Preliminary Performance Guideline for VRT Tests

ERCOT Transmission Planning. Revision 2, May 23, 2019.

Purpose:

This document is intended to clarify the expectations during VRT tests. **Disclaimer: This document is provided only as a general guideline; this document is not intended to spell out exact criteria.**

General suggestions:

Resources performing well during Voltage Ride Through (VRT) generally have the qualities of: (1) good dynamic response (e.g. capable of transitioning from maximum lagging to maximum leading power factor within 0.5 seconds of a large grid voltage disturbance), (2) Automatic Voltage Regulator response (e.g. regulate the POI voltage using a closed loop reactive power controller, and (3) do not cease producing power (momentary cessation). Recommend running VRT simulation to 20 seconds and plotting POI quantities. **Note to REs and equipment vendors: This test is easy to simulate yourself on your plant. It requires no external data.**

HVRT

- ✓ During the high voltage transient, the resource should provide a fast dynamic response to absorb reactive power
  - o Unit should be absorbing a significant amount of reactive power at the POI during the high voltage transient, and ideally within 0.5 seconds of the transient inception.
- ✓ For 1.1pu sustained POI voltage, the automatic voltage regulator (AVR) should move the resource towards nearly full reactive absorbing (Qmin).
- ✓ Real power should be sustained (the resource should not sacrifice real power (P) for reactive power (Q) during high voltage conditions)

LVRT

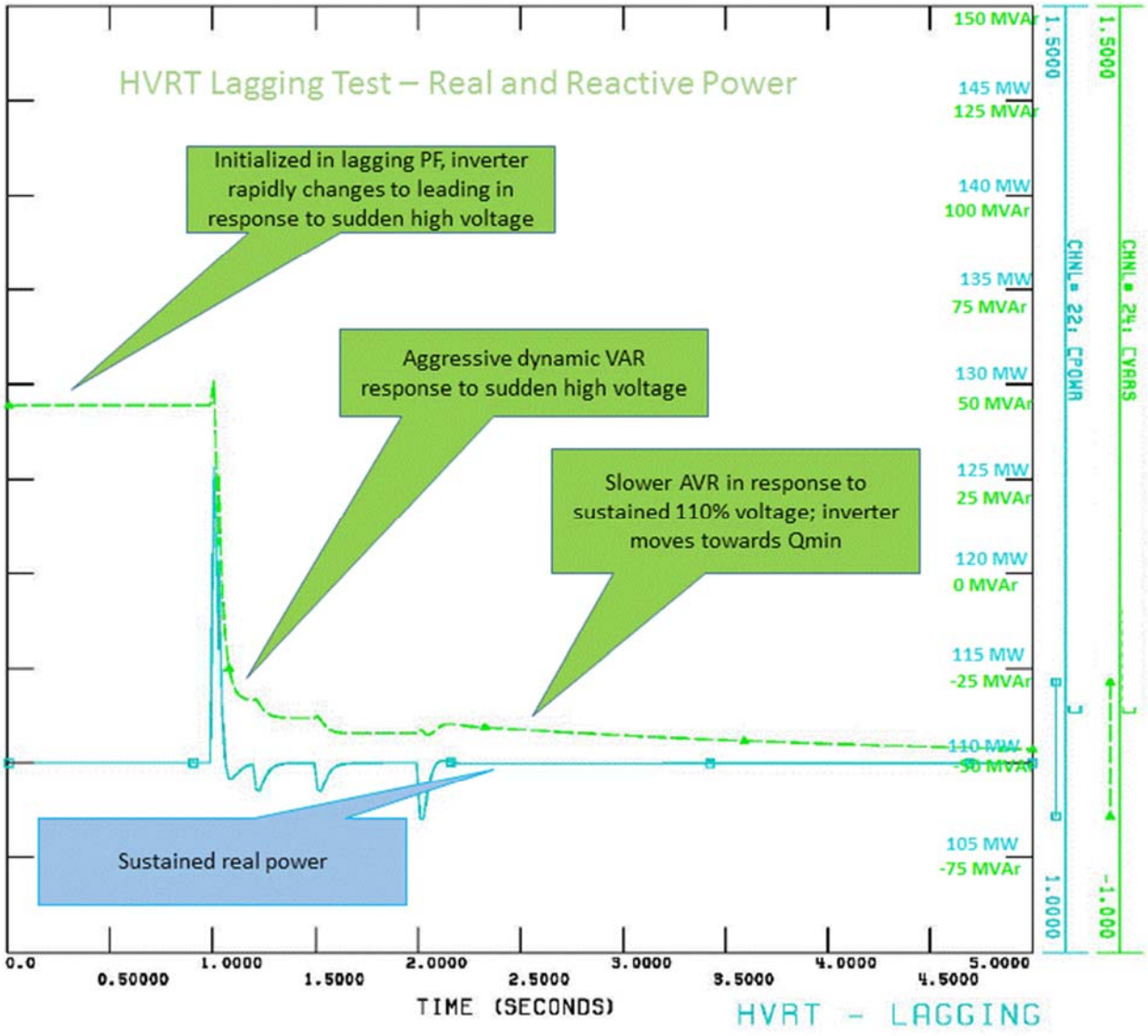
- ✓ For the low voltage transient, the resource should inject reactive current throughout the voltage recovery period.
  - o At POI, both P and Q are necessarily zero for zero voltage. Q injection at the POI should be observable immediately or very shortly after voltage begins ramp up from zero.
- ✓ At the completion of the LVRT test, the resource should continue to support voltage with a reactive output that settles significantly lagging.
- ✓ For 0.9pu sustained POI voltage, the AVR should move the resource towards nearly full reactive production (Qmax).
- ✓ Real power recovery should start prior to the POI voltage recovering to 0.9pu.
  - o Real power should recover to full output within 1.0 seconds of POI voltage recovery to 0.9pu. It may be okay if the real power only recovers to 90% of original dispatch if the reactive output at the POI is significantly beyond ERCOT 0.95 power factor requirements.

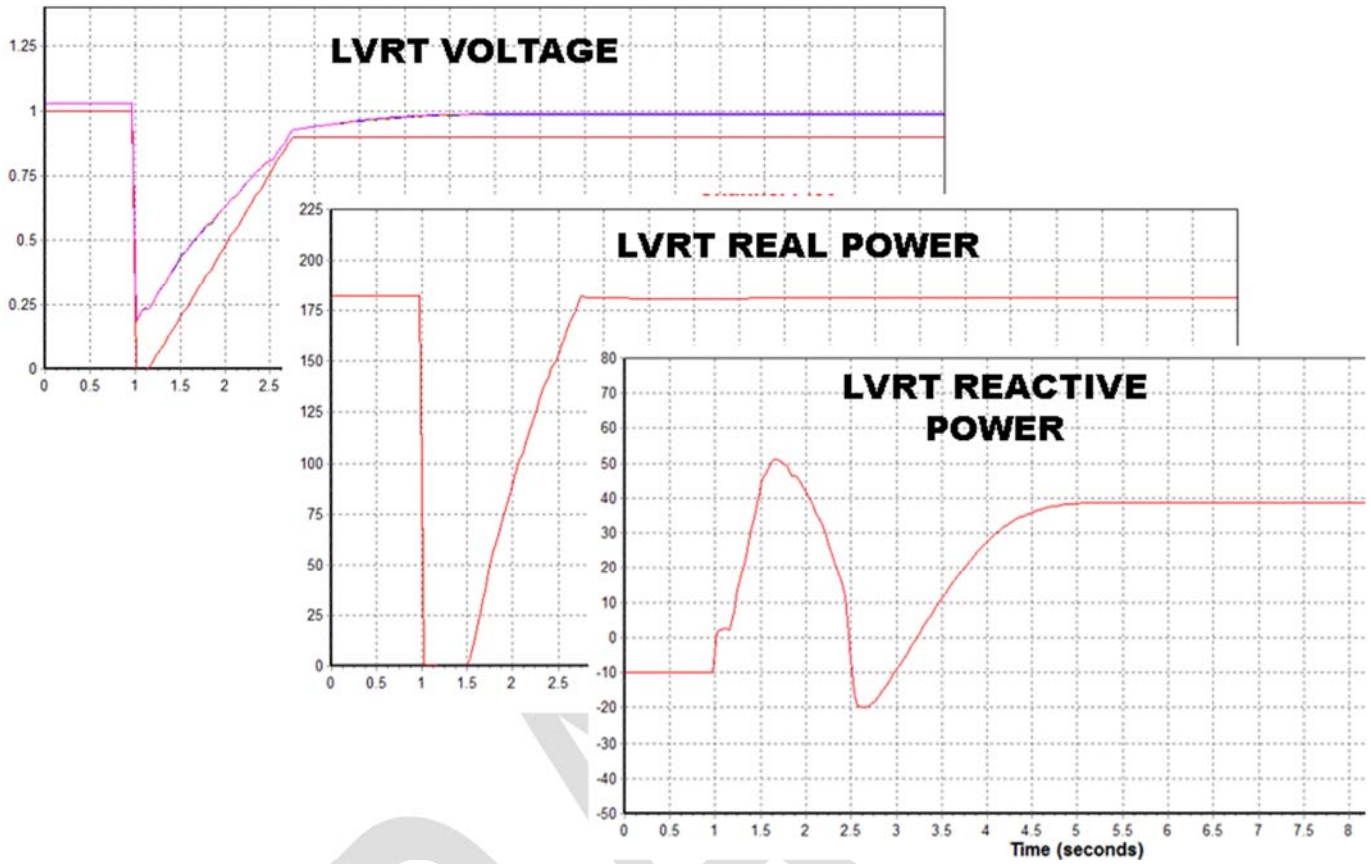
Protocol References:

- No Momentary Cessation During VRT: Operating Guide 2.9(2)
- Dynamic Reactive Power: Nodal Protocol 3.15(3)(c)
- Automatic Voltage Regulator: Protocol 3.15.3(4), 3.15(4), and Operating Guide 2.7.3.5(4)

Example Illustrations of Good Performance

- HVRT Lagging





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