# Misoperations Impact Score

Over the past several years, the ERO has identified numerous scenarios in which referencing only the misoperation rate calculation does not provide an accurate representation of how entities' protection systems are performing. In order to provide a more wholistic analysis of Bulk Electric System (BES) protection systems' performance, the ERO has worked with the Misoperation Information Data Analysis System (MIDAS) User Group to create a measure reflective of a misoperation's estimated impact to the BES. This calculation consists of factoring several fields that are reported into MIDAS and providing each option for those fields with a weight. Weights, shown in the equation below, and factors (see Table 5) were determined using existing regional calculations, with some adjustments following review. The resulting value, termed "misoperation impact score," is scalable down to the individual misoperation level and can be aggregated in a variety of ways such as daily, monthly, or yearly to illustrate trends in misoperations' general impact to the BES.

## Methodology

NERC, the Regions, and Entities should use the Misoperation Impact Score to:

- Trend their performance and

- Compare their performance against that of similarly sized companies.

NERC uses this metric to gauge relative performance and risks between Regions and includes it in the annual State of Reliability report. Regions use this metric to gauge relative performance and risks between entities.

The maximum score of 1.0 implies the worst impact an event is projected to have on the BES while a minimum score of 0.3034 reflects the least impact an event is projected to have on the BES.

As shown in Table 1, voltage class, equipment type, cause, and category were determined to be the fields that would determine the event's impact to the BES reliability. The general approach taken in assigning weightings is that Misoperations affecting certain equipment at higher voltage facilities or requiring more equipment be removed from service are generally going to be more impactful. For example, a relay failing to trip causing a 500-765kV bus to clear during a large storm with an unknown cause will generally be much more impactful to reliability, and more likely to reoccur, than a clear sky day unnecessary trip on a single 100-199kV circuit because of a clear relay malfunction requiring a replacement.

# Misoperation Impact Score Calculation

$M$isoperation Impact Score =

$$\frac{([\text{Voltage Class Factor}] * 0.3 + [\text{Equipment Type Factor}] * 0.2 + [\text{Cause Factor}] * 0.1 + [\text{Category Factor}] * 0.4)}{\text{Total Misoperation Count}}$$

## Voltage Class Sub-fields (30% weighting)

The Voltage Class sub-fields were selected to align with the TADS-established voltage ranges.

| Value | Factor |
|---|---|
| 0–99 kV | 0.4 |
| 100–199 kV | 0.5 |
| 200–299 kV | 0.65 |
| 300–499 kV | 0.85 |
| 500–765 kV | 1 |

## Equipment Type Sub-Fields (20% weighting)

The **Equipment Type** sub-fields include all options listed in the MIDAS Data Reporting Instruction Table G.4 and assigned factors that rank the equipment from least to greatest impact to the BES reliability.

| Value | Factor |
|---|---|
| BES UFLS, BES UVLS | 0.333 |
| Shunt Capacitor, Shunt Reactor/Inductor | 0.5 |
| HVdc, Line, Series Capacitor, Series Reactor/Inductor, Transformer, Breaker | 0.667 |
| Bus, Other | 0.833 |
| Dynamic VAR Systems, Generator | 1 |

## Cause Sub-Fields (10% Weighting)

The **Cause** is divided into three sub-fields: Equipment Errors (and Other), Human Errors, and Unknown.

- The Equipment Errors sub-field includes; AC System, Communication Failure, DC System, Relay failures/malfunctions, and Other/Explainable.

- The Human Errors sub-field includes; As-Left Personnel Error, Incorrect Settings, Logic Errors, and Design Error.

- The Unknown sub-field includes: Unknown.

| Value | Factor |
|---|---|
| Equipment Errors (and Other) | 0.5 |
| Human Errors | 0.85 |
| Unknown | 1 |

While a particular cause is not directly indicative of a Misoperation's impact, being unable to identify and resolve the actual issue (Unknown cause) or having inadequate, or unfollowed, processes (Human Errors) generally represent a greater ongoing risk than a one-off equipment failure.

The **Category** is divided into four sub-fields that capture all Misoperation Categories listed in the MIDAS Data Reporting Instruction Table G.6.

| Value | Factor |
|---|---|
| Slow Trip–Other than Fault | 0.167 |
| Unnecessary Trip–Other than Fault | 0.333 |
| Failure to Trip–Other than Fault, Unnecessary Trip–During Fault | 0.667 |
| Failure to Trip–During Fault, Slow Trip–During Fault 1 | 1 |