Lecture - 25

Aircraft Reciprocating Engine Inspection

Part - II

Our next inspection is the compression check of the engine, to ascertain the health of the engine, to ascertain the health of the cylinders, in case if you experience loss of power, increased oil consumption, hard starting or any other abnormal behavior in that case, we are supposed to carry out a compression check, it is a very important check as part of a routine maintenance, we are also supposed to carry out, at every 100 hours of operation, the manufacturer calls for a compression check at every 100 hours. So, a very important check to ascertain the health of the engine, we will start the check, the very first part of the check is to warm the engine, to start the engine, to bring it to the operating temperature and then slightly cool it and then we will carry out the check step by step. Let, so for our first part, I'm going to start the engine, I'm going to warm up the engine and then we will proceed.

So, we have just, have seen the daily inspection, that now we will see the daily inspection of the aircraft physically, the first point was check for general cleanliness of the surface and for signs of any oil leakage. Now, we will see the general cleanliness you can see here, the general cleanliness of the engine, we have to observe that there shouldn't be any leaks in the system, we can see that there are no leaks, no seepages around the crankcase, around the mating parts. So, we have to observe that there shouldn't be any leaks, we can see that there are no leaks, then this is your oil filter here, this white unit, this is your oil filter here, we will also see that there should be any signs of oil leakage, around the oil filter or just below it. So, we can see that there are no signs of leakage. So, this point we have to see all over the engine, we will see it, we have seen it on the right side, and then now we will see it on the other side of the engine, you can see here that there are no signs of leakage, everything is fine and the engine is Okay. On both the sides. Now, the second point was examined, the crankcase carefully for cracks, especially around the cylinder pads as far as possible. So, we have to check the crankcase, that it should be free of cracks, there shouldn't be any cracks especially around the cylinder base. So, let us see this is your crankcase here, you can see this this portion, this is your crankcase here and all around the crankcase, we will observe minutely, that there shouldn't be any cracks. Similarly, the crankcase should be examined on the other side also, you can see that there shouldn't be any cracks in the crankcase and especially around the cylinder parts. So, we have seen the crankcase on the bottom and also, we are seeing here around the cylinder points, that there shouldn't be any leakage. Similarly, we have to check the crankcase, that it is free of cracks, there shouldn't be any cracks on the crankcase, and also on the areas adjacent to the cylinders. So, we have seen we have observed, that there is there are no cracks. Similarly, in the same way, you will have to inspect the other side of the engine.

Next point is check exhaust manifold for security and blown joints. So, this is your exhaust here, you can see this is your exhaust here, we have read about the exhaust system earlier also in our earlier lecture, you

can see the exhaust system here, we will see that the exhaust manifold is secured, we will see that all those screws and fasteners, they are properly secured, all you can see, all the nuts everything is properly secured on all the sides, we will inspect all the points and we have to inspect the manifold, this is your manifold here, the manifold should be Okay. It should be secured, it should be free of any gas leakages. So, I cannot see any gas leakage here, we have read in our lecture, that incase if there is a gas leakage, there will be discoloration around the joints. So, you cannot see any discoloration here. So, there are no gas leakages also, plus your exhaust muffler is secured, all the linkages, all the fasteners, they are properly secured. So, your exhaust muffler is Okay. Your exhaust system is Okay. Similarly, in the same way you have to inspect the exhaust on the other side, on the right side of the engine also.

Next is your baffle fence for condition and security, now we have read about the baffles also. Earlier, these are your baffles, and these are your baffle seals here. So, we have to inspect as part of the daily inspection, that the baffles are secured, they are properly secured, there shouldn't be any cracks, all the fasteners are intact, all the seals, the rubber parts they are all properly sealing, we have to see, that there are no cuts in the sealing part. So, all along the the rubber seals, we will inspect, we will inspect the metallic baffles also, on all the sides. So, these are your metallic baffles and they are properly secured, there is no crack, they are not loose, and they are firmly in place. So, this is on one side. Similarly, on the other side, on the other side also, the baffles are perfectly fine, they are secured, the rubber seals, they're also perfectly Okay. So, we will check the baffles also as part of our daily inspection.

Next point is inspect cylinder fins for cracks and other damages, you can see the cylinders here, 3 cylinders, this is your port side, the left side of the engine. So, you can see these cylinders, this is cylinder number 2, this is cylinder number 4 and this is cylinder number 6, and we have 3 cylinders on the right side, the which are cylinder numbers 1, 3 and 5. Since, this is a 6 cylinder engine, so we will have to inspect all the 6 cylinders, we will have to inspect all the fins that they are free of cracks, there are no broken fins and the cylinder is secured, plus there shouldn’t be any gas leakages, there shouldn't be any leakage from the cylinder base. So, you can see here the cylinder base, you can see the fins here, and we have read about the fins also in our earlier lecture. So, you can see all the fins, we have to inspect, that they are free of cracks, it is, it is a daily inspection schedule and they are all visual checks, we are inspecting it visually, that things are free of cracks. Similarly, we will inspect the other 3 cylinders also, for the fins which should be free of cracks and other damages.

Next inspection is inspect magneto's for security of attachments, as you know that we have two magneto's on the engine, one on the left side, and one on the right side, you can see this black unit, this is your magneto here, this is your magneto, we will check the magneto is secured, you can see one, one holding nut here. So, this magneto is firmly placed, we can see that it is secured, we have to inspect the magneto, the both the magneto's, that all the leads on the magneto should be in place, they should be secured. Now, you can see the the wires coming out of the Magneto's, you need to ensure that these wires are secured,

they are not loose, and they are firmly in place. So, apart from the magneto mounting, we also need to check the electrical connections from the magneto. So, for both the magneto's, we will do this inspection. So, this is part of your daily inspection, after this magneto's, we also need to check the leads, the ignition leads, for condition, security and proper connection. So, you need see that, we have seen in our chapter of ignition, you see this is your ignition harness, this is your ignition harness and this ignition harness is being routed, to the respective spark plugs. So, you see this ignition harness here, we need to inspect the ignition harness, we need to inspect these leads going to each sparkplug, we need to inspect that they are firmly in place, they are properly routed, there is no breakage on the ignition harness, there is no chafing on the harness and the harness is properly secured. So, on the complete engine on both sides, we need to inspect this harness for proper routing, for proper security and breakage. So, the complete harness is to be checked.

Next comes your check total mixture carburetor heat controls for full and free movement, you know that these are your controls here, this is one control you have, then you have another control here, this is your throttle control, then the mixture control and we will move these controls and see, that these controls have full and free movement. So, as part of a daily inspection, we will also inspect these controls.

So, our next inspection is inspection of the controls. So, here is your throttle linkage, you can see here the throttle linkage, we will move the control from the cockpit and see that it is freely moving, there is no binding in the movement, that stops at the controls, they are touching each other and we will see the movement. So, now we will show you how the throttle is moving. Move the throttle, now you can see, the total control is moved and it is on one extreme end, now it will be on the other extreme end, it is touch the stop on one extreme, and now it will go to the other extreme. So, see it is going on the other extreme, it has touched this stop also, we can see that the throttle movement it is perfectly fine, there is no mov, there is no binding and it is free to move, all the, we also need to check the security of the controls, see all the nuts, all the quarter pins here, they are all in place, we need to be very sure about these quarter pins, they are very essential. So, these quarter pins, all these quarter pins are in place, though the control is firmly in place.

At the same time, a very important part of the inspection, we also need to see that the control is properly lubricated, you can see the grease here, it is there, the controls are properly lubricated also. So, this was your throttle control, on the other side if you see there, there is another control here, which is the mixture control. Now, we will show you, how the mixture control is moving, this is your mixture control, now this mixture control will be moved, see the mixture control is moving here, it is very freely moving and it will move to the other extreme now, see the control it has moved, freely it has touched its extreme stops also, and the quarter pins and the quarter pins on the control, you can see here, they are all in place. So, again the the mixture control is also free to move, it is firmly in place, it is secured, all the quarter pins are in

place and it is properly lubricated also. So, we have seen the throttle control, we have seen the mixture control.

Now, we will see the propeller control, it is there at the governor, which is there in the front portion, we will show you on this engine, now see, this is your propeller control, this is the governor here, and this is the control, we will see that the governor control, the propeller control is free to move, it is touching the extremes, it is sick secured, here you see, you will see the move control moving, and you can see the control moving here, it is cut, it is been moved and it is now coming to the other extreme and it is touching the stops so also, now you can see that it has a free movement, the pins are in place, the quarter pins are in place, the nuts are in place, the control is firmly secured and it is properly lubricated also, it is free to move. So, all the controls we have seen it on the engine, they are moving, they are touching their stops, we will also ensure that these controls are free to move, while we feel, feel their movement in the cockpit. So, these are your controls, this is your throttle control, this is your propeller control, this is a mixture control in the cockpit and we have checked the controls on the engine, they were free to move, they were secured and they were touching their extreme stops, apart from that we are also going to feel the movement here, that it is smooth, there is no problem here, you can see I am moving the throttle and it is very freely moving. So, there is no binding in the movement, this is your, this was your throttle control. Now, this is your propeller control, I will move the propeller control like this, and I can see that the propeller control is also free to move.

And similarly, this is your mixture control, I will move the mixture control and feel the movement and it is very smooth in operation. So, my controls are perfectly fine, another control we, you have the cowl flap control from here, you can see the movement of the cowl flaps, now they are closed, this is your cowl flap control, it is closed and now it is in the open condition. So, I can feel that it is free to move and there is no binding in the movement. So, this was your cowl flap control in the cockpit, I show you from outside also. So, these are your cowl flaps and we have seen in our videos earlier, the purpose of these cowl flaps, you have just now seen the control in the cockpit, the cowl flap control in the cockpit, and I'm again going to move the control from the cockpit and see the movement of this flap, and see whether it is flush and the flap itself is properly secured or not. So, now we I'm going to move the curve, the flap, the cowl flap, you see the cowl flap is moved and it is gone up, it has locked, and it is flush, there are no issues here. So, one cowl flap on this side, another cowl flap on the right side, it is perfectly fine. Now, this is cowl flap closed condition, we are going to open the cowl flaps, see the cowl flaps are being opened now, and it is completely opened, apart from this, we also see the security of the cowl flaps, you can see the linkage here, this side, you can see the linkage, inside if you see, that this is your linkage here, and the linkage is also perfectly fine, that is secured and there are no issues in it. So, this was your cowl flap inspection, then our next inspection is inspection of the induction air filter, next next inspection is inspection of the induction air filter, it has a visual, check, we will check that the filter is fine, there are no contaminants as

such and it is secured, firmly secured, apart from the filter, we will also check. So, this is your alternate air door, and we also need to ensure that the alternate air door is opening and closing, and it is not loose also. So, apart from these inspections, we will do a general inspection general visual inspection of the complete engine, to see that there are no loose linkages, everything is secured, there are no cracks as such, and this completes our daily inspection of the engine.

So, now the engine warm-up has been done the engine is, the aircraft is brought inside the hanger, the cowlings have been removed, you can see the cowlings have been removed, and we have brought the engine to a sufficiently warm temperature, and now it is ready for a compression check, why do we carry out a compression check? I have told you earlier and this is a service instruction from the engine manufacturer, you can see this is Lycoming as the manufacturer of the engine, and this is a Lycoming company service instruction, number 1191A, for cylinder compression. Now, how do we carry out the cylinder compression, basically in order to ascertain the health of the engine, the health of the cylinders, we will measure the static leak rate of the cylinder as compared to the leak around across a specified orifice. Now, this orifice is in a differential compression tester, this differential compression tester is the unit which is used to carry out the compression check, this is your differential compression tester, you can see the two gauges here, one gauge has a standard orifice and one gauge is connected to the respective cylinder, from the cylinder, we are going to remove the spark plug and we will come across the procedure step by step, but one gauge will measure the leak across the cylinder and another will be measuring the leak across a specified orifice of a standard size. So, this is your differential compression tester, and this has to be calibrated at regular intervals at an approved agency, and you can see this is your socket, this will go and connect to a special adapter, which will fit inside the spark plug hole, and you can see this is your adapter here and this will, this will go and fit in like this, and this will go inside this spark plug hole. So, let us go step by step, I have also told you, why it is required to carry out a compression check? Now, let us see, what are the steps involved in carrying out a compression check, first of all we are going to remove the spark plugs, to start with this check, we are going to start with cylinder number 1, this is your cylinder number 1, on the right side this is cylinder number 1, this is cylinder number 3, this is cylinder number five 5, and similarly on the other side you have cylinder number 2, cylinder number 4 and cylinder number 6. So, we will start with cylinder number 1 and we will remove the spark plug and bring the cylinder number 1, in the compression stroke. So, let us see, how are we going to remove the spark plug. So, here this is your cylinder number 1, and this is the spark plug in the top position for cylinder number 1, this we call it one top, you can see here, this is the harness, ignition harness, which is connected to the spark plug in the cylinder number 1, top position, we will remove this harness, we will loosen this harness from this position and then the spark plug will be removed. So, now you see, how we are going to remove it.

So, you can see the aggression harness is being removed, we have loosened the ignition harness and you see that, now the ignition harnesses out. So, this ignition harness is removed and now we will remove the spark plug. So, now we have attached the socket on the spark plug and we are losing it, it is being loosened, it is being removed and now you see, that the spark plug is loose and we are moving at anti clockwise, counterclockwise and it is being unscrewed, you see that the spark plug, it is removed, it needs to be cleaned, now since we have removed the spark plugs as part of our inspection, we will also clean the spark plugs, which you will see in our earlier, in our next video and this spark plug cylinder number one top, we will place it in the tray, meant for this purpose and this will be placed in cylinder number 1, top position. So, now the spark plug has been removed and we will, we will bring the cylinder number 1, to the compression stroke. Now, in order to bring the cylinder number one to the compression stroke, we will place our thumb on the spark plug hole, see, we have placed our thumb, we are placing our thumb on the cylinder number one sparkplug hole, we have removed the spark plug from that hole and we have placed it, and now we are turning the propeller in the direction of rotation, and we will feel the pressure on our thumb. Now, if the pressure is being exerted on our thumb outside, that means that cylinder number one is on the compression stroke, cylinder number one is, is ready for the check. So, once the cylinder number 1, is on the compression stroke, we are, we are going to put this adapter in that sparkplug hole, so that we can un, connect that compression tester to this adapter. So, now we are going to put the adapter in the spark plug hole, you see that the adapter is being put in at the spark plug hole, we are going to tighten the adapter, and now the cylinder compression tester is being connected to the adapter, now it is connected and now you see, that the compression tester is attached to the spark plug to the adapter, shown you the two gauges, the purpose of the two gauges, now next step will be to hold the propeller properly, so that because we are going to give an input pressure, air pressure, input air pressure of around 80 psi, which 80 psi will be regulated from this gauge, first of all before sending the pressure in this gauge, we are going to regulate it at the pressure source, which is the compressor there, so at that source, we are going to give a regulated pressure of 80 psi, 80 psi pressure will come in while the pressure is coming in at this this point, we have to rock the propeller slightly, so that the rings on the piston inside the cylinder, they are properly seated and there is no leakage. So, people they have, they are holding the propeller properly, we have to be very careful while holding the propeller, so that the propeller doesn't move, and now we are going to give an input pressure of 80 psi, which we will regulate, which we are going to observe it and regulate from this point, this is the regulator and you see, that the pressure is gradually being given here and this pressure is, you see gradually we are giving 80 psi pressure and, and you see that now the 80 psi pressure has come, it has been given and we have to observe the pressure in the cylinder, what we are getting? It is something around 78, something around 78 psi is the pressure in the cylinder, which is perfectly fine. Now, we are gradually releasing the pressure, the pressure is being

released you see, that and this pressure is released from cylinder number one. So, you see that we have given 80 psi of pressure in cylinder number one, and we have observed something around 78 psi in the cylinder. So, a very small leakage, in case if you have in the similar fashion, we are going to do the pressure test for all the cylinders, that cylinder pressure observed for all the cylinders should be almost the same, in case if there is a difference of 5 psi, then it is satisfactory, a difference of 10 to 5 psi, indicates an investigation should be done. So, the difference of 10 to 15 psi of pressure between the cylinders means that some investigation is needed, but incase if the pressure difference is around 5 psi, then it is perfectly fine, but a difference of 10 to 15 psi doesn't mean that we need to remove the cylinders, and do some overhaul, there might be a possibility at that very instant or at that occasion, when the test is being done, the see the rings have not properly seated after a few hours of operation, we should again do the test and see whether the leakage is still the same or it has improved, but in any case, if the leakage or if the pressure observed is below 60 psi, then need to remove the cylinder and go for an overhaul, anything about 70 psi or above is acceptable and the engine is considered satisfactory. So, this was the procedure, how we carry out the compression test of all the cylinders. One by one, we have to do the test for all the cylinders, in case if we observe that your air is passing, or you observe a low pressure in single cylinder. Suppose, you have done the compression test, and you observe the low pressure in a single cylinder, in that case it indicates that air is passing through the piston or by valve, but in case if the air is discharging from the breather or the oil filler tube, that indicates that the leakages in the area of piston and rings. Now, in case if you observe that the leakages from the filling part, filling tube or the breather point, you can see here, here you have the breather here, the engine breather, there is a breather tube here, so in case if the leakages through the breather tube or the oil filling part, in that case your, that indicates that the leaking, leakage is from the piston and rings. Anything air discharge from the intake indicates, that the leakage is at the intake valve, and air leakage from the exhaust indicates, that the leakages around the exhaust wall. So, in case if we are observing leakages, we have to find out where the leakage is from, whether it is from the intake, whether it is from the exhaust, whether it is from the filling point, whether it is from the breather? And for every leakage that we have, we can zero in, the leakage source, and the we have just now seen what are the ranges in which the engine can be considered satisfactory or unsatisfactory. So, this cylinder compression tech, check is a very important check, part of our 100 hours inspection and to ascertain the help of the engine, our next inspection is 50 hours of inspection, which is required to be carried out at after every 50 hours of operation. So, let us see, what are the inspections called for, in the 50 hours schedule, the first point is check for cowlings and cowl flaps. Cowlings in general, we check for the condition, we do a visual check, these are the bottom cowlings, we have the top cowlings also, we will inspect the cowlings visually for any cracks, for any scratches, for any dents. So, in general, thorough inspection of the cowling, a thorough visual inspection of the cowling in the 50 hours

inspection, apart from the cowling inspection, we have to inspect the cowl flaps, we have done it in the case of di inspection also, we are going to do it thoroughly during the 50hours inspection.

These are your cowl flaps, we will operate these cowl flaps from the cockpit, we have seen the control in the cockpit, we will operate these cowl flaps from the cockpit and see the movement, the movement should be smooth, there should not be any binding, you see the cowl flap is being operated and it has gone up. So, after it is up, I am going to inspect the cowl flap here, it is completely fine, it is secured, there are no issues here and the cowl flap linkages are also fine. So, this cowl flap, one is on the left side, one is on the right side, the cowl flaps are to be inspected in the 50 hours of inspection, the cowl flap movement, the cowl flap controls, the cowl flap linkages are to be inspected. Now, we will open the cowl flap, you see that the cowl flap is being open and see, now we have opened the cowl flap, a control is being moved from the cockpit and this cowl flap is coming down. So, now the cowl flap is down and you can see that it has moved freely, it has come down and the linkages are also in place, you see the linkage here inside this, this is also in place, this is also to be inspected and we find that the cowl flaps are perfectly fine. So, as part of our 50 hours inspection, we have checked the cowlings, we have checked the cowl flaps, another inspection is the alternate induction air system. So, now we will see the alternate induction air system, keep you can see this, this is your alternate air induction door. So, in our 50 hours inspection, we are going to do a visual check, we are going to operate this door also, and we will see that this is properly opening and closing, and it is firmly in place. So, this is also an inspection to be carried out at 50 hours.

Now, another system, another inspection is for the induction system, induction system you need to check security of clamps tubes and ducting inspect for evidence of leakage. So, coming to the induction system, so induction system, these are your intake tubes and we need to check security of clamps, these are your clamps here, they're the holdout nuts also bolts, we need to check whether it is properly secured, we need to check the tubes, the tubes, we need to check the ducts and we also need to check, whether there is any evidence of leakage. So, the complete induction system and the alternate induction should be thoroughly checked during the 50 hours of inspection. So, this was your 50 hours of inspection after this, we need to check the induction air filter, you can see here, this is your induction air filter, we will remove this induction air filter, you can see the bolts here, these are the bolts, we will open these bolts, one is here, another is on the top and another is here. So, we will open these bolts, and we will remove the induction air filter, and we will clean it is basically a paper induction air filter, and we will clean it to with a dry air, and we will tap gently on the ground to remove any dust. So, this filter should be cleaned at every 50 hours of operation. the manufacturer calls for its removal after every, one year. So, I will show you one induction air filter, this is the same filter which is fitted in this engine, you can see the induction air filter it has fitted, we have to remove the bolts from these positions and we have to, this is the paper filter inside and we have to clean it with the air, and we have to tap it gently on the ground. So, this filter is to be

replaced after every, one year even if it is in good shape, it is in good condition, in that case also, you just have to throw it out, and put a new filter. So, this is your induction air filter, then in general as part of your 50 years of inspection, we need to inspect for evidence of oil and fuel leaks, we will inspect the complete engine for any oil leak, for any fuel leak around the cylinders, just adjacent to the hole, hold down points here, the base, bolts and nuts, you can see here, the base, cylinder based attachments, we will check for any leave, leakage evidence of any leakage around the cylinder, we will check for any leakage around the crankcase, we will check for any leakage around the oil filter and in general, any leakage throughout the engine, and its accessories. So, this was for the engine general leakage, another is you can see, there are a lot of hoses running throughout the engine, you can see these orange hoses, lot of hoses ,fuel hoses, oil hoses, air hoses, lot of horses are running throughout the engine, you can see these metallic tubes, metallic lines, they are stainless steel lines, they are the fuel lines, this is a very important inspection, the manufacturer lycoming has called for an inspection, and it is through a service bulletin number 342, which calls for the inspection of these lines and their support clamps. So, we need to ensure that these lines are firmly in place, they are not broken, there is no lose lines and there is no leakage in these lines, these lines are very delicate and we have to be very careful about these lines, we need to do a thorough visual inspection, for the hoses, metal lines and the fittings.

Another inspection in the 50 hours is for the baffles and the seals, we have earlier also, told you that there are metallic baffles and the baffle seals, we need to ensure that these baffles are firmly in place, they are not loose, there are no cracks, all the seals they are properly in place, they are sealing once the cowling is over, over this, this baffle and the rubber seal, this will form a chamber. So, that the air is not leaking and is providing proper cooling. So, we have to ensure that these seals they are not broken, they are not, there are no weather cracks on these seals, they are flexible also, flexible enough to to seal the area. So, these baffles and the seals have to be inspected thoroughly, these baffles and seals they play a very important role in the in the operation of an engine, we have seen it earlier also in our lectures.

Next inspection is the exhaust system, you can see the exhaust system here, the exhaust muffler, the the exhaust tubes coming out from each cylinder. So, we need to see that these exhaust tubes, the exhaust muffler, they are firmly in place, the weld seams of the exhausts, they are not broken, there are no leakages from the joints, the in case if there is any leakage, then there will be discoloration in the adjacent area, we need to check the complete exhaust system very thoroughly in the 50 hours inspection also, and these clamps these rubber ducks which are connecting to the exhaust system should also be checked thoroughly, during the 50 hours of inspection. So, this this is on the right side, similarly there is a left, on the left side also you have an exhaust bank, which is also to be inspected.

After this, our next inspection is for the engine oil, the engine oil replacement is 50 hours or 4 months whichever is earlier is as specified by the manufacturer, 50 hours of operation or four months calendar time, this is your oil filling port, this is your place through which you fill the oil, we have to remove it,

this is your dipstick, we have seen how to measure the oil level, and this is the place from there, we have to or replenish it during the course of servicing, now this oil replacement is a very essential requirement, it is very very important to keep replacing the oil, after every 50 hours or 4 months, even if the engine has not operated for many hours, still then you have to replace the oil after 4 months for good health of the engine, we have seen how we have re replaced the oil, we have seen on this aircraft also, we have seen in the case of other aircrafts also, how the oil is replaced, during the replacement of oil, your oil filter is also supposed to be replaced, and your oil suction screen is also removed and cleaned, and then the complete system, the oil filter, the suction screen, the drain plug is wire locked and after filling in the oil, we will carry out an engine ground run, observe all the parameters are satisfactory and once the parameters are observed to be satisfactory, we will shut down the engine, open the cowlings and check for leaks. So, this is how your oil replacement is carried out, after oil replacement you have another inspection for the oil coolers, this is your oil cooler, we need to observe, check the oil cooler for any obstruction, for any leakage, we need to check the hoses, which are connected, they are properly fixed, there is no obstruction, there is no leakage, the fins, there is no damage on the fins and all these locking's are in place. So, this is the inspection on the oil cooler at 50 hours of operation, after that we have to lubricate, clean and lubricate the starter drive assembly, it is also a part of 50 hours of inspection.