The AC/DC converter can be implemented in many ways. For the motor drive application, the DC output of the converter should be controllable somehow. However, in any case, the input AC voltage will be rectified. There are many rectifier topologies utilizing diodes and thyristors. It should be noted that the output of the diode rectifiers is constant whereas the output of the thyristor rectifiers is adjustable. As discussed before, to be able change the speed of the rotor, a controllable DC voltage is required. This means, if the selected rectifier is a thyristor-based rectifier, then there is no need for supplementary circuitry to adjust the output DC voltage, since it is already adjustable by changing the firing angle of the thyristors. However, if the selected rectifier is a diode rectifier another circuitry must be implemented in order to adjust the output DC voltage. This circuitry is called DC/DC converter in general. In our application, a buck (step-down) converter should be utilized since the load will be a DC machine.

There are two types of rectifiers in terms of how they utilize the input voltage. Full bridge and half bridge. In general, half bridge rectifiers are not used since they give almost the half of the full bridge rectifier DC output voltage. Therefore, we will use full bridge variations.

Another important decision is the number of phases fed into the rectifier. We are given access to three phases. This means, we can choose to supply our rectifier either with a single-phase input or with a three-phase input. A single-phase full bridge rectifier has ripples of two times the frequency of the supplied input whereas a three-phase full bridge rectifier has ripples of six times the frequency of the supplied input. Therefore, if the chosen topology is fed with a single-phase input, in order to reduce the DC output ripple factor a large DC link capacitor is needed at the output of the rectifier. The tradeoff here is the number of rectifying components used. Evidently, for a single-phase rectifier fewer rectifying components are needed. Basically, a single-phase full bridge rectifier requires 4 diodes or thyristors and a three-phase full bridge rectifier requires 6. Also, it should be noted that the three-phase variation will output a much higher DC value. However, this is not a crucial consideration for our application because; firstly, the rated voltage of the DC machine is already low and secondly, we have access to a variac so that we can adjust the AC input of the rectifier so that we have a desired output DC voltage level at the beginning. Therefore, we can conclude that we will make use of three phases.

The last decision is the choice between diode and thyristor rectifier. As explained already diode rectifier outputs an uncontrollable DC voltage and hence a buck converter is needed. Buck converter is a very simple circuitry. It requires a switching device such as a MOSFET and filtering components such as a capacitor and an inductor. Also, a PWM signal which can be easily created is required for the switching device. Thyristor rectifier outputs a variable DC voltage by changing the firing angles of each thyristors. We have chosen that the rectifier will be a three-phase rectifier which means there will be 6 individual thyristors. At each firing instance two thyristors will be fired. Then after 60 degrees another set of thyristors will be fired. Generating these gate signals is a much harder procedure than designing a buck converter. Therefore, the topology we are going to implement is a three-phase full bridge diode rectifier followed by a buck converter.