Construction of Circle Diagram

Conduct No load test and blocked rotor test on the induction motor and find out the per phase values of no load current $I_0$, short circuit current $I_{SC}$ and the corresponding phase angles $\Phi_0$ and $\Phi_{SC}$. Also find short circuit current $I_{SN}$ corresponding to normal supply voltage. With this data, the circle diagram can be drawn as follows.

1. With suitable scale, raw vector OA with length corresponding to $I_0$ at an angle $\Phi_0$ from the vertical axis. Draw a horizontal line AB.
2. Draw OS equal to $I_{SN}$ at an angle $\Phi_{SC}$ and join AS.
3. Draw the perpendicular bisector to AS to meet the horizontal line AB at C.
4. With C as centre, draw a portion of circle passing through A and S. This forms the circle diagram which is the locus of the input current.
5. From point S, draw a vertical line SL to meet the line AB.
7. For a given operating point P, draw a vertical line PEGD as shown. then PE = output power, EF = rotor copper loss, FG = stator copper loss, GD = constant loss (iron loss + mechanical loss)
8. To find the operating points corresponding to maximum power and maximum torque, draw tangents to the circle diagram parallel to the output line and torque line respectively. The points at which these tangents touch the circle are respectively the maximum power point and maximum torque point.

Efficiency line
1. The output line AS is extended backwards to meet the X-axis at O'.
2. From any convenient point on the extended output line, draw a horizontal line QT so as to meet the vertical from O'. Divide the line QT into 100 equal parts.
3. To find the efficiency corresponding to any operating point P, draw a line from O' to the efficiency line through P to meet the efficiency line at T. Now QT is the efficiency.

Slip Line
1. Draw line QR parallel to the torque line, meeting the vertical through A at R. Divide RQ into 100 equal parts.
2. To find the slip corresponding to any operating point P, draw a line from A to the slip line through P to meet the slip line at R. Now RR is the slip.

Power Factor Curve
1. Draw a quadrant of a circle with O as centre and any convenient radius. Divide OC into 100 equal parts.
2. To find power factor corresponding to P, extend the line OP to meet the power factor curve at C. Draw a horizontal line CC to meet the vertical axis at C. Now OC represents power factor.