



Transformer Capacity - Single-Phase or Three-Phase

Distribution transformers must be adequately sized to satisfy the kVA requirements of the submersible motor. When transformers are too small to supply the load, there is a reduction in voltage to the motor.

Table 4 references the motor horsepower rating, single-phase and three-phase, total effective kVA required, and

the smallest transformer required for open or closed three-phase systems. Open systems require larger transformers since only two transformers are used.

Other loads would add directly to the kVA sizing requirements of the transformer bank.

Table 4 Transformer Capacity

| MOTOR RATING | | TOTAL EFFECTIVE KVA REQUIRED | SMALLEST KVA RATING-EACH TRANSFORMER | |
|--------------|------|------------------------------|--------------------------------------|--|
| HP | KW | | OPEN WYE OR DELTA 2- TRANSFORMERS | CLOSED WYE OR DELTA 3- TRANSFORMERS |
| 1.5 | 1.1 | 3 | 2 | 1 |
| 2 | 1.5 | 4 | 2 | 1.5 |
| 3 | 2.2 | 5 | 3 | 2 |
| 5 | 3.7 | 7.5 | 5 | 3 |
| 7.5 | 5.5 | 10 | 7.5 | 5 |
| 10 | 7.5 | 15 | 10 | 5 |
| 15 | 11 | 20 | 15 | 7.5 |
| 20 | 15 | 25 | 15 | 10 |
| 25 | 18.5 | 30 | 20 | 10 |
| 30 | 22 | 40 | 25 | 15 |
| 40 | 30 | 50 | 30 | 20 |
| 50 | 37 | 60 | 35 | 20 |
| 60 | 45 | 75 | 40 | 25 |
| 75 | 55 | 90 | 50 | 30 |
| 100 | 75 | 120 | 65 | 40 |
| 125 | 93 | 150 | 85 | 50 |
| 150 | 110 | 175 | 100 | 60 |
| 175 | 130 | 200 | 115 | 70 |
| 200 | 150 | 230 | 130 | 75 |

NOTE: Standard kVA ratings are shown. If power company experience and practice allows transformer loading higher than standard, higher loading values may be used to meet total effective kVA required, provided correct voltage and balance is maintained.

Effects of Torque

During starting of a submersible pump, the torque developed by the motor must be supported through the pump, delivery pipe or other supports. Most pumps rotate in the direction which causes unscrewing torque on right-handed threaded pipe or pump stages. All threaded joints, pumps and other parts of the pump support system must be capable of withstanding the maximum torque repeatedly without loosening or breaking. Unscrewing joints will break electrical cable and may cause loss of the pump-motor unit.

To safely withstand maximum unscrewing torques with a minimum safety factor of 1.5, tightening all threaded joints to at least 10 lb-ft per motor horsepower is recommended (table 4A). It may be necessary to tack or strap weld pipe joints on high horsepower pumps, especially at shallower settings.

Table 4A Torque Required (Examples)

| MOTOR RATING | | MINIMUM SAFE TORQUE-LOAD |
|--------------|----------------|--------------------------|
| HP | KW | |
| 1 hp & Less | 0.75 kW & Less | 10 lb-ft |
| 20 hp | 15 kW | 200 lb-ft |
| 75 hp | 55 kW | 750 lb-ft |
| 200 hp | 150 kW | 2000 lb-ft |