Test Description for McNary Dam

1.0 Setup:

1.1 With the shutdown, install transducers.

1.2 Start the unit and run offline at speed-no-load, verify all transducers are working properly. (total estimated time 15 min.)

1.3 Place the unit online at a low power level and verify all transducers are still working properly. (total estimated time 15 min.)

2.0 Governor Tests:

1.1 **Steady State Offline Measurements** (total estimated time 30 min.)

2.1.1 Start the unit offline and spinning at speed no load.

2.1.2 Starting at 60 Hz, take measurements of speed dial position and frequency.

2.1.3 Increase speed by about 1% increments taking measurements of speed dial position and frequency until 63 Hz. (Ramping rate can be at any rate specified by the Corps. Allow 2 to 3 minutes between each measurement for unit to steady out.)

2.1.4 After measurements are taken, return unit speed to 60 Hz. (Ramping rate can be at any rate specified by the Corps.)

2.2 **Steady State Online Measurements** (total estimated time 30 min.)

2.2.1 Put the unit online with no load.

2.2.2 Take measurements of the power and gate position for each speed dial position used in the steady state offline measurements. (Ramping rate can be at any rate specified by the Corps. Allow 2 to 3 minutes between each measurement for the unit to steady out.)

2.2.3 Note: this test will be taking measurements starting at 0 MW and increasing the load in about 5 or 6 steps until the unit is at full load.

2.2.4 After the final measurement at full load is taken, the unit shall remain online with the load reduced to 0 MW for the next test. (This ramp rate can be at any rate specified by the Corps.)

2.3 **Speed Step Response** (total estimated time 10 min.)

2.3.1 From the previous test, the unit should already be online and at no load.

2.3.2 Quickly adjust the speed dial in the amount that results in an increase in offline speed 1%. This will move the gates open approximately 20%. (The ramping rate will be determined by the governor response time but typical responses are in the 20 to 30 second range for the gate to reach steady state.)

2.3.3 After the gate position has reached steady state, repeat the test in the opposite direction (i.e. decreasing the power and closing the gates). (The ramping rate will be determined by the governor response time but typical responses are in the 20 to 30 second range for the gate to reach steady state.)

2.3.4 Keep the unit online but return to no load, if it is not already there.

2.4 **Gate Rate Limits** (total estimated operation time 5 min)

2.4.1 Place the gate limiter at the current gate position and adjust the speed dial well above the amount required to increase the offline speed of 1%.

2.4.2 Quickly move the gate limit in the open direction to the amount required to increase the offline speed of 1%. (The ramping rate will be at the maximum rate allowed by the stop nuts on the governor.)

2.4.3 After the gate position has reached steady state, quickly move the gate limiter back down to the previous position. (The ramping rate will be at the maximum rate allowed by the stop nuts on the governor.)

2.4.4 Return the speed dial to the speed no load position and move the gate limiter back to its normal position. Load the unit to about 10% MW for the next test. (This ramp rate can be at any rate specified by the Corps.)

2.5 **Partial-Load Rejection** (total estimated time <5 min.)

2.5.1 From the previous test, the unit should already be online and at about 10-20% load.

2.5.2 Once the unit is at the correct loading condition, it can immediately be tripped offline.

3.0 Exciter Tests:

3.1 **Offline Open Loop Step Response** (total estimated time 15 min.)

3.1.1 With the unit offline and spinning at speed-no-load, place the AVR into manual.

3.1.2 Insert a test signal into the summing junction of the AVR and record the AVR output.

3.1.3 Note: the unit will not be responding to the test signal because the AVR is in manual.

3.2 **Offline Closed Loop Step Response** (total estimated time 10 min.)

3.2.1 With the unit still offline and spinning at speed no load, place the AVR back into automatic.

3.2.2 Insert a test signal to create a 1-2% step in the terminal voltage. Wait 2-3 minutes for the voltage to reach steady state.

3.2.3 Step the voltage back to its nominal value.

3.3 **Online Closed Loop Step Response with the PSS Off** (total estimated time 10 min.)

3.3.1 Place the unit online at 0 MW and 0 MVARs and the PSS off.

3.3.2 Insert the same test signal used to step the voltage 1-2% in the offline test. Wait 2-3 minutes for the voltage and power to reach steady state.

3.3.3 Step the voltage back down to its original value.

3.3.4 Note: this test should not change the gate position or MW. Only the voltage and reactive power will be changing during the steps.

3.4 **Online Closed Loop Step Response with the PSS On** (total estimated time 10 min.)

3.4.1 Repeat previous test with the PSS on.

4.0 PSS Tests (total estimated time 45 min.)

The PSS has several tests that only require the unit to be offline and spinning at speed no load and with the AVR in manual. These tests won't affect the unit and will only be testing the electronics of the PSS.

Table 1: Estimated Time (minutes) at Power Ranges

Test Procedure	Offline at SNL	Online at No Load	Online Below 1% Criteria	Online Inside 1% Criteria	Online above 1% Criteria	Total
1.1	0	0	0	0	0	0
1.2	15	0	0	0	0	15
1.3	0	0	15	0	0	15
2.1	30	0	0	0	0	30
2.2	0	10	10	5	5	30
2.3	0	5	5	0	0	10
2.4	0	5	5	0	0	10
2.5	0	0	5	0	0	5
3.1	15	0	0	0	0	15
3.2	10	0	0	0	0	10
3.3	0	10	0	0	0	10
3.4	0	10	0	0	0	10
4	45	0	0	0	0	45
Total	115	40	40	5	5	205

Note: If slow ramp rates are required, time must be added to the estimated times in this document. These estimated times also assume an operator familiar with the test procedures. If operator requires detailed explanations between and during each test, additional time may be required.