In case of possibility of exceeding the design parameters, your local Flowserve representative shall be contacted. Operation may not start/ continue if the above is not met.*

Use this procedure to monitor the system.

Procedure

2. Monitor the system for correct operation. Also, refer to the periodic maintenance tables in section 8.2.
3. Make sure:
 - There are no leaks
 - There is no heavy vibration in the system
4. If you notice any problems with the system, follow plant regulation for reporting and correcting faulty equipment.

7.4 Shut down system


Xe **DANGER – EQUIPMENT OR PRODUCT DAMAGE:** *Always stop and UN-pressurize the pump before un-pressurizing the Seal and API 682 Plan 65A/B.*


1. Check if the system can be shut down.
2. Check if system can be de-pressurized without negatively affecting the mechanical seal installed in main pump. System cannot be shut down if the following main pump conditions occur:


- Main equipment/pump is pressurized
- Main equipment/pump is in operation
- Main equipment/pump is in hot stand-by

NOTE: Always shut down the system according to plant regulations/end user safety procedure

When above points are checked, the system can be shut down.

 **WARNING – HIGH PRESSURE:** *High pressure might be stored in the system. Before removing or re-installing the system, make sure the entire system has been de-pressurized (and drained if required).*

 **WARNING – HOT OR COLD SURFACES:** *The system and surrounding surfaces might be hot or cold. Take care when touching components. Wear the appropriate Personnel Protection Equipment (PPE), according to plant regulations.*

 **WARNING – DANGER CHEMICALS:** *Dangerous chemical might be released during removal of the system. Wear Personal Protective Equipment (PPE). Follow all safety regulations and Plant regulations.*

For removal and maintenance and before (re-)installation, the complete system must be de-pressurized (and drained if required)

8 Maintenance

⚠ DANGER – RISK OF EXPLOSION: To prevent ignition of a potentially explosive atmosphere during maintenance or repair, tools, cleaning products and paints should not increase the risk of sparks. If the use of these tools and materials increases the risk of sparks, maintenance shall be carried out in a safe area.

8.1 Introduction

Periodic maintenance must be done at regular intervals (weekly, monthly, yearly). Refer to the following tables. In addition, check the vendor documentation for any periodic maintenance procedures required for the vendor components.

A “system logbook” is supplied in the appendix. Copy this sheet and use it as a record of the maintenance done on your system. The engineer(s) responsible for the maintenance must enter their name and the date of the maintenance (as well as any relevant comments).

For information on replacing major components, refer to the GA drawings and vendor documentation in the appendix.

8.2 Periodic maintenance tables

Use the following tables to plan the periodic maintenance for your system (refer to the table of contents and the appendix for the relevant information):

Weekly maintenance

Check the seals, system, and interconnecting pipe work for leaks. Rectify if necessary.

Monthly maintenance

Do all weekly periodic maintenance procedures.

Check all earthing and electrical connections. Rectify if necessary.

Yearly maintenance

Do all weekly and monthly periodic maintenance procedures.

8.3 Repair work

Xe ***DANGER – RISK OF EXPLOSION: To prevent ignition of a potentially explosive atmosphere during maintenance or repair, tools, cleaning products and paints should not increase the risk of sparks. If the use of these tools and materials increases the risk of sparks, maintenance shall be carried out in a safe area.***

Broken or damaged equipment shall be replaced as specified by Flowserve.

9 Troubleshooting

Use the following table to troubleshoot the system. Once you have identified the problem, use the procedures in this manual to maintain the system. If you are not sure how to troubleshoot or maintain your Plan 65A/B system, please contact your local Flowserve representative.

Problem	Action
Not collecting any expected leakage from pump.	Check your isolation Valve 1 (figure 3 at page 17), which should be normally open
Significantly increasing level in reservoir	Piping & Orifice can be clogged. Check the system for contamination.
Significantly increasing level in reservoir	Possibility that the mechanical seal has failed. Check mechanical seal condition.
At Plan 65 B the vessel doesn't collect any leakage	Check your isolation Valve 2 (figure 3. at page 17), which should be normally closed

10 Spare Parts

- The system is designed to provide reliable operation under a wide range of operating conditions. However, repairs will be necessary when system components reach the end of their normal life expectancy or when the system has been operated outside of its design capabilities.
- All liabilities and warranties to Flowserve AMSS for damage incurred through the use of non-original replacement parts and accessories will be rendered null and void.
- Please note that special manufacturing and delivery specifications exist for all parts of our products manufactured or produced by ourselves and the replacement parts are always offered in accordance with the latest technology and with the most current regulations and laws.
- Flowserve uses SPIR lists with parts to be procured at Flowserve, that can be used for exchange when defect. Contact a Flowserve representative for a SPIR list of the system.

11.2 GA drawings

NOTE: Please see following inserted page(s):

11.3 Vendor documentation

NOTE: Please see following inserted page(s):

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