

Documenting RCM and Equipment Failure Modes in Maximo

Mark Lozina

Asset Management and Technology Development
Consolidated Edison of New York Inc.

Jeff Tippett

Vice President

Maintenance Group Inc.





Commodities:

- Electric
- Gas
- Steam

Over 10 million customers

\$62 billion in assets

\$12 billion in annual revenue

Central Operations (Transmission, Substations, and Power Generation) implemented Maximo in 1998



If we could go back in time and implement Maximo again, these are the 2 things we would do differently:

- 1 Categorize Equipment
- 2 Utilize failure mode coding

Reliability Centered Maintenance (RCM):

Reliability Centered Maintenance is an engineering framework that enables the definition of a complete maintenance regimen. It regards maintenance as the means to maintain the functions a user may require of machinery in a defined operating context.

1. What is the item supposed to do and its associated performance standards?
2. In what ways can it fail to provide the required functions?
3. What are the events that cause each failure?
4. What happens when each failure occurs?
5. In what way does each failure matter?
6. What systematic task can be performed proactively to prevent, or to diminish to a satisfactory degree, the consequences of the failure?

RCM Analysis Compilation

- Asset RCM Group
- Asset functions and functional failure
- Failure modes that cause functional failures
 - Component
 - Component problem
 - Cause of component problem
- Consequence of functional failure (system effects)
- Maintenance task to prevent failure or mitigate consequences



Applying RCM Analysis to an RCM Group

- Identify all assets in RCM Group
- Classify all asset locations
 - Criticality (Critical/Non-Critical)
 - Duty Cycle (High/Low)
 - Service Condition (Severe/Mild)
- Set Maintenance Group that reflects the PM Basis

Template View [Close Window](#)

Circuit Breakers

Plant Type: **FOSSIL**

Category/SubCategory: **Electrical / Breakers**

SME:

Backup SME: ,

Rev Number: **0**

Status: **Approved**

Approved By - Date:

Boundary Definition

SME Summary

Comments

Implementation History

Revision History

Operating Experience

Commitments

Condition Definitions

File Attachments(0)

Task View | [FMECA View](#)

View Basis Text

Component Classification		CHS	CLS	CHM	CLM	NHS	NLS	NHM	NLM	HS	LS	HM	LM
Criticality	Critical	x	x	x	x								
	Non-Critical					x	x	x	x				
Duty Cycle	High	x		x		x		x		x		x	
	Low		x		x		x		x		x		x
Service Condition	Severe	x	x			x	x			x	x		
	Mild			x	x			x	x			x	x
Time Directed													
COP - Calibrate protection relay(s)		4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	N/A	N/A	N/A	N/A
Failure Mode		Man Hours Needed: 0.00Hours Unavailable: 0Sort Order: 0											
COP - Current Injection Testing (600V)		6.00 Y	6.00 Y	6.00 Y	6.00 Y	6.00 Y	6.00 Y	6.00 Y	6.00 Y	N/A	N/A	N/A	N/A
Failure Mode		Man Hours Needed: 0.00Hours Unavailable: 0Sort Order: 0											
COP - Inspection		3.00 Y	3.00 Y	3.00 Y	3.00 Y	3.00 Y	3.00 Y	3.00 Y	3.00 Y	N/A	N/A	N/A	N/A
Failure Mode		Man Hours Needed: 0.00Hours Unavailable: 0Sort Order: 0											
COP - Trip test protection relay(s)		4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	4.00 Y	N/A	N/A	N/A	N/A
Failure Mode		Man Hours Needed: 0.00Hours Unavailable: 0Sort Order: 0											

What is Preventive Maintenance Basis?

RCM

Failure modes and actions to prevent or mitigate them

- Functional failures
- Component that causes asset failure
- Component problem
- Cause of component problem

} Failure Mode

Regulatory Requirements

Engineering Specifications

Manufacturer Recommendations

Operational Experience



What is a Failure Mode?

The failure mode contains 3 distinct pieces of information:

- **Failed Component** (a part of the asset)
- **Component problem**
- **Cause**

All 3 pieces are then concatenated together on the work order at job completion.

Failed Component + Component Problem + Cause

Work order description:	E63RD ST TR # 7 UNABLE TO MOVE TAPS LOCALLY AND SUPERVISORY
Location ID:	ME-E63-350-TRF-7-LTC
Work Performed:	drilled bracket to install new relay, installed new relay
Functional Failure:	Unable to regulate voltage
Component:	LTC voltage control relay
Component problem:	Worn/Deteriorated
Cause:	Normal wear

Relay worn due to normal wear

Why is knowing Failure Mode so important?

Failure Mode: Relay worn due to normal wear

Asset: Load Tap Changer

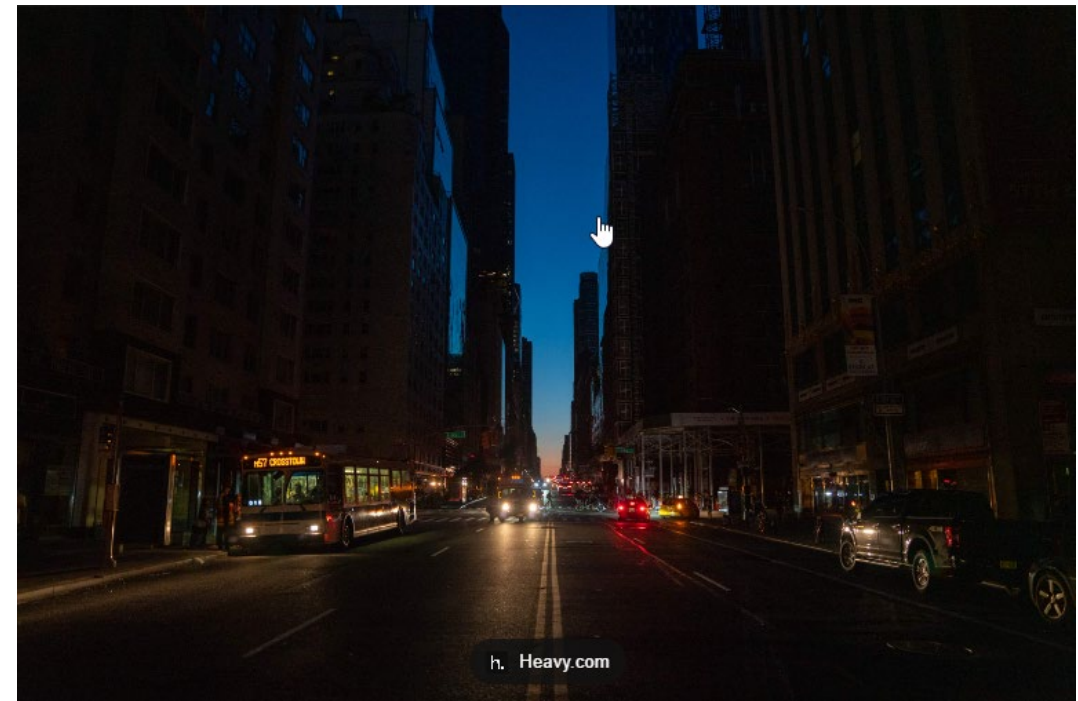
Maintenance strategy: Full PM 10 Years or 40,000 Operations

Is this a new failure mode?

How often do we see this failure mode?

Should we modify our maintenance strategy?

- Increase frequency of inspection?
- Modify scope of current PM?
- Create new PM?
- Maybe we need a relay that lasts longer?

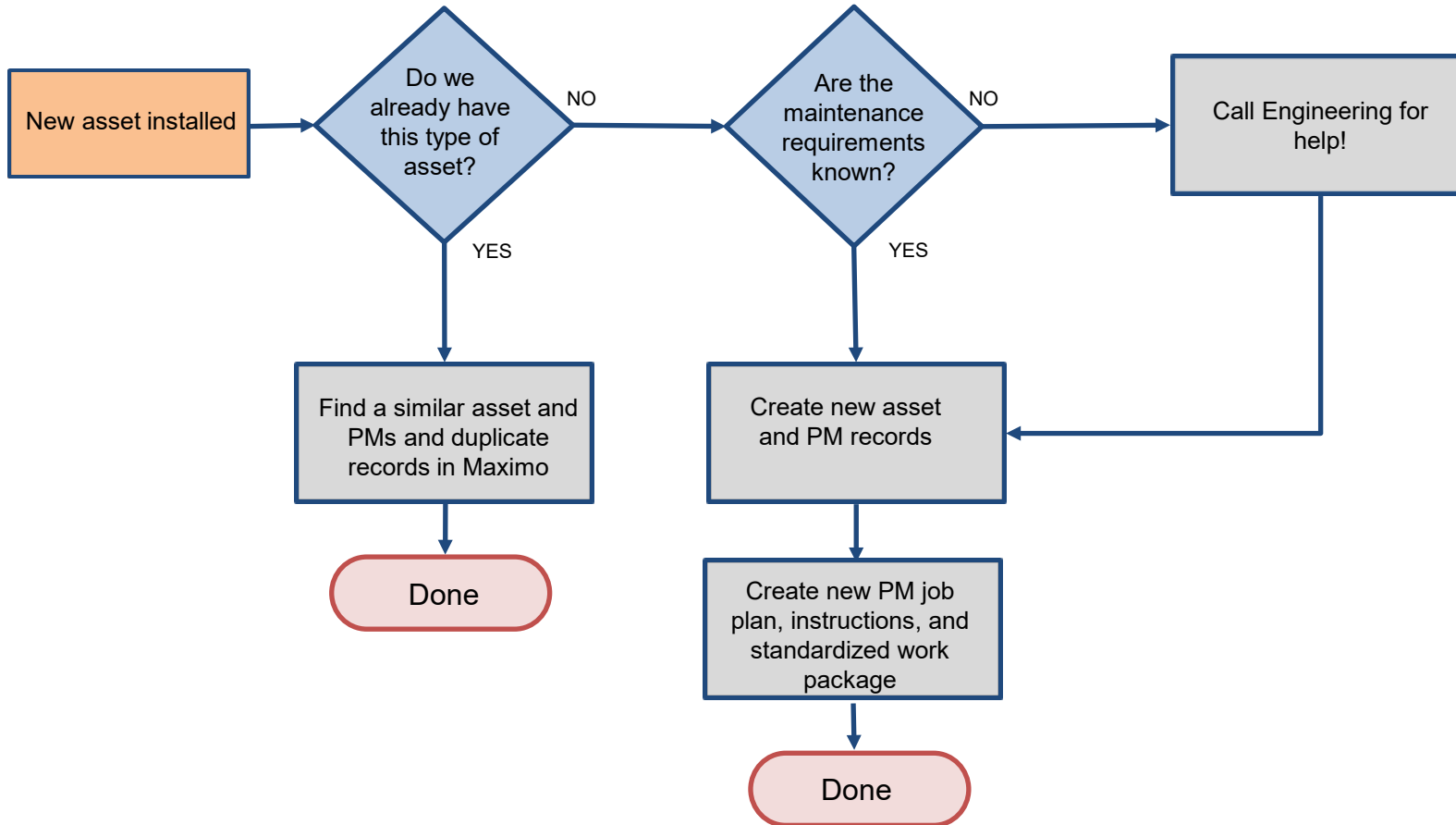


RCM and PM Basis Initiative

Changes:

- Assets will be categorized and classified
 - Equipment group – high level bundling used for budgeting
 - RCM group – assets that have the same functional failures and failure modes
 - Maintenance group – assets that have the same maintenance requirements
 - Criticality (critical, not critical)
 - Duty Cycle (high, low)
 - Environment (severe, mild)
- Master PMs created for all maintenance groups
 - Automatic notification of any missing PMs
- RCM documented for all major equipment types
 - Provides the following coding for CM work orders:
 - Functional failure/degraded condition
 - Component
 - Component problem
 - Cause
- PM changes processed in Maximo using Management of Change (MOC)
- Problem codes collected on CM work orders to categorize types of issues per RCM group
- Failure mode data collected on CM work orders for weekly review by Reliability Team
 - Cause codes will be added for all Functional Failures
- RCM module reports allow review of documented CM failure modes vs. RCM
- PowerBI reports utilized to standardize reliability team frequently used metrics

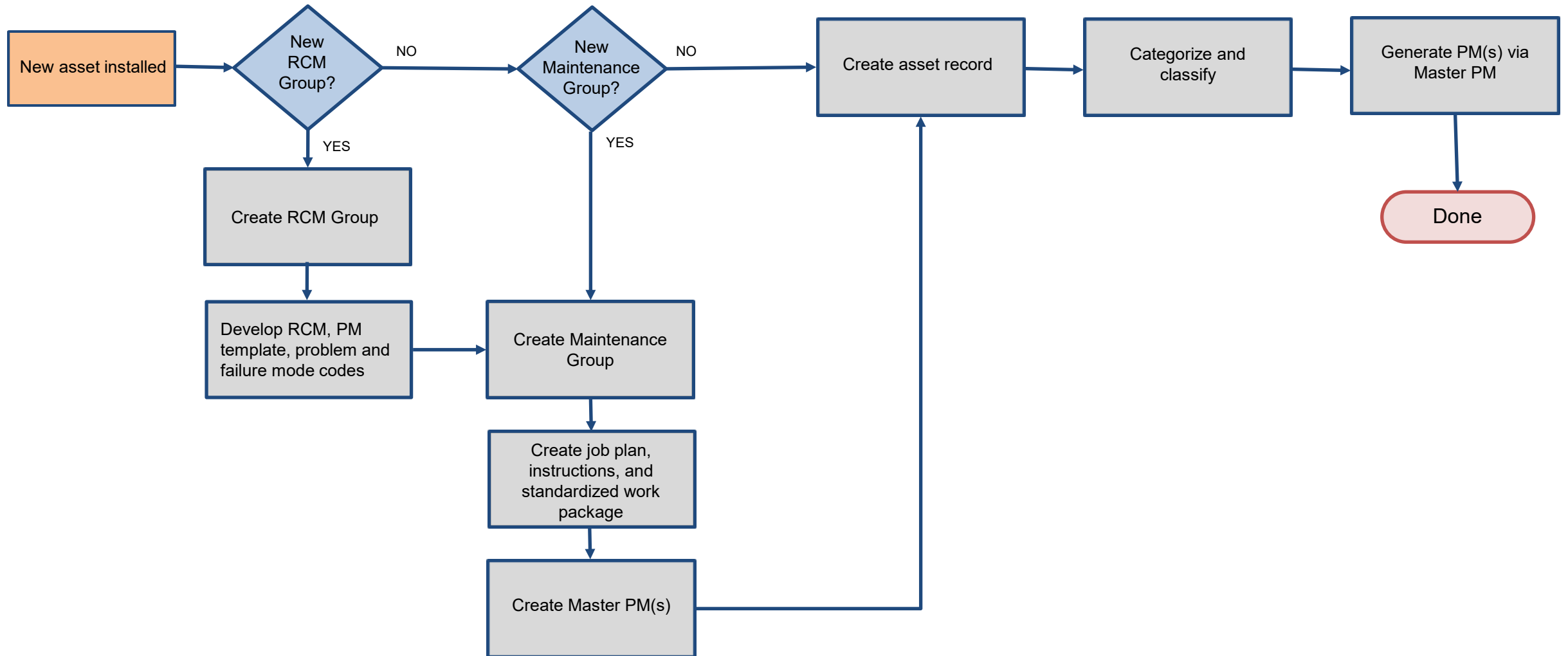
Asset On-boarding Process (Old)



Disadvantages:

- Record quality highly dependent on Maximo administrator
- Asset “categorization” is haphazard – difficult to query with accurate results
- Engineering doesn’t understand Maximo so help is difficult to obtain
- Record duplication is error-prone

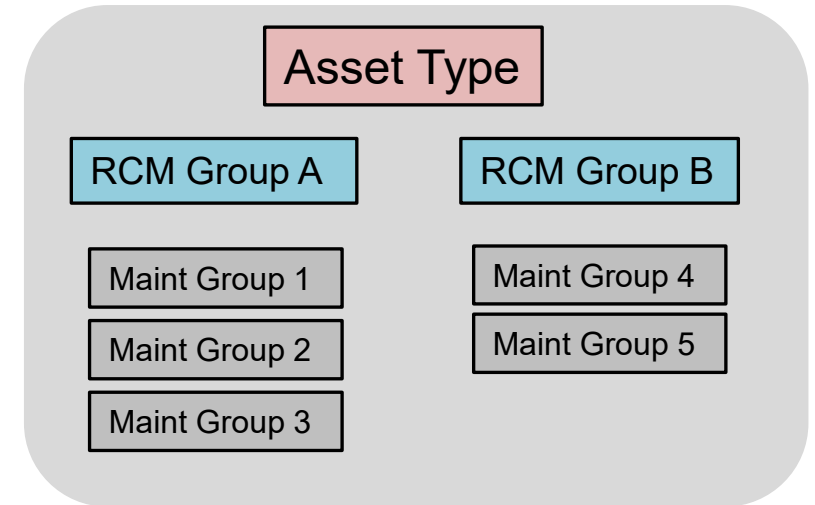
Asset On-boarding Process (New)



Use of RCM Group and Maintenance Group

RCM Group – Specific picklists for each of the following

- Functional failures
- Component that causes asset failure
- Component problem
- Cause of component problem



Maintenance Group

- Determines the applicable Master PM(s) for asset

An asset type can have one or multiple RCM Groups!

An RCM Group can have one or multiple Maintenance Groups!

Viewing RCM Group

RCM Group: BKR-HV-SF6

High Voltage Breakers

Organization: CONED

Status: DRAFT

Revision: 0

Site: SSO

Details

Responsibility

Modified

Asset Category:

Owner:

Change By: LOZINAM

Commodity Group: BKR-HV-SF6

Ownergroup:

Change Date: 7/27/22 9:01 AM

Responsible Area:

Component	Description
BKR-HV-SF6-M-HS-G	MECHANICAL - Hydraulic System - Gaskets
BKR-HV-SF6-I-SG	INSULATION - SF6 Gas
BKR-HV-SF6-M-S/CS(G)	MECHANICAL - Spring / Charging System (General)
BKR-HV-SF6-M-S/CS-M	MECHANICAL - Spring / Charging System - Motor
BKR-HV-SF6-M-AS-C	MECHANICAL - Air System - Compressor
BKR-HV-SF6-M-AS-G	MECHANICAL - Air System - Gaskets
BKR-HV-SF6-E/C-A/RC	ELEC / CONTROLS - Aux / Relay Contacts
BKR-HV-SF6-M-M-L	MECHANICAL - Mechanism - Linkage
BKR-HV-SF6-E/C-C/W-CW	ELEC / CONTROLS - Cable / Wiring - Control Wiring
BKR-HV-SF6-B(G)	BUSHING (General)

BKR-HV-SF6 High Voltage Breakers

Asset components to be used throughout application for failure mode reporting.

RCM Group – Defines Asset Functions

The screenshot displays the RCM Group (RCM) application interface. The top navigation bar includes a home icon, a menu icon, and the text 'RCM Group (RCM)'. Below this is a search bar with 'Query' and 'Find RCM Group' options, and a 'Select Action' dropdown. The main navigation tabs are 'List View', 'RCM Group', 'Functions & Failure Modes', 'Associated Maintenance Groups', and 'Analysis'. The current view is 'List View' for the 'RCM Group: BKR-HV-SF6' with the title 'High Voltage Breakers'. The organization is 'CONED' and the status is 'DRAFT'. The revision is '0' and the site is 'SSO'. The main content area shows a table of 'Asset Functions' with columns for 'Function', 'Functional Failure', and 'System Effect'. A red box highlights the 'RCM Group: BKR-HV-SF6' and the table. A red arrow points from the text box on the right to the 'System Effect' column of the first row in the table.

Function	Functional Failure	System Effect
Receives signal and actuates based on t	FAILS TO OPEN	Breaker fails to trip - equipment damage
Interrupts fault current	FAILS TO INTERRUPT	Equipment damage, loss of transmissio
Insulates conductor from ground	FAILS TO INSULATE	Unsafe condition, interruption of transn
Closes on demand	FAILS TO CLOSE	Possible increased operational risk for c
Provide equipment self-protection (trip	FAILS TO CARRY LOAD	Equipment damage, eventual loss of tre
Provide equipment self-protection (pre	FAILS TO CARRY LOAD	Equipment damage, eventual loss of tre
Provide equipment self-protection (clo	FAILS TO CARRY LOAD	Equipment damage, eventual loss of tre
Provide equipment self-protection (clo	FAILS TO CARRY LOAD	Equipment damage, eventual loss of tre
Maintain structural integrity	FAILS TO CARRY LOAD	Rupture valve operation - unsafe condit
Conducts power in a closed condition	FAILS TO CARRY LOAD	Single-phasing of connected equipmen

Details

Function: Receives signal and actuates based on trip signal from

Functional Failure: FAILS TO OPEN

System Effect: Breaker fails to trip - equipment damage, loss of transmission and station power - loss of generation and substation power input. Fails to isolate equipment on demand - unable to isolate equipment (safety issue), unnecessary outage due to opening of upstream device

BKR-HV-SF6 High Voltage Breakers

Define all asset functions and functional failures, including system effects for the RCM Group.

Maintenance Group – Created from RCM Group

Home Menu Maintenance Group (RCM)

Query Find Maintenance Group Select Action

List View Maintenance Group Functions & Failure Modes Associated Assets Associated Locations Specifications Analysis

Maintenance Group: **BKR-ABB-ELK** ABB ELK High Voltage Breakers Organization: CONED Status: DRAFT

Revision: 0 Site: SSO

Details Responsibility Modified

RCM Group: **BKR-HV-SF6** High Voltage Breakers Owner: Changed By: LOZINA

Asset Category: Owner Group: Change Date: 9/12/2

Manufacturer: ABB ABB

Model Number: ELK

Classification:

Class Description:

Maintenance Group: BKR-ABB-ELK

Associated with RCM Group BKR-HV-SF6 High Voltage Breakers

Maintenance Group can specify Manufacturer and Model Number as

Each manufacturer or model could have different maintenance requirements

Maintenance Group – Functions & Failure Modes

Maintenance Group (RCM)

Query Find Maintenance Group Select Action

List View Maintenance Group Functions & Failure Modes Associated Assets Associated Locations Specifications Analysis

Maintenance Group: BKR-ABB-ELK ABB ELK High Voltage Breakers Organization: CONED Status: DRAFT

Revision: 0 Site: SSO

Asset Functions Filter 1 - 10 of 19

Function	Functional Failure	System Effect
> Provide equipment self-protection (pre	DEGRADED CONDITION	Equipment damage, eventual loss of tra
> Provide equipment self-protection (trip	DEGRADED CONDITION	Equipment damage, eventual loss of tra
> Provide local status indications (break	DEGRADED CONDITION	Loss of information for operators to mal
> Provide local status indications (gas pre	DEGRADED CONDITION	Loss of information for operators to mal
> Provide remote status and alarm signal:	DEGRADED CONDITION	Loss of system operator's ability to rem
> Provide remote status and alarm signal:	DEGRADED CONDITION	Loss of system operator's ability to rem
> Provide remote status and alarm signal:	DEGRADED CONDITION	Loss of system operator's ability to rem
> Provide suitable cabinet environment (f	DEGRADED CONDITION	Eventual damage to control wiring and l
> Supplies secondary current signal to pr	DEGRADED CONDITION	Improper current flow signal supplied t
> Conducts power in a closed condition	FAILS TO CARRY LOAD	Single-phasing of connected equipment

New Row

Failure Modes Filter 1 - 9 of 9

Failure Mode	Failure Mode Indication	Control Type
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downst	PM - Time-Directed
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downs	PM - Condition-Monitoring
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downs	PM - Time-Directed
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downs	PM - Condition-Monitoring
> BKR-HV-SF6-M-M-TL WORN / DETERIO	Observation	PM - Time-Directed
> BKR-HV-SF6-M(G) WORN / DETERIORA	hidden failure, single-phasing of downs	PM - Time-Directed
> BKR-HV-SF6-E/C-TC WORN / DETERIOI	None	PM - Time-Directed

Maintenance Group Asset Functions and Failure Modes are copied from the RCM Group and only editable in the RCM Group application.

Maintenance Group – Mitigation Measures

Maintenance Group (RCM)

Query Find Maintenance Group Select Action

> Supplies secondary current signal to pri	DEGRADED CONDITION	Improper current flow signal supplied t	🗑️
> <u>Conducts power in a closed condition</u>	FAILS TO CARRY LOAD	Single-phasing of connected equipment	🗑️

New Row

Failure Modes Filter 1 - 9 of 9

Failure Mode	Failure Mode Indication	Control Type	🗑️
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downst	PM - Time-Directed	🗑️
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downs	PM - Condition-Monitoring	🗑️
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downs	PM - Time-Directed	🗑️
> BKR-HV-SF6-M-M/AC/AC CONTAMINAT	hidden failure, single-phasing of downs	PM - Condition-Monitoring	🗑️
> BKR-HV-SF6-M-M-TL WORN / DETERIC	Observation	PM - Time-Directed	🗑️
> BKR-HV-SF6-M(G) WORN / DETERIORA	hidden failure, single-phasing of downs	PM - Time-Directed	🗑️
> BKR-HV-SF6-E/C-TC WORN / DETERIOF	None	PM - Time-Directed	🗑️
> BKR-HV-SF6-E/C-AP LOSS OF AUX POW	alarm	PM - Failure-Finding	🗑️
> BKR-HV-SF6-E/C(G) WORN / DETERIOF	hidden failure, single-phasing of downs	PM - Time-Directed	🗑️

New Row

For each Failure Mode a mitigating Master PM(s) or Route Base PM(s) can be assigned.

The PM's for these Mitigation Measures define the maintenance strategy of the Maintenance Group to prevent the asset functional failures from occurring.

Mitigation Measures - Note: Deleting rows in the tables below does not delete the actual Master PMs or Route PMs

RCM Master PM Filter 1 - 1 of 1

Master PM	Description	Frequency	Frequency Units	Work Type	🗑️
> MPM-ABB-ELK-I	ASTORIA ANNEX CIRCUIT BREAKER 1	7	YEARS	PM	🗑️

New Row

RCM Route Based PMs Filter 0 - 0 of 0

PM	Description	Route Type	Frequency	Frequency Units	Work Type
----	-------------	------------	-----------	-----------------	-----------

Maintenance Group – Mitigation Measures (cont'd)

Mitigation Measures - Note: Deleting rows in the tables below does not delete the actual Master PMs or Route PMs

RCM Master PM Filter > 1 - 1 of 1

Master PM	Description	Frequency	Frequency Units	Work Type
MPM-ABB-ELK-	ASTORIA ANNEX CIRCUIT BREAKER 1	7	YEARS	PM

Details

Master PM: MPM-ABB-ELK- ASTORIA ANNEX CIRCUIT BREAKER 1 Frequency: 1
Frequency Units: YEARS

PM Component Classification

RCM Component: _____

High Criticality, High Duty Cycle, Mild Environment?	<input type="checkbox"/>	Low Criticality, High Duty Cycle, Mild Environment?	<input type="checkbox"/>
High Criticality, High Duty Cycle, Severe Environment?	<input type="checkbox"/>	Low Criticality, High Duty Cycle, Severe Environment?	<input type="checkbox"/>
High Criticality, Low Duty Cycle, Mild Environment?	<input type="checkbox"/>	Low Criticality, Low Duty Cycle, Mild Environment?	<input type="checkbox"/>
High Criticality, Low Duty Cycle, Severe Environment?	<input type="checkbox"/>	Low Criticality, Low Duty Cycle, Severe Environment?	<input checked="" type="checkbox"/>

Each Master PM will be assigned any combination of Asset Component Classification

Optionally an RCM Component value may also be assigned.

The system automatically associates all Maintenance Group Master PMs to associated assets based on matching this criteria.

Maintenance Group – Associating A New Asset

← List View Asset **RCM** Spare Parts Related Records JTS Inspection(Historic) Safety Meters Specifications Service Address Work Map Failure Analysis

Asset: BKR-0002588

ASTORIA ANNEX CIRCUIT BREAKER 4 (FUTURE)

Site: SSO

RCM Information

Asset Criticality: Low

Asset Duty Cycle: Low

Environment: Mild

Component Classification: LLM

RCM Asset Component: _____

RCM Source: _____

Asset Category: BKR-HV

RCM Group: BKR-HV-SF6 **High Voltage Breakers**

Maintenance Group: BKR-ABB-ELK **ABB ELK High Voltage Breakers**

Environment value based on asset location

On the asset record RCM tab, assign the Asset Criticality, Asset Duty Cycle, RCM Asset Component (optional) and the RCM Group and Maintenance Group. This will automatically associate the asset with the selected Maintenance Group.

Maintenance Group – Associating New Asset (Cont'd)

The screenshot displays the 'Maintenance Group (RCM)' interface. The top navigation bar includes 'List View', 'Maintenance Group', 'Functions & Failure Modes', 'Associated Assets', 'Associated Locations', 'Specifications', and 'Analysis'. The 'Associated Assets' tab is selected and highlighted with a red box. Below the navigation, the maintenance group is identified as 'BKR-ABB-ELK' (ABB ELK High Voltage Breakers) and the organization as 'CONED'. The site is 'SSO'. A table lists assets with columns for 'Issues Exist?', 'Asset', 'Description', 'Location', and 'Description'. The first row, 'BKR-0002588 > ASTORIA ANNEX CIRCUIT BREAKER 4 (FUTURE)', is highlighted with a red box. Below this, the 'Master PMs' tab is selected and highlighted with a red box. A table shows 'RCM Master PM' with columns for 'Issues Exist?', 'Master PM', 'Description', 'Frequency', 'Frequency Units', and 'Work Type'. The first row, 'MPM-ABB-ELK-PM ASTORIA ANNEX CIRCUIT BREAKER 1', is highlighted with a red box. Below this, the 'Associated PMs' section is shown, which is currently empty, with the message 'There are no rows to display.'

The new asset is automatically associated with the Maintenance Group.

“Bread crumbs” indicate that there are issues with the asset record.

The Master PM was automatically associated with the new asset, however there is no associated PM.

User must generate the associated PM for the Master PM – Asset combination.

Maintenance Group – Create Associated PMs (Cont'd)

The screenshot shows a software interface for creating associated PMs. At the top, there is a navigation bar with a home icon, a menu icon, and the text "Maintenance Group (RCM)". Below this is a search bar with "Query" and "Find Maintenance Group" options. A "Select Action" dropdown menu is open, showing options: "Activate Maintenance Group" and "Pull RCM Group changes to Maintenance Group".

The main content area is titled "Maintenance Group: BKR-ABB-ELK" and "Revision: 0". It features a table with columns "Issues Exist?" and "Asset". The table contains three rows:

Issues Exist?	Asset
<input checked="" type="checkbox"/>	BKR-0002588
<input type="checkbox"/>	BKR-0002585
<input type="checkbox"/>	BKR-0002586

Below the table, there is a "Create Associated PMs" section with a message: "The following master PMs will create PM records for the associated assets. To create the associated PMs, click OK." Below this message is a table of "Master PMs" with one row: "MPM-ABB-ELK-".

A "System Message" dialog box is open, displaying the message: "BMXAA2753I - Created PM 4175 for asset/location BKR-0002588." with an "OK" button.

Action menu, choose "Create"

Maintenance Group – Asset Associated

Home Menu Maintenance Group (RCM)

Query Find Maintenance Group Select Action

List View Maintenance Group Functions & Failure Modes **Associated Assets** Associated Locations Specifications Analysis

Maintenance Group: BKR-ABB-ELK ABB ELK High Voltage Breakers Organization: CONED

Revision: 0 Site: SSO

Filter 1 - 5 of 5

Issues Exist?	Asset	Description	Location	Description
> <input type="checkbox"/>	BKR-0002585	> ASTORIA ANNEX CIRCUIT BREAKER 1	Q-ASTA-150-BKR-1	ASTORIA ANNEX CIR
> <input type="checkbox"/>	BKR-0002586	> ASTORIA ANNEX CIRCUIT BREAKER 2	Q-ASTA-150-BKR-2	ASTORIA ANNEX CIR
> <input type="checkbox"/>	BKR-0002587	> ASTORIA ANNEX CIRCUIT BREAKER 3	Q-ASTA-150-BKR-3	ASTORIA ANNEX CIR
▼ <input type="checkbox"/>	<u>BKR-0002588</u>	> <u>ASTORIA ANNEX CIRCUIT BREAKER 4 (FUTURE)</u>	Q-ASTA-150-BKR-4	<u>ASTORIA ANNEX CIR</u>
> <input type="checkbox"/>	BKR-0002589	> ASTORIA ANNEX CIRCUIT BREAKER 5	Q-ASTA-150-BKR-5	ASTORIA ANNEX CIR

Master PMs **Asset PMs** Route Based PMs

Asset PMs Filter 1 - 1 of 1

PM	Description	Frequency	Frequency Units	Work Type	Master PM	Status
> 4175	ASTORIA ANNEX CIRCUIT BREAKER 1	7 YEARS		PM	<u>MPM-ABB-ELK-</u>	<u>ACTIVE</u>

Once the PM is reviewed, assigned a start date and activated, the Maintenance Group will report there are no issues with the associated asset. Completing the asset association.

Maintenance Group - Analysis Tab

← List View Maintenance Group Functions & Failure Modes **Associated Assets** Associated Locations Specifications Analysis

Maintenance Group: CAP-BANK Organization: CONED Site: SSO

Date Filter

Reported Date From: 2/11/19 9:40 AM
Reported Date To: 7/11/22 9:41 AM

Failures by Failure Mode Filter 1 - 10 of 10

Failure Mode (Component + Component Problem + Cause)	Failure Count
CAP-BANK - E/C C/W (G) LUBRICATION NORMAL WEAR	3
CAP-BANK - E/C C/W (G) CONNECTION PROBLEM NORMAL WEAR	3
CAP-BANK - E/C C/W (G) CONTAMINATION NORMAL WEAR	1
CAP-BANK - P/ST GRNDS DAMAGED FORCE MAJEUR	1
CAP-BANK - E/C (G) CATASTROPHIC FAILURE LUBE FAILURE	1
CAP-BANK - P/ST - CC (G) DAMAGED FORCE MAJEUR	1
CAP-BANK - P/ST (G) CONTAMINATION POWER FAILURE/SURGE	1
CAP-BANK - INS- I G (G) LUBRICATION AGING	1
CAP-BANK - E/C C/W (G) CONNECTION PROBLEM	1
CAP-BANK - P/ST (G) IMPROPER POSITION AGING	1

Assets with Failure Mode: CAP-BANK - E/C C/W (G) CONNECTION PROBLEM NORMAL WEAR 1 - 2 of 2

Asset	Description	Failure Count
CAP-000375	W19ST-CAPACITOR BANK-CAP 2	2
CAP-001631	W110 2-CAPACITOR BANK-CAP 5	1

CAP-BANK maintenance group analysis

Since 2019, 10 different failure modes have occurred

The highlighted example shows 3 similar failures: Electrical Control – Control Wiring – Normal Wear

This type of failure occurred twice on the same asset.

RCM Group - Analysis Tab

RCM Group (RCM)

Query Find RCM Group Select Action

List View RCM Group Functions & Failure Modes Associated Maintenance Groups Analysis

RCM Group: BKR-HV-SF6 High Voltage Breakers Organization: CONED Status: DRAFT

Revision: 0 Site: SSO

Date Filter

Reported Date From: 1/1/17 12:00 AM Reported Date To:

Failures by Failure Mode Filter 1 - 4 of 4

Failure Mode (Component + Component Problem + Cause)	Failure Count
BKR-HV-SF6-E/C-S CORROSION AGING	1
BKR-HV-SF6-I-SG DAMAGED AGING	5
BKR-HV-SF6-E/C-C/W(G) CONNECTION PROBLEM POWER SUPPLY STABILITY	1
BKR-HV-SF6-M-M-TL IMPROPER POSITION FORCE MAJEUR	1

Maintenance Groups with Failure Mode: BKR-HV-SF6-I-SG DAMAGED AGING Filter 1 - 2 of 2

Maintenance Group	Description	Failure Count
BKR-ABB-ELK	ABB ELK High Voltage Breakers	3
BKR-ABB-362F	ABB 362PMR63-30B High Voltage Breakers	2

Assets for Maintenance Group BKR-ABB-ELK with Failure Mode: BKR-HV-SF6-I-SG DAMAGED AGING Filter 1 - 2 of 2

Asset	Description	Failure Count
BKR-0002585	ASTORIA ANNEX CIRCUIT BREAKER 1	1
BKR-0002585	ASTORIA ANNEX CIRCUIT BREAKER 2	2

BKR-HV-SF6 RCM Group analysis

Since 2017, 4 different failure modes have occurred

The highlighted example shows 5 of the same failure has occurred:
Insulation – SF6 Gas – Damaged Aging

This failure occurred 3 times in Maintenance Group BKR-ABB-ELK and 2 times in Maintenance Group BKR-ABB-362P.

For Maintenance Group BKR-ABB-ELK this failure occurred once on one asset and twice on another.

CM Work Order Process (for Maintenance Group assets)



Field documentation

Captured in Datasplice and written back to Maximo work order

- As-found
- Work performed
- Problem code – what is issue with asset?
- Functional Failure or Degraded Condition
- Component(s)
- Component problem

Reliability team review

Captured in Engage and archived to Engage Metrics Database

- Accuracy/correction of work order coding
- Cause coding of functional failures

Benefits of this approach

- Eliminates need for 3rd party solutions to house RCM, and maintenance strategy
 - Supports a “living” PM program
 - Ease of access to maintenance strategy
 - Captures evolution of maintenance strategy
- Continuous validation that all required PMs are in Maximo
- Consistency in asset and PM records
- Global PM change capability
- Significantly improved ability to analyze and trend equipment performance
- Data analytics to justify maintenance strategy changes



Mark Lozina
lozinam@coned.com
917-992-9304

Jeff Tippett
jeff_tippett@maintenancegroup.com
709-682-4806

Special thanks to John Reeve!

planschd@outlook.com

253-328-3586

CRL, CMM, Author, CMMS champion

U.S. Patent 7,421,372 Maintenance Scheduling, Order of Fire

Books

[Failure Modes to Failure Codes](#)

[Demanding Excellence from your Asset Management System](#)