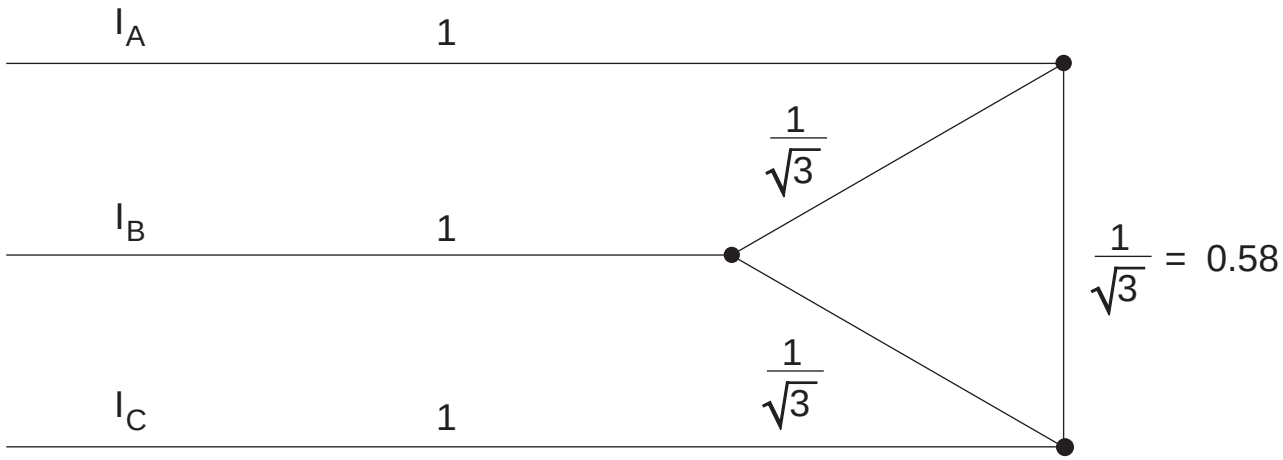
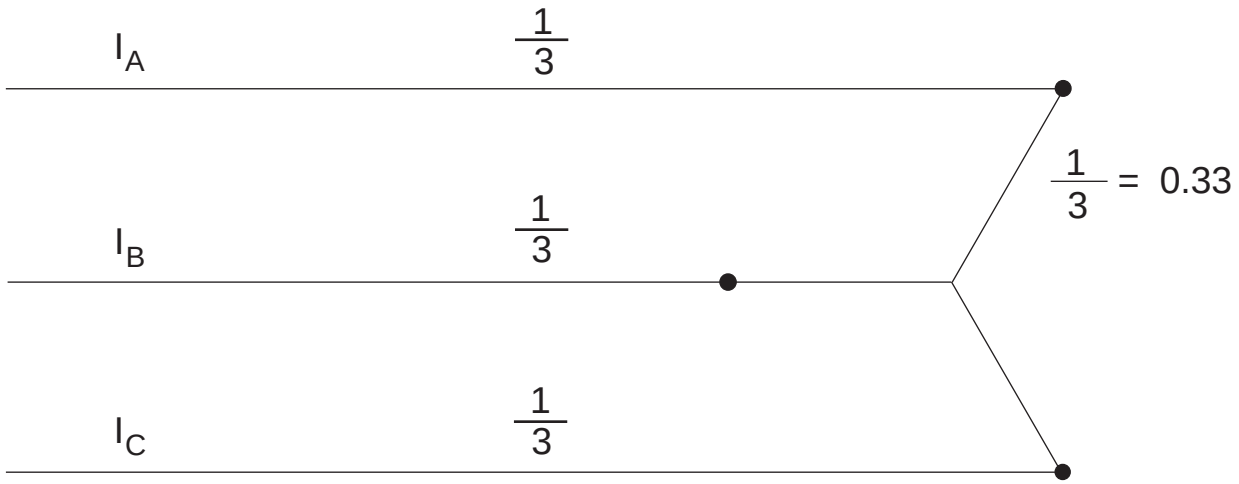
MP-05 : MOTOR PROTECTION WITH WYE-DELTA STARTERS

A wye-delta starter is a reduced-voltage starter that is suitable for an application that requires a long acceleration time, a low starting current, or frequent starts. It is used with a six-lead squirrel-cage induction motor that is rated for full voltage in the delta connection. When a motor is started in the wye connection, approximately 58% of full voltage is applied to each winding, the motor will draw 33% of its full-voltage starting current, and the motor will develop 33% of its full-voltage starting torque. Consider a normalized delta-rated load, reconnected in a wye, to illustrate these values:



$$P_{\Delta} = I_L V_L \sqrt{3} = \sqrt{3}\, V_L$$



$$P_Y = 3 \cdot \frac{1}{3} \cdot \frac{V_L}{\sqrt{3}} = \frac{1}{\sqrt{3}} V_L = \frac{1}{3} P_{\Delta}$$

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Because three times the power is delivered to the delta, when a heater-type overload is used with a wye-delta starter, overload current is measured inside the delta (load side of the starter) so that protection is coordinated with the windings for both connections. It is possible to select this type of starter in the MPS, which will automatically configure the correct settings. The MPU-32 can also be used in this configuration; however, the ammeter reading will be 58% of the line current when the motor is running. In most applications, it will be preferable to measure line current so that the ammeter will read correctly while running. When a motor is started in the wye connection and line currents are monitored, motor heating will be 1/3 of the delta connection heating. Consequently, a motor rated to withstand a 30 s stall time in the delta connection can only withstand 10 s when measured from the wye connection. If line current is the input to the MPU-32 must be set at 33% of the value calculated from the full-voltage locked-rotor time so that the motor will be protected while starting.

In summary, the usual procedure for using a MPU-32 with a wye-delta starter is the same as for a full-voltage starter with two exceptions. Lock-rotor cold time must be set at 1/3 of the value of the full-voltage locked-rotor time and the current transformers must be located on the line side of the starter. The only negative consequence is that the motor will be overprotected against cyclic running overloads. If cyclic running overloads will cause nuisance tripping, locate the current transformers inside the delta (load side of the starter). This will result in coordinated protection for both connections; however, full-load current must be considered to be 58% of the nameplate value. In this case, the value used for locked-rotor time is the same as for a full-voltage starter.