

Induction Motor 180 V 20-Minute Reversal Test

Repeated forward/reverse direction changes at 180 VDC and ± 60 Hz on the TECO MAX-IE3 induction motor to stress-test switching and current control.

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1. Induction Motor 180 V 20-Minute Reversal Test

This report records a 20-minute reversal endurance run of the TECO MAX-IE3 induction motor on the C2 power stage at 180 VDC. The motor was commanded to alternate between +60 Hz and -60 Hz every ~45 s to exercise direction-change sequencing, DC-link regulation, and current control under repeated inrush conditions.

1.1. Test setup

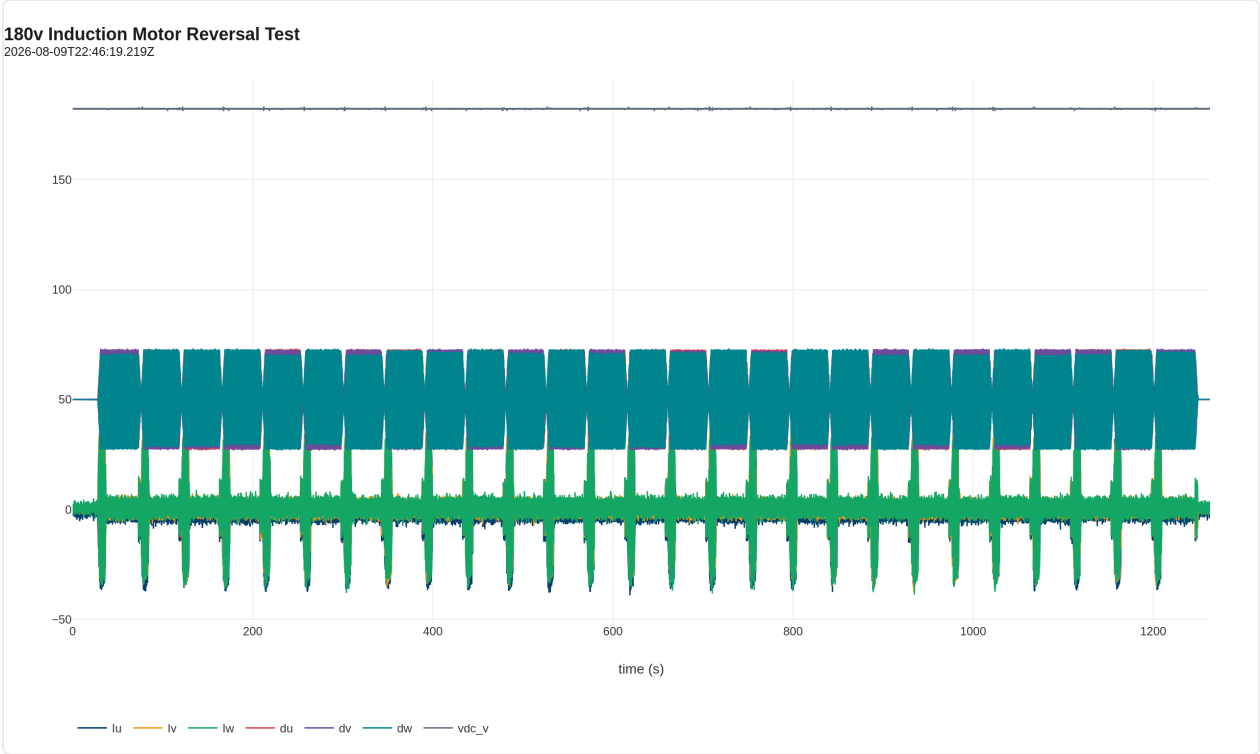
- **Motor:** TECO Westinghouse MAX-IE3 3-phase induction motor, 10 HP / 7.5 kW, 208 V, 60 Hz
- **Inverter:** OpenVVF C2 chassis with 200 V DC-link capacitors
- **Cooling:** Power stage baseplate passively cooled (no active cooling)
- **Control:** V/Hz open-loop excitation, commanded ± 60 Hz, reversing every ~45 s
- **Instrumentation:** Controller telemetry, Klein Tools TI250 thermal imager

1.2. Test conditions

Parameter	Value
DC bus voltage	~182 VDC
Commanded frequency	+60 Hz / -60 Hz, alternating
Reversal interval	~45 s
Mechanical load	None (free spinning shaft)
Duration	~21 min (1263 s)
Ambient temperature	~25 °C

1.3. Electrical observations

The plot below shows the full 20-minute run. The bus voltage remained stable near 182 V throughout. Phase-current spikes appear at each reversal as the inverter re-magnetizes the motor in the opposite direction while the rotor is still spinning the other way.



Telemetry overview of the 20-minute reversal test: phase currents, duty cycles, and DC bus voltage

Key metrics from the log:

Quantity	Value
Reversals completed	26
Average reversal interval	45.0 s
Average peak phase current at reversal	~35.6 A
Maximum observed phase current	~40.9 A
Maximum observed DC bus voltage	~183.2 V
Average DC bus voltage	~182.3 V

OPEN TELEMETRY LOG:
View the reversal test in the Telemetry Viewer

1.4. Thermal results

Thermal spot-checks at the end of the run with no active cooling:

Location	Steady-state temperature
Power stage baseplate	~33 °C
Motor frame	~31 °C

Ambient temperature was ~25 °C, so the temperature rise was modest under the repeated reversal stress.

1.5. Results

- The C2 power stage completed 26 consecutive reversals at 180 VDC without fault.
- DC bus regulation remained stable; voltage sagged only slightly during reversal current spikes.
- Peak reversal currents averaged ~35.6 A and stayed below ~41 A.
- Direction-change sequencing behaved consistently across all 26 cycles.
- Steady-state temperatures stayed low with only passive cooling on the power stage.

1.6. Conclusion

The power stage and V/Hz control tolerate repeated full-speed reversals at 180 VDC on an unloaded induction motor. This validates direction-change robustness for 200 V-class operation and provides a baseline before adding mechanical load.

1.7. Artifacts

- Decimated telemetry log (JSONL, 0.2 s) - open in Telemetry Viewer
- Telemetry overview plot (PNG)

1.8. Notes

- The full-rate telemetry log is ~62 MB; the linked file is decimated to 0.2 samples per second for the repository.
- This test used an unloaded motor; loaded reversals will produce higher inrush currents and should be validated separately.