MINISTRY OF ENERGY
THERMAL POWER PLANTS HOLDING COMPANY
TPPH

GHODS NIROO
ENGINEERING COMPANY

ZAHEDAN GAS POWER PLANT PROJECT (1x42MW – MGT40)
ENGINEERING, PROCUREMENT AND COMMISSIONING (EPC) SERVICES

LUBE OIL PURIFIER SKID- SYSTEM DESCRIPTION

IN-HOUSE REVISIONS							DOCUMENT REVISIONS					
A4							D					
A3							C					
A2							B					
A1							A					
A0	1ST ISSUE	RAMEZANI	SHIRI		VALIZADEH	FEB-18	0	1ST ISSUE	RAMEZANI	SHIRI	VALIZADEH	FEB-18
Rev.	DESCRIPTION	PREP	CHKD	HEAD	APPR	DATE	Rev.	DESCRIPTION	PREP	CHKD	APPR	DATE

MAPNA GROUP (PUBLIC STOCK)		MAPNA TUGA MAPNA TURBINE ENG. & MANUFACTURING CO		DOC TITLE: Lube Oil Purifier Skid- System Description		CONTRACT NO.:
MAPNA DOC. NO.	REV	CONTRACTOR DOC. NO.	REV	OWNER DOC. NO.	REV	DESIGN STAGE: BASIC DESIGN
DPO/PZ-01/TG-M-04-TG3-377	A0	RF-DD-09-OP260-A-303	0	MP-PZG-11M1-04-TG3-377	0	Page **1** of **22**

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1 INTRODUCTION

This document has been generated for 1x42 MW Gas Power Plant, located in SISTAN AND BALUCHESTAN Province, about 5.0 km to ZAHEDAN City.

1.1 Definitions

Owner: Thermal Power Plants Holding Company (TPPH).

EPC Contractor: MAPNA Group Company.

Vendor/Supplier: The firm or company who manufactures or supply material, equipment/system and/or provide services for the performance of his scope of work.

1.2 References

1.2.1 Documents and Drawings

Followings are reference Documents/Drawings referred to in this document:

Table 1: Reference Documents and Drawings

NO.	DOCUMENT NO.	DOCUMENT TITLE	REV.
1	MP-PZG-11M1-02-TG3-377	Lube Oil Purifier Skid - P & ID	0
2	MP-PZG-11M1-01-TZ3-372	Lube Oil Purifier Skid- General Layout	0

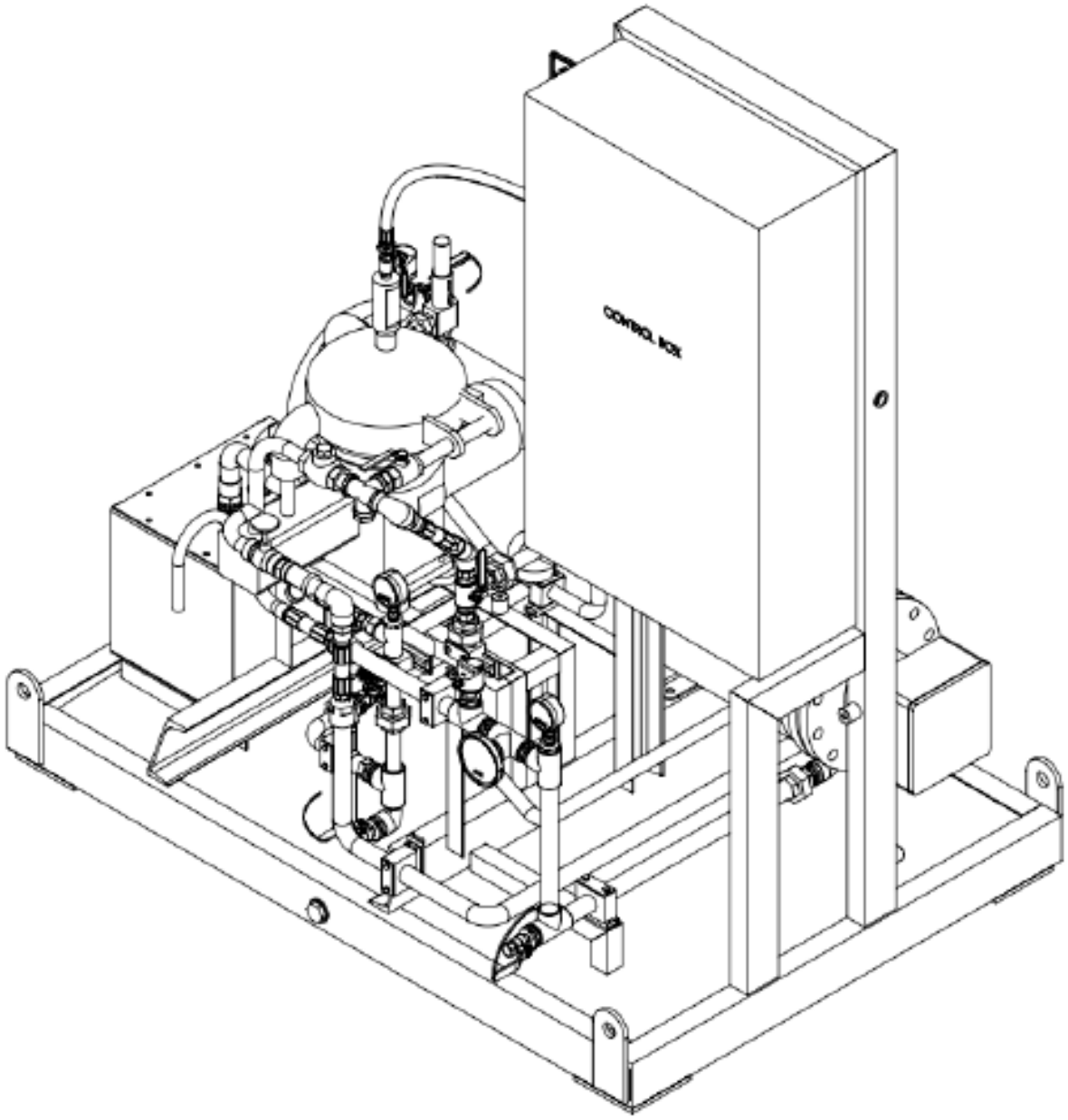
1.3 Site Condition and Data

For Site Data, Seismic Condition and Environmental Consideration of ZAHEDAN Gas Power Plant, reference shall be made to "Basic Engineering Design Data; MP-PZG-50GC-00-PG3-001".

Settings, limits and measuring ranges of the devices listed here are given as guideline values, the exact values will be generated separately as project specific documents.

PURIFIER MODULE

MAPNA MAB 103



2 INTRODUCTION

Present Maintenance Manual contains the information regarding operational safety, transport, storage and routine maintenance of purifier module.

ATTENTION

Before assembly and start-up of the purifier module it is necessary to acquaint with the content of this manual and Alfa Laval No. 1270118-02 Rev. 10 manual.

3 OPERATING SAFETY

Present manual contains basic safety rules, which should be adhered during assembly, start-up, maintenance and operation of the purifier module. Therefore it is important for the maintenance staff and people engaged in assembly to familiarize themselves with this manual before assembly and start-up of the purifier module. The manual should be kept at an accessible place and where the assembly is carried out.

3.1 Marking of instructions

- Instructions essential for maintenance staff safety are marked with general symbol:

- Instructions concerning the danger of electric shock are marked with symbol:

- Instructions of significant importance for correct operation the device are preceded with word:

ATTENTION

3.2 Staff qualifications

Personnel involved in operation or maintenance of the oil unit have to be qualified appropriately. The range of their responsibilities, competence and duties should be controlled entirely by the customer. The staff without appropriate qualifications must be trained and instructed. On customer request such training might be carried out by the unit manufacturer / supplier. Additionally the customer should assure that this instruction is completely understood by the staff.

3.3 General requirements for safety at work

- To acquaint position 2 of „Safety instructions" of Alfa Laval, No. 1270118-02 Rev. 10. To take precautions during works carried out close to devices being in operation, e.g. under no circumstances do not open cover of the purifier module until the drum stops.
- To keep clean the external surface of devices of purifier module and electric motor, to eliminate possibility of dust self-ignition
- To remove all oil leakages, because of direct danger for the maintenance staff. In case of oil leaks in pressure installations it is necessary to remove the leakage by means of tightening screws or fittings. These activities are permissible only when system is depressurized.
- To switch off the electric tension during assembly or maintenance works.

3.4 Dangers caused by not obeying the manual

Not obeying this manual causes danger for safety of maintenance staff, the device and environment. Proceeding contrary to the instruction may cause loss of the guarantee. Inappropriate use may cause: • Danger for maintenance staff out of mechanical, electrical or chemical influence reasons.

- Damages of main or auxiliary functions of the device.
- Environmental contamination as a result of deleterious substance leaks.

3.5 Unauthorized modifications

All the modifications are allowed only with permission of the device supplier / manufacturer. The device manufacturer admits of using only original spare parts of unit components. Application of spare parts other than original ones may be the reason of losing the guarantee.

4 TRANSPORT

Purifier module must be transported by another transport device. General guidelines regarding loading and lifting are listed below:

4.1 General safety remarks

- Purifier Module can be lift by fork-lift truck, or lifting gear and ropes with crane device, because of special leads on bottom of frame.
- For moving and loading the module, use lifting gears and ropes, which are adequately selected and meet local safety regulations
- During handling of the oil unit all the precautions should be taken and it is necessary to eliminate accidental stay of any person directly under the lifted part.

4.2 Lifting

- Before lifting electric cable should be wind up and mounted in recommended place on frame of the purifier module.
- Before lifting elastic hoses should be mounted on frame of the purifier module without possibility of slip.

ATTENTION

It is forbidden to lift the purifier module by means of its parts like pipes, engines and other components not provided for that purpose.

- If there is a possibility of damaging equipment of purifier module during the lifting, or if this equipment interfere to safety lifting, it should be disassemble.

ATTENTION

Dismounted equipment and connections from purifier module should be secure from infiltration of dirtiness into module.

4.3 Transportation

- Before transportation all connections should be blinded. • For longer transportation, or longer storage, it is essential to disassemble separator drum, to avoid damage of drive shaft bearing. For further information look to ALFA LAVAL, No. 1270118-02 Rev. 10 manual.
- During transportation purifier module should be secure for spontaneous moving.

- After transportation it is essential to check all components condition of purifier module. Noticed damages must be immediately reported.

5 STORAGE

- Before storage oil reservoir and pipelines should be empted.
- For longer than 1 month storage, it is essential to disassemble separator drum, to avoid damage of drive shaft bearing. For further information, look for ALFA LAVAL, No. 1270118-02 Rev. 10 manual.
- The purifier module should be stored in a closed and heated store-room. In case of storage in not heated store-room, purifier module should be corrosion protected. If storage in closed store-room is not possible, purifier module can be stored outside, only if purifier module has appropriate package and is corrosion protected.
- It is forbidden to store in the same room and at the same time chemically active substances like acids, lyes, salts, organic solvents etc., and charged batteries.
- During storage all connections and free cable inlets should be blinded.

6 PURIFIER MODULE DESCRIPTION

Purifier module is designed for removing solid contamination, water and most water in oil. To obtain a purifier module high efficiency temperature of oil should be at 45÷650 C level. Purifier module is equipped in flow oil heater. In his opinion, it is to keep temperature 45÷650 C. Purifier module can run in lower temperature only if efficiency of purified module is lowered. Otherwise water seal might brake down and oil will leak to leakage reservoir.

6.1 Structure

Figure 1. present purifier module with main parts:

- Centrifugal separator (pos. 1),
- Flanged immersion heater (pos. 2),
- Safety relief valve (pos. 3),
- 3-way ball valve hand operated (pos. 4),
- Resistance thermometer (pos. 5),
- Calorimetric flow sensor (pos. 6)
- Base frame (pos. 7),
- Pressure vessel, cylindrical horizontal (pos. 8),
- Tank atmospheric, cylindrical horizontal (pos. 9),
- Bourdon tube pressure gauge (0÷10 bar) (pos. 10),
- Bourdon tube pressure gauge (0÷4 bar) (pos. 11),
- Bimetal thermometer (pos. 12),
- 2-way ball valve hand operated (pos. 13, 17, 22, 23, 25),
- Y – Strainer (pos. 14, 18),

- Globe valve (pos. 15, 24),
- Check-relief valve (pos. 16)
- Check valve (pos. 19),
- Float level switch (pos. 20),
- Electrical control system (pos. 30).

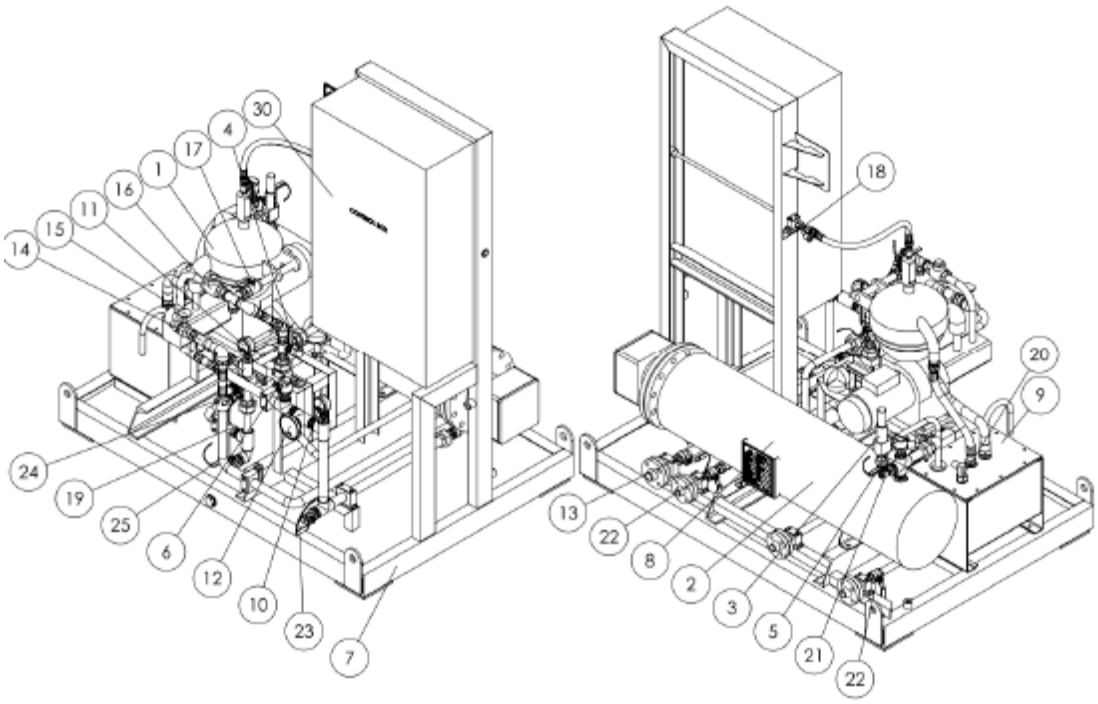


Figure 1. Purifier Module general view with main parts specified

7 ELECTRICAL CONTROL CABINET

7.1 Purpose

Each lube oil purifier set has its own control cabinet. The control cabinet enables local control (trough push buttons). The electrical control cabinet is equipped with EMERGENCY STOP button, which should be used for stop of operation of all devices in emergency.

7.2 Power supply

The control cabinet is supplied with 3x400 VAC (+N, PE) power supply. To provide appropriate electric shock protection it should be connected to a local power system with a five-core cable cross section 6 mm2. Power supply of heater is protected with 40 A circuit breakers. Control circuit is protected with a 6 A circuit breaker. No other supply is required for proper operation of the control cabinet.

ATTENTION

Phase sequence should checked, before pump will be flooded with oil, to avoid wrongly rotating motor.

7.3 Local control

To operate the control cabinet main power switch (-2F1) needs to be switched to ON position. Also inside control cabinet circuit breakers : -2F2, -3Q1, -3Q3 and -7F1 needs to be switched ON.

Buttons and switches description

Symbol	Button description	Button colour	Function
8S1	START	Green	Start of program.
8S2	STOP	Red	Stop of program.
8S3	EMERGENCY STOP	Red/Yellow	Emergency stop. Shutdown of main power relay (-2Q1).
8S1	RESET	Blue	Reset of alarms
2F1	MAIN SWITCH ON/OFF	Red/Yellow	ed/Yellow Switch-on and off the supply voltage.

Indicator lights description

Symbol	Signal lamps description	Colour	Function
7H1	POWER ON	White	Power on. Main power relay is closed.
7H2	PURIFIER MOTOR RUNNING	White	Purifier motor is running. Motor circuit breaker (-3Q1) and relay (-3Q2) are closed.
9S1	START	Green	Program started.
10H1	HEATER ON	White	Heater is working.
10H2	TANK LEVEL ALARM	Red	1) Flashing – tank is full in 50% 2) Continuous – tank is full in 90%. Also signalized on driver screen.
10H3	GENERAL FAULT	Red	1) Main power relay (-2Q1) is not closed. 2) Purifier motor circuit breaker (-3Q1) is not closed. 3) Feed pump motor circuit breaker (-3Q3) is not closed. 4) Heater protection switched from CLOSED to OPEN position. Switching point is 80oC. Also signalized on driver screen. 5) Temperature of oil is above 75°C and purifier unit will stop after 5 minutes. 6) Emergency pushbutton is switched. Also signalized on driver screen. 7) Loss of flow. Also signalized on driver screen.

8 PURIFIER MODULE MAINTENANCE

Purifier module service contains preparation to start-up, normal operation and stopping.

8.1 Start-up preparations

8.1.1 Separator drum assemble

If drum was not assembled earlier, it should be mounted. Drum can be used in two options:

- as clarification,
- as purification.

Purification option is correct assemble for drum to remove water and solid contamination from oil. For further information about this option look at position 3.2 of ALFA LAVAL, No. 1270118-02 Rev. 10 manual.

Instruction for separator drum assemble is at position 6.3.3 of ALFA LAVAL, No. 1270118-02 Rev. 10 manual.

ATTENTION

Special spanners should be use for assemble the separator drum.

8.1.2 Gravity disc choice

For the best result of purification the gravity disc should have as large diameter bore as possible, although it can't broke water seal. For mineral oil, VG32 viscosity class, density 880kg/m3 optimum gravity disc has 63 mm diameter. It should be installed. The placement of gravity disc I shown at position 8.3 of ALFA LAVAL, No. 1270118-02 Rev. 10 manual

8.1.3 Drum installation and separator cover lock correctness check

Before starting-up drum installation and cover lock should be check according to position 4.1.3 of ALFA LAVAL, 1270118-02 Rev. 10 manual:

- make sure that the bowl is clean and that the separator is properly assembled,
- make sure that the bolts of the outlet cover and the hooks and screws for the frame hood are fully tightened, - make sure that all couplings and connections are securely tightened to prevent leakage
- make sure that the inlet pipe is tightened,
- read the oil level. The line in the middle of the sight glass shows the minimum level. Refill if necessary,
- release the brake,
- make sure the direction of rotation of the motor and bowl corresponds to the sign on the frame

8.1.4 Separator's gear oil level check

Oil level should reach to middle of optic indicator. If gear is not manufactured filled, fill with VG220 viscosity class oil. For further information look at 5.5 position of Alfa Laval No. 1270118-02 Rev. 10 manual. According to position 8.9.2 of Alfa Laval No 1270118-02 Rev. 10 manual use proper kind of oil.

8.1.5 Purifier module emplacement

- purifier module should stand nearby oil reservoir connections,
- make sure the space around purifier module is enough for easy access.

8.1.6 Elastic hoses connection

Elastic hoses connect to correct connections at oil reservoir. Suction hose must be connected to bottom connection and discharge hose must be connected to top oil reservoir connection.

8.1.7 Valves position set up

- open suction valves and discharge port,
- fully open control valve (pos.24) after that, close it with 2 full revolutions,
- close all drain valves. .

8.1.8 Electric connection

According to the table below purifier module should be connected:

Sign	Parameter	Value
Un	Supply tension	3x400V AC
fn	Nominal frequency	50Hz
Pmax	Maximum power consumption	15kW
-	Supply wire conductor marks	L1, L2, L3, N, PE
-	Minimal cross-section of supply wire	5x6mm2

Electric connection should be done by qualified staff.
Local safety regulations must by obeyed

8.2 Start-up and operation

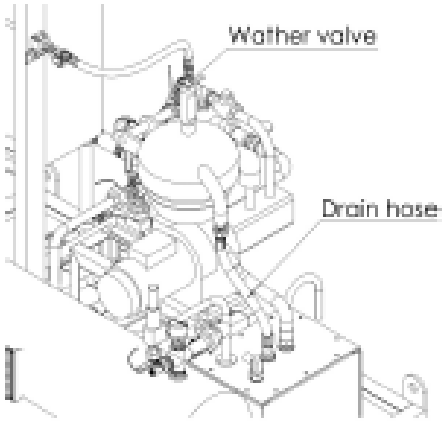
When you first start the separator must be to flood the pump with oil.

- Ensure min oil temperature 40°C at attempt tank

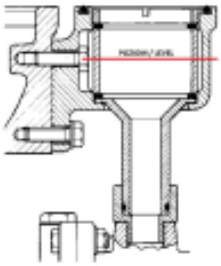
- Turn red/yellow main power switch (-2F1), mounted on front door, to vertical position ON.
- Check the direction of rotation. The revolution counter should run clockwise,

Revolution counter

- Push blue pushbutton RESET to erase all faults.
- Push green pushbutton START. Separator will start working
- When you turn on the separator to the flooding oil may not exceed 15 minutes. After the time, you should valve pos. 4 to direct to the separator in order to flood the pump oil.
- After dispersal of the drum of separator to rated speed to pour water (about 1 liter) to separator chamber using “water valve”, to create a water seal to overfill water by heavy phase outlet and then to close this valve. For the information about exceeding water shown in the drawing,



- •Three-way valve pos. 4 direct slowly to separator to prevent the rupture of a water seal and then to fill drum by oil,
- Check on manometer pos. 11 the pressure value. If it is lower than 1 bar should by control valve pos. 24 to set a pressure 1,5÷2 bar on leaving separator,
- Maintain a constant oil level sight glass - see the drawing below. Lack of adequate flow results in a rupture of a water jacket,



- • During start the current reaches a peak and then slowly drops to a low and stable value.
- • Purifier motor will work in range between 45°C and 65°C. If temperature will decrease above 75°C :
  - lamp GENERAL FAULT lights red,
  - heater shuts down,
- Purifier unit will shut down after 15 s if there will be no flow and GENERAL FAULT lamp will lights.
- Purifier will shut down if tank level reach 90%. Range between 50-90% will be signalized by flashing TANK LEVEL ALARM red lamp,

Purifier module during start-up should be attentively looked,
pay attention at abnormal noise or vibrations, if there is any suspicion of abnormal operation,
purifier module must be switch off.

8.3 Purifier module normal stop

- press the STOP button on the board of the electrical box to stop the operation of the module, when you press the system works 5 minutes without heater,
- after 5 minutes the system should shut off. When switching the device off, do:
- feed sealing water until water flows out through the water outlet. Then close this feed,
- turn off the oil feed. The valve pos. 4 direct to circulation,
- pull the brake. Wait until the separator has come to a complete standstill (2-5 minutes).

ATTENTION

After turn off should observe for any sings of rise in temperature on the heater.
In case of increase on/off system and wait another 5 minutes to cool the heater.

8.4 Purifier module emergency stop

In case of danger press EMERGENCY STOP button, which is at junction box switch board. Purifier module will be entirely disconnected from electric tension.

9 PURIFIER MODULE SERVICE

Purifier module service is mostly about separator service. Before any separator service works look at position 5 of Alfa Laval, No 1270118-02 Rev. 10 manual. Alfa Laval manual gives information about how often should service be done.

10 DETECTION AND REMOVING DEFECTS

To see most common problems, and how to remove it look at position 7 of Alfa Laval, No. 1270118-02 Rev. 10 manual.

11 OPERATING AND MAINTENANCE INSTRUCTIONS OF COMPONENTS

No.	Description	Producer	Element type
1	Centrifugal separator	ALFA LAVAL	MAB 103B - 24
2	Flanged immersion heater	LIMATHERM	ZGR – 4xFI50x1200-14kW/V=400
3	Safety relief valve	LESER	4384.2982
4	3 – way ball valve	SFERACO	780005
5	Resistance thermometer	LIMATHERM	AP2TOPGB-11-100-9-G1/2-3-2-LTT-0-3BU-DANAD
6	Calorimetric flow sensor	IFM	SI6600
7	Pressure gauge	WIKA	213.40
8	Thermometer	WIKA	A52
9	2 – way ball valve	SFERACO	708006
10	Y - Strainer	ALFA LAVAL	1”
11	Globe valve	ALFA LAVAL	G1”
12	Check - relief	ALFA LAVAL	G1”
13	2 – way ball valve	ALFA LAVAL	G ¾”
14	Y - Strainer	FEST	¼”
15	Check valve	SFERACO	320005
16	Float level switch	KTR	NVT-22-1-0-DM12KTR
17	2 – way ball valve	SFERACO	708002
18	2 – way ball valve	SFERACO	708005
19	2 – way ball valve	LEGRIS	4902 15 21
20	Globe valve	THERMADOR	G ¾” – female PN16 RB
21	2 – way ball valve	SFERACO	708004

12 PURIFIER MODULE PARTS LIST

13 ATTACHMENT

Fig1.MAB 103B-24, with feed and discharge pump.

Applications

The MAB 103 is a solids-retaining centrifuge in clarifier or purifier execution. It is used for separating mineral oils such as (fuel and lubricating oils, hydraulic, running in and metal working oils).

Working principle

The feed is introduced to the rotating centrifuge bowl (fig2) from the top (1) and is accelerated in a distributor (2)before entering the disc stack (3). It is between the discs that the separation takes place .

The water and the heavier solids are forced towards the bowl wall where the solids accumulate and the water proceeds over the top disc (4) to an open outlet (5).The light phase moves towards the centre and leaves the bowl through an open outlet (6). In clarifier design the heavy phase outlet is closed by the top disc without neck (7).

The light phase proceeds out through the discharge neck (8).The machine needs to be stopped at intervals for manual removal of the solids. The bowl is mounted on a vertical spindle (9) driven by a horizontally mounted motor, via a worm gear

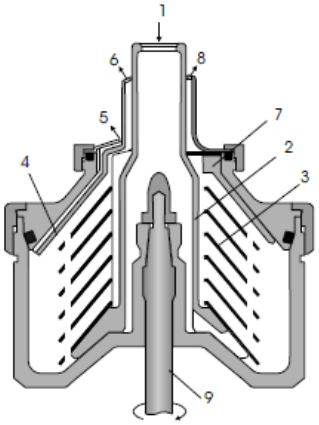


Fig2.Typical bowl drawing for a solids-retaining centrifuge. The right side shows clarifier execution and the left purifier execution. Drawing details do not necessarily correspond to the centrifuge described.

Features and benefits

Robust design with the following benefits

- Simple installation, operation and maintenance.
- Flexibility:——————————————The bowl may be used either as purifieror clarifier.

Standard design

Solids retaining separator comprising a frame containing in its lower part a horizontal drive shaft with friction clutch and brake, worm gear and vertical bowl spindle. The worm gear is placed in an oil bath.

The bowl is fixed on the top of the spindle inside the space formed by the upper part of the frame and the frame hood. The frame hood is hinged to facilitate easy access for cleaning the bowl, which is of solid- wall disc type.
The separator is equipped with a built-in feed and discharge pump.

Technical specification

Max. throughput capacity	1.4 m3/h 1)
Sludge and water space	0.57 l
Feed temperature range	0 - 100 °C
Installed motor power	0.75 kW
Noise level (ISO 3744 or 3746)	64 dB(A)

1)Actual capacity depends on composition of feed and separation demands.

Utilities consumption

Electric power	0.4 – 0.6 kW 1)

1)Actual consumption depends on throughput capacity, feed characteristics.

Shipping data (approximate)

Centrifuge with bowl and motor	
Net weight:	101 kg
Gross weight:	121 kg
Volume:	0.4 m3

Main dimensions (approximate)