

Technical Service

EKOSTAR Gas Heat Pumps

(Gas Heat Pumps)

Type:	EKOSTAR Gas Heat Pumps
Fuel:	Natural gas LPG
Refrigerant:	R407C / R507 / R134a
Valid since:	September 1, 2015



1.	INTRODUCTION – MAINTENANCE AND REPAIR	3
1.1	SCOPE OF TASKS PERFORMED BY THE OWNER (OPERATOR)	3
1.2	SCOPE OF TASKS PERFORMED BY SERVICE ORGANIZATION - TECHNICAL SERVICE AND SCHEDULED REPAIRS	5
2.	SCOPE OF WORKS PERFORMED BY THE SERVICE ORGANIZATION.....	6
2.1	TECHNICAL SERVICE 1 (TS 1)	6
2.2	TECHNICAL SERVICE 2 (TS 2)	8
2.2.1	TASKS PERFORMED DURING TS 2 AFTER NO MORE THAN 24 MONTHS	8
2.3	MEDIUM REPAIR	9
2.4	GENERAL OVERHAUL	9
3.	SERVICE TIME LINE OF TECHNICAL SERVICE AND PLANNED REPAIRS	10
3.1	PLANNED TECHNICAL SERVICE.....	10
3.1.1	FREQUENCY OF THE ENGINE OIL STORAGE REPLACEMENT	10
3.1.2	SHORTENING OF DEADLINES FOR SERVICE WORKS	10
4.	LIFE EXPECTANCY OF GHP COMPONENTS.....	11

1. Introduction – Maintenance and Repair

In the course of operation of GHP its individual parts change, get old, and wear out, and these parts require adjustment, maintenance, repair, and replacement. This refers to duties which are separated into:

- Tasks performed by the owner (GHP operator)
- Tasks performed by service organization authorised by the EKOSTAR to carry out the service activities (hereinafter "service organization")

WARNING!: EKOSTAR reserves the right to amend this document on the basis of new knowledge from operations and results of the research and development of GHPs.

1.1 Scope of Tasks Performed by the Owner (Operator)

Owner (GHP operator) shall carry out basic maintenance, minor repair and preventative measures to the GHP which are specified in:

- Operation and Maintenance Manual: Mechanical Part
- Operation and Maintenance Manual: Electrical Part

In the case of particular tasks the manual may contain a reference to a separate document which is a part of the accompanying documentation for the GHP.

Basic tasks performed by the operator are listed in the table below:

Activities	Interval
Checking the oil level in engine and replenishment tank, filling new oil into the replenishment tank	Once a week
Test operation of the GHP in the event of engine downtime during the previous running period	Once a month

Any issues (fault conditions) requiring intervention beyond the scope defined above must be consulted with the EKOSTAR service organization. Based on the nature of the defect additional procedures will be determined, which may include the dispatching of service organization and the carrying out of the repair.

It is recommended the owner to carry out the preventive tasks listed below. These activities are of a preventative nature. Their purpose is to ensure consistent and faultless operation:

Activities	Interval
Visual inspection of aggregate – outer tightness of the lubrication system, cooling system, primary circuit, suction and exhaust system, gas line tightness test	Once a week
Checking the oil level in compressor – visual check of the level in the compressor's sight glass	Once a week
Checking the compressor for leakage – visual check for possible leaks of oil	Once a week
Checking the pressure and levels of coolant in the primary circuit	Once a week
Inspection of cleanliness of cooling units (if installed)	Once a week
Analysis of the chemical composition of the storage of the secondary circuit – pursuant to the document – “Technical Instruction – Water Circuits” ¹⁾	Once a year

1) These documents are a part of the accompanying documentation for the GHP.

WARNING!: The activities described herein do not necessarily have to cover the entire subject matter of the GHP maintenance. These are better covered in the accompanying documentation folder for the relevant GHP: "EKOSTAR GHP Operation and Maintenance Manual", furthermore "GHP Operation and Maintenance Manual – Electrical Part".



1.2 Scope of Tasks Performed by Service Organization - Technical Service and Scheduled Repairs

It is a series of planned works which need to be performed on the GHP at regular intervals. These group tasks apply to the respective GHP:

- Technical Service 1 (TS 1)
- Technical Service 2 (TS 2)
- Medium Repair (MR)
- General Overhaul (GO)

The scope of these activities is defined in the section entitled “Scope of tasks performed by the service organization”. The frequency of these tasks is based upon the following factors:

- 1) **Based on the number of operational hours since the last service.** The interval is defined in Section 3 entitled “Service Time Line of Technical Service and Planned Repairs”. The control system of the GHP gives warnings regarding the current number of working hours to the next technical service.
- 2) **Based on the number of calendar days.** Calendar days are taken into consideration if, pursuant to paragraph 1 above, the number of working hours over a certain period of time in itself is insufficient – see notes in Section 3.

The aforementioned tasks are performed on the basis of a notice sent by the owner to the service organization. The owner is obliged to inform the service organization about the technical service one week ahead.

WARNING!: The criteria stipulated for natural gas in this document apply in case of the GHP intended for LPG fuel, unless otherwise stated.

2. Scope of Works Performed by the Service Organization

2.1 Technical Service 1 (TS 1)

Technical service TS 1 consists of the following tasks:

Lubrication system	natural gas / LPG	Replacement of oil in the combustion engine
		Oil filter replacement
		Lubricating system operation check
		Tightening screws in the engine oil pan
Engine head		Checking the valve embedding (measured from the cylinder heads) according to the actual wear and tear, replacement if required
		Valve clearance inspection, adjustment (if necessary)
		Depending on the TS 1 interval – every even TS – measuring and recording the compression pressures
		Spark plug replacement
Compressor		Checking the screws for tightness, oil level – checking the oil purity in sight glass
Output control		Inspection of the attachment of the actuating unit, maintenance of the butterfly flap control mechanism, cabling inspection, inspection of proper function of regulation, setting if required
Cooling systems		Checking the level of the equalizing reservoir of primary circuit (replacement if required)
		Checking the condition of rubber hoses, checking the tightness of the cooling system joints (repair if required)
		Inspection of water pump tightness and operation (repair, if necessary)
		Checking the fluid pressure in secondary circuit (adaptation if required)
		Checking the fluid level in primary circuit (adaptation if required)
		Bleeding air out of the cooling circuit
		Inspection of the pollution of external cooling units (if installed), cleaning and inspection of condition and function, if applicable
Exhaust gas and suction line		Measurement of the back-pressure of exhaust gases, and if necessary, cleaning the exhaust heat exchanger (if installed)
		Inspection of the suction and exhaust system, tightening screws of the suction of exhaust system of the combustion engine
		Inspection of exhaust conduit tightness in GHP (removal of leakages if necessary)
		Inspection of the overall condition of the flue conduit insulation in GHP, replacement if required by the actual wear and tear
		Checking tightness of the combustion air suction line in GHP (removal of leakages if necessary)
Cooling Circuit		Checking the cooling circuit for tightness, checking the cooling circuit for function
Sound enclosure		Checking the sound enclosure's door (replacement of seals if required)
Ignition		Cleaning and adjusting of the sensors
		Ignition – inspecting the primary cabling contacts for fixing

Fuel system	Inspection (and cleaning, if necessary) of the gas filter element
	Zero governor setting inspection
	Gas inlet pressure inspection at the inlet
	Inspection of the gas line for tightness (removal of leakages if necessary)
	Inspection of clogging in the combustion engine's air filters (replace if necessary)
	Inspection or adjustment of the mixture richness regulation system, operation check under the rated output
Electro installation	Checking switchboard and filters for condition and cleanliness
	Inspection of the overall condition of installation, insulation, sensors, cables and their fastening, replacement of thermocouple if necessary
	Inspection of power contacts between starter – starting device or battery (if used)
	Battery maintenance and charging control (if used), replacement if required by the actual wear and tear
Others	Measuring of temperature drops on the primary and secondary part of the primary circuit heat exchanger at nominal power (adjustment of the control flow valves if necessary)
	Inspection, repair or re-installation of loose or damaged parts and insulation (mechanical covers)
	GHP engine and interior cleaning
	Checking the engine for mounting, vibrations, inspection of mechanical covers for integrity, replacement of shock mounts according to the actual wear and tear
	Gas consumption verification (if the gauge is installed in the gas line of the engine house)
	Inspecting the crankcase for the internal pressure setting, adjustment if necessary
	Trial run at nominal power – emission limits, stable operation, exhaust gas temperatures, lubricating pressure, ventilation system inspection, compressor check (noise, oil return)
	Make workplace clean and tidy, complete relevant documents
	Other works – application of the adhesive sticker (label) with data about the next TS, completion of the job card, completion of the protocol on technical service (clean the space underneath the sound enclosure), amendment of parameters about the TS in CS, downloading of the GHP history
	Sealing of the ignition and regulating elements

2.2 Technical Service 2 (TS 2)

Technical service TS 2 consists of the activities performed within the framework of TS 1 extended by the following tasks:

Cooling systems	Checking the proportion of antifreeze and corrosion inhibitor in the coolant of primary circuit (check shall be made always before the onset of the heating season), if required, replacement of the primary circuit's charge depending on the operation time - see section "Life Expectancy of Parts"
	Testing the cooling circuit pressure-relief valves for function (throughput)
	Changing flexible hoses – based on their actual condition
Lubrication system	If the oil in the combustion engine has not been changed in the previous 12 months (with minimal equipment operational hours) replace the + filter element
Combustion engine, compressor	Inspection, cleaning, and adjustment of the mixer
	Cleaning the combustion engine
	Inspection of catalytic converter
	checking the motor-compressor connections for connected state + tightness
Fuel system	Tightening all the connections on the combustion engine
	Inspecting the internal seals of the electromagnetic gas valve – see the documentation from the valves' manufacturer
Exhaust discharge gas	Clean the exhaust heat exchanger (according to the level of deposits)
Electrical Installation	Complete testing of safety devices – according to SP-GHP-06_2013
	Inspecting the structural junctions of the unit, tightening all connections
Other works	Tasks in line with the relevant time line sequence – performed no later than after 24 months – see paragraph "Tasks Performed During TS 2 After No More Than 24 Months"

2.2.1 Tasks Performed During TS 2 After No More Than 24 Months

Cooling systems	Replacement of coolants in the combustion engine
-----------------	--

2.3 Medium Repair

Medium repair of the GHP represents such overall repair that includes checks of individual GHP's junctions for their operation, identification of wear and tear for all components, and their repair, if necessary.

From the viewpoint of combustion engine, the medium repair consists of the following:

- Cylinder head replacement, if necessary – according to the actual wear and tear
- when intervening combustion engine - visual check of cylinders / replacement of piston rings, if necessary (repair, if required – based on the course of measured compression pressures)
- when intervening combustion engine - check of the timing mechanism
- when intervening combustion engine - re-seal the engine when repairing it
- taking a sample of the compressor oil (replacement if necessitated by the result)

From the viewpoint of GHP, the medium repair consists of the following:

- water-to-water heat exchanger replacement if needed (depending on the actual condition)
- exhaust heat exchanger replacement if needed (depending on the actual condition)
- replacement of pumps and three-way valves, if needed (depending on the actual condition)
- replacement of sensors and switches
- replacement of the complete wiring

WARNING!: The medium repair interval can be adjusted based on actual wear and tear.

2.4 General Overhaul

General overhaul of GHP represents type of repairs that are connected with overall renovation of the GHP associated with the replacement or repair of the parts subject to wear:

- relevant parts and material of the medium repair interval
- combustion engine – rework or, if necessary, replacement
- compressor – inspection of wear and tear (consultation with the manufacturer, if necessary)
- gas line - replacement or refurbishment
- thermal insulations - replacement or refurbishment
- gas line elements – replacement
- replacement of the complete wiring

Detailed scope of works is determined upon the wear and tear before and during the general overhaul.

3. Service Time Line of Technical Service and Planned Repairs

3.1 Planned Technical Service

Technical service and planned repairs are performed at service intervals based upon the number of operating hours, as stipulated by the tables below:

Fuel: natural gas, LPG				
Moto hours	TS 1	TS 2 ¹⁾	MR I	GO
3 000	X			
6 000	X	X		
9 000	X			
12 000	X	X		
15 000	X			
18 000	X	X		
21 000	X		X	
24 000	X	X		
27 000	X			
30 000	X	X		
33 000	X			
36 000	X	X		
39 000	X			
42 000	X	X		
45 000	X			
48 000	X	X		X

1) TS 2 shall be performed at least once every 12 months

3.1.1 Frequency of the Engine Oil Storage Replacement

The frequency of oil exchange and oil filter replacement is based upon numerous operation-related factors and it does not necessarily have to be consistent with the frequency of TS 1 (technical service).

In the aforementioned case, the TS 1 frequency can be adjusted so that it coincides with the oil change interval. On the other hand, oil change can be performed as a separate service task.

The actual frequency shall be determined by a service technician based upon the form of operation of the GHP or the results of oil analyses.

3.1.2 Shortening of Deadlines for Service Works

It is necessary to take into consideration that the actual necessity for a particular technical service activity or repair is based on numerous factors. The main factors include the quality and purity of the fuel used or the operating conditions of the GHP (frequency of start-ups, operating load, and coolant temperature).

The data in Section 3.1 is only informative. The actual deadlines for repairs or technical service shall be determined by a technician based upon the actual tear and wear discovered during inspection.

4. Life Expectancy of GHP Components

Life expectancy of components	accumulated Mh or interval
engine oil in the engine + oil filter	natural gas – 3000 ¹⁾
ignition plugs	natural gas – 3000 Mh ²⁾
primary circuit coolant	9 000 Mh, 24 months ³⁾
starting batteries (if used)	24 ÷ 48 months
air filter element, suction air hose	6 000 Mh, max. 24 months
elastic mounts of the exhaust gas system	6 000 Mh, max. 24 months
hose members of the cooling circuits	9 000 Mh, max. 36 months
Lambda probe	9 000 Mh max. 36 months
primary circuit's equalizing reservoir	9 000 Mh , max. 36 months
compressor	60 000 Mh
acoustic cover lid gasket	9 000 Mh
butterfly flap control mechanism	12 000 Mh, max. 24 months
ignition system cables and coils	12 000 Mh, max. 24 months
heat insulation for exhaust piping – removable sections	12 000 Mh
shock mounts for the combustion engine and compressor mounting	12 000 Mh, max. 36 months
engine head	12 000 Mh ^{4) 5)}
catalytic converter	12 000 Mh ^{4) 5)}
thermocouples	18 000 Mh
mixture content control actuator (inching motor)	18 000 Mh ⁵⁾
pumps, three-way valves ...	24 000 Mh ⁵⁾
exhaust gas-water heat exchanger	24 000 Mh ⁵⁾
exhaust silencer	18 000 Mh ⁵⁾
sensors and switches (excluding thermocouples, Lambda probe, or exhaust gas system pressure sensors)	24 000 Mh ⁵⁾
gas line elements	51 000 Mh
heat insulation for exhaust piping – fixed sections	51 000 Mh
cables (not including cables for the ignition system)	51 000 Mh
water-to-water heat exchanger	24 000 Mh

1) earlier in special case of need (penetration of coolant into oil...) – for the used oil type see the "GHP Operation and Maintenance Manual" - the "Fuels - Other Parameters" chapter

2) ignition plugs – for the used type and electrode distance see the "GHP Operation and Maintenance Manual" - the "Fuels - Other Parameters" chapter

3) sooner, if required specifically (ingress of oil charge into coolant ...)

4) if specific GHP's assembly is under repair, minute parts that must be used newly during assembly are replaced additionally – so called Installation SET

5) Replacement according to the actual wear and tear