Aging Correctional Facility Electrical System Improvements

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Process

1. Establish Current Condition of Facility

2. Determine Likelihood of Serious Problem Based on this Condition

3. Sort to Find Equipment Most at Risk to Cause Problems

4. Identify the Predictive Techniques that Gives Early Warning of Problems at that Equipment

Situation

- The *'Quiet Crisis'*
  Term created by Paul Hubbel,
  Deputy Director, Facilities and Services,
  Marine Corps. *Government Executive Magazine, Sept 2002.*

  When he was asked "why isn't preventative maintenance adhered to more closely in government facilities?"

  "*We call it the 'quiet crisis' because a lot of maintenance problems take time to occur and are not noticed (to be problems) until damage occurs".*

Correctional Facilities

- Okay, so maybe the military has a problem with maintenance, but what about Correctional Facilities?
- What happens if the power goes out at your facility for an extended period of time?

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Case Study

- WASCO State Prison, California Department of Corrections

"*Wasco suffered an electrical failure in April 1999 that caused a total power outage lasting almost seven hours- a problem that Wasco could have prevented had management made certain that staff repaired previously identified flaws in the electrical system.*"

California State Auditor/Bureau of State Audits Summary of Report Number 99118 - October 1999

Case Study

- Yolo County Sheriff's Detention Facility, California

On Tuesday, July 9th 2002, the Sheriff's Department experienced a power outage. Normally, this is not a major problem as our backup generator provides electrical power in the event of an outage. However, this was not the case on July 9th, and the detention facilities did not have electrical power for four hours."

http://www.yolocountysheriff.com/myweb5/Sheriff%20Final/2002%20Commendation%20Awards/Tina%20Day.pdf

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Case Study

- Riverside Correctional Facility, Michigan

"…however, in April 1998, RCF lost its main power source and the emergency generator failed to start. This resulted in an emergency situation for RCF." Performance Audit, Michigan Department of Corrections, Feb 1999

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Case Study

- Mid-Michigan Correctional Facility (MMCF)

"Finding:
Preventive Maintenance and Safety Inspections
MMCF did not complete preventive maintenance and safety inspections on a timely basis. DOC policy and facility procedures require regular inspections to minimize equipment failures, breakdowns, or potential problem conditions with the facility's water, electrical, mechanical, and security systems and to identify and correct potential safety hazards. *Performance Audit, Michigan Department of Corrections, June 1999*

Why is Maintenance Skipped?

- Clearly there are problems, but why?
- Budget Cuts / Management Redirection of Maintenance Funds
- This results in “Crisis Mode Operation” or “Fix What’s Broke and Skip the Rest” mentality
- But how do you guess what will break next and where money should be targeted?

- Is there an analytical way of targeting scarce resources?

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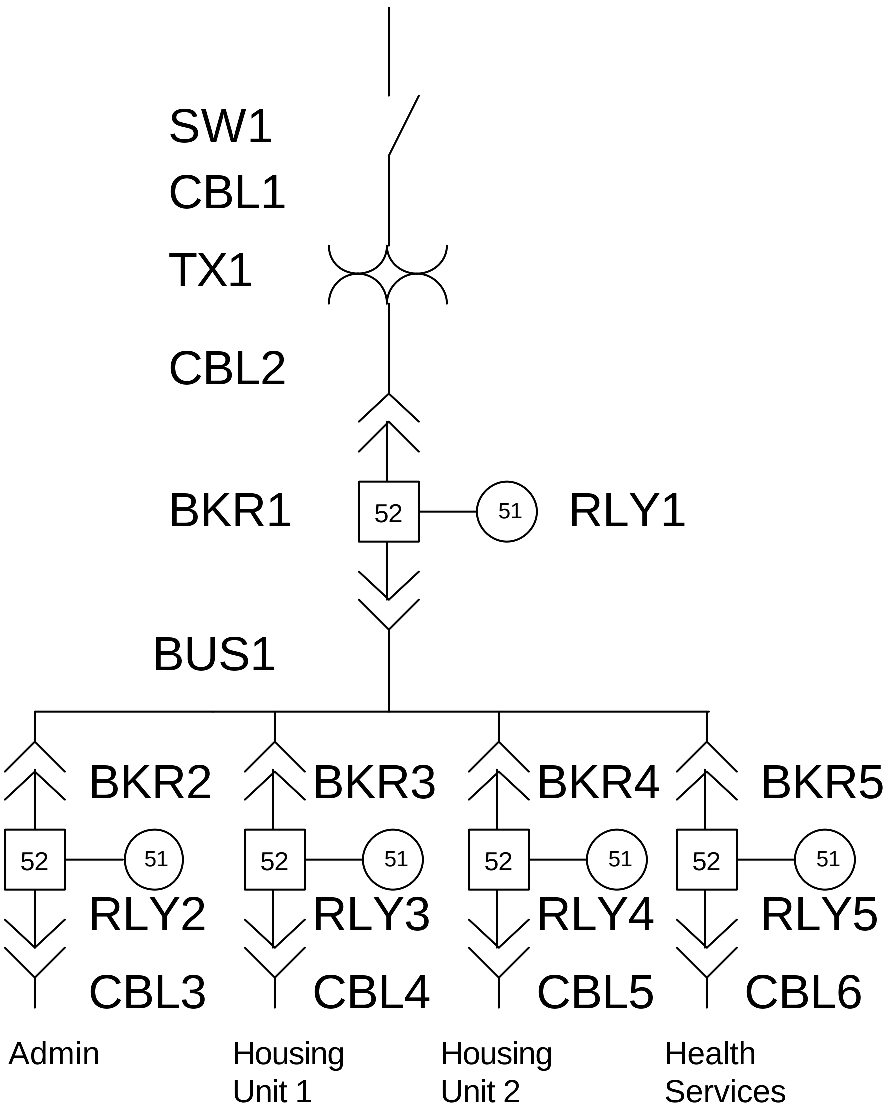
Switchgear Failure Scenario



- What is the likelihood of a loss of MV power at either the Administration Building or at Health Services?
- Answer:

  f(SW1) + *f*(CBL1)+ *f*(TX1)+ *f*(CBL2) + *f*(BKR1)+ *f*(RLY1)+ *f*(BUS1) + *f*(BKR2)+ *f*(RLY2)+ *f*(BKR5) + *f*(RLY5) + *f*(CBL6)

  - *f(…) means hours/year failure rate*

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Failure Time / Year

- Failures / Year
  - How often failures occur
  - Mean Time Between Failures
- Duration (hrs) / Failure
  - How long it takes to repair a failure

$$\frac{\text{Failures}}{\text{Year}} * \frac{\text{Duration}}{\text{Failure}} = \frac{\text{Duration}}{\text{Year}}$$

1. Establish Current Condition of Facility

↓

2. Determine Likelihood of Serious Problem Based on this Condition

↓

3. Sort to Find Equipment Most at Risk to Cause Problems

↓

4. Identify the Predictive Techniques that Gives Early Warning of Problems at that Equipment

IEEE Gold Book Analysis

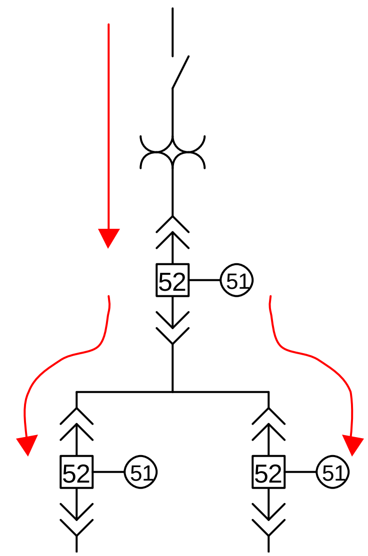
Category	Failures/yr	Hours/Failure	Hours/Yr
Prot. Relays	.0002	5	.001
LV Swgr Bkrs	.0027	4	.0108
MV Swgr Bkrs	.0036	2.1 / 83.1*	.0076/.2992
LV Cable (1000 ft)	.00141	10.5	.0148
MV Cable (1000 ft)	.00613	26.5	.1624
Disc. Switches	.0061	3.6	.022
Transformer	.003	342	1.026
LV Swgr Bus	.0024	24	.0576
MV Swgr Bus	.0102***	26.8	.2733

* when no on-site spare is available ** below ground *** 3 connected to 3 breakers

Switchgear Failure Scenario

f(SW1) + *f*(CBL1)+ *f*(TX1)+ *f*(CBL2) + *f*(BKR1)+ *f*(RLY1)+ *f*(BUS1) + *f*(BKR2)+ *f*(RLY2)+ *f*(BKR5) + *f*(RLY5) + *f*(CBL6)

- 1 incoming disconnect switch (.022 hrs/yr)
- 300’ incoming MV cable (300/1000 * 0.1624 = 0.049 hrs/yr)
- 1 incoming transformer (1.026 hrs/yr)
- 100’ cable (TX to gear) (100/1000 * 0.1624 = 0.0162 hrs/yr)
- 1 MV bus run with 3 MV breakers (.2733 + 3(.2992)=1.1709 hrs/yr)
- 3 protective relays (3*.001 = 0.003)
- 300’ outbound MV cable (300/1000 * 0.1624 = 0.049 hrs/yr)
- Total = 0.022 + 0.049 + 1.026 + 0.0162 + 1.1709 hrs/yr + 0.003 + 0.049 = **2.33 hrs/yr** (average)



8757.67 = 99.97%

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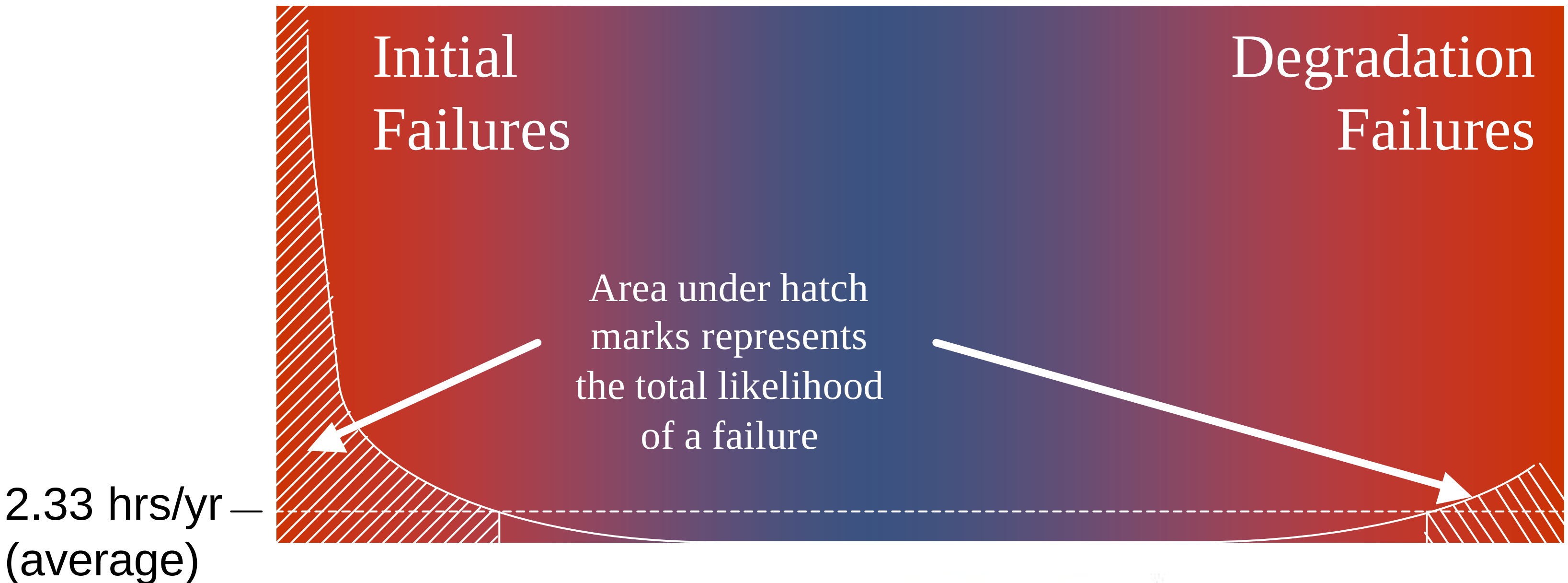
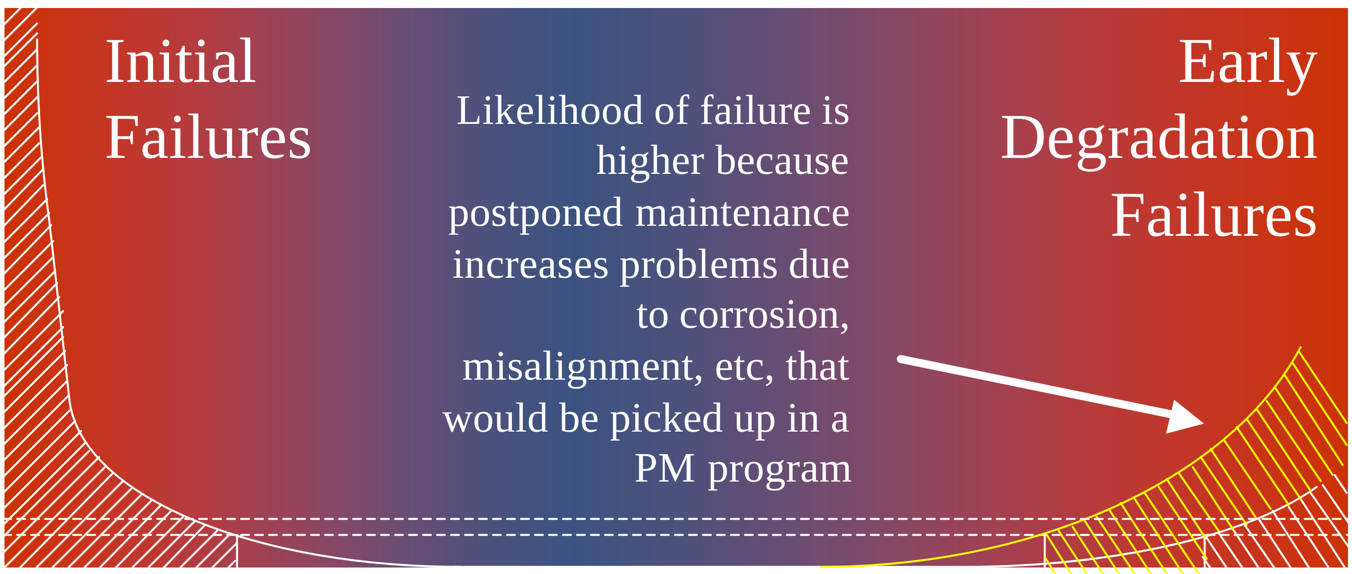
Equipment Failure Timing

- Initial failures (installation problems, infant mortality of installed components).
- Degradation over time (temperature, corrosion, dirt, surge)



Equipment Failure Timing

- Poor maintenance reduces equipment life since failures due to degradation come prematurely soon. IEEE says add 10% to likelihood of downtime.



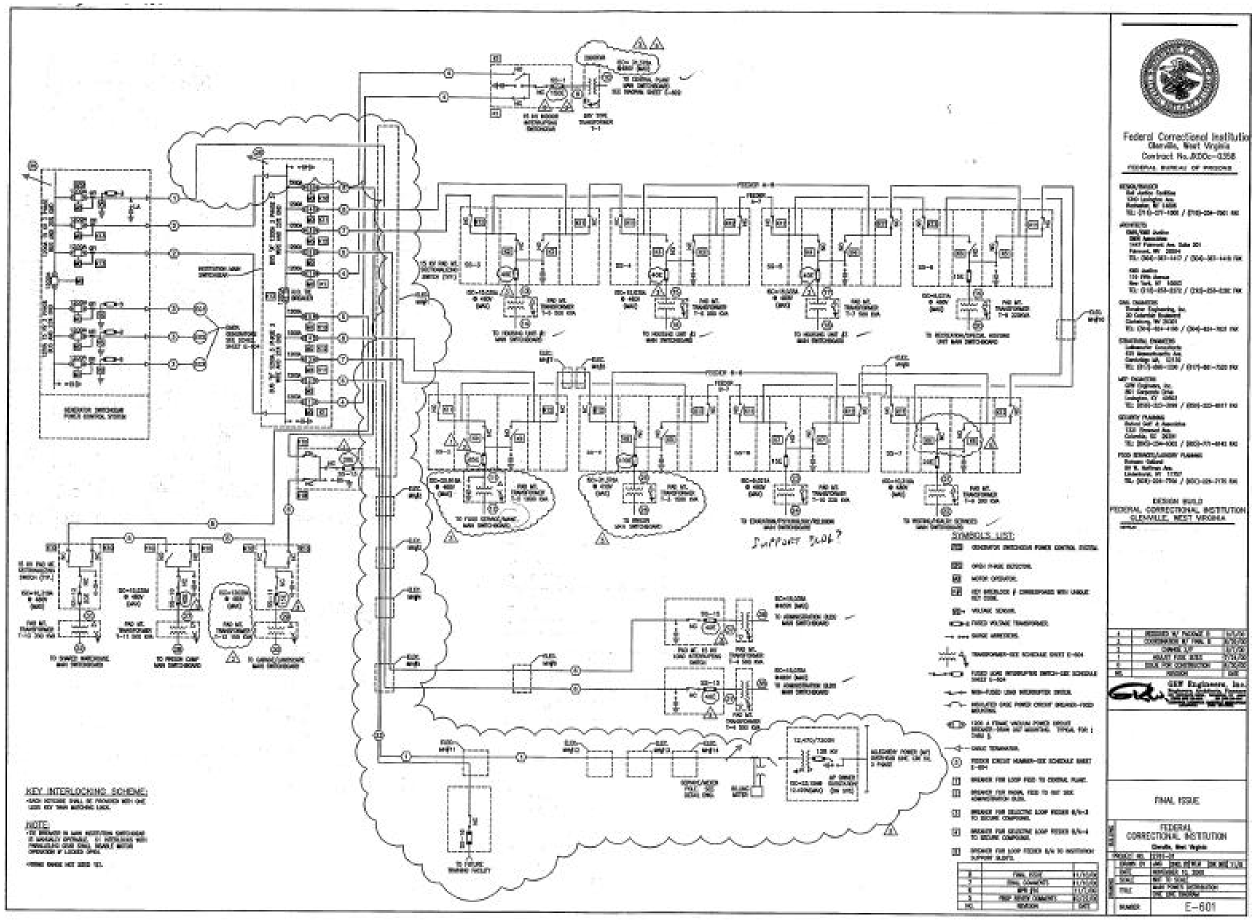
2.59 hrs/yr (average)

Results

- Fair Maintenance = 2.59 hrs/year downtime
- Good Maintenance = 2.33 hrs/year downtime
- 2.59 – 2.33 = 0.26 hr/yr less downtime
- 16 minutes per year more downtime
  Is that worth spending any time fixing?

… but this is only a simple example

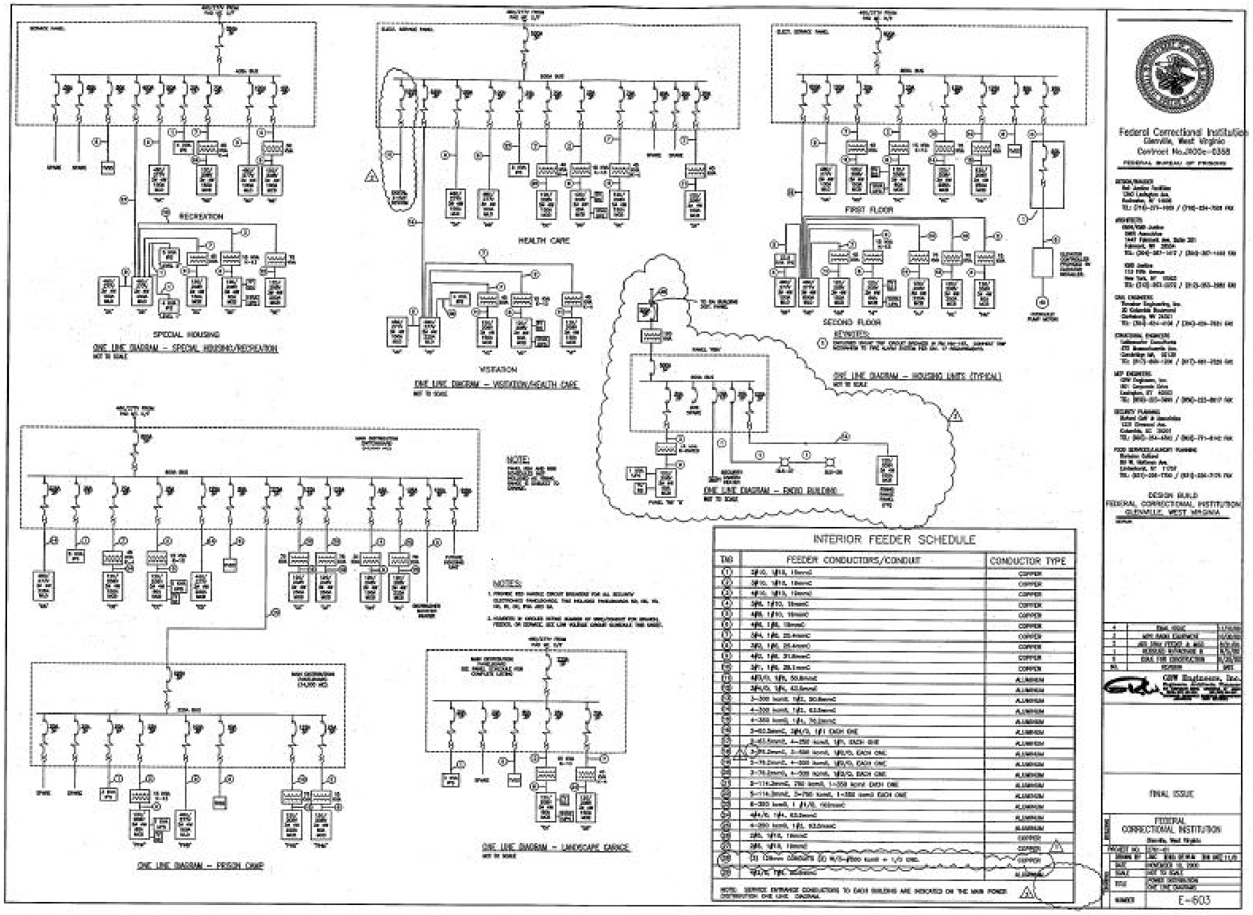
Real Systems Are Much Larger



Glenville Federal Penitentiary – MV System

- 17 MV breakers
- 14 MV loop feed switches
  - 3 switching elements
  - 42 total
- 31 MV internal bus runs
  - (17+14)
- 4000' MV cable
- 15 MV transformers
- 3 standby generators

LV System Are Very Complex Too…



- 13 switchboards containing:
  - 155 LV breakers
- 105 panelboards containing:
  - Over 2000 panelboard breakers
- 1000's of cable terminations
- 30000 feet of cable

Glenville Federal Penitentiary – LV System (Page 1 of 2)

Likelihood of Some Failure?

Just looking at a portion of the equipment…

- 42 MV disconnect switches (42 * .022 = 0.924 hrs/yr)
- 4000' MV cable (4000/1000 * 0.1624 = 0.649 hrs/yr)
- 15 MV transformers (15.39 hrs/yr)
- 30000' LV cable (30000/1000 * 0.0148 = 0.444 hrs/yr)
- 31 MV bus run with 17 MV breakers (31(0.2733) + 17(.2992)= 8.47 + 17.23 = 25.77 hrs/yr)
- 17 protective relays (17*.001 = 0.017)
- Total = 0.924 + 0.649 + 15.39 + 0.444 + 25.77 + 0.017
  = **43.19 hrs/yr** (average)
  (Assuming a 1 hr/per failure means you would expect an electrical problem 43 times per year or almost 1 per week!)

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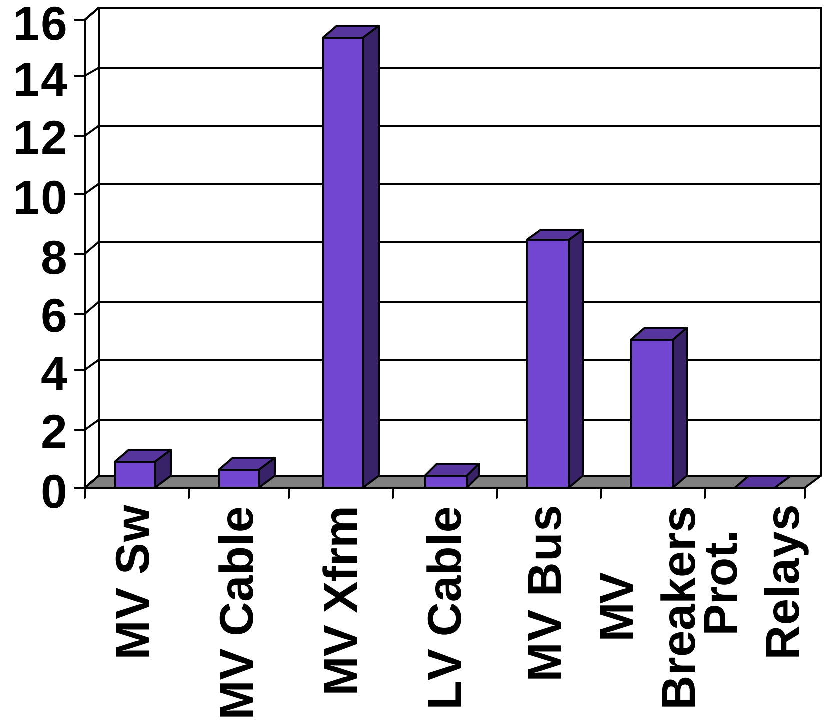
MV Transformers Win! (Lose?)



Final Step

1. Establish Current Condition of Facility

2. Determine Likelihood of Serious Problem Based on this Condition

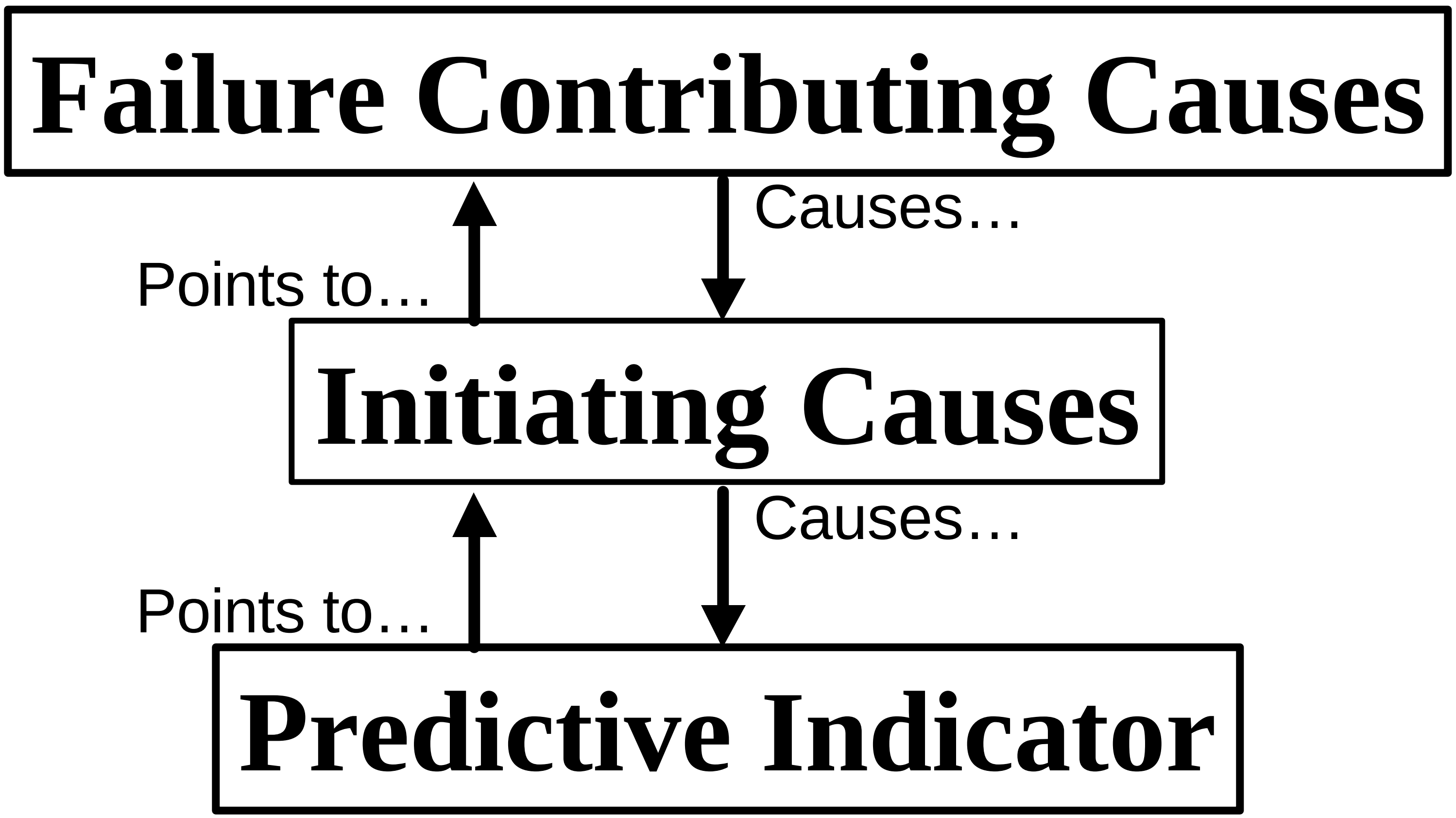
3. Sort to Find Equipment Most at Risk to Cause Problems

4. Identify the Predictive Techniques that Gives Early Warning of Problems at that Equipment

Now What?

- We now know how to figure “how many minutes of outage will occur each year” for each device.
- But ***how do we reduce that value?***
- We can recognize that failures can be predicted if we recognize the early warning signs
  - The so-called “Predictive Indicator”
- Once we know that, we can identify the likely cause and fix the problem before it is serious.

Predicting Failures



Failure Contributing Causes

Combined Analysis of Switchgear Bus and Circuit Breaker Failure Contributing Causes (%)					
Switchgear Bus Failure Contributing Cause (%) Percentage	Insulated Bus	Bare Bus	Breakers	Totals	Normalized to 100%
Thermocycling	6.6%		12.5%	19.1%	7.5%
Mechanical Structure Failure	3.0%	8.0%		11.0%	4.3%
Mechanical Damage From Foreign Source	6.6%			6.6%	2.6%
Shorting by Tools or Metal Objects		15.0%		15.0%	5.9%
Shorting by Snakes, Birds, Rodents, etc.	3.0%			3.0%	1.2%
Malfunction of Protective Relays	10.0%	4.0%		14.0%	5.5%
Improper Setting of Protective Device		4.0%		4.0%	1.6%
Above Normal Ambient Temperature	3.0%			3.0%	1.2%
Exposure to Chemical or Solvents	3.0%	15.0%		18.0%	7.1%
Exposure to Moisture	30.0%	15.0%		45.0%	17.7%
Exposure to Dust or Other Contaminants	10.0%	19.0%		29.0%	11.4%
Exposure to Non-Electrical Fire or Burning	6.6%			6.6%	2.6%
Obstruction of Ventilation		8.0%		8.0%	3.1%
Normal Deterioration from Age	10.0%	4.0%	11.0%	25.0%	9.8%
Severe Weather Condition	3.0%	4.0%		7.0%	2.8%
Testing Error		4.0%		4.0%	1.6%
Lubricant Loss, or Deficiency			18.0%	18.0%	7.1%
Lack of Preventive Maintenance			18.0%	18.0%	7.1%
Other - Breaker Related			40.5%		
Totals	94.8%	100.0%	100.0%	254.3%	100.0%

Contributing ➡ Initiating Cause

Switchgear Bus & Breaker Failure Contributing Cause (%)	**Most Probable Initiating Cause for Failure Contributor**	**%**
Thermocycling	Loose connections, load current, internal temperature, ambient, cubicle heaters, etc.	7.5%
Mechanical Structure Failure	Fatigue, vibration, electrical loose components	4.3%
Mechanical Damage From Foreign Source	Accidental action during maintenance / Enclosure Openings	2.6%
Shorting by Tools or Metal Objects	Accidental action during maintenance / Enclosure Openings	5.9%
Shorting by Snakes, Birds, Rodents, etc.	Enclosure Openings	1.2%
Malfunction of Protective Relays	Relay failure	5.5%
Improper Setting of Protective Device	Improper relay settings	1.6%
Above Normal Ambient Temperature	Ambient Temperature	1.2%
Exposure to Chemical or Solvents	Corona or Surface Tracking / Enclosure Openings	7.1%
Exposure to Moisture	Corona or Surface Tracking / Enclosure Openings / Cubicle Heater Circuit Failure	17.7%
Exposure to Dust or Other Contaminants	Corona or Surface Tracking	11.4%
Exposure to Non-Electrical Fire or Burning	External activity	2.6%
Obstruction of Ventilation	Clogged door or other filters	3.1%
Normal Deterioration from Age	Normal deterioration: corona or surface tracking of the insulation; contacts, interrupters, springs, mechanisms, etc.	9.8%
Severe Weather Condition	External activity	2.8%
Testing Error	External activity	1.6%
Lubricant Loss, or Deficiency	Overheating of the equipment and lubrication, aged lubricants or loss-of lubricants	7.1%
Lack of Preventive Maintenance	External activity	7.1%

Initiating Causes ➡ Predictive Indicators

Most Probable Initiating Cause for Failure Contributor	Available Solutions to address Initiating Causes	%
Loose connections, load current, internal temperature, ambient, cubicle heaters, etc.	On-Line Thermal Model Analyzer & Thermography for Hot Spots	7.5%
Fatigue, vibration, electrical loose components	Thermography for Hot Spots and Future Vibro-acoustics of electrical equipment	4.3%
Accidental action during maintenance / Enclosure Openings	Safety during maintenance & Visual Inspections	2.6%
Accidental action during maintenance / Enclosure Openings	Safety during maintenance & Visual Inspections	5.9%
Enclosure Openings	Visual Inspections	1.2%
Relay failure	Periodic Relay Testing	5.5%
Improper relay settings	Periodic Power System Study	1.6%
Ambient Temperature	On-Line Thermal Model Analyzer	1.2%
Corona or Surface Tracking / Enclosure Openings	Partial Discharge Detection & Visual Inspection	7.1%
Corona or Surface Tracking / Enclosure Openings / Heater Circuit Failure	Partial Discharge Detection & Visual Inspec-tion & On-Line Thermal Model Analyzer	17.7%
Corona or Surface Tracking	Partial Discharge Detection (External visual inspection can not detect internal bus)	11.4%
External activity	On-Line Thermal Model Analyzer & Inspection of External area	2.6%
Clogged door or other filters	On-Line Thermal Model Analyzer & Thermography for Hot Spots	3.1%
Normal deterioration: corona or surface tracking of the insulation; contacts, interrupters, springs, mechanisms, etc.	Partial Discharge Detection and Thermography for Hot Spots	9.8%
External activity	None	2.8%
External activity	Safety during maintenance & Improved preventive maintenance	1.6%
Overheating of equipment and lubrication age or loss-of lubricants	Future vibro-acoustics of electrical equipment	7.1%
External activity	Improve preventive maintenance	7.1%

Available Predictive Tools

Available Solutions to address Initiating Causes	Totals	Normalized to the new 100%	% of Total Failure Causes Addressed	On-Line Predictive Diagnostic - Monitoring Capabilities Available	
On-Line Thermal-Model Analyzer	32.1%	18.1%	15.6%	***Technology available for continuous monitoring***	15.6%
Thermography for Hot Spots	24.7%	13.9%	12.0%	***Yes - Periodic***	12.0%
Future vibro-acoustics of electrical equipment	11.4%	6.4%	5.6%	Not fully commercially available	
Safety during maintenance	10.1%	5.7%	4.9%	NA	
Visual Inspections (Switchgear Enclosure and Surrounding Area)	37.1%	20.9%	18.1%	***Periodic - Plant Personnel / Safety and Operating Procedures***	
Periodic Relay Testing	5.5%	3.1%	2.7%	Periodic Relay Testing	
Periodic Power System Study	1.6%	0.9%	0.8%	Periodic Power System Study	
Partial Discharge Detection	46.0%	26.0%	22.4%	***Yes - Periodic***	22.4%
Improve preventive maintenance	8.7%	4.9%	4.2%	NA	
Totals	177.2%	100.0%	86.3%	Total Causes address by CBM:	50.1%

CBM – Condition Based Maintenance

- Top 4 in order of importance are:

- Partial Discharge Diagnostics (22.4%)
- Visual Inspection (18.1%)
- On-Line Thermal Analyzer (15.6%)
- Thermographic Inspections (12.0%)

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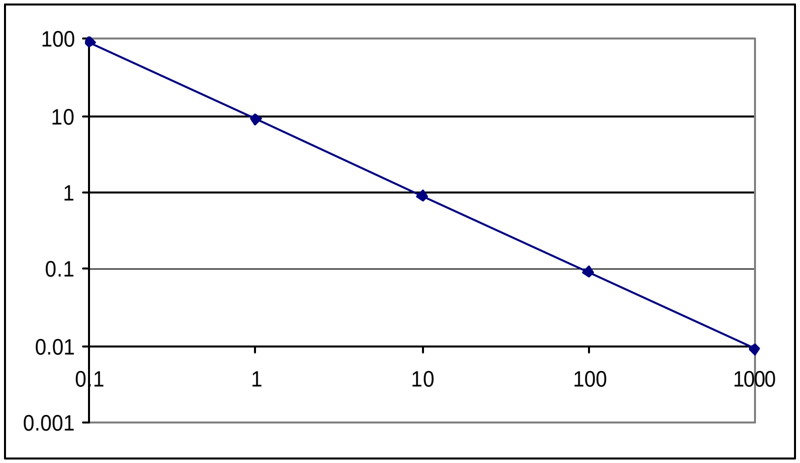
What If We Implemented One Predictive Solution?

- Partial Discharge – 22.4% of failures detected
  - Caveat: Only works on medium voltage (>1000 volts)
- Our example prison:
  - 15.39 hrs/yr from transformer failure
    - 22.4% reduction ⇨ 11.94 hrs/yr
  - 8.47 hrs/yr from MV bus failure
    - 22.4% reduction ⇨ 6.57 hrs/yr
  - 17.23 hrs/yr from MV breaker failure
    - 22.4% reduction ⇨ 13.37 hrs/yr

Reduction In Outages

- Transformer Failure (was 15.39 hrs/yr, now 11.94 hrs/yr)
  - Saving 3.45 hrs/yr
- MV bus failure (was 8.47 hrs/yr, now 6.57 hrs/yr)
  - Saving 1.9 hrs/yr
- MV breaker failure (was 17.23 hrs/yr, now 13.37 hrs/yr)
  - Saving 3.86 hrs/yr
- Total Savings from PD 9.21 hrs/yr
  - 1 hr/failure = 9 fewer failures
  - 10 hr/failure = 1 fewer failure



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Economic Justification

Category	Failures/yr	Hours/Failure	Hours/Yr
Prot. Relays	.0002	5	.001
LV Swgr Bkrs	.0027	4	.0108
MV Swgr Bkrs	.0036	2.1 / 83.1*	.0076/.2992
LV Cable (1000 ft)	.00141	10.5	.0148
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Transformer	.003	342	1.026
LV Swgr Bus	.0024	24	.0576
MV Swgr Bus	.0102***	26.8	.2733

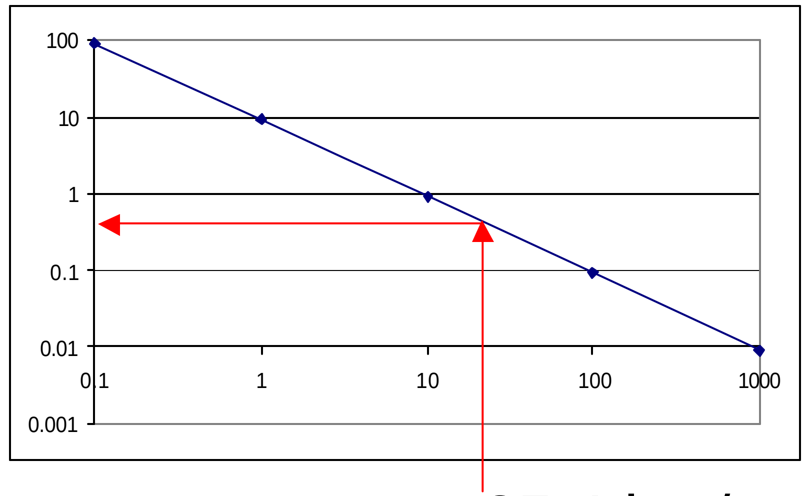
* when no on-site spare is available ** below ground *** 3 connected to 3 breakers

Average Outage

Device	Quantity	Hrs/Failure	Combined
MV Breaker	15	83.1	1246.5
MV Disconnect Switch	42	3.6	151.2
MV Bus	31	26.8	830.8
MV Cable (1000 ft)	4	26.5	106
	92		2334.5
		25.375	hours/failure
		(weighted average)	

Compute Likely Failure Rate

0.36 failures/ year



25.4 hrs/ failure

- Total Savings from PD 9.21 hrs/yr
  - 1 hr/failure = 9 fewer failures per year
  - 10 hr/failure = 1 fewer failure per year
  - 25.4 hr/failure = 0.36 fewer failures per year
    - 1 fewer failure every 3 years

How Much Does It Cost?

- We know that if we install PD sensors on all this equipment, statistically it will result in 1 less outage every three years.
- Each PD sensor costs ~ $7000 installed
- We have 92 items to be monitored
- $7000 * 92 = $644000
- Does saving an outage once every 3 years justify spending $644000?

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Failed Equipment Cost

$ Per Hour of Outage Cost
$10,000

	A	B	C	D	E	F	G
	Median Hours/Outage	% Related to Insulation Failure	Total Exposure	Monitor Material Cost	Installation Cost	Yearly Monitoring (5 Years)	Total Cost
Large Power Transformers (6 bushings)	1260	84	$10,584,000	$ 12,000	$ 10,000	$ 5,000	$ 27,000
Small Power Transformers (Liquid)	64	84	$ 537,600	$ 3,500	$ 3,000	$ 5,000	$ 11,500
Dry Type Transformers	28	84	$ 235,200	$ 3,500	$ 3,000	$ 5,000	$ 11,500
MV Switchgear (Bus Only) 10 Structures	26.8	95	$ 254,600	$ 15,000	$ 8,500	$ 5,000	$ 28,500
Bus Duct-30 Feet	9.5	75	$ 71,250	$ 8,500	$ 3,500	$ 5,000	$ 17,000
Large MV Induction Motors	91.5	53	$ 484,950	$ 7,500	$ 6,000	$ 5,000	$ 18,500
Large MV Synchronous Motors	153	53	$ 810,900	$ 7,500	$ 6,000	$ 5,000	$ 18,500
Steam Turbine Generators	66.5	7	$ 46,550	$ 10,500	$ 8,000	$ 5,000	$ 23,500
Gas Turbine Generators	92	7	$ 64,400	$ 9,500	$ 7,000	$ 5,000	$ 21,500
Notes	Data taken from IEEE Std 493-1997 - Pages 205-207	Data taken from IEEE Std 493-1997 - Pages 246-253	This equals $/Hr outage cost times Col A times Col B				Col D + Col E + Col F

Your Mileage May Vary…

Using this $10000 assumption…

- At $10,000 / hour of downtime costs
  - Loss of one of the small power transformers would cost:
    - $537000 of downtime ($240,000 / day)
  - Cost of a 1000 kVA indoor dry, MV power transformer
    - Assume $18/kVA or $18000
    - Assume labor $50/hr, 3 man-days labor
    - Total cost = (1000 * $18) + ($50 * 3 * 8) = $18000 + $1200
      Total cost = $19200
  - Downtime and material = $537000 + $19200
    Downtime and material = $556200

Compute Payback

- Our cost is $644000
- Our savings is $556200 once every 3 years or $185400 per year
- Assume we expect a 10% return on invested capital
- Assume 10 year project life
- Assume 2.5% inflation rate

Compute Equivalent Payback

- Cost = $644K, Savings = $185.4/yr, N=10 years, inflation = 2.5%, capital cost = 10%
- Is this a good investment?

Compounded IRR Calculator

$$n = \frac{\log_{10}\left(\frac{Cost}{Savings}\left(a - \frac{1}{a}\right) + 1\right)}{\log_{10} a}$$

Cost	installed cost of equipment
Savings	annual savings
a	(1+g)/(1+i)
i	interest rate
g	annual inflation rate
n	duration (payback period in years)

Compounded IRR Calculator

$$n = \frac{\log_{10}\left(\frac{Cost}{Savings}\left(a - \frac{1}{a}\right) + 1\right)}{\log_{10} a}$$

Cost	$644,000
Savings	$185,400
a	(1+g)/(1+i) = (1+0.025)/(1+0.1) = 0.932
i	10%
g	2.5%
n	10

Run The Numbers…

Cost	$644,000
Savings	$185,400
a	(1+g)/(1+i) = (1+0.025)/(1+0.1) = 0.932
i	10%
g	2.5%
n	10

$$n = \frac{\log_{10}\left(\frac{C}{S}\left(a - \frac{1}{a}\right) + 1\right)}{\log_{10} a} = \frac{\log_{10}\left(\frac{644000}{185400}\left(0.932 - \frac{1}{0.932}\right) + 1\right)}{\log_{10} 0.932}$$

Compute Payback

$$n = \frac{\log_{10}\left(\frac{644000}{185400}\left(0.932 - \frac{1}{0.932}\right) + 1\right)}{\log_{10} 0.932} = \frac{\log_{10}(3.47(-0.141) + 1)}{-0.0306}$$

$$n = \frac{\log_{10}(3.47(-0.141) + 1)}{-0.0306} = \frac{\log_{10} 0.510}{-0.0306}$$

$$n = \frac{\log_{10} 0.510}{-0.0306} = \frac{-0.292}{-0.0306} = 9.6$$

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What Does 9.6 Mean?

- Based on a cost of $644K, an annual savings of $185.4K, a required rate of return of 10%, and inflation rate of 2.5%…
  - 9.6 means a payback is achieved in 9.6 years
  - means that the payback is under 10 years
- Since our project life is 10 years

  …*this project is financially viable.*

Said another way:

- This project completely pays for its initial capital expense, plus it returns 10% additional cash over the 10 year life.

Do I have To Do All This Work?

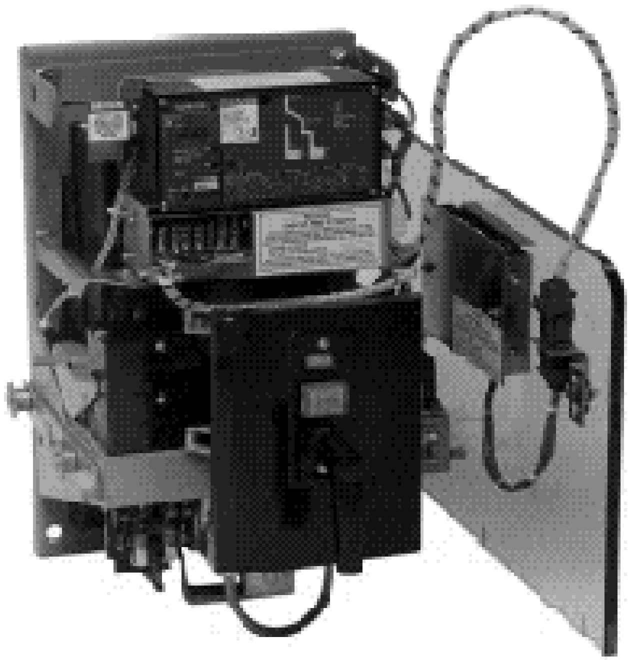
- Yes…*but*
- To simplify, use a web based calculator:
  - http://ppsnews.com/Internet/apps/pd/

I've Found Problems, Now What?

- If you catch it before it fails catastrophically, you can rebuild
- Many old electrical devices can be rebuilt to like new condition

LV Refurbished Power Breakers

- LV Equipment Retrofit / “Roll-In” Replacements



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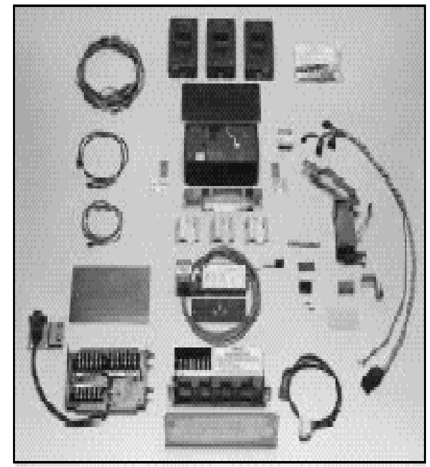
- ITE - GE

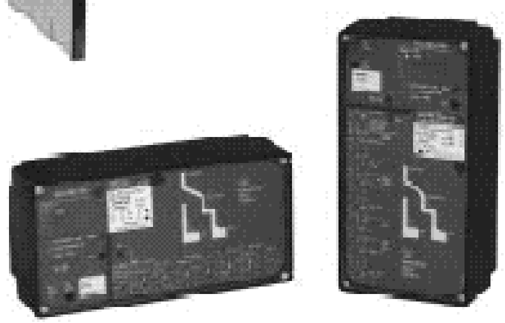
- AC - FPE

- Siem - R-S



510- Upgraded Trip

610- Display



810-KW-Comm-O/C

910-Harmonics

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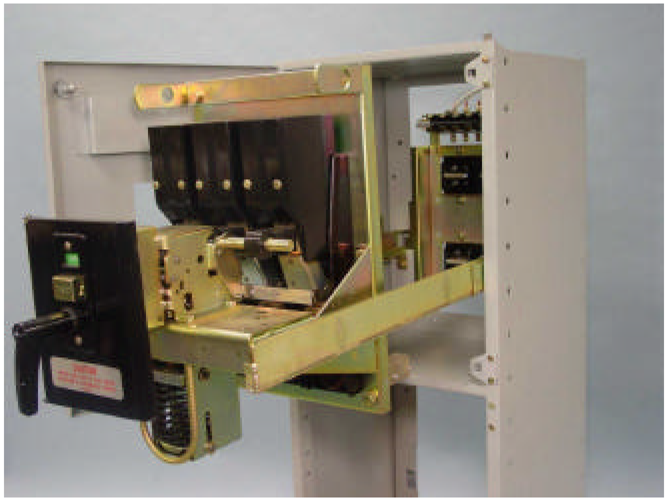
LV Rack-In Replacement With New (In Old Equipment)

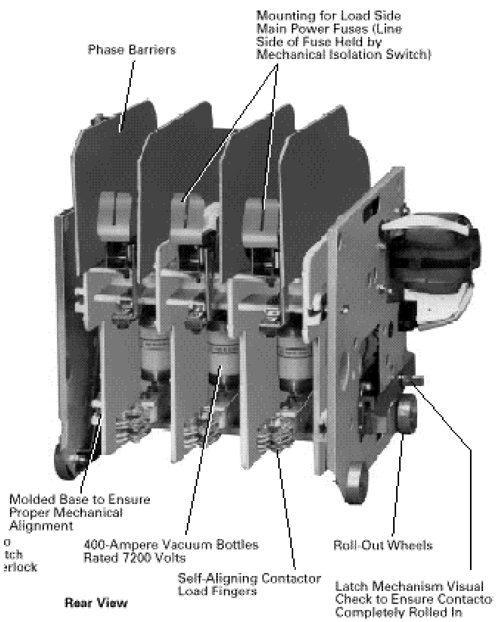


Old Breaker:
- Parts no longer available

Modern Breaker:
- New warranty
- Installed in the old structure

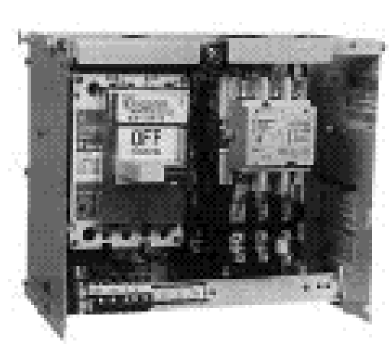
Motor Control Upgrades

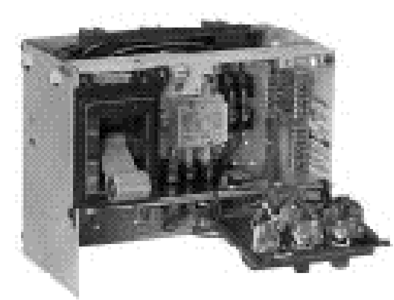
Breaker-to-Starter Conversions:
- circuit breaker used to start motor
- only good for 1000 or less operations
- replace breaker with starter
- now good for 1,000,000 operations



Continuous Partial Discharge Monitor

MCC Bucket Retrofits
- new breaker and starter





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MV Vacuum Replacement

- Vacuum replacement for Air Break in same space
- Extensive Product Availability
  - ANSI Qualified Designs
  - ***158*** Designs
- Non-Sliding Current Transfer
- *SURE CLOSE* - Patented (MOC Switches)
- 2-Year Warranty - Dedicated Service
- Factory Trained Commissioning Engineers
- Full Design & Production Certification
- ANSI C37.59 Conversion Standard
- ANSI C37.09 Breaker Standard
- ANSI C37.20 Switchgear Standard
- Design Test Certificate Available on Request

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Can’t Buy a Spare? Class 1 Recondition Instead

- Receiving & Testing
- Complete Disassembly
- Detailed Inspection and Cleaning
- New Parts
- OEM Re-assembly
- Testing
- Data-Base Tracking

Spot Network Upgrade

Network Protector Class 1 Recondition

Network Relay Upgrades...

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Transformer Oil Processing

Other Services Available:

- **Samples Obtained On-Site**
- **Mail-in Sampling Kits**
- **Complete Transformer Testing**

- PF, PCB & Dissolved Gas Analysis

On-Board Testing

Dielectric Testing
Karl Fischer Moisture Test
Acid Titration Testing

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Thank You

Supporting Documents

Wasco Situation

"Wasco has not followed its own policies that direct management to create an atmosphere of vigilance in which emergency equipment receives sufficient maintenance…" California State Auditor/Bureau of State Audits Summary of Report Number 99118 - October 1999

"Wasco has considerable backlog of incomplete maintenance and repairs on its critical equipment. Its failure to repair defective equipment nearly 4 years ago resulted in a complete loss of power in April 1999." California State Auditor/Bureau of State Audits Summary of Report Number 99118 - October 1999

Recommendations

Findings:

"RCF had not developed a comprehensive preventive maintenance plan.

DOC policy states that the warden shall develop a written preventative maintenance plan. The plan is to be designed to provide economical use of all facility equipment and to ensure that all equipment will operate effectively during emergency situations".

www.state.mi.us/audgen/comprpt/docs/r4723098.pdf