WESTERN UNDERGROUND COMMITTEE
GUIDE 2.7 (2.7/00/0370)

SUBMERSIBLE CAPACITOR EQUIPMENT

NOTE: This "Guide" summarizes the opinions, recommendations, and practices of the Western Underground Committee members and is issued only to assist these members in preparing their own specifications, or in making recommendations to specification agencies. Thus, this "Guide" may not reflect the complete requirements of each individual utility and is not binding upon them.

1.0 SCOPE

1.1 This "Guide" outlines the basic requirements for the design and manufacture of submersible capacitor equipment.

1.2 All components and associated accessory equipment shall be designed so as to permit the equipment to be used for submersible operation and shall be protected from corrosion so as to give a design life of 30 years.

1.3 The components required under this "Guide" will be (1) capacitor units; (2) switches; (3) protective devices; (4) monitoring and control devices.

These components shall be constructed in a modular form, which shall be compatible with each other. The purchaser will designate the various components required to provide the desired assembly.

1.4 It would be desirable if all components could be installed by the purchaser in one enclosure. However, the supplier's design should not be limited to a 36-inch diameter enclosure since adequate installation and maintenance room is a necessary requirement. All equipment shall be designed to operate continuously in an enclosure temperature of 54°C. measured at the top of the capacitor unit without a reduction in life.

2.0 CAPACITORS

2.1 The capacitor bank shall consist of only one unit per phase.

2.2 Each capacitor unit shall be single phase, submersible type, rated at 60 hertz.

2.3 The units shall be supplied in voltage ratings of:

Voltage	BIL KV
2400	60
4160	60
4800	75
7200	95
7600	95
7960	95
9540	95
9960	95
12470	95 and 125
13280	95 and 125
13800	95 and 125
14400	95 and 125

2.4 All units shall be tested and shall meet all requirements as specified in Part 5, NEMA Publication No. CP-1, except where noted.

2.5 The initial capacitor losses shall not exceed 0.9 watts per KVAR.

2,6 The capacitor shall be supplied with bushings that can accept a separable insulted connector or supplied with a universal bushing well as designated by the customer. The bushing and cable termination shall be of a type that can be held together by means other than suction or friction.

2.6 The supplier shall make the following design and production tests as specified in Part 5, NEMA Publication CP-1 except the air ambient should be 54°C. Certified results of these tests shall be supplied to the purchaser when requested in the bid proposal:

A—Design Tests

1. Dielectric strength test
2. Impulse withstand test
3. Thermal stability test

4. Radio influence voltage
5. Voltage decay test

B—Production Test

1. Short time over voltage test
2. Capacitance test
3. Loss determination test
4. Discharge resistor test
5. Leak test

3.0 PROTECTIVE DEVICE

3.1 A submersible protective device shall be supplied to adequately protect each phase of the system from capacitor faults.

3.2 An expulsion fuse will not be acceptable because of the confined area in which the fuse will operate.

3.3 The device shall have a continuous rating of 175-200 percent of the capacitor ampere rating and shall have a minimum interrupting rating or 16,000 amperes RMS asymmetrical.

4.0 SWITCHES

4.1 Switches shall be (single phase) (three phase) as designated by the purchaser and designed for submersible operation.

4.2 The switch shall be supplier with bushings that can accept a separable insulated connector or shall be supplied with a universal bushing well as designated by the customer. The bushing and cable termination shall be of a type that can be held together by means other than suction or friction.

4.3 The switch shall be capable of being controlled by the monitoring device or by manual operation from above the enclosure.

4.4 The switch shall have the following minimum ratings:

Continuous and load break capability	150 amperes at rated voltage @ 54°C.
Make and latch rating	16,000 amperes asymmetrical

Lifetime operations	10,000 off and 10,000 on @ 150 amperes 90° leading.

5.0 MONITORING AND CONTROL DEVICES

5.1 The required equipment shall be designed for submersible operation.

5.2 This equipment shall provide switching instructions to the switch in accordance to pre-selected values.

5.3 The sensor shall respond to one or more of the following values as specified by the purchaser: time, voltage, current, or bars.

5.4 Where a potential is required for both switching and monitoring, a dual-purpose device will be permitted.