

## EK: 2 Dizel Makina 48000 Saatlik Bakım İş Kapsamı

<b>W46 ENGINE 48K MAINTENANCE SCHEDULE</b>	
<b>Interval: 2000 operating hours</b>	
<b>Control and monitoring system</b>	Check the function of the safety system and automatic stop devices. Replace faulty sensors.
<b>Governor</b>	Change the lubricating oil.
<b>Mechanical overspeed trip device</b>	Check the mechanical overspeed trip device.
<b>Electro-pneumatic overspeed trip device</b>	Note that the electrical overspeed trip takes place first. Check the function and tripping speed. Check the electropneumatic overspeed trip device Note that the electrical overspeed trip takes place first. Check the function and tripping speed.
<b>Valves</b>	Check the yoke and valve clearances.
<b>Valve rotators</b>	Inspect the valve rotators visually
<b>Control mechanism</b>	Check the control mechanism and fuel racks Check for wear in all connecting links between the governor and all injection pumps. Check that the fuel racks moves easily and the fuel pumps follow.
<b>Interval: 3000 operating hours</b>	
<b>Injection valves</b>	Inspect the fuel injectors. Dismantle and inspect the fuel nozzles. Replace if necessary. Reassemble and check the opening pressure of the fuel nozzle. Replace outside O-rings.
<b>Interval: 4000 operating hours</b>	
<b>Control and monitoring system</b>	Check the connectors and connector holders Check the mounting and connector holders. Verify the presence of contact lubricant and add, if necessary. Check the tightness of the connections. Check the condition of cables, wires and cable glands. Rectify, improve or replace the equipment, if necessary.
<b>Turning device</b>	Grease the secondary shaft of the turning gear.
<b>Crankshaft</b>	Check the crankshaft alignment on a warm engine Use the measurement record Crankshaft deflection (4611V005)
<b>Flexible coupling (resiliently mounted)</b>	Check the alignment of the flexible coupling. Use the measurement record Alignment of flexible coupling (WV98V041)
<b>Resilient mounting (if equipped)</b>	Check the alignment. Check the compression of the thrust rubber elements. Inspect according to the maintenance instructions for the resilient installation.
<b>Lubricating oil low-pressure accumulator (if equipped)</b>	Check the condition of the membrane in the low-pressure accumulator. Replace, if necessary.
<b>Lubricating oil system (if equipped)</b>	Turbocharger lubrication
<b>Interval: 6000 operating hours</b>	
<b>Injection valves</b>	Inspect the injection valves Replace the nozzle with new ones. Check the effective needle lift. Check the springs. Renew the O-rings Adjust the nozzle opening pressure in a test pump. Renew the complete injection valve, if necessary
<b>Exhaust manifold</b>	Inspect the expansion bellows Replace parts, if necessary. Inspect the supports of the exhaust system.
<b>Flexible pipe connections</b>	Power plant installations: Follow the maintenance schedule of the installation.
<b>Wärtsilä Wetpac H (if equipped)</b>	Check the flexible pipe connection between the external system and the engine. Renew, if necessary
<b>Interval: 8000 operating hours</b>	
<b>Control and monitoring system</b>	Perform a general control and monitoring system inspection Check for insulation wear, loose terminals and loose wires Check for cable insulation wear, damages, loose cable glands, connectors, holders and loose grounding shields Check for loose grounding straps and corrosion Check the sensors, actuators, solenoids etc. for leakages and physical damages. Also check the signal and measurement, where applicable. Check the condition of vibration dampers and replace them, if



	necessary.
	Verify correct readings on engine displays and meters.
	Check the electronic modules visually for damages. Rectify, improve or replace the equipment, if necessary.
<b>Fuel system</b>	Check the sealing condition on cabinets and boxes
	Check and adjust the fuel system
	Check the adjustment of the pressure control valve.
<b>Interval: 12 000 operating hours</b>	
<b>Cylinder liners</b>	Inspect the cylinder liners
	Measure the bore using the measurement record Cylinder liner (4610V001).
	Replace liner if wear limits are exceeded. Hone the liners.
	Check the deposits from cooling bores. Clean, if the deposits are thicker than 1mm
	Renew the anti-polishing ring.
<b>Connecting rods</b>	Inspect one small-end bearing and piston pin per bank
	If you find defects, open all and replace, if needed.
	See the measurement record Gudgeon pin and small end bearing (4611V004)
<b>Pistons</b>	Check the cooling gallery deposit for one piston per bank
	If the deposition exceeds 0.3 mm, open all piston tops.
	Inspect the piston skirt, and clean the lubricating oil nozzles.
<b>Pistons, piston rings</b>	Inspect the pistons and replace the piston rings
	Pull, inspect and clean. Check the height of the piston ring grooves. Use the measurement records Piston ring grooves (4611V009) and Piston ring groove wear curve (4611V002).
	Check the retainer rings of the gudgeon pins.
	Replace the complete set of piston rings. Note the running-in programme.
<b>Cylinder heads</b>	Overhaul the cylinder head
	Dismantle and clean the inner side, inlet and exhaust valves and ports.
	Inspect the cooling spaces and clean if the deposits are thicker than 1 mm. If the cylinder head cooling waters paces are dirty, also check the cooling water spaces in liners and engine block and clean them all if the deposits are thicker than 1 mm. Improve the cooling water treatment.
	Grind all seats. Grind the valves.
	Inspect the valve rotators. Check the rocker arms.
	Replace the O-rings in the valve guides.
	Replace the O-rings at bottom of the cylinder head screws at every overhaul
	Replace the knocking sensors.
	Check the starting valves. Renew parts, if necessary.
	Check the safety valve.
	Replace the soft insulation at the cylinder head exhaust pipe connection
<b>Valve rotators</b>	Dismantle, inspect and clean.
<b>Camshaft driving gear</b>	Inspect the intermediate gears
	Inspect the teeth surfaces and running pattern.
	Replace the parts, if necessary.
<b>Fuel injection pumps</b>	Overhaul the injection pumps
	Clean and inspect the injection pumps. Replace worn parts
	Replace the erosion plugs.
<b>Injection valves (direct water injection)</b>	Send the complete injection valves to Wäertsilä for water-solenoid recalibration
<b>Pilot injection valves (if equipped)</b>	Replace the pilot nozzles.
<b>Lubricating oil pump driving gear (if equipped)</b>	Inspect the lubricating oil pump driving gear. Replace parts, if necessary
<b>HT water pump driving gear (if equipped)</b>	Inspect the HT water pump driving gear. Replace parts, if necessary.
<b>LT water pump driving gear (if equipped)</b>	Inspect the LT water pump driving gear. Replace parts, if necessary
<b>Waste gate (if equipped)</b>	Perform a general overhaul of the wastegate valve and actuator
	Change the positioner pilot valve
<b>Control and monitoring system</b>	Recalibrate the I/P converter and replace the filter.
	This should be done every 12 000 operating hours or every second year at the latest.
<b>Interval: 24 000 operating hours</b>	
<b>Piston</b>	Inspect the piston cooling gallery for all cylinders
<b>Valves</b>	Replace the inlet and exhaust valves.
<b>Valve rotators and valve guides</b>	Replace the valve rotators and valve guides.
<b>Fuel injection pump</b>	Replace the fuel injection pump elements.
<b>Lubricating oil thermostatic valve</b>	Clean and inspect the lubricating oil thermostatic valve.
	Clean and check the thermostatic element, valve cone casing and sealings
<b>HT water thermostatic valve (if equipped)</b>	Clean and inspect the HT water thermostatic valve.



	Clean and check the thermostatic element, valve cone casing, and sealings.
<b>LT water thermostatic valve(if equipped)</b>	Clean and inspect the LT water thermostatic valve.
	Clean and check the thermostatic element, valve cone casing, indicator pin and sealings.
<b>Exhaust manifold</b>	Replace the expansion bellows between the exhaust pipe sections after the cylinder head and before the turbocharger.
<b>Flexible pipe connections</b>	Replace the flexible pipe connections.
<b>Main starting valve</b>	Main starting valve. Replace worn parts
<b>Governor driving gear</b>	Inspect the governor driving gears. Replace parts, if necessary
<b>Wärtsilä Wetpac H</b>	Replace the flexible pipe connection.
<b>Control and monitoring system</b>	Replace the drive electronics, such as the cylinder control module, coil drivers, fuel injection controls and power distribution modules.
	At the latest, the electronics must be replaced every tenth year.
	Replace the vibration dampers (rubber elements).
	Replace the rubber elements for components such as connection boxes, control modules, connection rails and the main cabinet.
	Replace the vibration dampers every 24 000 operating hours or every fourth year depending on whichever comes first.
	Replace the I/P converter.
	Check and clean the Seitz solenoid valves with a neutral cleaning agent. Replace wear parts. Use only original repair kit components
	Add lubricant to the seals and gliding surfaces.
	Seitz solenoid valves are typically start solenoid CV321, stop solenoid CV153, and slow turning CV331. Others can be identified from installation specific attachments
	This should be done every 24 000 operating hours or every fifth year depending on whichever comes first.
<b>Interval: 48 000 operating hours</b>	
<b>Piston</b>	Renew the piston crowns
<b>Interval: 48 000 operating hours</b>	
<b>Control and monitoring system</b>	Replace measuring electronics and display units
	At the latest, the electronics must be replaced every tenth year
<b>Camshaft</b>	Renew the camshaft bearing bushes.
	Renew the camshaft driving end bearing bush and camshaft thrust bearings
<b>Charge air bellows</b>	Renew expansion bellows between the turbocharger and air inlet box
<b>Control mechanism</b>	Renew
	• Bearing bushes and thrust washers for control shaft
	• Ball joints between the control shaft and control racks
	• Bearing bushes for transversal connection bars (V46)
	• Ball joint for the spring loaded rod



EK: 1 Dizel Makina 36000 Saatlik Bakım İş Kapsamı

**W46 ENGINE 36K MAINTENANCE SCHEDULE**

<b>Interval: 2000 operating hours</b>	
<b>Control and monitoring system</b>	Check the function of the safety system and automatic stop devices. Replace faulty sensors.
<b>Governor</b>	Change the lubricating oil.
<b>Mechanical overspeed trip device</b>	Check the mechanical overspeed trip device. Note that the electrical overspeed trip takes place first. Check the function and tripping speed.
<b>Electro-pneumatic overspeed trip device</b>	Check the electropneumatic overspeed trip device Note that the electrical overspeed trip takes place first. Check the function and tripping speed.
<b>Valves</b>	Check the yoke and valve clearances.
<b>Valve rotators</b>	Inspect the valve rotators visually
<b>Control mechanism</b>	Check the control mechanism and fuel racks Check for wear in all connecting links between the governor and all injection pumps. Check that the fuel racks moves easily and the fuel pumps follow.
<b>Interval: 3000 operating hours</b>	
<b>Injection valves</b>	Inspect the fuel injectors. Dismantle and inspect the fuel nozzles. Replace if necessary. Reassemble and check the opening pressure of the fuel nozzle. Replace outside O-rings.
<b>Interval: 4000 operating hours</b>	
<b>Control and monitoring system</b>	Check the connectors and connector holders Check the mounting and connector holders. Verify the presence of contact lubricant and add, if necessary. Check the tightness of the connections. Check the condition of cables, wires and cable glands. Rectify, improve or replace the equipment, if necessary.
<b>Turning device</b>	Grease the secondary shaft of the turning gear.
<b>Crankshaft</b>	Check the crankshaft alignment on a warm engine Use the measurement record Crankshaft deflection (4611V005)
<b>Flexible coupling (resiliently mounted)</b>	Check the alignment of the flexible coupling. Use the measurement record Alignment of flexible coupling (WV98V041)
<b>Resilient mounting (if equipped)</b>	Check the alignment. Check the compression of the thrust rubber elements. Inspect according to the maintenance instructions for the resilient installation.
<b>Lubricating oil low-pressure accumulator (if equipped)</b>	Check the condition of the membrane in the low-pressure accumulator. Replace, if necessary.
<b>Lubricating oil system (if equipped)</b>	Turbocharger lubrication
<b>Interval: 6000 operating hours</b>	
<b>Injection valves</b>	Inspect the injection valves Replace the nozzle with new ones. Check the effective needle lift. Check the springs. Renew the O-rings Adjust the nozzle opening pressure in a test pump. Renew the complete injection valve, if necessary
<b>Exhaust manifold</b>	Inspect the expansion bellows Replace parts, if necessary. Inspect the supports of the exhaust system.
<b>Flexible pipe connections</b>	Power plant installations: Follow the maintenance schedule of the installation.
<b>Wärtsilä Wetpac H (if equipped)</b>	Check the flexible pipe connection between the external system and the engine. Renew, if necessary
<b>Interval: 12 000 operating hours</b>	
<b>Cylinder liners</b>	Inspect the cylinder liners Measure the bore using the measurement record Cylinder liner (4610V001). Replace liner if wear limits are exceeded. Hone the liners. Check the deposits from cooling bores. Clean, if the deposits are thicker than 1mm Renew the anti-polishing ring.
<b>Connecting rods</b>	Inspect one small-end bearing and piston pin per bank



	If you find defects, open all and replace, if needed.
<b>Pistons</b>	See the measurement record Gudgeon pin and small end bearing (4611V004)
	Check the cooling gallery deposit for one piston per bank
	If the deposition exceeds 0.3 mm, open all piston tops.
<b>Pistons, piston rings</b>	Inspect the piston skirt, and clean the lubricating oil nozzles.
	Inspect the pistons and replace the piston rings
	Pull, inspect and clean. Check the height of the piston ring grooves. Use the measurement records Piston ring grooves (4611V009) and Piston ring groove wear curve (4611V002).
	Check the retainer rings of the gudgeon pins.
<b>Cylinder heads</b>	Replace the complete set of piston rings. Note the running-in programme.
	Overhaul the cylinder head
	Dismantle and clean the inner side, inlet and exhaust valves and ports.
	Inspect the cooling spaces and clean if the deposits are thicker than 1 mm. If the cylinder head cooling waters paces are dirty, also check the cooling water spaces in liners and engine block and clean them all if the deposits are thicker than 1 mm. Improve the cooling water treatment.
	Grind all seats. Grind the valves.
	Inspect the valve rotators. Check the rocker arms.
	Replace the O-rings in the valve guides.
	Replace the O-rings at bottom of the cylinder head screws at every overhaul
	Replace the knocking sensors.
	Check the starting valves. Renew parts, if necessary.
	Check the safety valve.
<b>Valve rotators</b>	Replace the soft insulation at the cylinder head exhaust pipe connection
<b>Camshaft driving gear</b>	Dismantle, inspect and clean.
	Inspect the intermediate gears
	Inspect the teeth surfaces and running pattern.
	Replace the parts, if necessary.
<b>Fuel injection pumps</b>	Overhaul the injection pumps
	Clean and inspect the injection pumps. Replace worn parts
	Replace the erosion plugs.
<b>Injection valves (direct water injection)</b>	Send the complete injection valves to Wäertsilä for water-solenoid recalibration
<b>Pilot injection valves (if equipped)</b>	Replace the pilot nozzles.
<b>Lubricating oil pump driving gear (if equipped)</b>	Inspect the lubricating oil pump driving gear. Replace parts, if necessary
<b>HT water pump driving gear (if equipped)</b>	Inspect the HT water pump driving gear. Replace parts, if necessary.
<b>LT water pump driving gear (if equipped)</b>	Inspect the LT water pump driving gear. Replace parts, if necessary
<b>Waste gate (if equipped)</b>	Perform a general overhaul of the wastegate valve and actuator
	Change the positioner pilot valve
<b>Control and monitoring system</b>	Recalibrate the I/P converter and replace the filter.
	This should be done every 12 000 operating hours or every second year at the latest.
<b>Interval: 18 000 operating hours</b>	
<b>Turning device</b>	Change the lubricating oil in the turning device.
<b>Crankshaft</b>	Inspect the main bearings.
	Inspect one main bearing. If found in bad condition, check and change all main bearings. Note the type of bearing in use and inspect accordingly.
	Check the thrust bearing clearance.
	Check the axial clearance.
<b>Lubricating oil pump</b>	Inspect the lubricating oil pump.
	Replace the bearings and shaft sealing.
<b>HT water pump</b>	Inspect the HT water pump.
	Dismantle and check the pump. Replace the bearings and shaft sealing, if necessary.
<b>LT water pump</b>	Inspect the LT water pump.
	Dismantle and check the pump. Replace bearings and shaft sealing, if necessary.
<b>Governor</b>	General overhaul of the governor
	Can be sent to engine manufacturer for overhaul.
<b>Engine fastening bolts</b>	Check the tightening of the engine fastening bolts.
<b>Interval: 36 000 operating hours</b>	
<b>Main bearings</b>	Replace the main bearing shells, flywheel bearing shells and thrust



	bearing halves
<b>Crankshaft</b>	Renew the crankshaft seal.
<b>Cylinder liners</b>	Clean the cylinder liner cooling water spaces.
	Clean the cylinder liner cooling water spaces. Replace the liner Orings at every overhaul.
<b>Connecting rods</b>	Replace the big end and small end bearing shells.
	Replace the big end bearing shells, small end bearing shells and shim plate.
<b>Valve mechanism</b>	Check the bearing clearances in the tappets and rocker arms, one per cylinder.
	Dismantle one rocker arm assembly for inspection. Proceed with other rocker arm bearings if defects are found.
	Renew the valve tappet roller bearing bushes.
<b>Valve seats</b>	Replace the inlet and exhaust valve seats.
<b>Camshaft</b>	Inspect the camshaft bearing bushes, one per bank.
	If defects are found, inspect all including driving end and thrust bearing. Renew, if necessary.
	Use the measurement record Camshaft bearing (4610V003).
<b>Camshaft coupling at camshaft's driving end</b>	Dismantle and inspect the coupling. Change the bearing bushes, if necessary.
	For changing the spring packs, contact Wärtsilä
<b>Air cooler</b>	Renew the charge air coolers.
<b>Fuel injection pump</b>	Renew the fuel injection pump parts.
	Renew fuel injection pump tappet roller pins, control sleeve and control rack.
<b>Exhaust manifold</b>	Renew the exhaust pipe support plates.
<b>Starting air distributor</b>	General overhaul of the starting air distributor.
	Renew worn parts.
<b>Piston</b>	Renew pistons crowns.