

TABLE 5.5

Component Unavailability Expressions for Standby Systems

Component Type/ Unavailability Mode	Time-Averaged Unavailability Expression	Parameter Definition	Data Requirements for Parameter Estimation
<p>1. Tested Standby Components</p> <p>1.1. Hardware Failure</p> <p>1.2. Test outage</p> <p>1.3. Repair outage</p> <p>1.4. Scheduled Maintenance</p>	$1 - \frac{1 - e^{-\lambda_s T}}{\lambda_s T}$ $\frac{\tau}{T} q_0$ $\lambda_s T_R$ $f_m T_m$	<p>λ_s: Standby failure rate</p> <p>T: Component Test Period</p> <p>τ: Average test duration</p> <p>q_0: Override unavailability (if applicable) obtained from system analyses</p> <p>T_R: Mean time to repair</p> <p>f_m: Scheduled maintenance frequency (includes interface maintenance)</p> <p>T_m: Mean time of scheduled maintenance action</p>	<p>λ_s</p> <ul style="list-style-type: none"> o Number of observed Failures o Total component standby time $\frac{\text{Number of observed Failures}}{\tau}$ <ul style="list-style-type: none"> o Observed test durations $\frac{\text{Observed test durations}}{T_m}$ <p>T_R, T_m</p> <ul style="list-style-type: none"> o Observed individual times for repair and maintenance, respectively, including detection and wait time

TABLE 5.5 (Continued)

Component Unavailability Expressions for Standby Systems

Component Type/ Unavailability Mode	Time-Averaged Unavailability Expression	Parameter Definition	Data Requirements for Parameter Estimation
2. Untested Standby Component	$1 - \frac{1 - e^{-\lambda_s T_p}}{\lambda_s T_p}$ $\frac{\lambda_s T_R}{1 + \lambda_s T_R}$	λ_s : Standby failure rate T_p : Fault Exposure Time T_R : Mean time to repair	T_p Inferred from replacement times of component due to other failures or if not replaced, then assume $T_p = 40$ years
3. Monitored Standby Component			

TABLE 5.6

Component Unavailability Expressions for Online Systems

Component Type/ Unavailability Mode	Time-Averaged Unavailability Expression	Parameter Definition	Data Requirements for Parameter Estimation
1. Nonrepairable Component	$1 - e^{-\lambda_0 T_M}$	λ_0 : Operating Failure Rate T_M : Mission Time (obtained from success requirement)	<ul style="list-style-type: none"> • λ_0 Number of observed Failures • Total time-to-Failure <hr style="width: 100%;"/>
2. Online Repairable Component	$\frac{\lambda_0 T_R}{1 + \lambda_0 T_R}$	T_R : Mean Time to Repair	T_R Observed individual times for repair