



## EC54 – Pre-Instructional Survey Answer Sheet

1. How should a redundant system respond upon detection of a dangerous fault?

- d. Continue operating as long as the fault is repaired within a specified time

2. The standard allows testing of systems either end-to-end or in parts. What are the pros and cons of testing in parts?

Testing in parts is acceptable because different devices have different failure rates, failure modes and levels of diagnostics, therefore their performance varies widely. Less reliable and safe devices need to be tested more often. More reliable devices do not need to be tested as often (as long as the target performance is maintained), thereby saving money.

The drawback of testing in parts is that some interfaces might not get tested. There have been cases of individual devices all working when tested, but not working as a complete system.

3. What benefit will 1oo2 transmitters provide compared to a switch and transmitter voted 1oo2, and why?

Transmitters voted 1oo2 offer a benefit over a switch and a transmitter in that the transmitter analog values can be compared for discrepancies. This provides an additional level of comparison diagnostics beyond the standard level of diagnostics already provided by the transmitter. Comparing a discrete switch signal with an analog transmitter signal offers no such benefit.

Assuming failure rates for both devices are the same, the MTTF<sub>spurious</sub> for both arrangements will be the same, but the RRF for the voted transmitter arrangement will be considerably higher (due to the higher level of diagnostics).

4. Will triplicated switches offer the same level of performance (safe & dangerous) compared to triplicated transmitters, and why?

A voted transmitter arrangement will offer a high level of comparison diagnostics. Comparing three switches offers no comparison diagnostics at all. (If one switch is stuck, there is still no way to automatically detect the failure.)

Assuming failure rates for both devices are the same, the MTTF<sub>spurious</sub> for both arrangements will be the same (both are equally fault tolerant), but the RRF for the voted transmitter arrangement will be considerably higher (due to the much higher level of diagnostics).