Global 8D
Reference Guide

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The Reference Guide summarizes key course content (i.e., concepts, charts, definitions). The purpose of the guide is to provide you with a reference of information you may need on the job. Use the File/Print command or click on the Printer icon to print a copy.

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Key Concepts

This guide covers the team member content of the Global 8D Web-based course. It does not include content on the optional team leader section of the course.

Change-Induced and Never-Been-There Problems	A problem is a deviation from expectation, or any unwanted effect where the cause is not known. The nature of this deviation differs between the following two types of problems: *Change-induced problems* are those in which a product or process deviates from the expected level of performance. The change in performance may happen gradually or abruptly and may be intermittent, unpredictable, or unstable. *Never-been-there problems* are those in which the desired or intended level of performance of a system has never been reached.
Inductive and Deductive Approach	An *inductive* approach starts from data based on observation and sets out to develop a theory consistent with the data. A *deductive* approach starts from a given theory and attempts to prove that a theory applies in a particular situation by collecting and analyzing data and seeing if the data is consistent with the theory. G8D uses both methods to resolve a problem.
ERA	Any action taken to protect customers and affected parties from the symptom(s) of the problem while it is determined if a G8D is necessary
Repeated Whys	The process of asking, "Why is that happening?" over and over again (also known as stairstepping).
Is/Is Not	What the problem is and what it is not but logically could be, where the problem is and where it is not but logically could be, when the problem occurs and when it does not occur but logically could, and how big the problem is and how big it is not but logically could be.
ICA	An action based on knowledge of the problem that prevents customers from experiencing the symptoms of a problem.
Verification and Validation	In the context of G8D, verification and validation have distinct meanings. *Verification* provides evidence before an action is taken that the action will be successful. *Validation* provides evidence, that once implemented, an action is successful.
Root Cause Theories	A *root cause theory* is any theory that describes how the problem may have occurred. The *most-likely root cause* is the theory that best explains the available data. The *root cause* is the cause that explains the problem description and can be manipulated to make the problem come and go.
Comparative Analysis	An examination of the facts that surround the problem to identify differences and relevant changes between "Is" and corresponding "Is Not" items.
PCA	The optimal solution to the problem that eliminates the root cause and hence removes the problem's symptoms by removing the problem itself.
Problem Prevention	An analysis to determine what could go wrong and what might cause it to go wrong in each key step of an implementation plan to identify actions, to prevent things from going wrong, and take contingency actions if the prevention action fails.
Underlying Cause	That which allows the root cause to occur.
Systemic Cause	That which allows the underlying cause to occur.
Recognition	An acknowledgment of a team's quantity of work, quality of effort, and value of the team's accomplishments.

Section 1: Global 8D Overview

G8D

Global 8D is a problem-solving methodology for product and process correction and improvement that is structured into eight disciplines (D1–D8), plus one preparation step (D0):

D0	**Prepare for the Global 8D Process:** In response to a symptom, evaluate the need for the G8D process. If necessary, perform Emergency Response Actions (ERAs) to protect the customer and initiate the G8D process.
D1	**Establish the Team:** Establish a small group of people with process and/or product knowledge, allocated time, authority, and skill in the required technical disciplines to solve the problem and implement actions that will correct and prevent the problem from recurring. The group must have a designated champion and team leader.
D2	**Describe the Problem:** Describe the internal/external customer problem by identifying what is wrong with what and detail the problem in quantifiable terms by creating a problem description that describes what, where, when, and how big the problem is and is not.
D3	**Develop Interim Containment Actions (ICAs):** Define, verify, and implement actions to isolate any internal/external customer from the effects of the problem until the problem can be resolved permanently. Validate the effectiveness of these actions.
D4	**Define and Verify Root Cause and Escape Point:** Determine the root cause by identifying alternative causes and selecting the one that best explains the problem. Determine the place in the process closest to where the problem is generated where the effect of the root cause should have been detected and contained but was not (the escape point). Verify that the selected root cause is the actual root cause.
D5	**Choose and Verify Permanent Corrective Actions (PCAs) for Root Cause and Re-evaluate Escape Point:** Determine the best PCA to eliminate the effect of the root cause. Re-evaluate the escape point in light of the PCA. Verify that the PCA will be successful when implemented without causing undesirable effects.
D6	**Implement and Validate Permanent Corrective Actions (PCAs):** Plan and implement the selected PCAs for the root cause and improve the control system at the escape point. Validate that these actions are effective and monitor the long-term results.
D7	**Prevent Recurrence:** Modify the necessary systems, including policies, practices, and procedures, to prevent recurrence of this problem and similar ones. Make recommendations for systemic improvements, as necessary, and document technical lessons learned.
D8	**Recognize Team and Individual Contributions:** Complete the team experience. Present technical lessons learned. Sincerely recognize both the team and individual contributions and celebrate the success of the project.
G8D Vision and Mission	The vision of G8D is to implement a common, worldwide problem-solving process for Ford Motor Company and its suppliers. The mission of G8D is to provide a common process that defines and resolves problems effectively and prevents their recurrence.

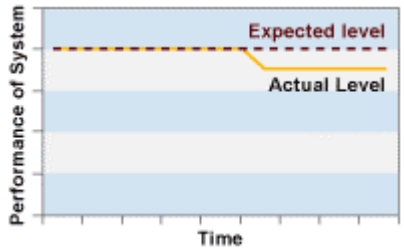
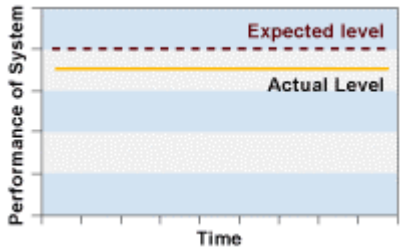
Elements of G8D

There are three elements to G8D:

- Problem Solving Process
- Reporting Format
- Corporate Standard

Change-Induced and Never-Been-There Problems

A problem is a deviation from expectation, or any unwanted effect where the cause is not known. The nature of this deviation takes two distinct forms giving rise to change-induced and never-been-there problems:

Change-induced problems: Initially, the system operates as expected, but at some point it suddenly deviates from the expected performance level.	Never-been-there problems: The performance of a system has never achieved the expected level.
	

Problem Correction and Problem Prevention

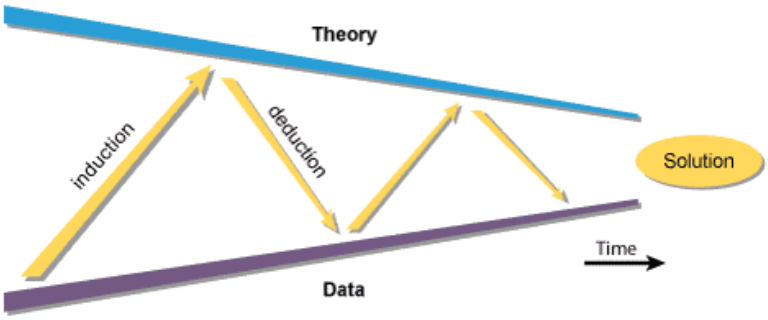
A reliable product or process is one in which failure modes are avoided. The ultimate goal of problem resolution is to prevent problems from occurring. Even with the most disciplined process some level of mistakes is inevitable, and mistakes lead to problems. Once a problem has been detected, it must be corrected and resolved. To resolve a problem, counter-measures must be taken to ensure that the problem and others like it do not recur.

Inductive and Deductive Approach

G8D uses both inductive and deductive approaches to resolve a problem.

An *inductive approach* starts from data based on observation and sets out to develop a theory consistent with the data. During the initial stages of applying the G8D process, the approach is primarily inductive. Data is collected and analyzed to describe the problem being resolved. Alternative root cause theories are identified and compared to the problem description. The theory is selected that is most consistent with the data that describes the problem.

A *deductive approach* starts from a given theory and attempts to prove that a theory applies in a particular situation by collecting and analyzing data and seeing if the data is consistent with the theory. After identifying the root cause, deductive methods are used to confirm that the selected root cause is the actual root cause. Finally, deductive methods are used to permanently correct for the root cause and ensure that the problem, and others like it, does not occur in the future.



G8D and 6-Sigma

There are two 6-Sigma processes used in Ford: DMAIC and DCOV. DMAIC is a systematic methodology for reducing defects resulting from a process. DCOV is a disciplined methodology for designing and manufacturing products that perform at, or above, the level expected by the customer.

G8D, DMAIC, and DCOV form a complementary suite of problem resolution approaches, with G8D best suited to resolving special cause or change-induced problems and DMAIC best suited to common cause problems, which includes never-been-there problems. DCOV is suited to prevent both special cause and common cause problems.

Other Problem Solving Methods

Other problem-solving methods that are sometimes used within Ford and outside of Ford include: 14D, High Mileage Resolution Process (HMRP), Shainin, and Structured Inventive Thinking (SIT).

G8D Tools

Tools used to facilitate the G8D process include:

- Flowcharts — can be used throughout the G8D process to identify key actions inputs, outputs, and decision points, and to check progress
- Assessing questions — help G8D teams determine if the steps of the Global 8D process have been completed appropriately
- Problem-Solving Worksheet — ensures consistent application of the G8D process

G8D Web Application

The Global 8D on the Web application is the single-source location for G8Ds within Ford and its supply base. G8D teams should begin using the Web application at D0. The Web application provides teams with a valuable tool to track and document the G8D process and additional structure to the problem-solving process by asking for key information at each step. It is also a communications tool for teams not located together geographically and a "lessons learned" database of past problem-solving efforts within Ford Motor Company.

Section 2: Prepare for Global 8D and Establish the Team

D0

D0 Goal

The goal of D0 is to prepare for the G8D process. Key tasks are to:

- Define and quantify symptom(s)
- Select an Emergency Response Action (ERA)
- Verify an ERA
- Develop an action plan and implement an ERA
- Validate an ERA
- Ensure G8D meets application criteria
- Determine if the symptom duplicates an existing G8D, or is a new G8D issue
- Initiate the G8D process

Symptoms

The G8D problem-solving process distinguishes between problems and symptoms. Symptoms are measurable events or effects (that must be experienced by customers) that indicate the existence of one or more problems. Without a symptom, you don't know that there's a problem.

The G8D process at D0 provides a means to respond to symptoms. Symptoms should only be considered when they can be measured or quantified. If symptoms cannot be measured then there probably is not enough information about the problem. Quantification may come from data that already exists, such as warranty repairs/costs or customer satisfaction surveys. Sometimes, measurable ways to quantify the symptom may have to be developed.

Emergency Response Action

An *ERA* is any action taken to protect customers and affected parties from the symptom(s) of the problem while it is determined if a G8D is necessary. An ERA is not always necessary. The seriousness of the problem and its effect on the customer will determine if an ERA is required. For example, problems that potentially affect safety will almost certainly require an ERA.

Select, Verify, Implement and Validate an ERA

The most appropriate ERA is usually best identified by a small number of people, for example, the champion and one or two people with knowledge of the system that has the problem. Once the best ERA is identified, the fact that it will protect the customer from the symptoms of the problem must be verified before it is implemented. Verification is normally based on an engineering test.

After implementation, an ERA must be validated to confirm that it is successful and does not introduce additional problems. In the context of G8D, verification and validation have distinct meanings.

- Verification provides evidence, before the ERA is implemented, that it will protect the customer from the effects of the problem.
- Validation provides evidence, that, once implemented, the ERA is protecting the customer from the effects of the problem.

Application Criteria

Six criteria must be met before initiating the Global 8D process:

1. The symptom has been defined and quantified.
2. The G8D customers experiencing the symptom and the affected parties have been identified.
3. Measurements taken to quantify the symptom(s) demonstrate that a performance gap exists, and/or the priority (severity, urgency, growth) of the symptom warrants initiation of the G8D process.
4. The cause is unknown.
5. Management is committed to fixing the problem at the root cause level and preventing recurrence.
6. The problem is too complex for one person working alone to resolve.

If all six criteria are met and no other G8D teams are working on the same or similar problems, then the G8D process should be initiated.

D1

D1 Goal

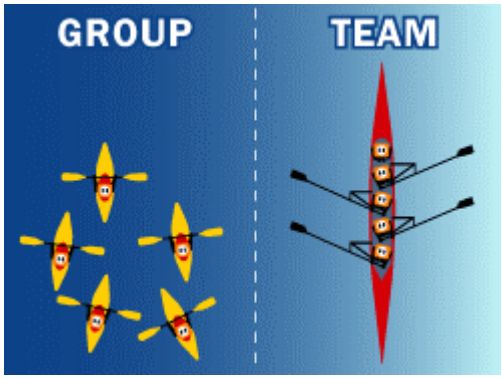
The goal of D1 is to establish the team. Key tasks are to:

- Identify the team's champion
- Identify the team leader
- Determine whether team members have the process and/or product knowledge, allocated time, authority, and skill in the required technical disciplines to solve the problem being addressed and implement corrective actions
- Select team members
- Establish team goals and membership roles

Group Versus Team

It is important that those working on a G8D project work as a team and not as a group.

- A group is a number of individuals with a common goal, but who may work independently and without interaction and collaboration (e.g. a group of kayakers, each of whom is paddling their kayak to achieve their individual goal of moving through the water).
- A team is a number of individuals working together as a cohesive unit toward a common goal. Team members use both interdependent and collaborative efforts to reach the goal (e.g. a team of rowers who are each operating the oars, acting as a cohesive unit to reach the common goal of moving through the water).



Determine Team Membership

A team can be more successful by following certain guidelines for team membership:

- Limit membership to between four and seven members. Fewer than four members will not produce enough innovation. Teams with more than seven members may experience interpersonal problems and may have trouble reaching agreement.
- Choose members with the right skills, knowledge, resources, authority, etc., to help solve the problem.
- Choose the right mix of qualifications. Don't choose everyone from the same department or with the same job functions. People with different experiences and talents will help teammates see the situation from different perspectives.
- Change team membership as needed throughout the project. At different times, various expertise or information may be needed. Allow members to rotate on and off the team.

Team Roles

Once a G8D team has been selected, team members must work as effectively as possible. The G8D process depends upon the efforts of all team members to achieve the team's objectives. To do this, each member performs one or more of the following roles:

- The champion has the authority to make (and implement) decisions regarding Interim Containment, Permanent Corrective, and Prevent Actions. He or she also supports the team's problem-solving efforts throughout the process

- The team leader leads team members through the G8D process. This person has leadership and interpersonal skills.
- The time manger ensures that the team makes the best use of meeting time.
- The scribe ensures that all important conclusions are clearly documented for all to see.
- The recorder generates, holds, and publishes team reports, such as G8D reports, meeting minutes, action plans, etc.
- The facilitator's primary task is to help with interpersonal issues such as resolving conflict, arriving at consensus (when required), handling negative group behaviors, etc.
- Team members are selected to participate on the G8D team because of their experience and knowledge. They are subject matter experts who may not perform another role on the team. Team members might change during the G8D process.

Some guidelines to keep in mind when implementing team roles are:

- Roles are not people; roles are functions that people fulfill. However, certain people are better at certain roles than others. For example, someone who is not assertive may make a poor time manager or leader. The team should match individual skills to roles so that each role will be handled as effectively as possible.
- Members often hold roles for the duration of the meeting or longer. Roles can be changed in the middle of a meeting. However, when team members exchange roles in the middle of a meeting, confusion can result unless all team members are aware of the change.
- When the leader or facilitator offers an opinion, they automatically leave their role to become a team member. The team will be without a leader or facilitator until someone else assumes the vacant role.
- Some roles can be shared. For example, facilitator and time manager, or recorder and scribe. Team leader and facilitator roles should not be shared.
- Facilitation is essential throughout discussion. This means that the person who is facilitating is not participating directly in the problem-solving task. When all team members have acquired the skill of facilitation, the person who potentially has the least amount of input during any given meeting should adopt the facilitator role.

Section 3: Describe the Problem and Find Root Cause

D2

D2 Goal

The goal of D2 is to describe the problem. Key tasks are to:

- Develop a problem statement by identifying "what is wrong with what?" in quantifiable terms.
- Describe the problem in detail in terms of what it "is" and "is not" (i.e., develop an objective problem description).
- Identify the process flow
- Identify, collect, and analyze additional data
- Ensure the problem relates to a something changed situation
- Review the problem description with affected parties

In D2 teams develop a clear problem statement and an objective problem description to help them focus their effort on the real problem and avoid jumping to conclusions or making unsubstantiated assumptions about the problem. A problem statement is a simple, concise statement that identifies the object and the defect of a problem for which the cause is

unknown. The purpose of the problem statement is to narrow the search for the root cause and serve as a starting point for the problem description.

Preliminary Problem Statement

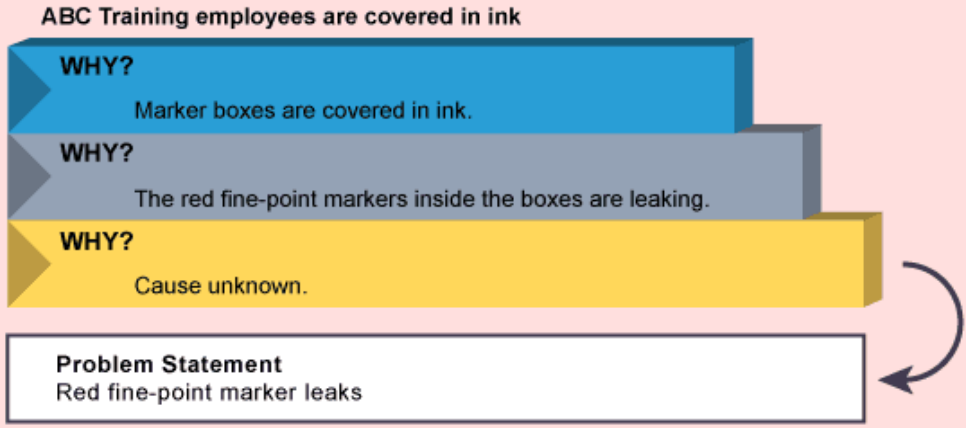
When developing a problem statement, the team first establishes a preliminary problem statement in terms of the object and defect of a problem. The object and defect are identified by asking the question "What is wrong with what?"

- "What is wrong" is the defect, which is an unwanted characteristic present in a product or process.
- "...with what?" is the object, which is the name given to a specific product or process that exhibits the defect

The Repeated Whys Technique

Once a team has a preliminary problem statement it is refined by asking the question "Why is that happening to that object?" Refining the preliminary problem statement helps to focus efforts on a single problem with a single root cause, get as near as possible to the root cause using existing data, and check that the cause of the problem is unknown.

The process of asking, "Why is that happening to that object?" over and over again is called the repeated whys technique or stairstepping. The team continues asking the question until the question cannot be answered with certainty (i.e., until the answer is, "I don't know."). The last object and defect with an unknown cause is the problem statement.



Observations versus Conclusions

When developing the problem statement the team should make observations and not draw conclusions about the problem. The differences between observations and conclusions are summarized below.

Observations

- Consist of observable, quantifiable information
- Have a high incidence of accuracy
- Tend not to be disputed since they are usually just a list of facts
- Usually describe what, who, when, where, and how big
- Detail the effects
- Should be done before drawing conclusions
- Are frequently done incompletely
- Tend to be considered less important, go unrewarded, and are unappreciated
- Are made in D2
- Reveal the symptom/defect

Conclusions

- Are decisions based upon deductions
- Have a low incidence of accuracy
- Tend to be debated until proven valid by testing
- Usually describe the "why"
- Describe the cause
- Should be done after making observations
- Are frequently jumped to
- Are highly valued, usually rewarded, and reinforced
- Are drawn in D4
- Focus on cause

The key to accurately defining and describing a problem is to make observations and save any conclusions for after all information is gathered and examined. Once a conclusion is reached, it is difficult for most people to re-examine the facts.

Collect Additional Data

Additional data will probably be required to refine the preliminary problem statement and develop the problem description.

To ensure that relevant data is collected, information surrounding the problem should be examined closely. The team should develop a common understanding of the process associated with the problem by identifying the process flow and documenting this on a flowchart or process map.

Once there is a common understanding of the process, the team can focus on the process steps relevant to the problem and gather information.

Problem Description

The problem description is the output of a process used to amplify the problem statement in terms of what, where, when, and how big. This is often called the "Is/Is Not". The problem description defines the boundaries of the problem, in terms of what it is and what is not but logically could be. This helps to narrow the search for the root cause of a problem by limiting or excluding illogical possibilities and provides the basis for testing the cause of the problem.

Teams should use page 1 of the Problem-Solving Worksheet when developing a problem description. The problem description is developed by asking:

- What the problem is and what it is not, but logically could be
- Where the problem is and where it is not, but logically could be
- When the problem occurs and when it does not occur, but logically could
- How big the problem is and how big it is not, but logically could be

It is important to take the problem statement and develop a problem description, because everything teams do at D4 in identifying the root cause of the problem builds on the problem description developed during D2. How well teams identify the root cause at D4 depends on the information they summarized in D2.

Review Nature of the Problem

As discussed in Section 1, G8D is best suited to resolving change-induced problems, while other methods are better suited to resolve other types of problems. At the end of D2, an objective and detailed problem description has been developed, and the Is/Is Not information should now be reviewed to verify the problem is a change-induced problem. For example:

- When a problem is seen after a particular date, but not before, this indicates a change-induced problem
- When a product had a problem since first being produced, this indicates the problem is not change-induced, and a problem solving technique such as DMAIC 6-Sigma would be

more appropriate

If the problem is a change-induced problem, it is time to move on to D3. However, before beginning, the problem description should be reviewed with those affected by the problem to ensure it is a good problem description.

Further refinements to the problem description might be needed after this type of review.

D3

D3 Goal

The goal of D3 is to develop an Interim Containment Action (ICA). Key tasks are to:

- Re-evaluate the ERA with knowledge gained in D2
- Identify alternative ICAs
- Compare alternative ICAs to selection criteria
- Select the best ICA
- Verify the ICA
- Implement the ICA
- Validate the ICA

Interim Containment Action (ICA)

An ICA is any action that prevents customers from experiencing the symptoms of a problem. An ICA isolates the effects of the problem from both internal and external customers until a Permanent Corrective Action (PCA) can be implemented. An ICA is similar to an ERA; however, ICAs are more refined and focused than ERAs. Like ERAs, ICAs:

- Attack the symptom of the problem
- Are verified for effectiveness before they are implemented
- Are monitored while they are in use
- Are documented
- Add cost to the process/operations

An ICA works against the problem symptoms, not against the root cause.

Re-evaluate the ERA

When developing the problem description in D2, more knowledge is gained about the problem than was available in D0 when an ERA may have been implemented. Assuming that the customer still needs protection from the problem, the team should re-evaluate the ERA since this may be effective and cost-efficient enough to continue as the ICA. Often, however, the team's greater understanding of the problem allows them to replace the ERA with a more effective and less costly ICA.

Develop and Implement an ICA

Six tasks are required to develop and implement an ICA:

- Identify alternative ICAs
- Compare alternative ICAs to selection criteria
- Select the best ICA
- Verify the ICA
- Implement the ICA
- Validate the ICA

Identify Alternative ICAs

Brainstorming helps to identify alternative ICAs. Teams can also consider how the ERA might be modified to form an ICA. Although the team may have decided not to continue with the ERA, armed with the knowledge of the problem that they gained in D2 the team may be able to modify the ERA to make it more effective and less costly.

Compare Alternative ICAs and Select the Best

To select the best ICA from a list of alternatives, the team first establishes selection criteria. Typical selection criteria include, the time frame within which the ICA should be implemented, a minimum performance level, and a cost target. Selection criteria fall into two categories: features that must be present in an ICA (**Givens**) and features that would be nice to have (**Wants**). As well as comparing each ICA option to the selection criteria, the team must analyze the risks of implementing each option before selecting the one ICA with the best balance of benefits and risks.

Verify an ICA

Once selected, an ICA must be verified. As with an ERA, verification of an ICA provides a comparison of the effect of the problem with and without the ICA. Verification also confirms before the ICA is implemented that the customer will not experience the problem and that no new problems will be introduced. Verification is normally based on an engineering test. However, in some situations, ICA verification may simply be common sense, for example, where the ICA is to stop shipment of the product with the problem, it is clear that this will protect the customer from experiencing the effect of the problem.

ICA Implementation Action Plan

To achieve effective ICA implementation, it is useful to develop an action plan describing who needs to do what by when. The action plan should also include a clear statement of the objective of the implementation. The action plan can also be used to demonstrate to the champion that all the necessary actions have been identified. An ICA should not be implemented without the champion's knowledge or involvement. The Deming/Shewhart Plan, Do, Study, Act (PDSA) cycle can be used as a guide for implementing an ICA. Software packages such as eTracker are also available to facilitate action plan development and management.

Validate an ICA

After the ICA is implemented, it must be validated. Validation is ongoing evidence that the implemented action is doing what was intended without introducing any new problems. Validation is based on data that reflects the effect of the problem on the customer (e.g., data that quantifies the symptoms of a problem). Validation should always follow successful verification, and provides evidence that the ICA is masking the problem symptoms experienced by the customer.

D4

D4 Goal

The overall goal of G8D is to resolve change-induced problems. D4 helps to achieve that goal by determining and verifying the root cause and escape point of the problem. The output from D4 sets the stage for eliminating the problem so that it never occurs again. The primary tool used during D4 is the Problem-Solving Worksheet.

The process for completing D4 is divided into two paths:

- Determine the root cause
- Identify the escape point

Root Cause

G8D teams determine the root cause of a problem in D4 by analyzing information using a filtering process, which starts with a large number of root cause theories from which the most-likely root cause theories that best explain the available data are selected. The root cause is then identified as the most-likely root cause that fully explains the problem description and can be verified by making the problem come and go.

Update the Problem Description

The first task in determining root cause involves updating the problem description that was developed in D2 so that it reflects the most current information about the problem. Accurate information is imperative to the success of the G8D process. When updating the problem description, the Is/Is Not analysis should be up-to-date and all entries in the Is/Is Not analysis should be facts. In addition, all information about the problem that can be gathered should be gathered and any new information about the problem should be reviewed.

Complete a Comparative Analysis

Once the problem description is updated, the team performs a Comparative Analysis. Change-induced problems stem from changes and typically, the root cause of the problem will relate to one or more of these changes. The Comparative Analysis allows the team to examine facts that surround the problem to identify differences and relevant changes. Completing a Comparative Analysis results in information that has been filtered to remove what is unlikely or unfounded. This ensures that the team will focus only on those root cause theories relevant to the facts surrounding the problem.

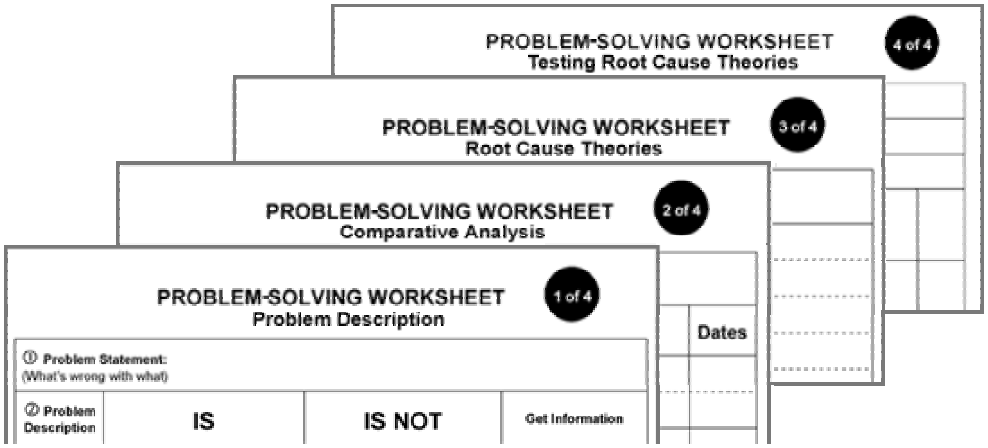
There are two components to completing a G8D Comparative Analysis:

1. Examine Is/Is Not to identify differences, that is facts that are only true of the IS column when compared to the IS NOT column. Differences may be related to methods, equipment, measurements, people, or the environment.
2. Examine differences to identify changes; that is things that have changed in, on, around, or about the differences. Changes should also be related to methods, equipment, measurements, people, or the environment.

The Differences and Changes are documented on page 2 of the Problem-Solving Worksheet

Develop Root Cause Theories

Following completion of the Comparative Analysis, teams develop root cause theories about how the problem could have occurred. Root cause theories are statements that explain how a change (or combination of changes) may have caused the problem or created the unwanted effect. Teams develop root cause theories by asking the question, "How could this change have caused the problem?" The root cause theories are documented on page 3 of the problem solving worksheet.



Test Theories to Identify the Most Likely Root Cause Theory

The team tests its root cause theories to determine the most-likely root cause theories by using a process of elimination to determine those theories that best explain the available data. Team members critically evaluate each theory against the Is/Is Not data to test the plausibility of each theory. For each Is/Is Not pair, the team asks, "Does this theory account for both the Is and the Is Not?" The results of testing the most-likely theories are documented using the test matrix on page four of the Problem-Solving Worksheet. A coding system such as '+', '-', '**?**' as outlined below is used in completing the worksheet.

Code	Meaning
+	The root cause theory completely explains an Is/Is Not pair
-	The root cause theory does not completely explain an Is/Is Not pair
?	It is unclear whether the root cause theory completely explains an Is/Is Not pair

Root cause testing allows the team to select the best or most-likely root cause theories on the basis of facts alone. That is, root cause theory selection is not made by subjective judgment. When it is feasible and practical to do so, the team should resolve items with question marks (?s) by collecting additional data and re-testing the theory against the new Is/Is Not data. Ideally, the worksheet should end up with very few or no question marks. However, it is not always feasible or practical to collect sufficient data to eliminate all question marks. When this happens, the team should identify any theory with a combination of pluses and question marks as worthy of root cause consideration and eliminate any theory with one or more minuses. In practice, sometimes more than one theory may pass testing with a combination of pluses and question marks. When this happens, each passing theory will require further investigation. If only one root cause theory passes testing (with all pluses or a combination of pluses and questions marks), then this is the most-likely root cause theory.

Verify the Root Cause

Before a most-likely root cause theory can be selected as the root cause of a problem, it must be verified. Verification involves team members manipulating the most-likely root cause variable to make the problem come and go, or switching the problem on and off.

The Escape Point

Once the team has verified the root cause, it must determine how the problem escaped to the customer. This is referred to as identifying the escape point. The *escape point* is the place in the process closest to where the problem occurred and where the effect of the root cause should have been detected and contained but was not. To identify the escape point, team members need to ask and answer two questions — "Why did we not discover and contain the problem when it occurred?" and "What caused the problem to escape to the customer?" To answer these questions, the team must review the process in which the problem occurred. This review focuses on the location in the process where the root cause occurred. Its goal is to determine where the problem escaped to the customer.

Verify the Escape Point

The team must verify what it has identified as the escape point of the problem. This is best done by "turning the root cause on" and establishing whether the method used to detect the problem (termed the control system) does so at the escape point. In verifying the escape point, the control system should be restored to the state it was in when the problem occurred, because an inadequate control system may be the cause of the escape point. The ICA must be discontinued while the escape point is verified if this masks the problem symptoms.

- When the problem is **not** detected by the control system with the root cause turned on, it **is** the true, verified escape point.
- When the problem **is** detected by the control system with the root cause turned on, it is **not** the escape point.

If the problem is detected with the root cause turned on, either the identified escape point is not valid or the control system has not been restored to the state it was in when the problem occurred. If the control system has been restored to the state it was in when the problem occurred and the problem is detected, the team needs to identify and verify an alternative escape point. When the control system is not able to detect the effect of the problem at the escape point, it is improved as a part of D6.

Section 4: Select and Implement a PCA

D5

D5 Goal

The goal of D5 is to select the best Permanent Corrective Action (PCA) to remove the root cause of the problem. D5 tasks focus on decision-making and verification, allowing the team to select the best PCA based on benefits and risks and verify that the chosen PCA will work. Adhering to the D5 process prevents the team from rushing into a solution and ensures that the problem will not occur again and that new problems do not arise.

The process for completing D5 is divided into two paths:

1. Chose and verify PCA for root cause.
2. Re-evaluate the escape point

Permanent Corrective Action (PCA)

Both ERAs and ICAs protect the customer from the effects or symptoms of a problem, but they generally do not eliminate its root cause. Instead, these actions protect the customer from the symptoms of the problem while the underlying problem remains. A PCA, on the other hand, is the best action that eliminates the root cause of a problem. The PCA removes the problem's symptoms by removing the problem itself. A PCA is the optimal solution to the problem.

Choose and Verify a PCA for the Root Cause

There are six key tasks for choosing and verifying a PCA for root cause:

- Establish decision criteria
- Identify alternative PCAs
- Compare alternative PCAs to decision criteria
- Analyze risks
- Select best PCA
- Verify PCA

Establish Decision Criteria

The purpose of establishing decision criteria is to set the requirements that the PCA must meet including those necessary to eliminate the problem's root cause and maintain or restore customer satisfaction. These criteria frequently include cost and timing considerations and are usually established in discussion with the champion. As with an ICA, the criteria used to select the best PCA fall into the two categories of Givens and Wants.

Identify Alternative PCAs and Compare Decision Criteria

The team generates a list of alternative PCAs that would solve the problem at the root cause by brainstorming. When alternative PCAs have been identified, the team evaluates how well each option meets the established decision criteria. This allows the team to assess how well several alternative PCAs meet defined criteria and identify the PCA that best meets the criteria through consensus based on discussion and learning instead of compromise.

Analyze Risks and Select Best PCA

After comparing PCA alternatives to the decision criteria, the team analyzes the risks associated with each option. Team members analyze the risks associated with alternative PCAs to ensure that the one best meeting the criteria will not create additional problems if implemented. Using both decision criteria and conducting a risk assessment helps the team make a sound, balanced selection, based on all available information. This ensures that the PCA the team selects is the best choice for the situation.

Verify the PCA

Once selected, a PCA must be verified. Verification of the PCA proves, before implementation, that the PCA ensures that the root cause of the problem is eliminated and will not introduce any new problems. Verification is normally based on an engineering test.

Re-evaluate the Escape Point and Identify a New Escape Point, If Necessary

After verifying the PCA, the team is ready to re-evaluate the problem's escape point to determine if the PCA affects its location. Normally the escape point that was identified in D4 is not affected by the PCA. Sometime, however, the PCA does affect the location of the escape point. For example, a process operation might be eliminated as a part of the PCA. If the escape point was located in this operation, a new escape point would need to be identified.

If, following the implementation of the PCA, the escape point identified in D4 is no longer the escape point, it is likely because the PCA is such that the problem cannot recur in the form that it did originally. A new escape point must be identified.

D6

D6 Goal

The goal of D6 is to implement the PCA chosen in D5 to eliminate the root cause of the problem, and to validate the PCA and monitor its long-term results. D6 tasks focus on planning, problem prevention, and implementation. Thorough planning helps ensure that the PCA implementation goes smoothly. Problem prevention involves examining each element of the plan prior to implementation to ensure problems do not occur.

The process for completing D5 is divided into two paths:

1. Implement and validate the PCA
2. Verify the control system

Implement and Validate a PCA

There are four key tasks for implementing and validating a PCA:

- Develop an Action Plan for PCA Implementation
- Implement PCA
- Remove ICA
- Validate PCA

Develop an Action Plan for PCA Implementation

The action plan spells out the objective of the implementation, the standards and conditions that the implementation must meet, and the key steps that must be completed to achieve the implementation. The key action plan steps are often documented in a simple table indicating what the action is, who must complete it, and when it must be complete.

Once the action plan for the PCA implementation is complete, the team must analyze the plan to determine what could go wrong and what might cause it to go wrong in each key step. The team then identifies ways to prevent things from going wrong by developing prevention actions and contingency actions to take if the prevention action fails.

Implement the PCA and Remove the ICA

After developing the action plan, it is carried out and the PCA is implemented. Once the PCA is implemented, the team must remove the Interim Containment Action (ICA), as it represents unnecessary cost and could make validation of the PCA difficult by masking the unwanted effect (problem symptoms).

Validate the PCA

After implementation, the PCA must be validated. Validation confirms that the PCA removes the problem at its root cause. It is ongoing evidence that the implemented action is doing what was intended without introducing any new problems. Unlike the ERA and ICA,

which protect the customer from the symptoms of the problem, the PCA eliminates the root cause of the problem. Nevertheless, since customers experience problems through their symptoms, as with the ERA and ICA, validation of the PCA is based on data that reflects the effect of the problem on the customer (e.g., data that quantifies the symptoms of a problem).

Evaluate the Need to Improve the Control System

After PCA implementation, the team must ensure that, should the problem recur, it will be detected at the escape point. This means reviewing the way in which the problem is detected at the escape point (i.e., the control system), and improving it if necessary.

Section 5: Complete the Global 8D

D7

D7 Goal

The goal of D7 is to prevent recurrence. Key tasks include:

- Identify the underlying cause of the problem
- Prevent recurrence of the present problem
- Identify affected parties and opportunities for similar problems to occur and escape
- Analyze how similar problems could be addressed
- Identify, verify, implement, and validate actions to prevent the occurrence of similar problems
- Identify the systemic cause of a problem and make recommendations for systemic improvements
- Document technical lessons learned

Preventing Problem Recurrence

Behind every problem that creates the need for a G8D team, there is at least one system, practice, procedure, or policy that allowed the problem to occur and escape. At D7, teams look at the big picture, and determine what allowed the problem to occur and escape. Often, problems result from the carry-over of historic procedures, policies, and practices, without carefully applying them to new situations. If these practices, procedures, or policies remain unchanged, the same or similar problems will continue to occur.

D7 is the most important step in the G8D process. Identifying actions to prevent recurrence of the present problem, and the occurrence of similar problems, and sharing this information with other people in the company, allows them to take a proactive approach and identify and resolve potential failures before problems occur. This leads to improved quality and reduced cost.

Why Teams Do Not Complete D7

The following factors might explain why D7 is often not completed:

- D7 is never started. After the present problem is corrected, other priorities get more attention.
- D7 evolves into a blame session. Rather than focus objectively on what happened, the team focuses on who did/did not do something.
- The G8D process stopped at D3. Preventing recurrence of the root cause is impossible because the root cause was never found.
- The G8D process was never used. One person created a G8D report.
- People fear consequences and believe identifying system inadequacies might get them in trouble.
- The champion is too low in the company's management structure to implement any changes resulting from D7.
- No changes are implemented. System owners will not try to improve since they do not have to live with the consequences, or the organization is unwilling to invest time or resources into improvements.

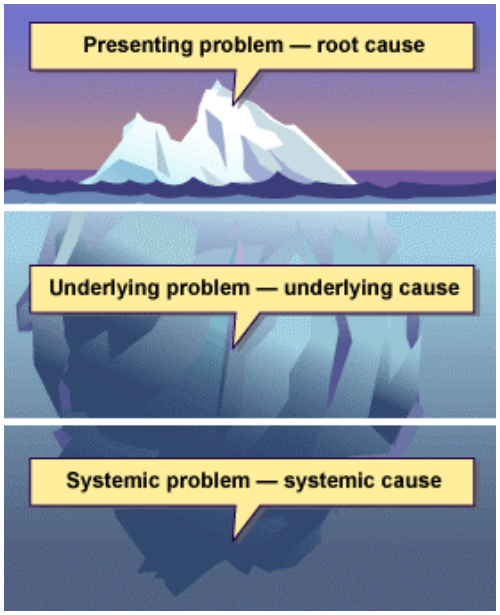
Underlying Cause and Systemic Cause

A problem has a visible and a less visible, or hidden part.

Like an iceberg, a problem's hidden part often is the largest part. A problem can be divided into three layers:

- Present problem — the problem directly associated with the problem symptoms due to the root cause identified in D4
- Underlying problem — due to the underlying cause, which allows the root cause to occur
- Systemic problem — due to the systemic cause, which allows the underlying cause to occur

The underlying and systemic causes that form the hidden part of a problem have more impact than the root cause and often take more time and effort to resolve than the root cause. However, the benefits from resolving the underlying and systemic causes are generally greater.

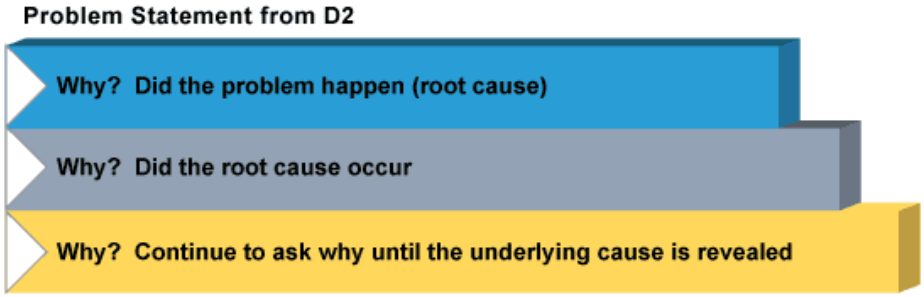


G8D resolves the present problem by identifying and eliminating the root cause through a permanent corrective action (PCA). The underlying and systemic problems also can be resolved by identifying the underlying and systemic causes and taking action.

Identify the Underlying Cause(s) of the Problem

The systems, methods, and procedures that allowed the problem to occur and escape form the basis of the underlying cause of the present problem. By the time it gets to D7 the team will have sufficient understanding of the problem to be able to identify the underlying cause by reviewing the problem history and analyzing how the problem occurred and escaped. The simplest way to identify the underlying cause(s) is to use the repeated whys technique (i.e., stairstepping) used earlier in D2 Describe the Problem.

During D2, the repeated whys technique focuses on identifying the problem statement and starts by asking why the problem occurred, as described by the preliminary problem statement. During D7, the repeated whys technique can be used to identify the underlying cause by starting with the problem statement and asking why the root cause was able to occur for every cause and effect identified until you get to the underlying cause of the present problem.



Prevent the Present Problem from Recurring

The answers generated from using the repeated whys technique to get to the underlying cause of a problem will point to the breakdown in systems, policies, and procedures that allowed the problem to occur and escape (i.e., allowed the root cause to occur). Each of these breakdowns provides opportunities to improve the system and help prevent the problem from recurring. By identifying the underlying cause, actions can be taken to reduce or eliminate the opportunity for the root cause to recur.

Prevent Similar Problems from Occurring

The underlying cause allows the present cause to occur and escape, and potentially allows problems similar to the present problem to occur and escape. Once the team identifies the underlying cause and takes actions to prevent recurrence of the present problem, it can establish actions to address the potential occurrence of similar problems.

Just like the PCA that addresses root cause, any actions that prevent the occurrence of similar problems by addressing the underlying cause should be verified before, and validated after, being implemented. One significant difference between verifying and validating the PCA and verifying and validating prevent actions that address the underlying cause is that the customer does not experience a problem (i.e., the present problem has been resolved and the similar problems are only potential problems). Thus the verification and validation of the prevent actions for the underlying cause cannot be based on determining that the customer no longer experiences the problem's symptoms.

Identify Systemic Cause

After considering the underlying cause of the present problem and taking measures to prevent recurrence of the present problem and occurrence of similar problems, G8D teams should then identify the reasons why the underlying cause occurred (i.e., identify the systemic cause of the problem). Identifying the systemic cause provides further opportunities to improve the broader systems, policies, and procedures that relate to the present problem. This further reduces the chances for the recurrence of the present problem or the occurrence of similar problems. The repeated whys technique used to identify the underlying cause can again be used to identify systemic causes, this time starting with the underlying cause.

Make Systemic Prevent Recommendations

The systemic cause allowed the underlying cause to occur, which then allowed the root cause to occur and cause the present problem. Eliminating or reducing the opportunity for the systemic cause to occur gives the G8D team the greatest leverage on preventing the recurrence of the present problem and similar problems. The team should identify actions that can address the systemic cause. However, systemic causes, by their nature, have wide-reaching implications.

While it is the G8D team's responsibility to establish actions to address the systemic cause, it is very likely that the team will not have the authority to implement these improvements. The team should recommend actions to the champion. The champion may not have the authority to implement the recommendations either. In this case, the champion should present the recommendations to those who do have the authority to implement them.

The Champion's Role During D7

The team relies on the champion's active support while completing D7 tasks. To support the team and ensure that the team's recommendations to prevent recurrence are implemented, the champion should:

- Discuss with the team and agree on the systemic prevent recommendations
- Concur with the identified prevent actions and plans to prevent the occurrence of similar problems
- Share the systemic prevent recommendations with the appropriate decision makers
- Use his or her authority to fix the system, practice, or procedure that led to the present problem

Document Technical Lessons Learned

Finally in D7, the G8D team documents its technical lessons learned. Technical lessons learned result from resolving the present problem or from identifying prevent actions for the present and similar problems. Documenting technical lessons learned allows them to be shared with the champion, provides a database for other G8D teams, and conserves resources by preventing the need to repeat the same work on other problems.

The easiest way to document technical lessons learned is to update standard company documents (e.g., control plans, Design Verification and Production Validation Methods, FMEA, process maps) and attach them to the G8D report. If the G8D team identifies information of interest to the wider engineering community, which may or may not be directly related to the resolution of the immediate problem, the team should archive this in the Enterprise Knowledge Base (EKB).

D8

D8 Goal

The goal of D8 is to recognize team and individual contributions. Key tasks are to:

- Select key documents for retention
- Document team and G8D project lessons learned
- Present technical lessons learned
- Recognize the team's collective efforts in solving the problem
- Mutually recognize all contributions to the problem-solving process
- Celebrate achievements

Select and Retain Key Documents

During D7, the team documented its technical lessons learned. D8 presents the final opportunity to ensure that all key documents have been retained. One of the main reasons for implementing a global problem-solving process is to build efficiency through reusability. The team should identify documents not already retained as a part of documenting technical lessons learned that might be useful to other G8D projects and teams. Key documents that need to be retained include the G8D report and any attachments. Ideally, the report and attachments will have been retained within the G8D Web application; therefore, in D8, it is only necessary to ensure that all documents the team should have retained have been retained and are up to date.

Review Process Lessons Learned

While concluding its G8D project, the team should reflect on how well things have gone and how improvements might be made in conducting a future project. The focus here should be on using the G8D process and how well it worked to resolve the problem. The team might consider any tools other than the G8D worksheets that they used and would recommend to others. The team should also identify particular aspects of the G8D process that proved difficult to complete and why this was the case.

Review Team Lessons Learned

In addition to considering the use of the G8D process, the team should consider how well it has worked together as a team. A team meeting could be dedicated to considering both the use of the G8D process and the team process.

Present Technical Lessons Learned

Technical lessons learned were documented in D7. During D8, as the G8D process nears completion, the team should present these lessons learned to the champion. The team should focus on wider issues in this presentation, rather than detailing how the present problem was resolved, by considering any generic issues stemming from the technical lessons learned documented in D7. The team is likely to have updated various documents such as a process map, an FMEA, or a Design Verification Method, and it should consider the reasons why it was necessary for these documents to be updated.

The champion should judge if the team's technical lessons learned should be shared with others, just like the systemic recommendations were shared when identified during D7. The champion should actively support sharing these lessons learned with others.

Recognize Team and Individual Contributions

D8 brings formal closure to the G8D process by saying it is time for everyone involved to return to their regular duties as project work is drawing to a close. While team responsibilities are winding down and changing, it is important to recognize the team's hard work. The process at D8 allows everyone involved to complete the team experience by sincerely recognize the contribution of others and celebrate the team's achievements. In addition to the team and individuals within the team receiving recognition from people external to the team, it is important that team members mutually recognize each other.

Recognition works best when it is perceived to be sincere. It is also important that team

contributors who are no longer team members receive recognition. Recognizing team and individual contributions gives everyone closure with the process and shows participants that their efforts are valued and appreciated. When efforts are recognized, those involved are more likely to work on and support future G8D projects.

Recognition

Recognition is more than simply acknowledging a team's work. It is important to acknowledge the quantity of work, the quality of effort, and the value of the team's accomplishments. To be effective, recognition should be fit, focused, and timely. The form of recognition should fit the contribution of the team or individual, or it should fit the situation. If no recognition is offered, team members assume that their contributions are not valued. If recognition is not offered soon after process completion, or if it is not specific, the impact of positive reinforcement is lost. Recognition reinforces good practice by saying doing a good job matters. It also builds self-esteem and says that the organization is results-oriented. Recognition does not have to be expensive in financial terms, but requires an investment of time. It works best when it's unique, somewhat of a surprise, and considered valuable.

Recognition can be presented in two forms: tangible and intangible.

- Tangible recognition comes in the form of material rewards (e.g., money and plaques)
- Intangible recognition, which is verbal and/or written praise acknowledging an individual's or team's achievement, can be just as meaningful and effective. It may simply be an announcement to others that the team has done a good job.

The team champion is responsible for any type of recognition that is external to the team. In addition, the champion should attend the last team meeting and recognize the efforts of everyone involved.

Celebrate Completion of the Team's Task

The final team closure act should be a celebration that the team has completed its task and should occur outside the context of the team's usual business to signal that it is special. For example, the team might go out to lunch or dinner together. It is important to include the whole team in the celebration, including past team members and the champion.

Conclusion

This reference guide has summarized the content of the team member course. Further details of the G8D process can be found in the optional Team Leader material in the course (Section 7).