THERMOSYPHON SYSTEM OPERATING MANUAL

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DRAWING	**SEE DRAWING**
HAZARD ANALYSIS	**SEE DRAWING**

2. CODES

- **EU Directive 2014/68 / EC (PED)**
- **ASME VIII Div. 1 – Edition. 2015**

3. DESCRIPTION

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3.1 Data sheet

PRESSURE EQUIPMENT DIRECTIVE P.E.D. 9723//CE				
	Fluid Group	Table no.	Risk Catergory	PED Module
Coil side	1	1	Art.4 par.3	
Shell side	1	1	II	A2

Design Pressure	(bar g)	Shell side	16,00	Coil side	16,00
Hydrostatic Pressare	(bar g)	Shell side	24,00	Coil side	24,00
Design Temperature	(°C)	Shell side	-60 / +200	Coil side	-60 / +200
Capacity	(l)	Shell side	8,00	Coil side	0,25
Corrosion allowance	(mm)	Shell side	0,00	Coil side	0,00

NB:

Safety accessories are supplied on request. It is essential that the client take the necessary technical measures to prevent the occurrence of pressure and temperature values which exceed those indicated on the nameplate of the appliance.

3.2 Safety

During installation and maintenance work, be sure to **always** use **only** approved lifting gear.
Proper use of the pressurisation reservoir is a prerequisite for ensuring safety.
For this purpose the **user must**, but not only:

- Use the reservoir correctly, i.e. within the pressure and temperature limits of service as shown on the nameplate of the manufacturer and the inspection document, which must be carefully preserved. In particular the appliance must not be used with a vacuum inside the reservoir;

- Avoid the use of fluids other than specified in the design;

- Avoid any welding of parts which under pressure

- Avoid knocks a/o falls;

- Ensure that the reservoir is always fitted with efficient and sufficient safety and monitoring accessories. When needed, replace with accessories with equivalent features, as recommended by the manufacturer. In particular excess-pressure control accessories, such as safety valves, must have a discharge capacity exceeding the quantity of producible steam;

- Raise the reservoir with safety harnesses that comply with safety standards;

- Before use, secure the reservoir before use with appropriate supports;
- The reservoir should be installed in areas not accessible to unauthorized personnel. Make sure that during operation, the reservoir is not subject to vibrations that can generate fatigue failure;

- The external loads on the reservoir must not exceed 30N;

- Once a year check for possible corrosion on the surface of the reservoir, intensifying this check if fluids other than light oil or glycol have been used. However, the actual thickness must not be less than that indicated on the attached drawing;

- Protect the reservoir from stray currents by using dielectric joints

- Clean the reservoir with fluids or cleaning agents suitable for stainless steel type 316 / L;

- **TAMPERING WITH OR MISUSE OF THE RESERVOIR IS STRICTLY PROHIBITED**

- It is incumbent on the user to respect local laws, in the country where the appliance is to be used, regarding the use of pressurise appliances vessels

3.3 Introduction

In rotating machinery, such as pumps or agitators which are used in chemical or petrochemical plants, double mechanical seals are the most common choice as they do not emit the mostly harmful or toxic process fluids into the atmosphere.

To ensure correct functioning, it is necessary to distinguish between the two types of installation of double mechanical seals:

3.3.1. SEALS DOUBLE PRESSURIZED (API PLAN 53)

The two seals, installed in tandem or back-to-back, are pressurized by a barrier fluid at a pressure higher than that of the process fluid.

For a satisfactory performance, please note the following:

a) The seal chamber must be filled with a fluid which is compatible with the pumped product

b) The pressure of the lubricating liquid must be kept higher (1 - 2 bar (g) or even 10% more) than that of the pumped product so that any leakage from the internal seal does not leak to the outside, but returns to the inside of the machine

c) A good circulation of the barrier liquid is necessary to prevent the overheating of both the liquid and that of the mechanical seal.

3.3.2. DOUBLE TANDEM SEALS (API PLAN 52):

Although this installation enables the quick resolution of problems, is unsuitable for particularly dangerous process liquids i.e. lethal a/o toxic.
Unlike double pressurised seals , in this system there is no contamination of the product pumped by the liquid barrier, which is always kept at atmospheric pressure.

It is essential to ensure:

a) That the seal chamber is filled with barrier liquid

b) The circulation of the liquid on the seal faces, to remove the heat generated

c) Compensation for the physiological leaks of seals:

The filling liquid is contained in special tanks called flushing reservoirs which indicate any eventual breakdown or breakage of mechanical seals and perform the following functions: circulation, pressurisation of the barrier fluid and dissipation of the heat generated by the rotation of mechanical seals installed on rotating machines (e.g. pumps or mixers).
Should the mechanical seal break, the flushing reservoir must be able to withstand the maximum pressure transmitted from the rotating machine.
The flushing reservoir is constructed in stainless steel type 316 / L.

3.4 Functions of Reservoir

The mechanical seal auxiliary system should guarantee the following:

3.4.1. FLUSHING LIQUID CIRCULATION

This can be delivered by:

a) Thermo siphon system - circulation induced by the difference in temperature between the connection pipes to the reservoir so generating circulation between the seal chamber and the reservoir

b) Pumping rig mounted on rotary ring of the mechanical seal, that activates the circulation of the circuit

c) Circulation pump

3.4.2. DISSIPATION OF THE HEAT GENERATED

Heat is generated by friction at the seal faces.
Heat can be dissipated by:

a) Natural convection between the reservoir walls, pipes of the flushing circuit with the atmosphere

b) The cooling coil incorporated in the reservoir

c) An air or water cooled heat exchanger placed between the reservoir and the mechanical seals chamber

3.4.3. PRESSURISATION OF THE FLUSHING LIQUID

The support system can be pressurised by:

a) Neutral and inert gas from external source (nitrogen - N2)

b) Centralised pumping system

c) Pressurisation cylinders (pressure boosters) operated by the pumped product

3.4.4. LEVEL

Refilling the support system with flushing fluid to compensate for leakage, or for when it is replaced, its can be carried out via

a) Manual refilling using a funnel

b) Centralised pumping system

3.4.5. DETECTION OF MECHANICAL SEAL AND SYSTEM FALURES

These are obtained the correct equipment, mounted onto the reservoir, which reports information locally a/o at a distance.

3.5 Connections

The Mechanical Seal Support System is supplied with the following as standard:

- Threaded connections for return and sending of barrier liquid from and to mechanical seal;
- Drainage connection
- Pressurisation connection
- Cooling coil Inlet and outlet
- Refilling connection;
- 2 extra connections for additional instrumentation requested
- Level indicator (sight glass)
- Thermometer placed on the seal return circuit;
- Pressure gauge;

Other accessories, instrumentation and flanged connections available on request.

3.6 Instrumentation

The standard instruments and accessories are supplied on all reservoirs are:

⇓

PRESSURE INDICATOR	P1
THERMPERATURE INDICATOR	TI
LEVEL INDICATOR	LI

On request the following can be provided

PRESSURE SWITCH	PS (H / L)
LEVEL SWITCH	LS (H / L)
RELIEF SAFETY VALVE	PSV

CHECK VALVE

FILLING FUNNEL
AUXILIARY RESERVOIR
CONNECTIONS WITH VALVES
CIRCULATION PUMP

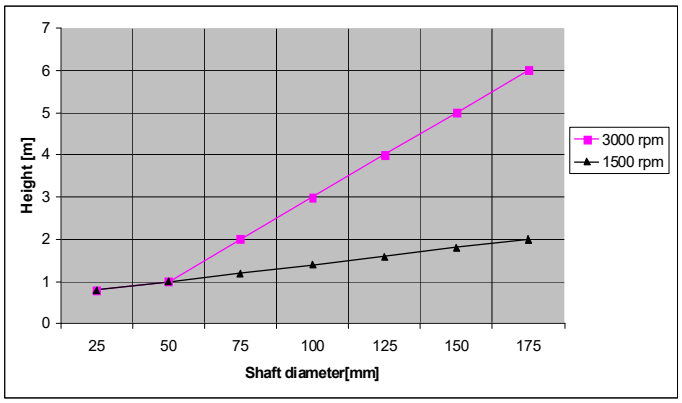
The choice of instrumentation is based on the operating conditions as well as the specifications of the plant in which the reservoir will be employed

3.7 Installation and connections

For efficient circulation of the barrier fluid it is important to implement the following recommendations:

3.7.1. HEIGHT OF RESERVOIR POSITIONING

The positioning of the reservoir is established in function of the diameter of the mechanical seals on which it is applied, to the speed of the machine and of the service for which it is intended.
The height of the reservoir positioning is always referred to as MINIMUM LEVEL (MIN) of the barrier liquid, for optimum operation even in extreme conditions.
Using the section of the chart below, one can determine the installation height.
The graph below shows the required height for a given shaft size and shaft speed.
As a general rule the reservoir must be installed at least 0.8 meters above the mechanical seals.



3.7.2. ORIENTATION AND SUPPORT OF THE RESERVOIR

Position the reservoir in such way that ensures easy reading of the instruments and accessibility to the valves.
The reservoir is provided with a special bracket to connect it to a dedicated stand; it must bear the weight of the reservoir in operation; the 12 litre reservoir weighs about 20 kg.

3.7.3. CONNECTIONS TO THE MECHANICAL SEALS

Install the reservoir as close as possible to the mechanical seal.
In order to reduce passive resistance and pressure losses in the circuit, avoid tight corners, elbows, and complicated circuits,. The circuit must be self-bleeding to avoid air pockets forming.

Do not install shut-off valves on the circuit, which may cause interruptions of the circulation of the liquid.

3.7.4. EXTERNAL CONNECTIONS

a) *Using double pressurised mechanical seals (API PLAN 53*):

Connect the safety valve to bleed line of the venting system and to the pressurisation line to the corresponding attachment site on the reservoir.
A check valve should be fitted to prevent abnormal back pressure inside the reservoir.

b) Using double tandem mechanical seals (API PLAN 52):

3.7.5. ELECTICAL CONNECTIONS

Refer to the instructions of the terminals and to the manuals of each instrument installed..

3.8 Barrier Fluid

The chosen fluid must be.

a) Free from foreign substances, have a good fluidity and be able to prevent the formation of deposits or sedimentation. Fluids normally used are listed below.

b)

Operating temperature (°C)	Type of Fluid
-100 / 0	Isopropyl alcohol
-40 / + 100	Ethylene glycol
-10 / + 120	Light oils (viscosity of 2 – 3 °E @ 50°C)
+120 / + 350	Oils for high temperatures

The use of water is recommended when the environmental and operating temperatures do not create vaporisation, ice or sedimentation of salts, all of which would compromise the correct functioning of the mechanical seals

c) Resistant to aging

d) Stable in operating temperature and pressure, and prevent vaporisation, solidification and of foam

e) Compatible with the process fluid; if the mechanical seal should break, there may be contamination between the two fluids

f) Compatible with the environment; ts leakage into the atmosphere must be admissible

3.9 Start-up

Before starting-up the machine, (e.g. pump or mixer) carry out the following operations:

3.9.1. PRESSURISED DOUBLE MECHANICAL SEAL (API PLAN 53)

a) Ensure the tank is topped up tp the maximum level indicator, (MAX) indicated on the drawing; do this by opening the vent valve;

b) If fitted, close the shut-off valve between the storage reservoir and reservoir, completely fill the storage reservoir and close the vent valve on the filling funnel;

c) Open the pressurisation circuit valve; the pressure inside the reservoir must be kept at a value of about 1 - 2 bar (g) higher than the operating pressure (generally the reservoir pressure, in the case of mixers or aspiration pressure in pumps).
During operation ensure that there are no fluctuations in pressure of the process fluid and of the circuit;

d) The reservoir pressure is indicated by the pressure gauge supplied;

d) When supplied, make sure that the point of the pressure switch (SET POINT) is appropriate to the operating conditions, approximately 0.5 to 1 bar (g) lower than the pressure of the reservoir operating normally in pressure drop;

3.9.2. USING NON-PRESSURISED TANDEM SEAL (API PLAN 52)

a) Fill the reservoir with the selected fluid for the operation until reaching the maximum level (MAX) indicated on the drawing, do this by opening the vent valve;

b) If installed, close the shut-off valve between the storage reservoir and reservoir, completely fill the storage reservoir and close the vent valve on the filling funnel;

c) The reservoir pressure is indicated by the pressure gauge supplied;

d) Where provided, make sure that the (SET POINT) point of the pressure switch is suitable for the operating conditions, i.e. 0.3 to 0.5 bar (g) lower than the pressure upstream of the mechanical seal, normally in pressure increase

e) Check that there are no leakages in the circuit connections

f) Connect the cooling circuit; we recommend installing the control valve upstream of the circuit with the indicator (indicating the flow) downstream

g) Make sure the machine (e.g. pump or mixer) is filled with liquid up to the operating pressure to prevent dry-running of the product-side seal

h) Check the electrical connections of installed equipment.

4. INSPECTION AND E MAINTENANCE

The reservoir does not have special openings for internal inspection; if necessary, an endoscope can be used.

After each decoupling of flanged joints (also valid for the level indicator present on the reservoir), always replace the gaskets.

During normal operation of the machine, correct operation is maintained by ensuring that the level never falls below the minimum level (MIN) admissible; should this occur, perform the refilling operations.

The level should be checked periodically (recommended frequency: every 48 hours of continuous operation).

Make sure that the return pipe from the mechanical seal to the reservoir is at a temperature higher than that of the supply pipe to ensure an effective circulation of the flushing liquid.

Verify the proper functioning of the cooling coil.

WARNING:

The level of the operation flushing liquid must never go below the minimum value indicated on the drawing (MIN).

NAMEPLATE INFORMATION:

Every reservoir is supplied with a nameplate which indicates the main features of the reservoir, calculation and design parameters.