

Ontic offers this brief tutorial to assist you in pursuing your Root Cause investigation associated with the product or process noted on the accompanying Supplier Corrective Action Request.

The Root Cause Analysis method described in this tutorial is based on the premise that there are normally two avenues of investigation that must be pursued:

- The Root Cause associated with the **generation** of the defect.
- The Root Cause associated with the **escape** of the defect to Ontic.

The first page of this tutorial displays a flowchart depicting the suggested general thought process that may be used during the “Defect/Escape” Root Cause Analysis. Please note that some basic elements of the two parallel investigations may be interdependent. For example, there may be an interlinked Failure Mechanism (sometimes referred to as the Direct Cause). This interdependency is especially common in the case of administrative process discrepancies that are under investigation.

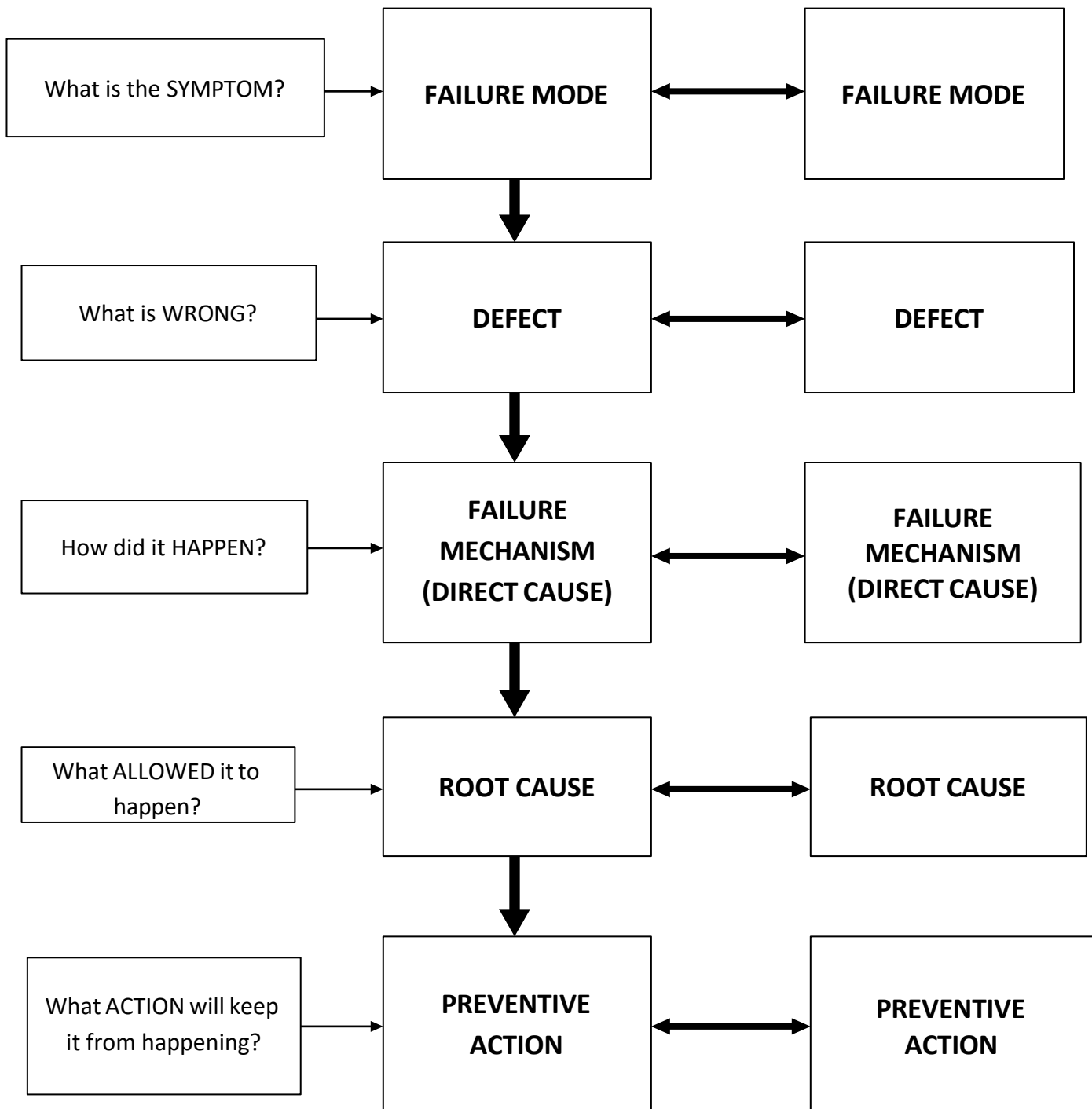
The second and third pages of this tutorial display detailed flowcharts illustrating each of the two parallel Root Cause investigations. Please note that the example Failure Modes and suggested associated Defects, Failure Mechanisms, Root Causes and Preventive Actions are broad representations (investigation of real-life occurrences would uncover multiple potential Failure Mechanisms, Root Causes, etc.).

The fourth page of this tutorial is a more in-depth explanation of the general terms used (i.e. Failure Mode, Defect, etc.). Your investigation should be enhanced if members of your investigating team fully understand the terms/concepts, and use the terms as a universal language during the investigation.

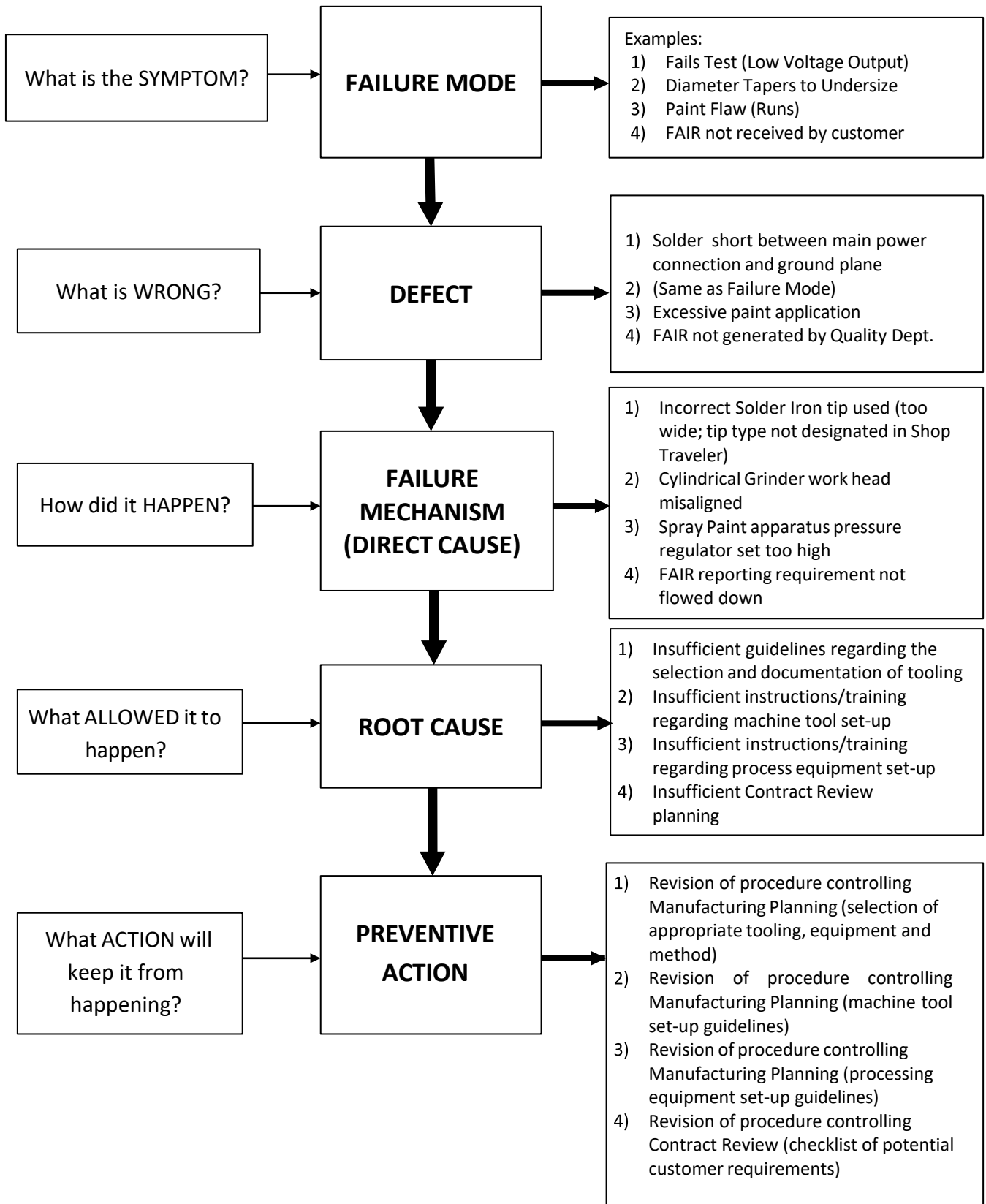
ROOT CAUSE ANALYSIS FLOW

DEFECT GENERATION

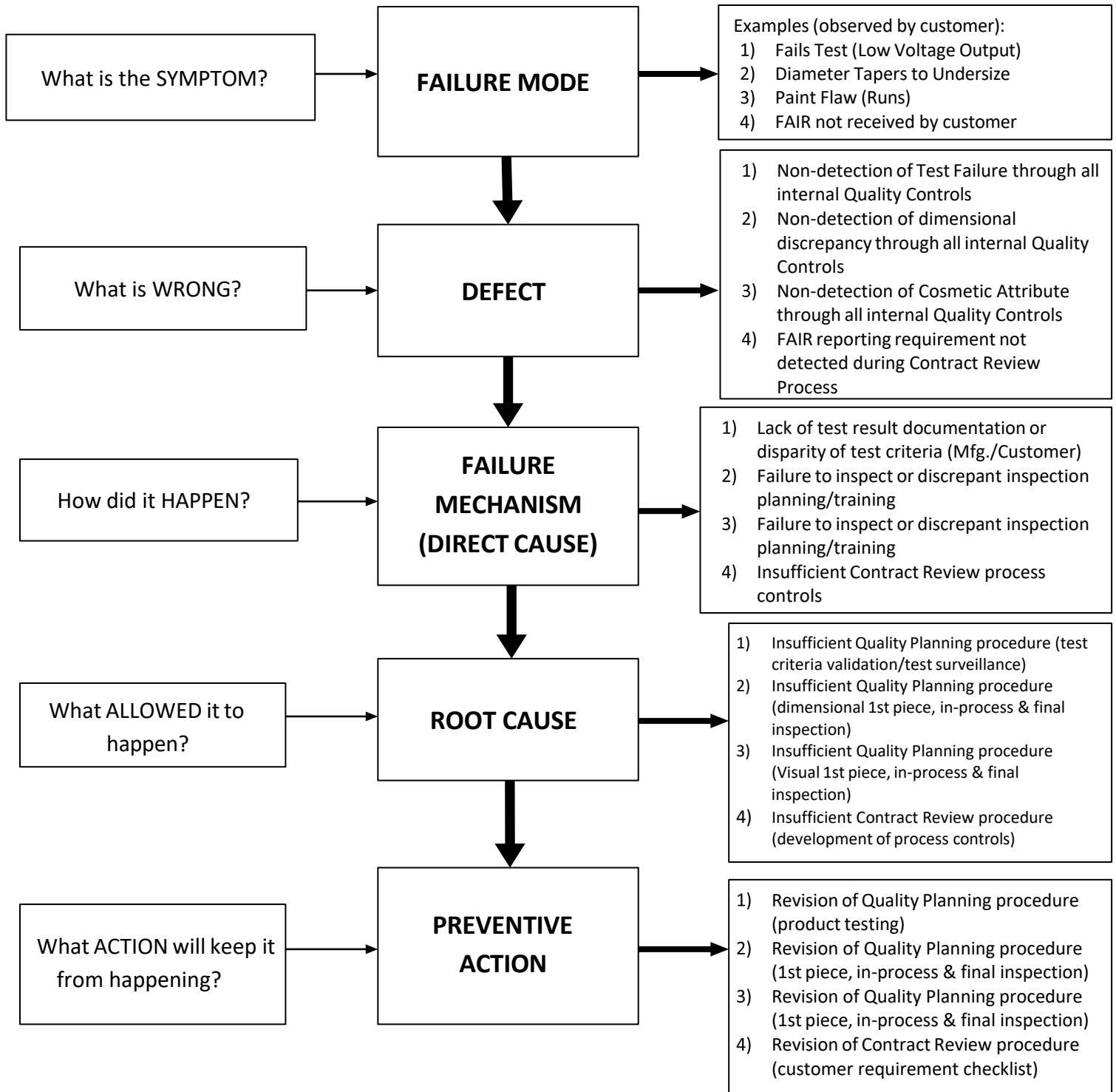
DEFECT ESCAPE



ROOT CAUSE ANALYSIS FLOW (GENERATION OF THE DEFECT)



ROOT CAUSE ANALYSIS FLOW (ESCAPE OF THE DEFECT)



EXPLANATION OF TERMS/CONCEPTS

FAILURE MODE:

- The symptom or event that hints at the deeper problem (the Defect)
- The observed failure/reduction in product performance or ability of the product to meet all specifications
- Examples: Unit fails test (low output voltage), undersize diameter, late delivery to customer, blistered paint, realized manufacturing cost exceeds estimated cost, etc.

DEFECT:

- The actual flaw in the product or process that is responsible for the Failure Mode
- When dealing with special processes, machined parts (or other structural parts or assemblies), the Defect can be identical to the Failure Mode (i.e., undersize diameter, stock material thickness oversize, sheet metal enclosure height undersize, etc.).
- The Defect identification must be as detailed as possible to facilitate the investigation.

FAILURE MECHANISM (DIRECT CAUSE):

- The machine, hardware, or process discrepancy that results in the Defect (i.e., broken tool bit, work piece holding fixture misaligned, late delivery from supplier, machine tool program error, undefined manufacturing process, lack of in-process inspection process, etc.)
- There often exists multiple Failure Mechanisms associated with a single defect; each one should be prioritized as to having the highest likely affect on the discrepant product/process.
- The identified Failure Mechanism is sometimes mistakenly considered to be the Root Cause.

ROOT CAUSE:

- The systemic deficiency that allowed the Failure Mechanism to occur, and to affect the product or process (i.e., insufficient in-process inspection planning process, insufficient machine tool set-up instructions, insufficient manufacturing planning process, existence of undocumented manufacturing process/practices, etc.)
- The Root Cause is addressed through Preventive Actions aimed at eliminating the identified Failure Mechanism(s).

PREVENTIVE ACTION:

- The permanent systemic improvements that address the Root Cause and eliminate the Failure Mechanism
- Preventive Actions can include procedural improvements, tooling redesign, mistake proofing (through special tooling in the case of manufacturing processes, or the application of appropriate computer software in the case of administrative or document related events), employee training per revised procedures, etc.
- Preventive Actions addressing the actual Root Cause are systemic in nature and transcend all immediate corrective actions/discrepant product containment actions related to a specific part number, discrete process, etc.