

**In addition to this summary, this report includes the following forms:**

Functional Failure Analysis
Failure Effect Categorization (One per Effect)
Maintenance Task Selection (One per Cause)
Tasks

RCM++ Report Sample

This report was generated with ReliaSoft's RCM++ software in Microsoft Word. Similar reports can also be generated in Microsoft Excel. You can easily replace the RCM++ logo graphic with your own company logo. Within Word and Excel, reports can be edited/annotated, if necessary, and generated in PDF and/or HTML format for easy distribution.

This report includes:

- The functional failure analysis spreadsheet report.
- The full details of the failure effect categorization (FEC) values identified during the analysis.
- The full maintenance task selection details for each failure mode identified during the analysis.
- A summary of the maintenance tasks created during the analysis.

The analysis shown in the report is based on the SAE JA1012 "A Guide to the Reliability-Centered (RCM) Standard" guidelines.



**Functional Failure Analysis
Pump_Centrifugal_Motor Drive**

Date: 8/31/2015

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Function #	Function	Failure #	Functional Failure	Effect #	Effect	Cause #	Failure Mode
TAG# 1234567 - Pump_Centrifugal_Motor Drive							
1	Move a given fluid while maintaining an acceptable leak rate at the Shaft	1	Functional Failure: External leak rate at the Shaft is above the acceptable rate Failure Mode: Packing worn	1	Loss of fluid to the ground / sewer	1	Packing Gland too tight or loss of lubrication
						2	Incorrect installation
						3	Wear Out - Normal wear
		2	Functional Failure: Leak rate at the Shaft is below the acceptable rate Failure Mode: Packing mis-adjusted (too tight)	1	Packing prematurely worn	1	Packing bolts over tightened
		3	Functional Failure: Catastrophic failure of the Shaft Seal Failure Mode: Seal/Packing blowout	1		Process impact and Loss of fluid to the ground / sewer	1
							2
Impeller and shaft sub-assembly							
1	Induce fluid movement at xx gallons per minute and xx lbs force with yy head pressure	1	Low output volume less than xx gpm	1	Loss of production.	1	Vane wear due to fluid dynamics
						2	Broken / damaged impeller vane due to age, fatigue, debris in fluid

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FAILURE EFFECT CATEGORIZATION

Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft
Functional Failure	1 - Functional Failure: External leak rate at the Shaft is above the acceptable rate Failure Mode: Packing worn
Effect	1 - Loss of fluid to the ground / sewer

Failure Effect Categorization		Answers and Explanations	
<p>1 - (A) Will the loss of function caused by this failure mode on its own become evident to the operating crew under normal circumstances?</p> <p>Yes No</p>		1	Yes
<p>2 - (B and C) Is there an intolerable risk that the effects of this failure mode could injure or kill someone OR Is there an intolerable risk that the effects of this failure mode could breach a known environmental standard or regulation?</p> <p>Yes No</p>		2	No
<p>3 - (E and F) Is there an intolerable risk that the effects of the multiple failure could injure or kill someone OR Is there an intolerable risk that the effects of the multiple failure could breach a known environmental standard or regulation?</p> <p>Yes No</p>		3	
<p>- 1 - Evident Safety and Environmental Consequences</p> <p>- 2 - Evident Economic Consequences</p> <p>- 3 - Hidden Safety and Environmental Consequences</p> <p>- 4 - Hidden Economic Consequences</p>		<p>Category - 2 - Evident Economic Consequences</p> <p>Remarks Will affect the production line and may affect output.</p>	

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FAILURE EFFECT CATEGORIZATION

Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft
Functional Failure	2 - Functional Failure: Leak rate at the Shaft is below the acceptable rate Failure Mode: Packing mis-adjusted (too tight)
Effect	1 - Packing prematurely worn

Failure Effect Categorization	Answers and Explanations	
<div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 80%;"> 1 - (A) Will the loss of function caused by this failure mode on its own become evident to the operating crew under normal circumstances? </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Yes No </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 90%;"> 2 - (B and C) Is there an intolerable risk that the effects of this failure mode could injure or kill someone OR Is there an intolerable risk that the effects of this failure mode could breach a known environmental standard or regulation? </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Yes No </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 10px; margin: 10px auto; width: 90%;"> 3 - (E and F) Is there an intolerable risk that the effects of the multiple failure could injure or kill someone OR Is there an intolerable risk that the effects of the multiple failure could breach a known environmental standard or regulation? </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Yes No </div> </div> </div> <div style="display: flex; justify-content: space-around; margin-top: 20px;"> <div style="border: 1px solid black; padding: 5px; width: 20%;">- 1 - Evident Safety and Environmental Consequences</div> <div style="border: 1px solid black; padding: 5px; width: 20%;">- 2 - Evident Economic Consequences</div> <div style="border: 1px solid black; padding: 5px; width: 20%;">- 3 - Hidden Safety and Environmental Consequences</div> <div style="background-color: green; color: white; padding: 5px; width: 20%;">- 4 - Hidden Economic Consequences</div> </div>	1	No
	2	
	3	No
	Category - 4 - Hidden Economic Consequences	
	Remarks	

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FAILURE EFFECT CATEGORIZATION

Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft
Functional Failure	3 - Functional Failure: Catastrophic failure of the Shaft Seal Failure Mode: Seal/Packing blowout
Effect	1 - Process impact and Loss of fluid to the ground / sewer

Failure Effect Categorization	Answers and Explanations	
<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> 1 - (A) Will the loss of function caused by this failure mode on its own become evident to the operating crew under normal circumstances? </div> <div style="display: flex; justify-content: space-around; margin-top: 5px;"> Yes No </div> <div style="display: flex; justify-content: space-between; margin-top: 20px;"> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 10px; margin-bottom: 5px;"> 2 - (B and C) Is there an intolerable risk that the effects of this failure mode could injure or kill someone OR Is there an intolerable risk that the effects of this failure mode could breach a known environmental standard or regulation? </div> <div style="display: flex; justify-content: space-around; margin-bottom: 5px;"> Yes No </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px; text-align: center;"> - 1 - Evident Safety and Environmental Consequences </div> </div> <div style="width: 45%;"> <div style="border: 1px solid black; padding: 10px; margin-bottom: 5px;"> 3 - (E and F) Is there an intolerable risk that the effects of the multiple failure could injure or kill someone OR Is there an intolerable risk that the effects of the multiple failure could breach a known environmental standard or regulation? </div> <div style="display: flex; justify-content: space-around; margin-bottom: 5px;"> Yes No </div> <div style="border: 1px solid black; padding: 5px; margin-top: 10px; text-align: center;"> - 3 - Hidden Safety and Environmental Consequences </div> </div> </div>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> 1 </div>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> Yes </div>
<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> 2 </div>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> 2 </div>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> No </div>
<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> 3 </div>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> 3 </div>	<div style="border: 1px solid black; padding: 10px; margin: 0 auto; width: 80%;"> - 2 - Evident Economic Consequences </div>
<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> - 2 - Evident Economic Consequences </div>	<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> - 1 - Evident Safety and Environmental Consequences </div>	<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> - 4 - Hidden Economic Consequences </div>
<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> - 3 - Hidden Safety and Environmental Consequences </div>	<div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> Category: - 2 - Evident Economic Consequences Remarks: </div>	

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FAILURE EFFECT CATEGORIZATION

Name	1.1 - Impeller and shaft sub-assembly
Function	1 - Induce fluid movement at xx gallons per minute and xx lbs force with yy head pressure
Functional Failure	1 - Low output volume less than xx gpm
Effect	1 - Loss of production.

Failure Effect Categorization		Answers and Explanations	
<p>1 - (A) Will the loss of function caused by this failure mode on its own become evident to the operating crew under normal circumstances?</p> <p><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p>		1	No
<p>2 - (B and C) Is there an intolerable risk that the effects of this failure mode could injure or kill someone OR Is there an intolerable risk that the effects of this failure mode could breach a known environmental standard or regulation?</p> <p><input type="checkbox"/> Yes <input type="checkbox"/> No</p>		2	
<p>3 - (E and F) Is there an intolerable risk that the effects of the multiple failure could injure or kill someone OR Is there an intolerable risk that the effects of the multiple failure could breach a known environmental standard or regulation?</p> <p><input type="checkbox"/> Yes <input checked="" type="checkbox"/> No</p>		3	No
<p>- 1 - Evident Safety and Environmental Consequences</p> <p>- 2 - Evident Economic Consequences</p> <p>- 3 - Hidden Safety and Environmental Consequences</p> <p>- 4 - Hidden Economic Consequences</p>		<p>Category - 4 - Hidden Economic Consequences</p> <p>Remarks</p>	

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MAINTENANCE TASK SELECTION

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Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive	FEC -2- Evident Economic Consequences
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft	
Functional Failure	1 - Functional Failure: External leak rate at the Shaft is above the acceptable rate Failure Mode: Packing worn	
Effect	1 - Loss of fluid to the ground / sewer	
Failure Mode	1 - Packing Gland too tight or loss of lubrication	

Question	Yes	No	Explanation
4: Is a scheduled on-condition task technically feasible and worth doing?		X	
5A: Is a scheduled restoration task technically feasible and worth doing?		X	
5B: Is a scheduled discard task technically feasible and worth doing?	X		

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	Training; Maintenance - Proper Packing		Tra	1 Year	PM Crew \$180/Hr	40.000000 Hour
2	IN - Inspection for leaks		OC	6 Week	Pump Crew - Inspection	0.250000 Hour

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MAINTENANCE TASK SELECTION

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Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive	FEC -2- Evident Economic Consequences
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft	
Functional Failure	1 - Functional Failure: External leak rate at the Shaft is above the acceptable rate Failure Mode: Packing worn	
Effect	1 - Loss of fluid to the ground / sewer	
Failure Mode	2 - Incorrect installation	

Question	Yes	No	Explanation
4: Is a scheduled on-condition task technically feasible and worth doing?		X	
5A: Is a scheduled restoration task technically feasible and worth doing?		X	
5B: Is a scheduled discard task technically feasible and worth doing?		X	

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	Training; Maintenance - Proper Packing		Tra	1 Year	PM Crew \$180/Hr	40.000000 Hour

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MAINTENANCE TASK SELECTION

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Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive	FEC -2- Evident Economic Consequences
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft	
Functional Failure	1 - Functional Failure: External leak rate at the Shaft is above the acceptable rate Failure Mode: Packing worn	
Effect	1 - Loss of fluid to the ground / sewer	
Failure Mode	3 - Wear Out - Normal wear	

Question	Yes	No	Explanation
4: Is a scheduled on-condition task technically feasible and worth doing?		X	
5A: Is a scheduled restoration task technically feasible and worth doing?	X		
5B: Is a scheduled discard task technically feasible and worth doing?		X	

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
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MAINTENANCE TASK SELECTION

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Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive	FEC -4- Hidden Economic Consequences
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft	
Functional Failure	2 - Functional Failure: Leak rate at the Shaft is below the acceptable rate Failure Mode: Packing mis-adjusted (too tight)	
Effect	1 - Packing prematurely worn	
Failure Mode	1 - Packing bolts over tightened	

Question	Yes	No	Explanation
9: Is a scheduled on-condition task technically feasible and worth doing?		X	
10A: Is a scheduled restoration task technically feasible and worth doing?		X	
10B: Is a scheduled discard task technically feasible and worth doing?		X	
11: Is a scheduled failure-finding task technically feasible and worth doing?		X	

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	Training; Maintenance - Proper Packing		Tra	1 Year	PM Crew \$180/Hr	40.000000 Hour

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Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive	FEC -2- Evident Economic Consequences
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft	
Functional Failure	3 - Functional Failure: Catastrophic failure of the Shaft Seal Failure Mode: Seal/Packing blowout	
Effect	1 - Process impact and Loss of fluid to the ground / sewer	
Failure Mode	1 - Induced - Gland Follower corrosion / failure	

Question	Yes	No	Explanation
4: Is a scheduled on-condition task technically feasible and worth doing?	X		
5A: Is a scheduled restoration task technically feasible and worth doing?		X	
5B: Is a scheduled discard task technically feasible and worth doing?		X	

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	OC- Inspection for corrosion		OC	12650 Hour	Pump Crew - Inspection	0.500000 Hour

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MAINTENANCE TASK SELECTION

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Name	TAG# 1234567 - Pump_Centrifugal_Motor Drive	FEC -2- Evident Economic Consequences
Function	1 - Move a given fluid while maintaining an acceptable leak rate at the Shaft	
Functional Failure	3 - Functional Failure: Catastrophic failure of the Shaft Seal Failure Mode: Seal/Packing blowout	
Effect	1 - Process impact and Loss of fluid to the ground / sewer	
Failure Mode	2 - Induced - Gland Follower stress / failure	

Question	Yes	No	Explanation
4: Is a scheduled on-condition task technically feasible and worth doing?		X	
5A: Is a scheduled restoration task technically feasible and worth doing?	X		
5B: Is a scheduled discard task technically feasible and worth doing?		X	

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	PM - Gland Follower		RR	330000 Hour	PM Crew \$180/Hr	3.000000 Hour

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MAINTENANCE TASK SELECTION

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Name	1.1 - Impeller and shaft sub-assembly	FEC -4- Hidden Economic Consequences
Function	1 - Induce fluid movement at xx gallons per minute and xx lbs force with yy head pressure	
Functional Failure	1 - Low output volume less than xx gpm	
Effect	1 - Loss of production.	
Failure Mode	1 - Vane wear due to fluid dynamics	

Question	Yes	No	Explanation
9: Is a scheduled on-condition task technically feasible and worth doing?		X	
10A: Is a scheduled restoration task technically feasible and worth doing?		X	
10B: Is a scheduled discard task technically feasible and worth doing?		X	
11: Is a scheduled failure-finding task technically feasible and worth doing?		X	

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	PdM - Track Flow Rate		OLM	1 Month	Pump Crew - Inspection	0.250000 Hour

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MAINTENANCE TASK SELECTION

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Name	1.1 - Impeller and shaft sub-assembly	FEC -4- Hidden Economic Consequences
Function	1 - Induce fluid movement at xx gallons per minute and xx lbs force with yy head pressure	
Functional Failure	1 - Low output volume less than xx gpm	
Effect	1 - Loss of production.	
Failure Mode	2 - Broken / damaged impeller vane due to age, fatigue, debris in fluid	

Question	Yes	No	Explanation
9: Is a scheduled on-condition task technically feasible and worth doing?		X	
10A: Is a scheduled restoration task technically feasible and worth doing?		X	
10B: Is a scheduled discard task technically feasible and worth doing?		X	
11: Is a scheduled failure-finding task technically feasible and worth doing?	X		

#	Task Description	Status	Type	Assigned interval	Crew	Task Duration
1	Inspect for broken / damaged impeller vane		IN	3 Month	PM Crew \$180/Hr	0.500000 Hour

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TASKS

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Task ID	Task Description	Type	Status	Reference Document	Proposed Interval	Assigned interval	Condition	Comments	Zone	Access	Last Updated By	Last Updated	Name	Failure Mode
32	Training; Maintenance - Proper Packing	Tra				1 Year					ReliaSoft Corporation	4/9/2013 10:53 AM	Pump_Centrifugal_Motor Drive	Packing bolts over tightened
35	PM - Gland Follower	RR				330000 Hour					ReliaSoft Corporation	4/9/2013 10:53 AM	Pump_Centrifugal_Motor Drive	Induced - Gland Follower stress / failure
34	OC- Inspection for corrosion	OC				12650 Hour					ReliaSoft Corporation	4/9/2013 10:53 AM	Pump_Centrifugal_Motor Drive	Induced - Gland Follower corrosion / failure
32	Training; Maintenance - Proper Packing	Tra				1 Year					ReliaSoft Corporation	4/9/2013 10:53 AM	Pump_Centrifugal_Motor Drive	Packing Gland too tight or loss of lubrication
36	IN - Inspection for leaks	OC				6 Week					ReliaSoft Corporation	4/9/2013 10:53 AM	Pump_Centrifugal_Motor Drive	Packing Gland too tight or loss of lubrication
32	Training; Maintenance - Proper Packing	Tra				1 Year					ReliaSoft Corporation	4/9/2013 10:53 AM	Pump_Centrifugal_Motor Drive	Incorrect installation
31	Inspect for broken / damaged impeller vane	IN				3 Month					ReliaSoft Corporation	4/19/2013 11:53 AM	Impeller and shaft sub-assembly	Broken / damaged impeller vane due to age, fatigue, debris in fluid
33	PdM - Track Flow Rate	OLM				1 Month					ReliaSoft Corporation	4/9/2013 10:53 AM	Impeller and shaft sub-assembly	Vane wear due to fluid dynamics

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