The starting point for the oil is the oil pan, or sump. It is then run through the oil strainer at the bottom of the pan, and flows through an intake tube through the oil pump and through a full flow, and fine filter. There is also a bypass valve before the filters to ensure required pressure is always met through the system if the filters become clogged. The regulated pressure for the pressure relief valves is 78psi. The total flow of oil through the system (and thus the pump) is 1.23gal/min at maximum rated RPM, with an estimated total volume of oil in the system of 1.27 gallons. The selected pump is a helical gear style of pump and is an electric pump powered by the actuator. An electric pump was chosen so that it could easily sit outside the crankcase and the camshaft/s would not have to be extended to drive the pump, and also an additional timing chain on the crankshaft would not be needed. After flowing through the filters, the oil goes to a pressure relief valve directly outside the main engine block drillings to ensure that the system is never too highly pressurized. These drillings are drilled as a secondary operation, and some have specific extrusions made for them through the block to ensure there is enough material around them to prevent leaks. These drillings take the oil to three different places. The first destination is the main crankshaft bearings. From here the oil leaks out of the bearings, and also flows through a drilling within the crankshaft to the connecting rod bearings. Here, the oil again leaks out the side and also flows through drillings in the connecting rods to the piston pin. The pistons are lubricated through the oil that leaks out of the sides of the bearings. This oil drips onto the spinning crankshaft and is flung onto the pistons through splash lubrication. Another engine block channel takes the oil to the camshaft bearings. Here the oil again leaks out onto the spinning shaft to lubricate the surrounding components as it lubricates the camshaft as well. The third place that the oil channels deliver oil to is the tappets, or valve lifters, at the base of the pushrods. The oil flows into these lifters and this helps control the accuracy of the lifters over the rise and fall of the cycle. From the lifters, the oil then flows through the pushrods, which have center bores drilled through them. Since these bores only carry a fraction the the oil flowing through the system, they only need to be wide enough to carry the oil needed for two valves each, as that is where the oil goes after flowing through them. This smaller flow of oil allows the bores drilled through the center of the rods to be small enough so such that it should not cause them to yield under the stress of normal operating conditions. After flowing through the rods, the oil enters holes drilled into the rocker arms above the cylinder head. From here oil is sprayed out onto the valve heads and surrounding areas. There are oil return channels drilled through the cylinder head, piston chamber, and engine block to allow the oil sprayed over the valves to return to the sump. The drillings have been placed at the lowest point on the cylinder head to ensure that all the oil will return to the sump. At all other places where the oil is sprayed out, it then flows back down the sides of the engine block and crankcase where it is returned to the oil pan for refiltering and circulation. As the engine is run and components wear, the oil begins to degrade slightly, and debris particles from the engine begin to build up. The filters are meant to catch particles large enough to damage the engine and extend the operating life of the oil and overall system, however they, along with the oil itself, must be changed periodically. Since it is difficult to estimate the amount of wear particles that will be deposited in the oil through purely theoretical calculations the initial oil change period will be specified as the recommendation of the oil used. The oil used for analysis and recommended type is SAE 10W-40 which is a multigrade oil, so a maintenance period of 5,000 miles is specified. However, as physical models are produced and testing can occur, this will be modified to fit the particular wear properties of this engine. The oil filter should also be changed will every oil change. It should be noted that the mounting for the filter and pump have not been included in the design of this engine. Because an electric pump was specified, it was decided that the mounting would be left to the bike manufacturer for easier maintenance, as an inlet to the engine drillings has been design into the bike, so the manufacturer must only connect the pump to the inlet. The mounting for the filter was also deemed to be out of scope for this project, as it can simply be mounted with the pump which was did not have a designed mount either.