



AKKAYA
B O I L E R S

USER MANUAL

**KYK H MODEL
THERMAL OIL HEATERS**





INDEX

1. Introduction.....	4
2.General Design and Construction Features.....	6
2.1 Design.....	6
2.2 Working Principle.....	7
2.3 Construction.....	8
2.4 Quality.....	8
2.4.1. Steel Materials.....	8
2.4.2 Tubes.....	8
2.4.3 Welding.....	8
2.4.4 Isolation.....	9
2.5. Product Coding.....	10
2.6. Boiler Name Plate (sample).....	10
3. Transportation Instructions.....	12
3.1. Placing the Heater on Transport Vehicle.....	12
3.2. Transporting The Heater.....	12
3.3. Placing The Heater In The Boiler Room.....	12
4. Installation of HEATER and Auxillaries.....	14
5. Start-Up , Operating, Cleaning and Maintenance.....	18
5.1 Start-Up And Operating The Heater.....	18
5.2 Shutdown And Discharging The Heater.....	20
5.3 Precautions.....	20
5.5 Cleaning & Maintenance.....	20
5.6 Thermal Oil Properties and Quality Tracking.....	21
APPENDIX 1 - Dimension Table of KYK H Model thermal oil heaters.....	23
APPENDIX 2 - system Accessories and Auxiliary Equipment Explanations.....	24
APPENDIX 2.1 Burner.....	24
APPENDIX 2.2 Oil Inlet/Outlet Valves.....	24
APPENDIX 2.3 Oil Inlet/Outlet temperature control and alarm system (Thermocouple).....	25
APPENDIX 2.4 Thermal Oil Heater Oil Inlet/Outlet Pressure Switch.....	25
APPENDIX 2.5 Pressure Transmitter.....	26
APPENDIX 2.6 Thermal Oil Heater Oil Inlet/Outlet Manometer and valves.....	26
APPENDIX 2.7 Thermal Oil Heater Oil Inlet/Outlet Thermometer.....	27
APPENDIX 2.8 Exhaust Gas Temperature Sensor.....	27
APPENDIX 2.9 Thermal Oil Heater Inlet/Outlet Air Vent Valves.....	28
APPENDIX 2.10 Safety Valve.....	28



APPENDIX 2.11 Electrical Control Board.....	29
APPENDIX 2.12 Leakage Tank.....	29
APPENDIX 2.13 Thermal Oil Circulation Pump Group.....	30
APPENDIX 2.14 Thermal Oil Filling Pump Group.....	30
APPENDIX 2.15 Thermal Oil Reserve Tank.....	31
APPENDIX 2.16 Deaerator.....	31
APPENDIX 2.17 Expansion Tank.....	32
APPENDIX 3 -CONTROL SYSTEM STANDARD Alarms Explanations.....	33
High Temperature Alarm.....	33
High Pressure Alarm.....	33
Low Pressure Alarm.....	33
Low Oil Level Alarm.....	33
High Oil Level Alarm.....	33
Oil Leakage Alarm.....	33
Flow Switch Alarm.....	33
Burner Error/ Failure.....	33
Circulation Pump & Feed Pump Operation.....	33
Hooter/ Siren Shutdown.....	33
Manual Restart Button.....	33
Burner Alarm Reset.....	33

1. INTRODUCTION

Valuable Customer,

Akkaya thermal oil heater you have purchased is produced according to EN & TURKISH norms.

This user guide is prepared for Akkaya KYK H model, oil or gas fired thermal oil heater.

This user guide includes technical information about the heater and operating and safety instructions as well.



Owner must employ a licensed or certificated boiler operator for a safe and efficient use. Any accidents or breakdowns caused by operating conditions, other than described in this guide, shall be customer's responsibility. All local legal requirements must be fulfilled by the owner prior and during operation of the boiler.

There are some information and charts referred to standards and norms in this manual. Please refer to the latest versions of the standards and norms.



GENERAL DESIGN and CONSTRUCTION



2.GENERAL DESIGN AND CONSTRUCTION FEATURES

2.1 Design

- In this design the oil is passing inside the coiled tubes and the hot exhaust gases pass out of the tubes and in between the coils.
- The coil orientation and the number of smoke passes are selected to obtain the highest efficiency and the safest operation. Please refer to the technical file in order learn about the coil design of your heater.
- Heater capacity, total heat transfer surface, used tube length, thermal oil flowrate and pressure loss are precisely calculated during design stage.
- Thermal oil heaters are designed in such a way that the velocity of the oil in the coil is mostly kept in the range of 2.5 – 4 m / sec. This helps to keep the oil film temperature below the cracking temperature level.
- Front door hinges are designed for effortless operation. Opening the front doors are quite easy and safe.
- The heater body is designed according to PED2014/68 directive and CE marked.
- EN12952, EN13445, DIN 4754 & AD2000 norms are followed where applicable.
- Akkaya Boilers company has ISO3834 & ISO9001 quality system certificates.
- The KYKH model thermal oil heaters design can be oriented as vertical in some special requested cases.

2.2 Working Principle

Hot smoke / fire circulates around the horizontal, coiled, oil tube bundles and useful heat is transferred to the oil inside these tubes.

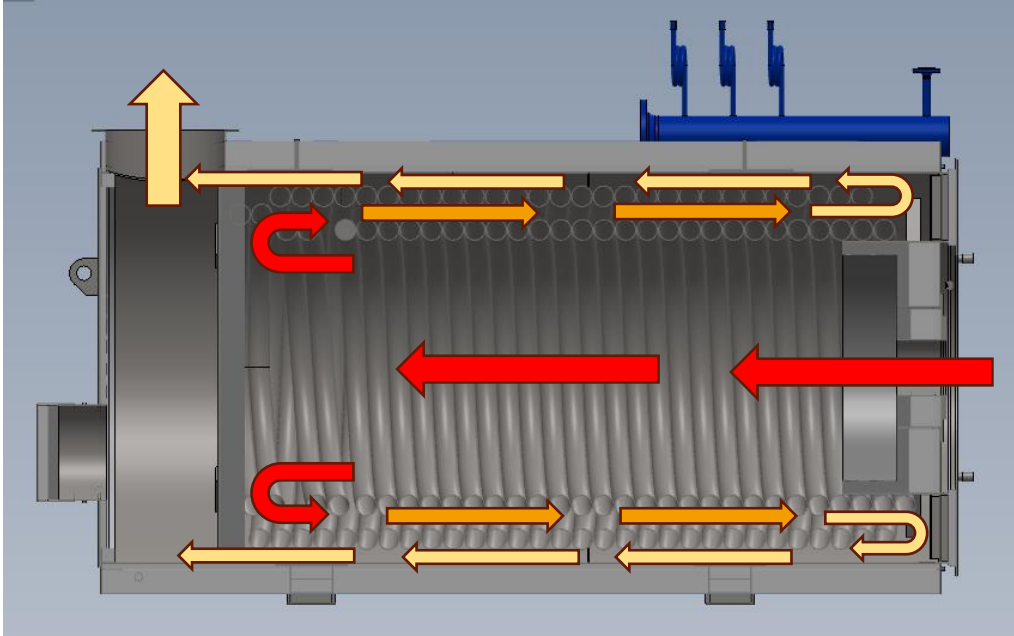
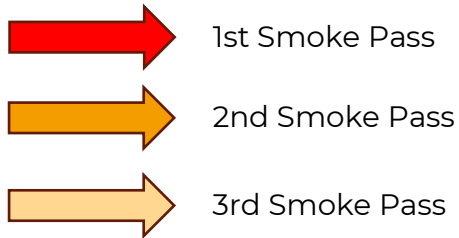


Figure 2.2.1 KYK H Working Principle



2.3 Construction

KYK H Heater body consists of a: Cylindrical main body, and wet type horizontal coiled tubes grouped at sufficient number according to the required capacity. EN12952 & DIN4754 is taken as reference for design calculations where applicable.

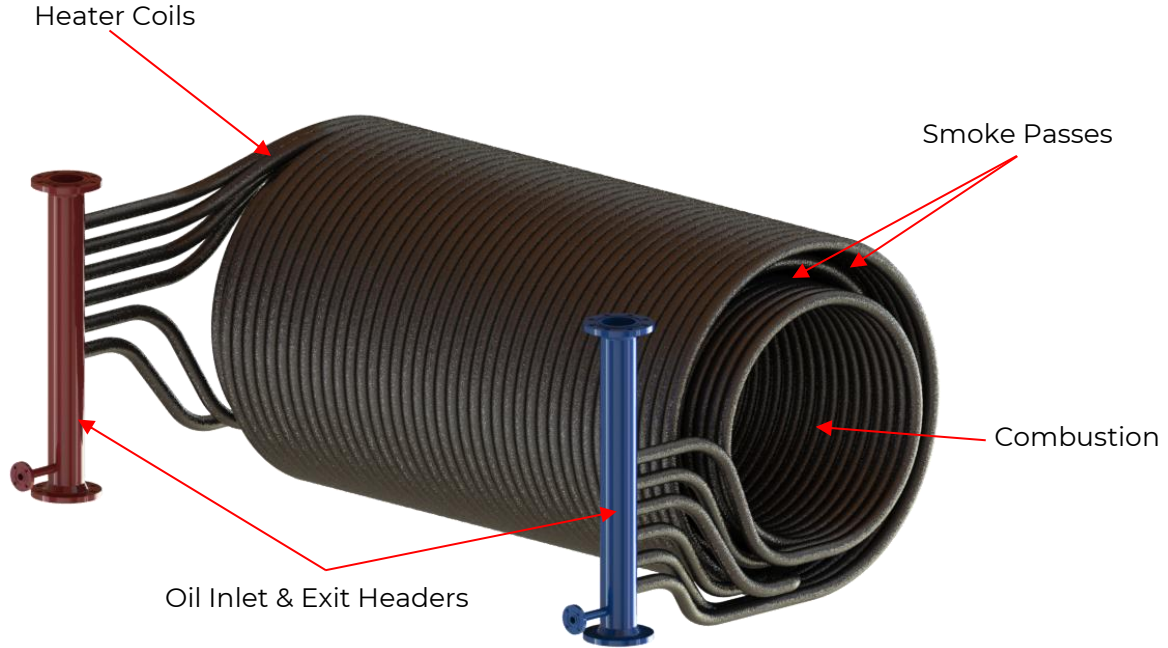


Figure 2.3.1 KYK H Heater Inner Structure Components

2.4 Quality

2.4.1. Steel Materials

In accordance with the requirements of EN12952 and EN10028-2, P265GH- P295GH - P355GH quality carbon steel in the pressure-exposed parts and S235JR - S355JR quality steel materials in non-pressure parts, are used.

2.4.2 Tubes

In accordance with the requirements of EN12952: EN10216-2 P235GH, 16Mo3 or similar quality seamless steel tubes and EN10217-2 P235GH quality ERW (welded) tubes are used. The details of the materials used can be found in the "Technical File" of the boiler.

2.4.3 Welding

Welds were performed by certified welders according to EN9606, in accordance with EN15609, EN15614-1, EN15614-8 requirements of welding procedure specifications. According to EN12953-5, welds are subjected to necessary non-destructive testing procedures (UT / RT, VT, MT / PT). The weld details including WPS, PQR, welding maps, NDT reports, welder certificates can be found in the "Technical File" of the boiler.

2.4.4 Isolation

The outer shell of the heater is isolated with 100 mm thick and 80 kg / m³ dense rockwool over 25mm thick ceramic blanket. The insulation is protected with PVC and protective film coated galvanized sheet or aluminum or, stainless steel coating (specifications of which can be changed according to customer request). Rear smoke box and front door side panels are isolated by ceramic-based insulation materials to decrease heat loss and to let safer operation. The combustion chamber back wall and the burner connection front door is made of high alumina refractory material.

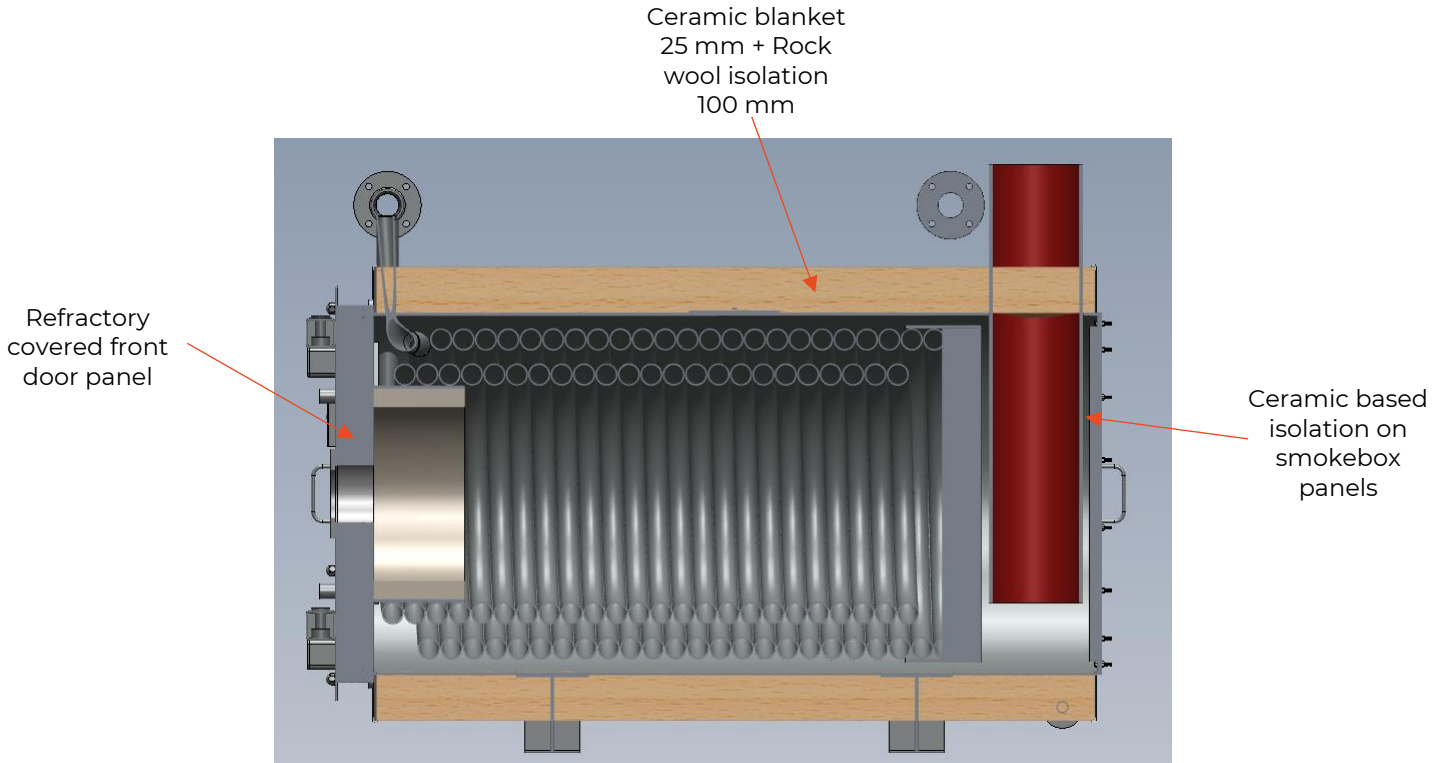
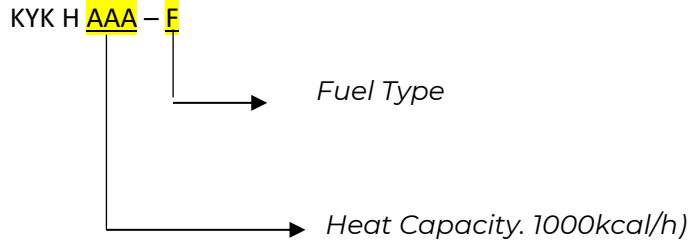



Figure 2.4.1 KYK H Heater Isolation

2.5. Product Coding



2.6. Boiler Name Plate (sample)



AKKAYA

BOILERS

AKKAYA ISI MAKİNALARI VE DOĞALGAZ SAN. VE TİC. A.Ş.
AKKAYA HEATING INSTRUMENTS & NATURAL GAS INC.

Tanım Description	_____
Tipi Type	_____
Seri No Serial Number	_____
Standart Standard	_____
Max. Isıl Kapasitesi Maximum Thermal Capacity	_____
Akışkan Tipi Fluid Type	_____
Isıtma Yüzeyi Heating Surface	_____
Müsaade Edilen En Yüksek Basınç Max. Allowable Working Pressure	_____
Müsaade Edilen En Yüksek Sıcaklık Max. Allowable Working Temperature	_____
Hidrostatik Test Basıncı (bar) Hydrostatic Test Pressure (bar)	_____
Hidrostatik Test Tarihi Hydrostatic Testing Date	_____
İmalat Tarihi Manufacturing Date	_____
CE	_____

📍 1 OSB Yerli Su Sok. No:2
Selçuklu / KONYA - TURKEY
☎ +90 332 248 92 21
+90 332 248 91 45
✉ akkaya@akkaya.com.tr
www.akkaya.com.tr



TRANSPORTATION INSTRUCTIONS



3. TRANSPORTATION INSTRUCTIONS

3.1. Placing the Heater on Transport Vehicle



Figure 3.1.1 Placing Heater on Transport Vehicle

- 1- An open top vehicle must be selected for transportation of the heater (either with truck or container)
- 2- While loading heater on a vehicle, a crane (with proper load capacity) must certainly be used. All the covers / doors of the vehicle must be opened before the heater is lifted for placing.
- 3- Lifting eyebolts of the heater must be used while lifting to place it on the vehicle. (In Figure 3.1.1)
- 4- Rope or chain must be selected carefully to carry the heater safely. Connection and angle of the ropes/chains must be done according to the instructions & confirmations given by Akkaya.
- 5- Placing on the vehicle and positioning the heater must be done carefully and instructions from the transport vehicle operator must be followed.
- 6- The lashing of the heater on the vehicle or container must be carried out by professional and certificated companies.



When you lift the heater from the ground level, there must be **NOBODY under or close to the heater. Utmost care must be taken to avoid accidents.**

3.2. Transporting The Heater

- 1- Before carrying the heater on a vehicle, it must be fixed to the vehicle by being tied with barrier to prevent slipping. The lashing must be done by certificated companies.
- 2- Heater mustn't be carried together with fragile equipment and/or living creatures.
- 3- The driver of the vehicle must avoid any sudden movements. The speed limits of the road must strictly be obeyed.

3.3. Placing The Heater In The Boiler Room

- 1- Heater must be placed in a boiler room, specially built for heater and its auxiliaries.
- 2- Local legal regulations and rules must be followed for the boiler room placement and construction.
- 3- Heater must be unloaded from the vehicle, using a crane. The eyebolts of the heater must be used for crane operation.
- 4- If it is not possible to take the heater inside the boiler room, either from its roof or doors, some agents like rollers or similar items can be used to slide the heater on.
- 5- Experienced staff must be in charge for unloading and placing the heater in the boiler room. Safety tools like helmets, gloves, eye protectors... etc. must be provided.
- 6- The boiler room must be free from dust, flammable materials, dangerous or corrosive gases.
- 7- The fire protection & extinguishing system must be installed.



INSTALLATION OF HEATER AND AUXILIARIES



4. INSTALLATION OF HEATER AND AUXILIARIES

For the boiler room dimensions and construction rules please refer to the local regulations. Please consult Akkaya for the dimensions of the heater and auxiliary equipment to be installed inside the boiler room.

- 1- All required legal permissions for fuel supply, electrical power supply, piping & plumbing must be completed and provided by the owner.
- 2- The height of the boiler room must be built at least 2 m higher than heater's height.
- 3- The boiler room must have at least two facing doors one of which must have ventilation openings to allow air circulation.
- 4- The doors must have at least 2 m height and 0,9 m width.
- 5- The boiler room floor must be a smooth concrete or a non-flammable basement.
- 6- The boiler room must be well ventilated but protected from outdoor conditions or wind.
- 7- Any flammable objects mustn't exist in the room.
- 8- The installation of the heater and its auxiliary accessories must be carried out by an experienced and qualified staff.
- 9- If there is more than one heater to be installed in the same boiler room, there must be minimum 1 m space between heaters.
- 10- Adequate space must be left to access the heater for inspection or service purposes.
- 11- Easy access to the electrical control board and sufficient clearance must be provided.
- 12- Pressure drop in the boiler room can be maximum 0,5 mbar. It must be ensured that there is no negative pressure in the boiler room.
- 13- In case any kind of suction fan exists in the boiler room, it must be ensured that heater flame draft is not affected. In case needed a draft inducer or engineered flue system must be provided.
- 14- The proper oil exit and return piping and fuel line piping must be completed before the boiler start-up. P&ID (piping and instrumentation diagram) and item list of the equipment must be provided and must be kept for future records.

If the auxiliaries and accessories of the thermal oil heater is in the scope of contract P&ID and item list is supplied by Akkaya. Please consult Akkaya for these documents.



The owner of the heater must complete the following pre-works before start-up.

- 1- Proper oil supply line must be built.
- 2- Threaded connections must be avoided in the system to prevent possible leakages.
- 3- Possible leakage points like valves, pumps, flanges, extension joints must be insulated with closed-cell type insulation, or **no insulation** must be made to such parts to be able to detect and prevent fire.
- 4- Carbon or graphite fiber sealing materials and gaskets or high temperature resistant gaskets, without asbestos must be used for the connection of the flanges.



The most important point to be taken care of in the thermal oil systems is the detection and prevention of the possible oil leakages. For this reason, potential leakage points in the line must be specified prior to system operation and any insulation material other than high temperature resistant closed-cell type must not be used. The potential leakage points MUSTN'T be insulated.

- 5- Expansion tank must be installed at a position higher than the highest point of the whole oil circulation pipeline system. Expansion tank's location must be selected properly to keep its surface temperature under 55° C. The expansion tank and its connection pipes must NOT be isolated. Keeping the expansion tank as cool as possible must be aimed.
- 6- The connections and piping between reserve tank, deaerator, expansion tank, heater and the circulation pump groups must be carried out by paying attention to the connection warnings in items 2, 3 and 4.
- 7- A proper electrical power supply cabling to the electrical control board must be done and its earthing (grounding) must be completed. Please refer to the electrical wiring diagram for selection of the power supply cables and protection switches (to be supplied by Akkaya if the control system supply is in the scope of the contract).
- 8- In case the heater is not delivered as a packaged system with all accessories mounted on, Akkaya's authorized staff must be waited to connect all the accessories to the heater. Also, the electrical control board connection of the heater accessories shall be done by Akkaya's technicians, too if these works are in the Akkaya's scope of supply.
- 9- Heater must be connected to a properly designed and certificated chimney. The calculations and the construction of the chimney and the smoke channels must be done according to EN norms.



Too long horizontal section or improper dimensioned smoke channels may cause poor draft. Chimney draft is very important for the combustion quality. Also, the diameter of the chimney is very important for draft and must be selected properly.

- 10- System and operation area must be cleaned completely before start-up. All solid / liquid residues, dirt, slug...etc. must be removed from the operation area and the system line, which may slow the oil flow.



If oil flow slows down below the critical velocity or blocked, this may cause over heating of the oil in the system. Overheated oil loses its heat transfer properties because of cracking. Formation of carbon residues may also damage the system lines and components.

- 11- After system assembly is completed, system must be filled with inert gas to be sealed against corrosion and to be able to perform a simple soap bubble test for detecting possible leakage points.
- 12- Using copper parts must be avoided in the thermal oil systems. The copper can easily be oxidized at high temperatures.



Line leakage tests after installation & assembly MUST NOT be carried out with water. Lines can be tested with compressed air.

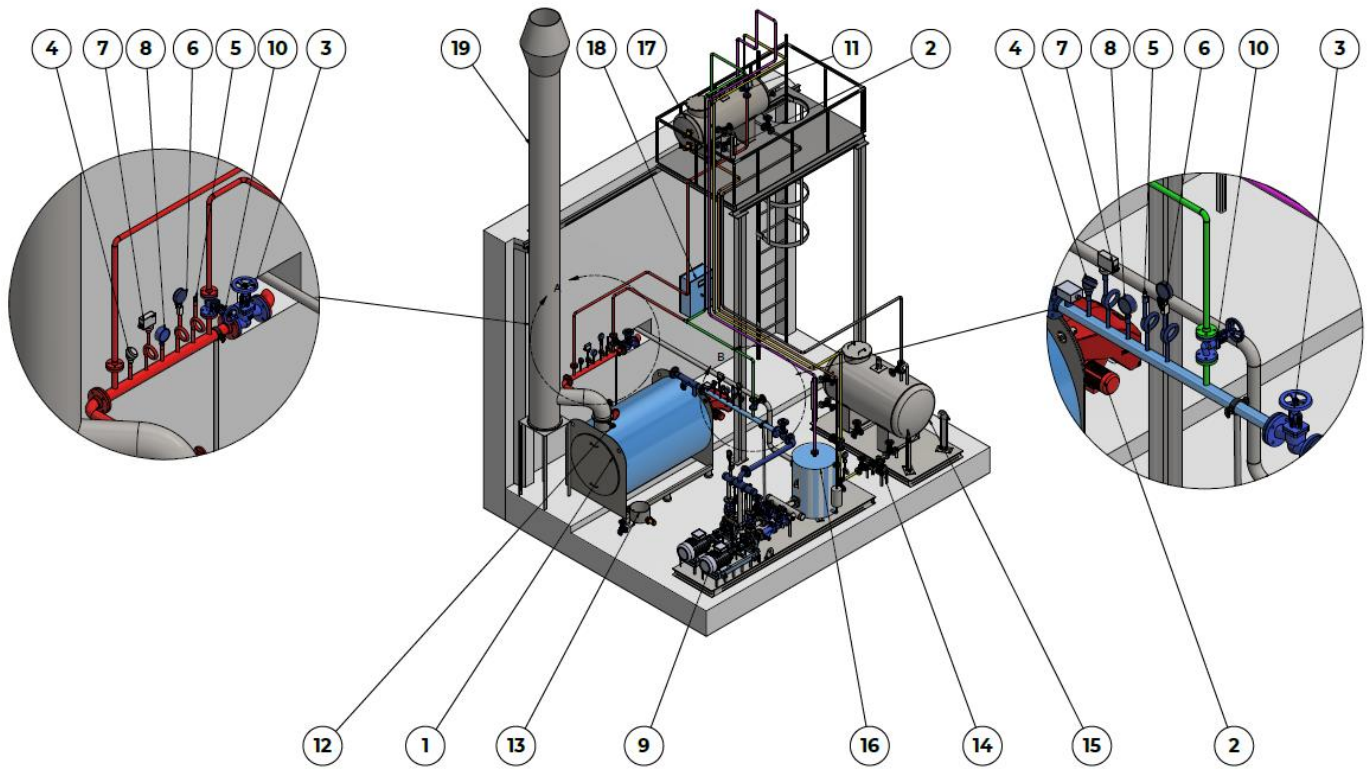


Figure 4 Sample Thermal Oil Heater Accessories & Auxiliaries

The configuration and the equipment descriptions given in this manual are for a standard package KYK H heater system. The specifications and quantities of the accessories may vary due to customer's requests. For safety accessories DIN4754 has been taken as reference where applicable.

No	Component	No	Component
1	Thermal Oil Heater	11	Safety Valve
2	Burner	12	Exhaust Gas Temperature Sensor
3	Oil Inlet/Outlet Header Valves	13	Leakage Tank and Accessories
4	Oil Inlet/Outlet Temperature Sensor	14	Thermal Oil Filling Pump Group
5	Oil Inlet/Outlet Pressure Sensor	15	Oil Reserve Tank and Accessories
6	Oil Inlet/Outlet Manometer & Valves	16	Deaerator Tank and Accessories
7	Oil Inlet/Outlet Pressure Switch	17	Expansion Tank and Accessories
8	Oil Inlet/Outlet Thermometer	18	Electrical Control Board
9	Thermal Oil Circulation Pump Group	19	Chimney
10	Thermal Oil Heater Inlet/Outlet Air Vent Valves		



START-UP, OPERATING, CLEANING AND MAINTANENCE INSTRUCTIONS



5. START-UP , OPERATING, CLEANING AND MAINTANENCE

5.1 Start-Up And Operating The Heater



The heater's first start-up & commissioning must be done by Akkaya's Technical Service. The guarantee of the heater will be invalid unless the commissioning is done or approved by Akkaya.

When the heater is turned off manually and needs to be started up again the following steps must be completed to operate the heater safely.

Boiler operators must have a valid license, or a certificate taken from official authorities (In Türkiye MYK certification is required). The operators must be responsible for interfering in any urgent situation. So, it is very important that they know the functional properties and operating principles of all equipment used in boiler systems.

- 1- All combustion equipment and chimney system must be checked for a safe operation. This check is done to be sure:
 - a) There is no unfired fuel / oil / flammable object deposit inside the combustion chamber.
 - b) There is no gas deposition inside the heater.
 - c) There is no leakage at the fuel line and the heater & burner peripheral is clean and free from fuel / oil / flammable object.
 - d) The chimney and smoke channels are open and clean. Proper suction exists in the combustion chamber. There are no hurdles in the smoke way. All the auxiliaries' (like economizer, recuperator, etc.) dampers are fully open, and smoke can pass through easily.
 - e) There are no hurdles in front of the gas explosion door, and it is functioning well.
- 2- If there is any automatic combustion or control equipment in the system; electrical protection and functional controls and locking system controls must be done. All this equipment must be in operation.
- 3- All valves, joints, flanges...etc. must be checked for no leakage.
- 4- All control equipment on the heater must be checked strictly, for correct operation.
- 5- If the heater has stayed non-operating for more than 2 weeks, all valves, fittings and control equipment must be checked for any kind of faults before restarting.
- 6- Reserve tank must be filled with thermal oil.
- 7- After resting the oil 2 -3 hours in the tank, some amount of oil must be drained from the reserve tank in case there is some water, dirts or metals inside the reserve tank.
- 8- Open the oil feeding pump valve, heater oil filling valve and deaerator drain valve.
- 9- Operate the feed pump to fill the system with oil.
- 10- Make sure that the heater vent valve is open, and air is being discharged.
- 11- To make the system filling properly check the P&ID of the system and consult to Akkaya Technical Service.



System is preferred to be filled with thermal oil after it is purged with an inert gas (like nitrogen). System must be filled with oil from the bottom to let the air or gases pushed to the expansion tank.

- 12- Filling of the system must be carried out until the expansion tank minimum filling limit is reached and indicated. If high limit is reached, system automatically stops the feed pump.
- 13- The system must rest for approximately 1 hour after filling. Then little amount of oil must be drained from the bottom valves of inlet / outlet collectors of the heater, deaerator's drain valve and other bottom valves of the system.
- 14- The circulation pumps must be operated before the combustion system is turned on to provide a cold circulation of oil for a while. By this way possible leakage or control equipment's failures can be detected.
- 15- In case any leakage is detected, immediately repair the leaking part. If welding is required for repairing make sure that all inlet and outlet valves to this point are closed, all the oil around the place is cleaned and all precautions are taken against fire.
- 16- Flow must be checked for proper operation. The flow inside the heater is usually controlled with differential pressure sensors. These sensors can be digital pressure transmitters or mechanical pressure

switches. For some applications (especially low temperature applications) mechanical flow switches can also be used. In any case flow must be insured by means of at least two control system.

- 17- Check the pressure indicator of the circulation pump. If an overflow at the expansion tank is observed the diameter of the pipeline between the expansion tank and the deaerator line must be decreased by adding an orifice. If the circulation pump pressure is higher than desired value, slightly open the circulation pump by-pass line.
- 18- After assuring the normal circulation conditions, the combustion system must be turned on to release heat to the system.
- 19- Combustion Air & Fuel quantity adjustment must be made by an expert using exhaust gas analyzer.
- 20- During first ignition, the flame must be less than its maximum formation and it must be observed at minimum length at least one hour without increasing.



Before ignition of the combustion system, make sure that there is nobody in front of the heater

- 21- During start-up the temperature of the circulating oil must be raised up to maximum 100 ° C. At this temperature the water starts to boil, and steam can form inside the heater or inside the pipeline. The steam formation temperature depends on the system's pressure. When the steam formation occurs, the oil can overflow from expansion tank or from air vent valves of the heater. This situation is dangerous and can cause big mechanical hammers and noise. During the vaporization the operator must be very careful. This situation can go on for long time until the whole water is vaporized and purged out of the system. The whole system must be checked again for any failures.
- 22- If every device is operating correctly, rising of the oil temperature must be carried out slowly until reaching required operating pressure.
- 23- The system devices operation and expansion tank level must be checked in every 25 ° C temperature rise until a steady operation is obtained. The expansion tank level must be at most 3 / 4 of its maximum filling limit.



Be careful when the oil temperature rises at 100 ° C and above. Some accidents due to overflow from expansion tank or leakages in the systems can occur because of the vaporization of the water left inside the system.

- 24- The thermal oil system must be observed continuously during operation although it has an integrated, automatic control system between combustion system, circulation pump, expansion tank level controller, flow switch, temperature controller and pressure switches. If the system's steady sound is interrupted by an unusual crack, bang, knock...etc., this may indicate water existence in the system.
- 25- Check the pumps for an unfamiliar sound which may be caused by cavitation that requires urgent intervention.
- 26- All system components must be observed for any abnormal vibration.
- 27- If there is any leakage detected, the part where leakage occurs must be cleaned, dried and urgent action must be carried out to stop leakage and prevent fire.
- 28- Boiler operator must record all the operations done on the boiler regularly.



THE FLAME MUST BE OBSERVED DURING HEATER OPERATION. IF THE BURNER DOES NOT STOP AUTOMATICALLY AT THE SET TEMPERATURE VALUE, THE FUEL VALVE MUST BE CLOSED IMMEDIATELY AND AKKAYA TECHNICAL SERVICE MUST BE INFORMED.



IF THE FLAME CAN NOT BE FORMED IN A SHORT TIME AT THE FIRST IGNITION, THE FUEL VALVE MUST BE CLOSED. THE IGNITION MUST BE TRIED AGAIN AFTER BURNER & COMBUSTION CHAMBER IS FULLY VENTILATED AND CLEANED FROM FUEL RESIDUES. DEPOSITED FUEL RESIDUES OR COMBUSTIBLE GASES MAY CAUSE EXPLOSION!

5.2 Shutdown And Discharging The Heater

- 1- Before discharging, the oil temperature and flame must be lowered by stopping fuel feeding to the system and shutting down the combustion system.
- 2- The circulation pumps must be kept running to homogenize the oil temperature and oil flow until oil temperature drops down to approximately 100 ° C (Please be careful about possible cavitation indications.). The automatic control systems provided by Akkaya Boilers has a feature that does not let circulation pump to stop until the system drops down to the safe value. The circulation pump stop temperature set is done by Akkaya Technical Service.
- 3- After the system cools, the circulation pumps can be stopped.
- 4- Discharge the oil from heater by the drain valves quickly. In some cases, the piping design is done to let the filling pump to be used also a discharge valve. Please check the P&ID and consult Akkaya Technical Service to learn more about draining your system.
- 5- Observe the discharged oil to detect any deformations or solid particles.
- 6- Expansion tank and reserve tank must be observed, too.



Be careful! The oil is very hot and can burn your skin at direct contact.

- 7- Drain valves must be closed tightly after the heater is fully discharged and warning signs as "do not open" on the drain valves must be placed.

5.3 Precautions

- 1- Do not fire the heater with insufficient oil circulation.
- 2- Do not put your hands, your head or any of your body parts in or go inside it, while heater is operating.
- 3- Do not close chimney damper fully.
- 4- Insufficient chimney draft is harmful for human health and reduces heater efficiency. So, the draft must be kept adequate by means of cleaning and fan installation.
- 5- Chimney must be kept clean and in good condition for sufficient combustion. Before starting the heater, the chimney draft must be controlled.
- 6- Be careful about the possible leakage at chimney and chimney connections.
- 7- Cleaning door on the chimney connection must be closed during operation.
- 8- The doors of fume box and chimney cleaning door must not be opened during operation.
- 9- Before ignition, be sure that there are no flammable objects around the system and the furnace is clean.
- 10- You must keep the heater under control during operation frequently.
- 11- Do not cook anything in the heater.
- 12- Do not use fuel with high sulfur content or materials that are harmful for human health as fuel.
- 13- Do not use coke coal as fuel not to damage the combustion system components.
- 14- Please contact authorized service in case of an extraordinary condition.

5.5 Cleaning & Maintenance

The perfect reference for a boiler operator is a clean and well cared boiler room. Obtaining high efficiency and continuous operation depend on boiler's and boiler room's condition.

The cleaning and maintenance cost can be kept at a very low level by performing it correctly and frequently. If done so the boiler will have a very long operating life, high efficiency and return of the investment cost will take shorter time.

General cleaning Instructions:

- 1- All equipment that does not belong to the boiler room must be removed.
- 2- The room must be cleaned easily by water.
- 3- The boiler outer shell must be cleaned frequently to keep new and good appearance.

- 4- The control equipment, joints, flanges, gaskets must be checked for leakage. If there is no leakage at any part of the system, the heater will be clean and safe all times.
- 5- The flanges and fitting connections must be tightened every two months to prevent leakages.
- 6- After the discharging the system as instructed, washing the system with oil must be carried out.
- 7- When system is filled with washing oil, the combustion system must be operated until the oil temperature rises to 100 ° C.
- 8- Then the combustion system must be shut off, but circulation pumps must continue to operate to circulate the washing oil thoroughly in the system.
- 9- After a certain while the washing oil must be discharged as instructed above.
- 10- The discharged oil must be observed for impurities. If there are too many residues, particles and dirt, washing may be repeated.



The best way to provide a long operational life and a problem free performance for the system is making periodical maintenance.

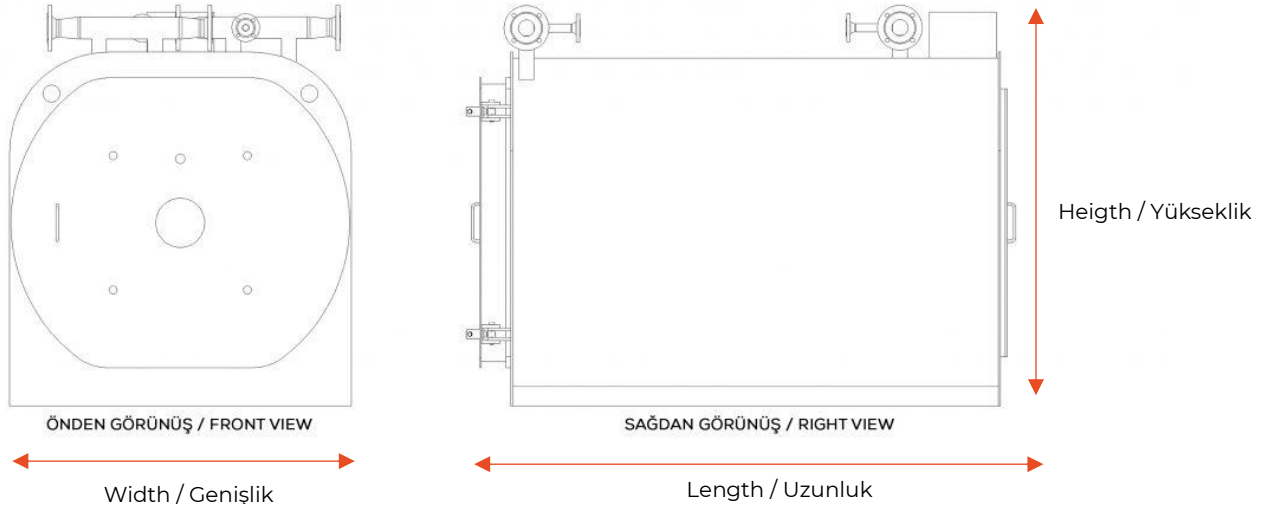
- 11- Prepare a daily / weekly check list for system control.
- 12- Observe the valves and joints between the system components and pipelines.
- 13- Try to detect if there is an unusual smell (like burnt vegetable oil) at any part of the system. This is the most important sign of leakage.
- 14- Any part that a leakage detected at, must be immediately cleaned, dried, and repaired to stop the leakage. Oxidation (air contact) of the leakage or oil vapor can cause fire.
- 15- Control the air vent valve of the expansion tank. Any steam or soot at this part shall indicate water existence in the system or malfunction of oil.
- 16- In case hot oil flow at the expansion tank is detected, check the heater 's air vent valve position, it must be in closed position during normal operation. Deaerator connection pipe diameter must be decreased by using an orifice. For other possible reasons please consult to Akkaya Technical Service.

5.6 Thermal Oil Properties and Quality Tracking

- 1- Thermal oil must never be heated above its auto ignition point which refers to oil ignition point at direct air contact.
- 2- Oxidation, which causes the rapid decay of the thermal oil, must be prevented by avoiding the direct air contact of thermal oil. Due to oxidation, thermal oil viscosity can change, and velocity of the oil can decrease. This will end up with thermal oil contacting hot surface of the tubes longer. The film temperature of the oil can go above its limit (the maximum film temperature of the oil can be learnt from its data sheet) and losing its heat transfer properties as well as forming more corrosive substances like carbon dioxide, carbon monoxide, water vapor. Smell of the thermal oil must be checked occasionally to detect oxidation. The oxidation creates a smell like burnt vegetable oil.
- 3- If there are copper materials in the system, the oxidation happens faster because of copper's behavior as a catalyst in the reaction. If thermal oil oxidation gets faster because of copper, the smell becomes acidic like vinegar. Bottom of expansion tank must be observed for acid-mud formation to detect this problem.
- 4- Quality and heat conductivity of thermal oil may decrease due to dust, dirt, slag...etc. Also, the system components like pumps, valves, gaskets may be damaged or blocked by solid substances. Thermal oil cleanness must be checked in certain intervals to provide a safe operation.
- 5- Quick filling of the system with the cold thermal oil may cause cavitation in the pumps because of air bubbles formed in the thermal oil barrels during transportation or storage. So, having the barrels rested for a few days without moving is recommended.

APPENDIXES



APPENDIX 1 - DIMENSION TABLE OF KYK H MODEL THERMAL OIL HEATERS


Model	Maximum Thermal Capacity (kcal/h)	Minumum Oil Flowrate (ΔT 20°C) (m³/h)	Length (mm)	Width (mm)	Height (mm)	Weight* (kg)
KYKH300	258.000	35	1900	1100	1300	1200
KYKH500	500.000	50	2550	1300	1500	1800
KYKH750	750.000	75	2800	1500	1700	3500
KYKH1000	1.000.000	100	3100	1600	1800	4500
KYKH1250	1.250.000	130	3400	1750	1950	5200
KYKH1500	1.500.000	160	3600	1850	2050	6200
KYKH1750	1.750.000	185	4100	2000	2200	7000
KYKH2000	2.000.000	210	4400	2100	2300	8500
KYKH2500	2.500.000	260	5000	2250	2450	10000
KYKH3000	3.000.000	300	5400	2450	2650	11000
KYKH3500	3.500.000	370	5400	2800	3000	16000
KYKH4000	4.000.000	420	5900	2850	3050	18000
KYKH4500	4.500.000	475	6200	2950	3150	19500
KYKH5000	5.000.000	525	6900	2950	3150	21500
KYKH5500	5.500.000	580	6900	3050	3350	23500
KYKH6000	6.000.000	630	7300	3150	3350	25500
KYKH6500	6.500.000	685	7300	3350	3550	28000
KYKH7000	7.000.000	735	7400	3450	3650	31500
KYKH7500	7.500.000	790	7600	3550	3750	34000

*Empty W/O accessories. Akkaya keeps the right to make modifications and changes in the design and dimensions. For the exact dimensions and design information of your heater please refer to the technical file provided by Akkaya.

APPENDIX 2 - SYSTEM ACCESSORIES AND AUXILIARY EQUIPMENT EXPLANATIONS

The accessories and auxiliaries explained here may be different than the configuration you have purchased. To be sure about your equipment scope please refer to P&ID and item list provided to you by Akkaya.

APPENDIX 2.1 Burner



Figure Ap. 2.1 Burner on the Boiler

According to the fuel type, KYK H model heaters must be equipped with a proper capacity burner as indicated in each models' technical specification table. KYK H models can be fired with natural gas, biogas, diesel, heavy fuel oil or biofuel burners. Consult to burner's manufacturer user manual for details.

For modulating burner systems, the heater temperature set value may need to be entered separately both on the boiler control panel and on the burner controller according to the control system design.

APPENDIX 2.2 Oil Inlet/Outlet Valves

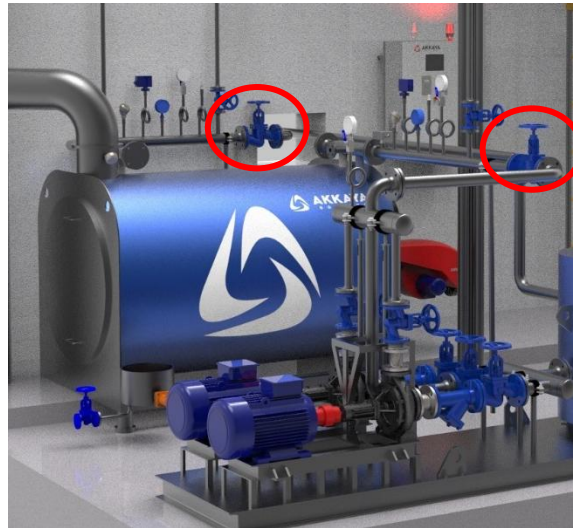


Figure Ap. 2.2 Oil Inlet/Outlet Valves

Oil inlet / outlet valves are selected according to the flow rate of the system. PN40, bellow sealed globe valves are used to handle high temperature and leakage danger at the system.

APPENDIX 2.3 Oil Inlet/Outlet temperature control and alarm system (Thermocouple)

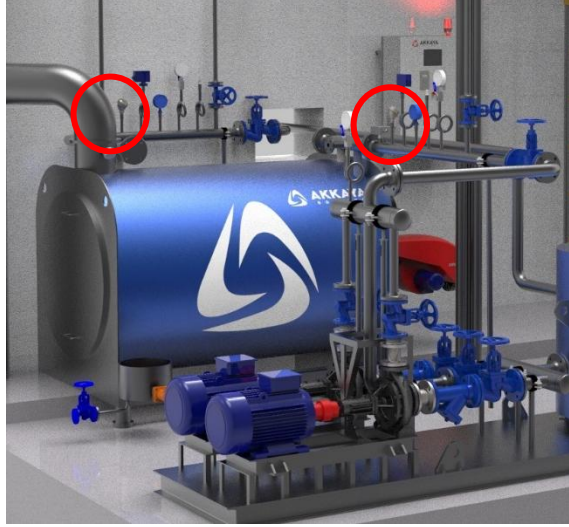


Figure Ap. 2.3 Temperature Sensors

KYK H model boilers' control panel is equipped with a digital heat indicator and alarm system, receiving the heat value by the help of a thermocouple placed on the boiler top.

There are 2 thermocouple type temperature sensors to measure oil inlet, outlet temperatures of the system. This heat controller is a safety device. It saves the boiler from getting damaged by low or high temperature.

APPENDIX 2.4 Thermal Oil Heater Oil Inlet/Outlet Pressure Switch



Figure Ap. 2.4 Pressure Switches

There are pressure switches at the inlet and outlet of the heater. Pressure switch for alarm and safety must be installed to the heater. The set value interval of the pressure switches must be proper for the maximum operating pressure of purchased KYK H model heater.

The pressure switches and transmitters must be connected onto a siphon (or omega) type tube. This prevents the pressure switch to get harmed by high temperature and sudden pressure hit.

The pressure switch at the oil inlet line is adjusted to control lowest pressure value and the pressure switch at the oil exit line is adjusted to control high pressure value.

To check the oil flow, mechanical differential pressure switch (with or without flow display) can be used. Please refer to the P&ID and Item list for detailed information.

APPENDIX 2.5 Pressure Transmitter

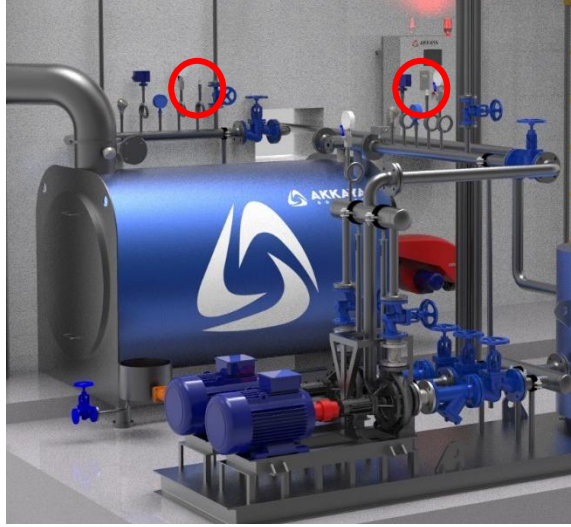


Figure Ap. 2.5 Pressure Transmitter

The pressure transmitter is used to convert the pressure in the boiler to an electrical value (4-20 mA).

Pressure transmitter sends the pressure value information to the main board to regulate the burner's operation. There are two pressure transmitters on the heater. One of them is installed at the oil inlet line and the other is installed at the oil exit line.

The signals taken from transmitters are used to control high pressure, low pressure, and differential pressure alarms.

APPENDIX 2.6 Thermal Oil Heater Oil Inlet/Outlet Manometer and valves

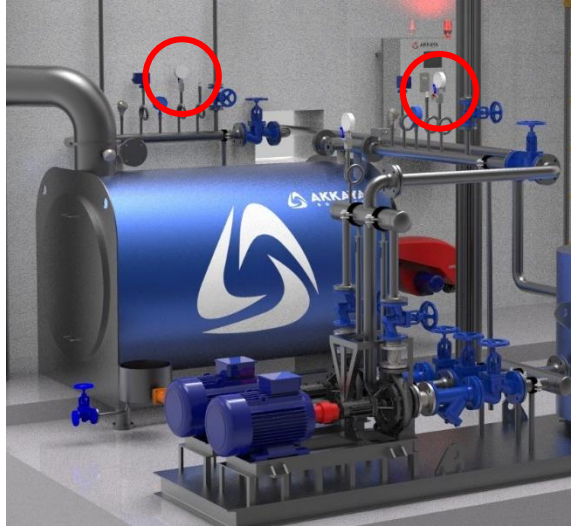


Figure Ap. 2.6 Manometer & Manometer Valves

There are pressure indicators (manometers) and manometer valves at the inlet and outlet of the heater. Manometers with valve is used to observe the pressure of the heater.

The scale of the manometer must be able to show maximum working pressure of the heater. A valve with drain outlet is used under the manometer. The manometers must be connected onto a siphon (or omega) type tube.

APPENDIX 2.7 Thermal Oil Heater Oil Inlet/Outlet Thermometer



Figure Ap. 2.7 Thermometer

There are 2 temperature indicators (thermometers) to measure oil inlet, outlet temperatures of the system. The values observed on the temperature indicators (thermometers) and the values seen on the PLC HMI screen can be slightly different. If the values are different more than 10° C, please consult Akkaya Technical Service. The thermometer wells must be installed on the pipe properly that the bulb of the thermometer can get the correct value. The wells must be filled with oil to improve thermal conductivity.

APPENDIX 2.8 Exhaust Gas Temperature Sensor



Figure Ap. 2.8 Exhaust Gas Temperature Sensor

There is a thermocouple type temperature sensor to measure stack temperature of the system. Stack temperature control is vital for the system's safety and efficiency.

In case of an oil leakage in the system, the flue gas temperature rises. Also, if the smoke passes of the coils are covered by soot or dust the stack temperature rises. The low-quality heat transfer oil is another reason to get high stack temperature alarm.

APPENDIX 2.9 Thermal Oil Heater Inlet/Outlet Air Vent Valves



Figure Ap.2.9 Inlet/Outlet Air Vent Valves

There are 2 air vent valves to discharge air from the heater inlet and outlet headers.

Air remaining in the system must be discharged. This air contains some gases such as O₂, N, S etc. that can harm the heat transfer fluid. This air also acts as an insulating material, and this situation reduces system efficiency. In the heater or in the piping system the air can also block the flow of the oil and can ruin the circulation.

APPENDIX 2.10 Safety Valve

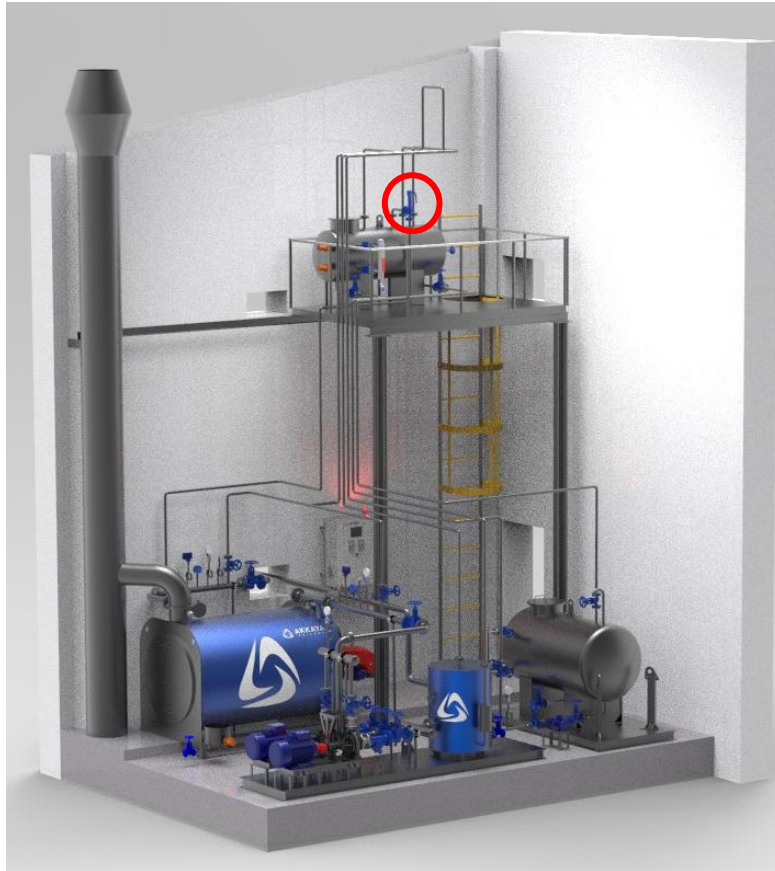


Figure Ap.2.10 Safety Valve

A safety valve is supplied with the system. Its function is to prevent the thermal oil heater from operating at a pressure exceeding the maximum permissible pressure. It must be connected directly to an independent oil outlet of the thermal oil heater and no valves must be placed in between. The safety valve must be vertically mounted. The safety valve preferably installed near to the expansion tank. By this way the temperature of the safety valve is kept in safe region also as the safety valve is installed at a high position no counter pressure on the exit line of the safety valve effects the opening pressure.

Safety valve must be chosen to discharge the oil when boiler is at its full load without increasing 6% of maximum operating pressure. Safety valves set value must be adjusted to 10% higher than boiler's maximum operating pressure. All valves must be CE certificated.

APPENDIX 2.11 Electrical Control Board

A PLC board is provided in the standard package of KYK H Heaters. The control board contains the operation system, and the safety system controls.

There is an emergency stop button (can be increased in serial connections) to stop the whole operation in case of emergency or unexpected situations.

A hooter connected to board gives an auidial alarm signal in case of safety failures. Also, a flashlight on top of the board gives visual alarm.

A remote connection option is included in the control board by which Akkaya technicians can connect the boiler system remotely if customer provides a cable internet connection to the board.

A separate electrical control board manual and wiring diagram is provided by Akkaya for each purchased heater.

APPENDIX 2.12 Leakage Tank

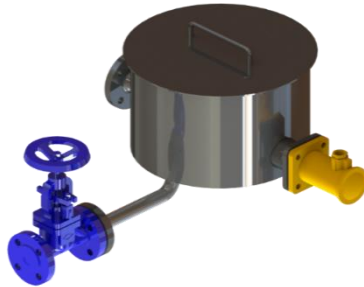


Figure Ap. 2.12 Leakage Tank

To collect the leaking oil, a leakage tank is supplied with the system. It is a small pot that is installed at the bottom of the boiler shell or a suitable location where oil leakage can be expected. Tank is furnished with a high-level controller and a drain valve. When there is a leakage in the system and the tank is filled, the level switch activates to give alarm. The level switch must be ordered in accordance with the Thermal Oil's density. Please refer to item list for details.



The leakage inside the heater can cause fire.

APPENDIX 2.13 Thermal Oil Circulation Pump Group

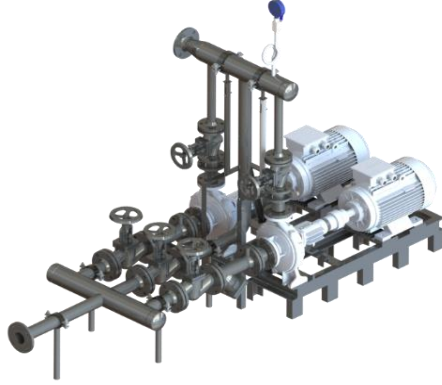


Figure Ap. 2.13 Thermal Oil circulation Pump Group

When selecting the pump, the operating temperature, cold start temperature and properties of the thermal oil must all be considered. Pump motors must be selected based on the cold start conditions and the duty required.

Circulation pump group consists of below components.

Horizontal, multistage pumps (with at least 1 extra set as stand-by), inlet, outlet valves, compensators, inlet strainer, outlet check valve, by-pass valve, manometer.

APPENDIX 2.14 Thermal Oil Filling Pump Group



Figure Ap. 2.14 Thermal Oil Filling Pump Group

The thermal oil filling pump is used to fill the system with heat transfer oil. In some applications this pump also used to drain the oil from system to the reserve tank. Please check the P&ID to learn more about the filling pump operation.

Thermal oil filling pump group consists of; Horizontal, gear pump, inlet & oil feed line valves, inlet strainer, outlet check valve and manometer.

APPENDIX 2.15 Thermal Oil Reserve Tank



Figure Ap. 2.15 Thermal Oil Reserve Tank

Reserve tank is used to store oil in the whole system. Oil is provided to the heater during first system filling from the reserve tank.

Reserve tank is equipped with below components:

Thermal oil feed pump group, Inlet and exit valves, level indicator, thermometer, drain valve. Level indicator must be ordered in accordance with the Thermal Oil's density. Please refer to item list for details.

APPENDIX 2.16 Deaerator

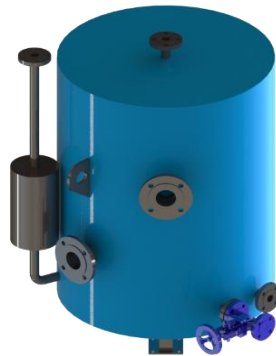


Figure Ap. 2.16 Deaerator

A deaerator in the system is used to purge the corrosive gases (like oxygen, vapor, air...etc.) from the thermal oil. This function is carried out by separating the gases from oil in mechanical manner and keeping the oil, stored in this tank for a certain period before circulating through the system. The deaerator is furnished with a drain valve.

APPENDIX 2.17 Expansion Tank

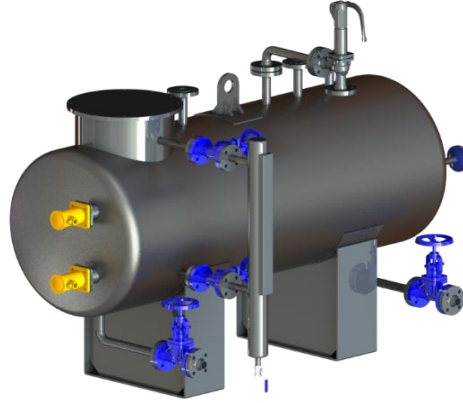


Figure Ap. 2.17 Expansion Tank

Thermal oil expands in volume when heated and this must be considered when designing the system. A properly designed thermal oil system must include an expansion tank that is sized to accommodate the expanded volume of the system. When selecting a tank, the system volume (including the initial oil load in the expansion tank), the operating temperature and the fluid's coefficient of thermal expansion should be considered. As different types of thermal oil expand at different rates, the expansion tank capacity must certainly be verified according to the selected thermal oil's properties.

If your boiler room do not allow installing the expansion tank on higher place than the highest point of the whole system (including pipeline), a pressurized closed type, expansion tank must be preferred.

A correctly designed expansion tank permits expansion of the oil without exposing hot oil to air. It functions as an oil seal between air and the hot thermal oil in the system. The low temperature of oil in the expansion tank will contribute to long service life of the oil and the proper operation of the system. Generally, oil temperature below 100° C is preferred.

A secondary, but important, function of the expansion tank is to provide a way for the escape or intake of air as the oil level in the tank rises and lowers. The tank must be ventilated to permit the escape of air and must be placed at an elevation above all outlets. It is connected to the pump suction, or return, line. **To maintain cool oil in the expansion tank, the connecting pipeline and the tank should not be insulated.** Large-diameter lines should be avoided since they increase the heat transfer to the oil in the tank.

An open type, expansion tank is equipped with below components:

Drain valve, low level and high-level switches, thermometer, level Indicator. Level indicator and level switch must be ordered in accordance with the Thermal Oil's density. Please refer to item list for details.

APPENDIX 3 -CONTROL SYSTEM STANDARD ALARMS EXPLANATIONS

High Temperature Alarm

Heater high temperature alarm turns on in cases where the oil temperature at the exit of the heater exceeds the high temperature alarm set value. In this case burner stops. Burner can be operated again by MANUAL RESTART after the temperature is decreased. The oil leakage in the heater, bad adjustment or sensor failure may cause this situation. It must strictly be investigated by the authorized personal / service.

High Pressure Alarm

This alarm triggered by the pressure switch installed on the heater's oil exit line or by the pressure transmitters installed on the heater. It turns on when the system pressure is higher than the pre-set alarm value. In this case burner stops automatically. To operate the boiler again, after the pressure decreases to normal value, MANUAL RESTART must be done.



In high pressure cases burner automatically stops. But if the pressure continues to increase, safety valves automatically open and oil is discharged until the pressure decreases to set value and alarm turns-off.

Low Pressure Alarm

This alarm triggered by the pressure switch installed on the heater's oil inlet line or by the pressure transmitters installed on the heater. The low pressure indicates a problem in the oil circulation system. Please check the circulation pump's operation and manometers. If the signal is coming from the transmitter at the exit line, there may be a big oil leakage in the heater, or the oil circulation is blocked inside the heater.

Low Oil Level Alarm

This alarm triggered by the level switch installed on the expansion vessel. If the oil level is low this signal is taken. Check if the oil is decreased because of a leakage. If there is no leakage in the system, fill the system with oil to reset this alarm.

High Oil Level Alarm

This alarm triggered by the level switch installed on the expansion vessel. If the oil level is high this signal is taken. This switch also stops the oil filling pump. The oil level can increase because of thermal expansions. If this high-level alarm repeats too much, some amount of oil can be drained to reserve tank.

Oil Leakage Alarm

This alarm triggered by the level switch installed on the leakage tank. If there is an oil leakage in the heater, the pot is filled with oil and the level switch triggered. Sometimes due to water condensation on the exhaust line this pot can fill with water and a false alarm can be activated. In such cases drain the pot and keep on normal operation.

Flow Switch Alarm

This alarm can be triggered by the differential pressure switch, pressure transmitters and the flow switch. In such a case the circulation pump's operation and pressure values from manometers must be checked. When the temperature of the system increases, and the viscosity of the thermal oil changes the pressure indications at the switches and the transmitters change. Additional adjustment may be needed during operation. Always consult to Akkaya Service when this alarm is observed.

Burner Error/ Failure

Signal indicates that there is a fault in burner operation. Boiler must be re operated only after the fault is investigated and eliminated by an authorized service or staff.

Circulation Pump & Feed Pump Operation

- Circulation Pump 1 On / Off must be "on" in normal operation.

- Circulation Pump 2 On / Off must be "off" in normal operation as stand-by.

In cases where "pump error" signals are on, faulty pump must be stopped manually and other one must be operated. The pump error signal comes from the motor protection thermic switch. It must be reset from thermic relay.

Hooter/ Siren Shutdown

It is for shutting down the voice of boiler controls. It only shuts down the voice alarms, signals continue to function.

Manual Restart Button

It is for deleting the alarm warning on the screen and to re-start the boiler. It aims to prevent the heater's self, re-starting and forces the operator to go next to the heater physically to see the alarm and take necessary actions.

Burner Alarm Reset

For some burner types, burner alarm reset button may be placed on the boiler control board instead of burner control board. This button is to reset the burner alarm from the boiler control board.



ATTENTION: Information in this section is to give general idea to the operator, about boiler control board and main controls on it. The number of equipment, switches and controllers may vary according to the purchased configuration. The main source for reference shall be the special "electrical control board diagram" that is provided to the customer during the system installation.



PLEASE KEEP THE FOLLOWING DOCUMENTS WHICH HAS BEEN SUPPLIED BY AKKAYA IN A SAFE LOCATION DURING THE ENTIRE LIFETIME OF THE BOILER

- a. USER MANUAL**
- b. P&ID (PIPING AND INSTRUMENTATION DIAGRAM)**
- c. ITEM LIST**
- d. TECHNICAL FILE, INCLUDING CERTIFICATES**
- e. ELECTRICAL WIRING DIAGRAM WITH CONTROL ALGORITHM**

A COPY OF THIS USER MANUAL WITH THE ABOVE DOCUMENTS HAS BEEN RECEIVED BY US AND THE EXPLANATION OF THIS USER MANUAL HAS BEEN DONE BY AKKAYA TECHNICAL SERVICE. WE AGREE TO OPERATE THE HEATER UNDER THE CONDITIONS EXPLAINED IN THIS USER MANUAL.

CUSTOMER NAME:

ADRESS:

DATE:

SIGNED BY (NAME-SURNAME-SIGNATURE):



 1. OSB Yerli Su Sokak No: 2
Selçuklu /Konya / Turkey

 **+90 332 248 92 21**
+90 332 248 91 45

 **+90 332 248 77 10**

 **akkaya@akkaya.com.tr**

 **akkaya.com.tr**

   **/akkayaboilers**