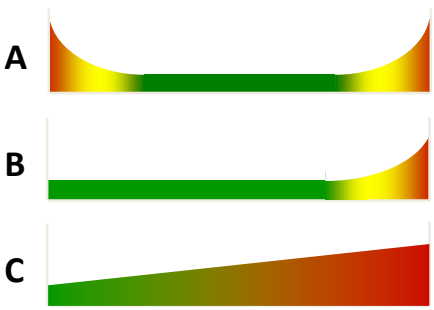
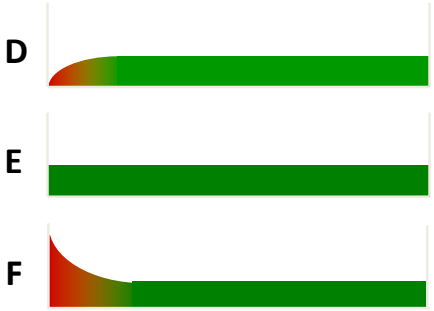
Meeting end-user expectations requires different strategies for various asset classes



Building fabric

Many of these assets provide sufficient warning before they are considered to be in a 'failed' state. This makes planning relatively easy but can lead to significant interruption to operations

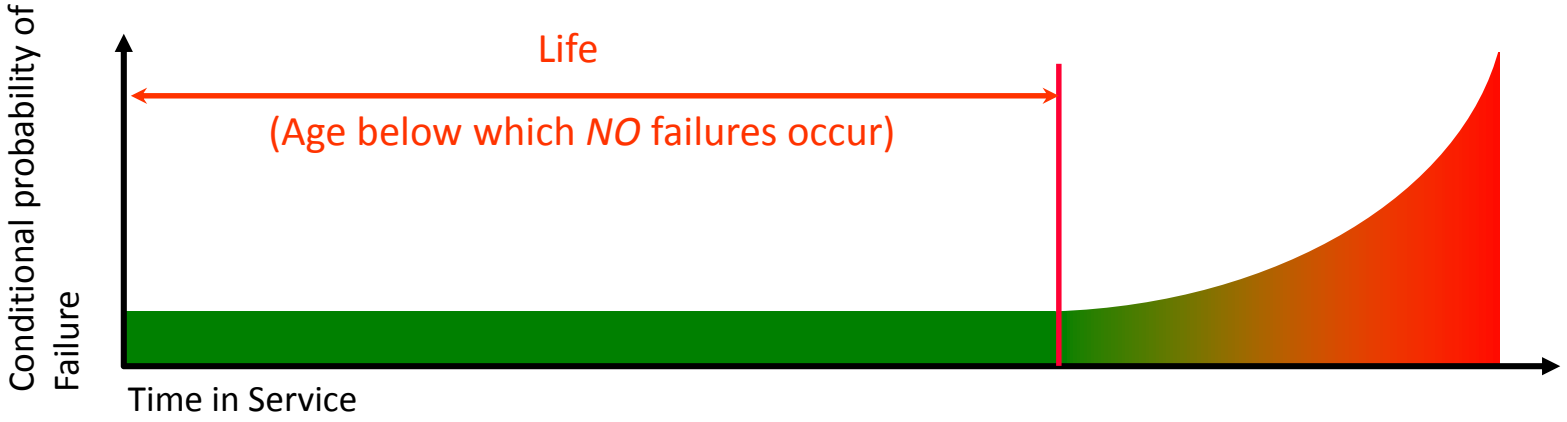


ECG Monitors

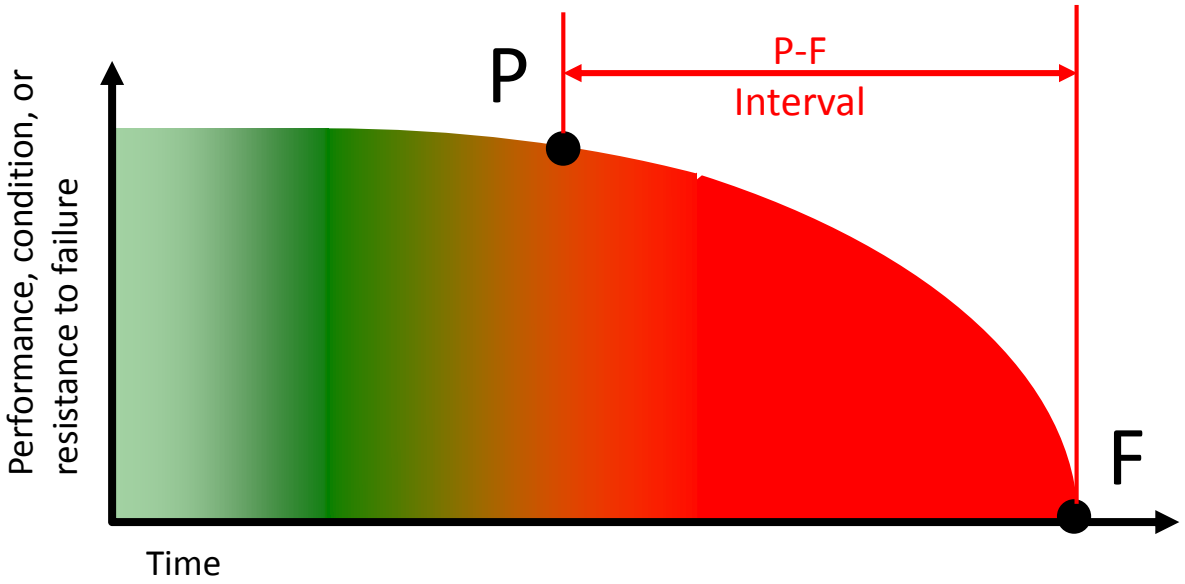
However, many of these types of assets provide little warning of failure and need different strategies to manage the consequences of failure. Where maintenance cannot prevent failure, keeping spares may be the best option

Periodic replacement of assets is technically feasible if:

- There is an age where there is a rapid increase in the conditional probability of failure
- Most items survive to this age



Periodic inspection of assets is technically feasible if:



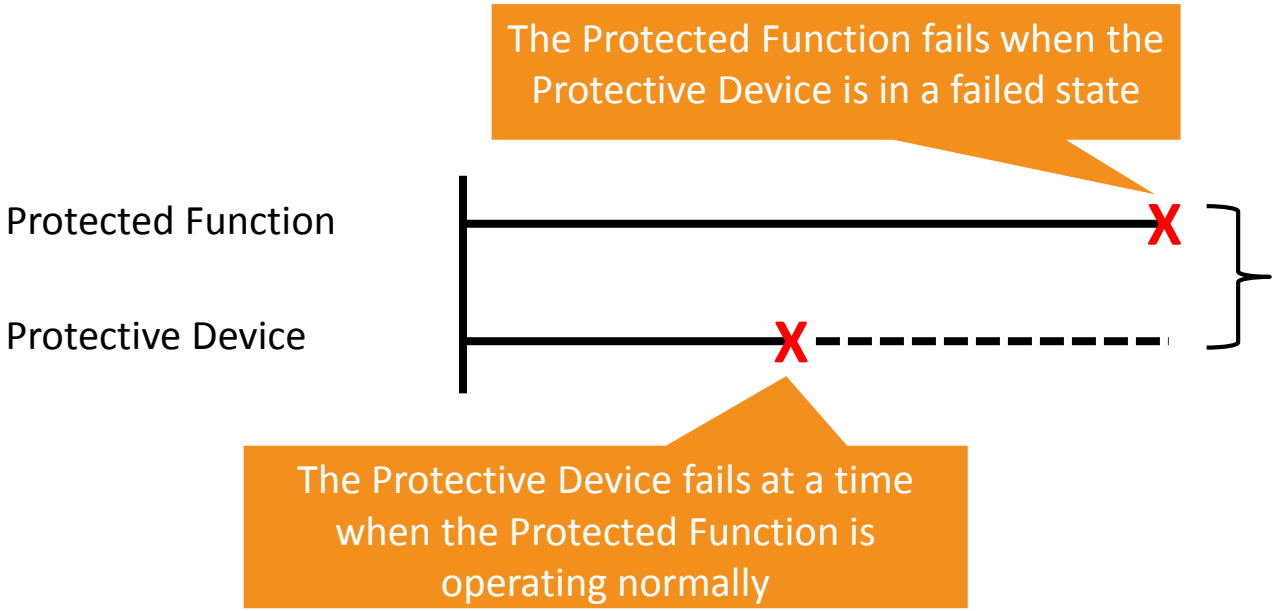
- There is a clear potential failure condition, i.e., there is a clear indication that failure is about to occur
- The P-F interval is long enough for action to be taken to avoid or mitigate the consequences of failure
- The P-F Interval is reasonably consistent
- The task can be done at intervals less than the P-F interval.

Protective devices also need different treatment

Protective devices include:

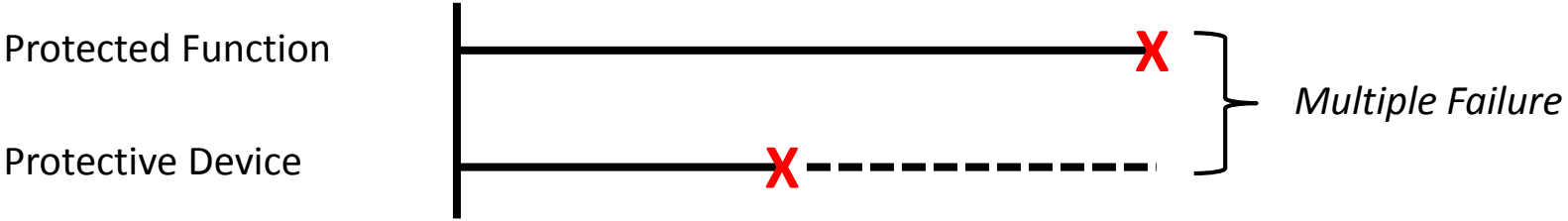
- Emergency Stop Buttons
- Circuit Breakers & Fuses
- Over-temperature Alarms
- Fire Sprinkler Systems
- Smoke Detectors
- Contents of Emergency Medical Cabinets
- Thermal Overload Protection
- Low level alarms
- Emergency Bunding
- Emergency Lighting
- Emergency Generators
- Under-pressure Trips
- Standby Plant
- Eyewash Station

They should be inspected to see if they are in a failed state to ensure a tolerable level of availability



Multiple Failure - is an event that occurs if a Protected Function fails while its Protective Device or Protective System is in a failed state

Failure finding intervals can be calculated to achieve a desired availability



Failure Finding Interval (FFI) = 2 * $MTBF_{TIVE}$ * U_{TIVE}

Where:
$MTBF_{TIVE}$ is the Mean Time Between Failures of the protective device
U_{TIVE} is the acceptable unavailability of the protective device

Availability required from Hidden Protective Device	99.99%	99.95%	99.90%	99.50%	99.00%	98.00%	95.00%
Failure Finding Interval as % of $MTBF_{TIVE}$	0.02%	0.10%	0.20%	1.00%	2.00%	4.00%	10.00%

ISO 55001 is influencing all industries, including health

Clause	Implication
4.1 Asset management objectives, included in the strategic asset management plan (SAMP), shall be aligned to, and consistent with, the organisational objectives.	Asset design and maintenance should be aligned with end user requirements, e.g. availability (U_{TIVE}) and condition
6.2.1 When establishing its asset management objectives, the organisation shall consider the requirements of relevant stakeholders	Measurable objectives should be assigned to reflect desired targets
6.2.2 The organisation shall establish, document and maintain asset management plan(s) to achieve the asset management objectives	These objectives should be documented in asset management plans
7.5 The organisation shall determine its information requirements to support its assets, asset management, asset management system and the achievement of its organisational objectives	Data should be collected to support decisions which enable achievement of these objectives, e.g. MTBF