APPENDIX B

GUIDELINES FOR IDENTIFYING MISOPERATIONS[1]

	Operation Example	Misoperation	Reason
	A. Fault Conditions		
1	A line fault occurs, clearing by Zone 1 relays at all terminals. An analysis shows that the pilot scheme failed to operate.	Yes	The pilot scheme failed to operate for a fault within its zone of protection.
2	A line fault occurs, clearing by Zone 1 relays at all terminals. An analysis failed to determine whether the pilot scheme operated, but there is no incontrovertible evidence of a pilot scheme failure.	No	There was no evidence that the pilot scheme or any Protection System element failed to operate.
3	A fault occurs the next day on the same line as in the previous example but in a different location, clearing on Zone 2 time from one end. However, should the event on the previous day then also be classified as a misoperation?	Yes No	The pilot scheme failed to operate for a fault within its zone of protection. The prior event should be re-examined, but a verified misoperation on a similar event does not result in a direct determination that the earlier event was a misoperation.
4	A line fault occurs and clears high speed at all terminals. No target information whatsoever is available for analysis.	No	In the absence of all evidence, a misoperation should not be assumed.
5	A fault occurs on a line protected by two pilot schemes. An analysis shows that one of the two pilot schemes failed to operate.	Yes	According to the NERC definitions, misoperations are determined on a "Protection System element" basis.

[1] This table provides examples to be used as a reference for the Reliability*First* "Procedure for Reporting, Review, and Analysis of Protection System and Under Voltage Load Shedding (UVLS) Misoperations". (Examples were provided and reviewed by the Reliability*First* Protection Subcommittee and/or Reliability*First* staff.)

6	A breaker failure (stuck breaker) operation occurs (with no other failures) due to a mechanical problem in the breaker.	No	The breaker (other than the trip coil) is not part of the Protection System.
7	A line fault occurs and the primary (pilot) relaying operates correctly but does not trip the breaker because the primary trip coil is defective.	Yes	The trip coil is part of the Protection System.
8	A line fault occurs and the primary (pilot) relaying operates correctly but the primary trip coil is defective. A cross-tripping scheme activates the backup trip coil from the primary relays resulting in high-speed clearing.	Yes	The primary trip coil, which is part of the Protection System, did misoperate, in that it was called on to operate but didn't.
9	A fault develops internal to a line GCB and all local sources clear by bus differential. The remote terminal clears by pilot relaying but not in the expected time. Blocking carrier noise due to the fault is suspected.	Yes	The pilot scheme failed to operate within its expected time.
10	A unit connected to the 230 kV system trips following a line fault for reasons other than the operation of the generator protective relaying (i.e., boiler control systems, drop-out of motor contactors, etc.)	No	This is not a misoperation of a Protection System.
11	Relay test and maintenance personnel completed their work and left the station with open test switches. The relays on a 230 kV line subsequently failed to operate during a fault.	Yes	By leaving the station with test switches open, the maintenance personnel essentially left the Protection System in an improperly-wired configuration.

	Operation Example	Misoperation	Reason
	B. Non-Fault Conditions		
1	Relay test and maintenance personnel forget to open test switches while actively performing work at the station resulting in the inadvertent tripping of a 230 kV line terminal.	No	The Protection System operation occurred during "on-site maintenance and testing activity" and is therefore excluded.
2	Relay test and maintenance personnel completed their work and left the station with open potential test switches. The relays subsequently operated due to load current.	Yes	Even though the problem was related to maintenance activity, the station was left unattended in an improper configuration.
3	A 230 kV line trips at one end, no targets were reported. Personnel were in the control house at the time of the trip, but state that they were not involved. An investigation reveals nothing.	No	There is no clear indication that a Protection System operated to trip the line.
4	A phase impedance relay is set with a reach which exceeds the criteria set forth in the NERC transmission relay loadability criteria. Due to the setting, the relay operates on a severe load condition, tripping a 230 kV line.	Yes	In the absence of approved technical exceptions, the relay was improperly set.
5	A phase impedance relay is set in conformance with the NERC transmission relay loadability criteria, but it operates when a recoverable power swing causes the apparent impedance to enter the tripping characteristic.	No	A relay which was properly set and applied responded as expected to abnormal system conditions.
6	A 230 kV line has a tap to a distribution station with no high-side breaker. A defective sudden pressure relay at the distribution station falsely operates, closing a high-side ground switch onto the line, which clears the line properly.	No	Although the defective sudden pressure relay improperly operated, the Protection System and ground switch are not part of the BES; therefore, the operation is not required to be reported.
7	A 230 kV line terminates in a two-breaker position. A defective protection system component causes one of the breakers to trip, but line power flows are not affected.	Yes	Even though the failure does not directly impact the transmission system, an unintentional Protection

			System operation occurred.
8	A SCADA RTU module failure results in the tripping of one or more 230 kV breakers.	No	SCADA facilities are not part of the Protection System.
9	A defective breaker failure relay trips breakers at station "A" and keys transfer trip to station "B". A defective transfer trip receiver results in the failure of the terminal at "B" to trip.	Yes Yes	The breaker failure relay falsely operated. The receiver did not operate as designed.
10	A generator was being brought online. The substation breaker was given a close command and it immediately tripped off. Two directional overcurrent relays dropped A and B TOC targets. Analysis revealed that a contact on the sync scope selector switch (recently installed) was the improper type allowing the sync check relay to be bypassed when the sync scope selector switch was in the automatic position. Incorrect switch selection in the sync check circuit allowed for the out of sync closure of the generator. Once closed, all relaying operated properly to clear the fault condition.	No	The directional overcurrent relays operated correctly for an out of sync condition.
11	An under frequency relay caused a 115 kV breaker to trip and lock out. No other under frequency relays operated and the system frequency at the time was 60.00 Hz.	No	Under frequency relay misoperations are not addressed in NERC PRC-004, PRC-016 and PRC-022.
12	Substation personnel are looking for a ground on the positive side of the station battery. A control fuse is pulled and a 230 kV line terminal trips.	No	The false trip occurred during maintenance activities.
13	When taking a generator offline, a reverse power relay used in the control logic of a sequential tripping scheme to shut down the unit does not operate. However, the reverse power relay used to protect the generator from motoring does operate to trip and lockout the generator.	No	The relay that did not operate was performing a control function rather than a protective function and was not part of a Protection System.

Document Revision History

Issue	Reason for Issue	Approved By	Date
0.0	Original Appendix B	Rich Gloff	03/19/08
1.0	Moved operation example B9 up and inserted as example B6 and renumbered examples. Added examples B10 and B11.	Rich Gloff	08/31/09
2.0	Added footnote 1 to title. Changed column titles. Revised legacy remarks for each operation example into reason for classification. Removed example A5. Added footnote 2 to example B6. Revised examples B7 and B9. Added example B12.	Rich Gloff	03/02/10
3.0	Revised operation examples B6 and B9 and added example B13. Renumbered examples A6-A12.	Art Buanno	08/02/10
3.1	Revised title of document in footnote [1]	Raymond J. Palmieri	11/09/10