

Projects in Real Life



Case Study of Project Risk MW Rail & Workshop

**Prepared by Ferenc Birloni, PhD
2017**

IMPORTANCE OF EXPERIENCE

- ✓ Who knows what Experience is?
- ✓ Do you know how to quantify experience?

Content - Case Studies

- **MW Rail**

- Railway Signalling / Construction Works



- **MW Factory**

- Air Conditioning Control Panel

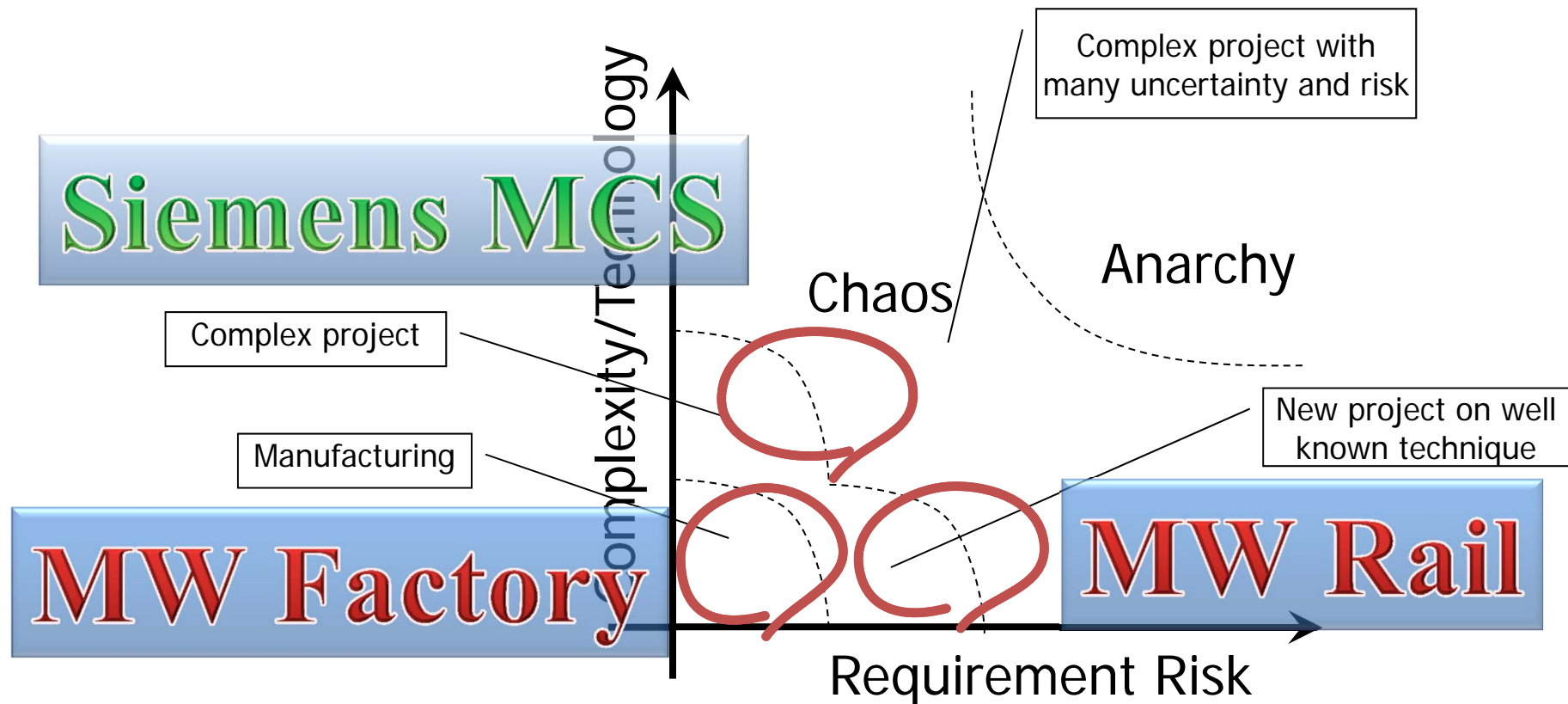


- **Siemens PSE**

- R&D Risk Metrics
- Documentation / Code Review Metrics



Project Risk Level Assessment



MW RAILWAY SIGNALLING

- ✓ Risk – The Background Preparation
- ✓ Project Risk Assessment
- ✓ Project Execution – Working with Risk
- ✓ Project Review

Preparation

- Site visit
- Walk through
 - GPS – pictures
 - design check (if available)
- What else to look for?



Risk Management Plan - Rail

- Responsibilities
- Level of Consequence
- Likelihood
- “As low as Reasonably Practical”
- Risk Ratings

Industry Certificates, Trainings

- Medical
- WS Construction Industry
- Rail Safety Worker



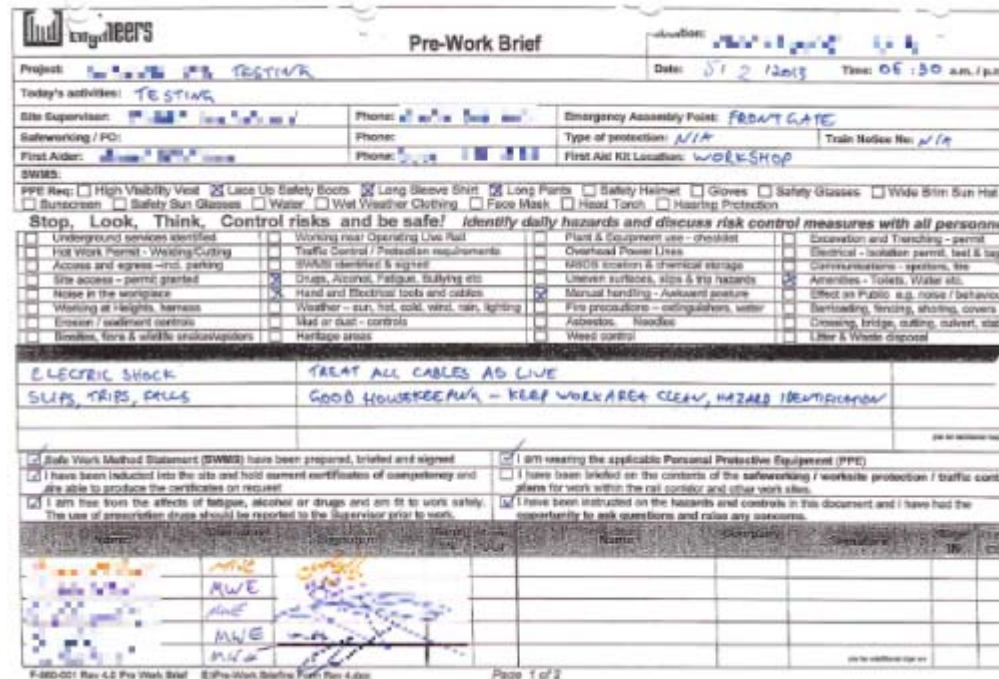
Weather conditions / Access

- Heavy rain, or high temperature can delay instantly the execution of a project
- Limited access to site / permission required
- Mobilise / Demobilise
- Stand by rate applies



Project execution

- Step to step, phase to phase assess & manage the risk
- Even on a day to day basis with a pre work briefing



everyneers Pre-Work Brief

Project: **TESTING** Date: **01/2/2013** Time: **06:30 A.M. / P.M.**

Today's activities: **TESTING**

Site Supervisor: [Signature] Phone: [Number] Emergency Assembly Point: **FRONTGATE**

Safety Warden / PC: [Signature] Phone: [Number] Type of protection: **N/A** Train Notice No: **N/A**

First Aider: [Signature] Phone: [Number] First Aid Kit Location: **WORKSHOP**

SWMS:

PPE Req: ☐ High Visibility Vest ☒ Lace Up Safety Boots ☒ Long Sleeve Shirt ☒ Long Pants ☐ Safety Helmet ☐ Gloves ☐ Safety Glasses ☐ Wide Brim Sun Hat ☐ Sunscreen ☐ Safety Sun Glasses ☐ Water ☐ Wet Weather Clothing ☐ Face Mask ☐ Head Torch ☐ Hearing Protection

Stop, Look, Think, Control risks and be safe! Identify daily hazards and discuss risk control measures with all personnel.

<input type="checkbox"/> Underground services identified	<input type="checkbox"/> Working near Operating Live Rail	<input type="checkbox"/> Plant & Equipment use - checklist	<input type="checkbox"/> Excavation and Trenching - permit
<input type="checkbox"/> Hot Work Permit - Working/Cutting	<input type="checkbox"/> Traffic Control / Protection requirements	<input type="checkbox"/> Overhead Power Lines	<input type="checkbox"/> Electrical - isolation permit, test & tags
<input type="checkbox"/> Access and egress - not parking	<input type="checkbox"/> SHARPS containers & spillage	<input type="checkbox"/> WOOD storage & chemical storage	<input type="checkbox"/> Communications - spotters, etc.
<input type="checkbox"/> Site access - permit granted	<input checked="" type="checkbox"/> Drugs, Alcohol, Fatigue, Bullying etc.	<input type="checkbox"/> Uneven surfaces, slips & trip hazards	<input checked="" type="checkbox"/> Arteries - Voids, Water etc.
<input type="checkbox"/> Noise in the workplace	<input checked="" type="checkbox"/> Hand and Electrical tools and cables	<input checked="" type="checkbox"/> Manual handling - Awkward posture	<input type="checkbox"/> Effect on Public e.g. noise / behaviour
<input type="checkbox"/> Working at Heights, harness	<input type="checkbox"/> Weather - sun, hot, cold, wind, rain, lighting	<input type="checkbox"/> Fire precautions - extinguishers, water	<input type="checkbox"/> Battering, fencing, shoring, covers
<input type="checkbox"/> Erosion / settlement controls	<input type="checkbox"/> Mud or dust - controls	<input type="checkbox"/> Asbestos, Noodles	<input type="checkbox"/> Crossing, bridge, cutting, culvert, station
<input type="checkbox"/> Bombs, fire & wildlife smokestacks	<input type="checkbox"/> Heritage assets	<input type="checkbox"/> Weed control	<input type="checkbox"/> Litter & Waste disposal

ELECTRIC SHOCK **TREAT ALL CABLES AS LIVE**

SLIPS, TRIPS, FALLS **GOOD HOUSEKEEPING - KEEP WORKAREA CLEAN, HAZARD IDENTIFICATION**

☒ Safe Work Method Statement (SWMS) have been prepared, briefed and signed

☒ I have been inducted into the site and hold current certification of competency and am able to produce the certificate on request

☒ I am free from the effects of fatigue, alcohol or drugs and am fit to work safely

☒ The use of prescription drugs should be reported to the Supervisor prior to work

☒ I am wearing the applicable Personal Protective Equipment (PPE)

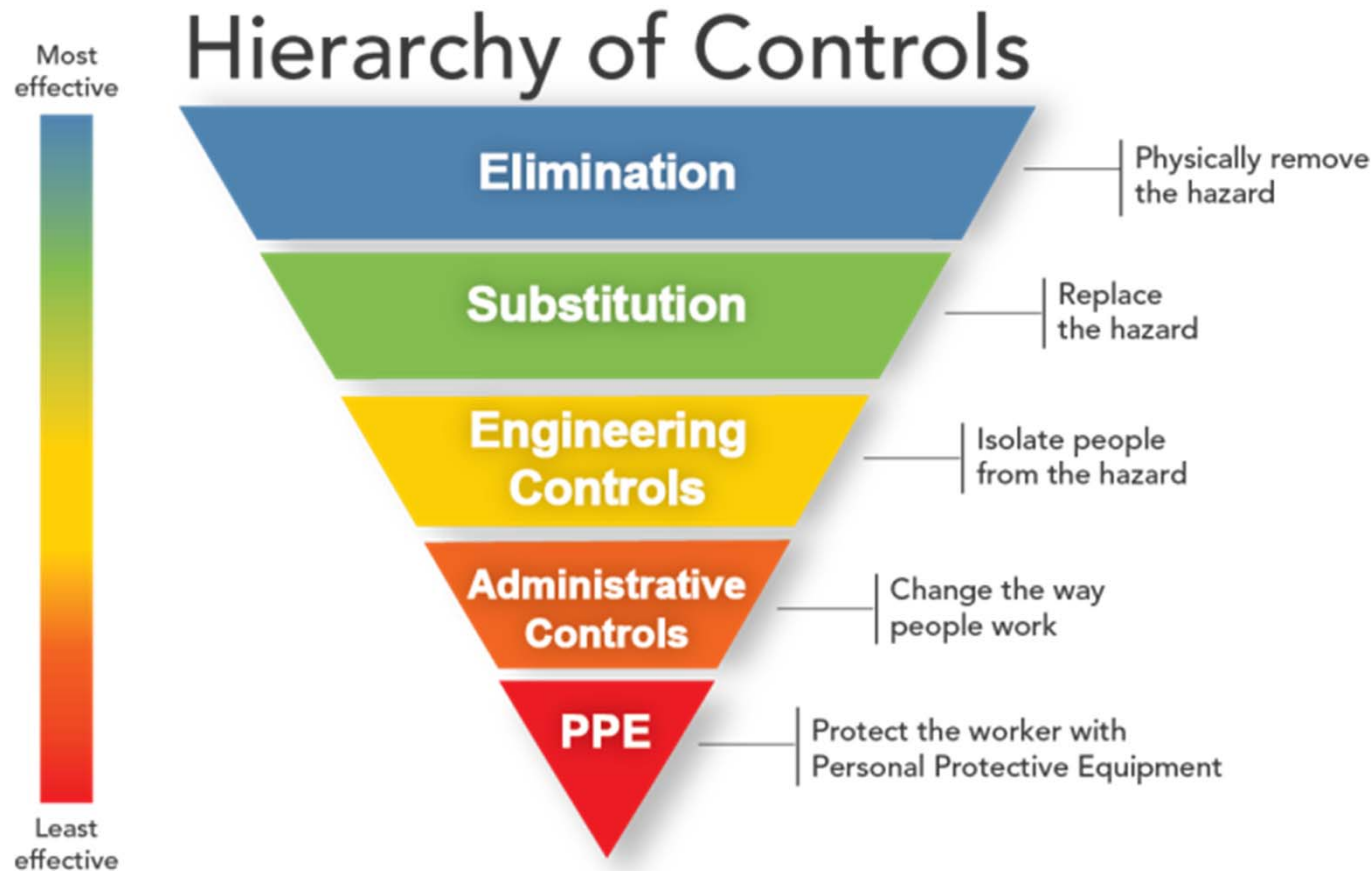
☒ I have been briefed on the contents of the safety/warning / worksite protection / traffic control plans for work within the rail corridor and other work sites

☒ I have been instructed on the hazards and controls in this document and I have had the opportunity to ask questions and raise any concerns

Signature: [Signatures] Date: [Date]

Page 1 of 2

The Hierarchy of Control



Environment problems

- Significant delay in project execution by environmental problems associate high cost increase
- Can lead to re-design
- Cost associated:
 - Special equipment
 - Additional work / delay
 - Standby cost of stuff




Trenching – rock / cable

- Trenching several hundreds of meters along the rail line can end up with cutting rock in the way
- Cost/risk calculation:
 - \$175 per cubic metre rock rate



- Hit PWR/Com cable
 - **Dial before you dig**

SWMS - Trenching

		SAFE WORK METHOD STATEMENT TASK: TRENCHING MWE Doc No: 710-603 Rev C		MW Engineers Pty Ltd ABN 81 109 732 881 Unit 5/71 Strezlecki Avenue, Sunshine West, VIC 3020 P: 03 9311 1666 F: 03 9312 3500	
---	--	--	--	--	--


Hazard Identification Checklist		
Plant, Equipment & Traffic	Contact with moving parts (e.g. entanglement or crush)	<input checked="" type="checkbox"/>
	Pedestrian contact with vehicles or mobile plant	<input checked="" type="checkbox"/>
	Collision between vehicles or mobile plant	<input checked="" type="checkbox"/>
	Cuts or abrasion (e.g. exposed blades, sharp objects)	<input checked="" type="checkbox"/>
	Fall from heights (ladders / platforms / roof)	<input checked="" type="checkbox"/>
	Struck by falling object or ejected material	<input checked="" type="checkbox"/>
Work Environment	Confine	<input type="checkbox"/>
	Fire/exp	<input type="checkbox"/>
	Contact	<input type="checkbox"/>
	Contact	<input type="checkbox"/>
	Overhe	<input type="checkbox"/>
	Undergr	<input type="checkbox"/>
Manual Handling	Obstruc	<input type="checkbox"/>
	Fall into	<input type="checkbox"/>
	Poor lig	<input type="checkbox"/>
	Excessi	<input type="checkbox"/>
	Work in	<input type="checkbox"/>
	Exposur	<input type="checkbox"/>
Substances & Environment	Poor ve	<input type="checkbox"/>
	Trip haz	<input type="checkbox"/>
	Snake o	<input type="checkbox"/>
	Exertion	<input type="checkbox"/>
	Highly ri	<input type="checkbox"/>
	Harmful	<input type="checkbox"/>
Plant, Equipment & Traffic	Prolong	<input type="checkbox"/>
	Fatigue	<input type="checkbox"/>
	Lifting ir	<input type="checkbox"/>
	Lifting a	<input type="checkbox"/>
	Harmful	<input type="checkbox"/>
	Harmful skin or eye contact	<input type="checkbox"/>
Substances & Environment	Ignition of flammable liquids or gas	<input type="checkbox"/>
	Exposure to biological or infectious substances (e.g. needle sticks)	<input type="checkbox"/>
	Spill to land or water	<input type="checkbox"/>
	Production of nuisance noise or dust	<input type="checkbox"/>
	Destruction of trees or vegetation	<input type="checkbox"/>
		<input type="checkbox"/>

9. Risk Matrix

Hazard Identification Checklist		
Plant, Equipment & Traffic	Contact with moving parts (e.g. entanglement or crush)	<input checked="" type="checkbox"/>
	Pedestrian contact with vehicles or mobile plant	<input checked="" type="checkbox"/>
	Collision between vehicles or mobile plant	<input checked="" type="checkbox"/>
	Cuts or abrasion (e.g. exposed blades, sharp objects)	<input type="checkbox"/>
	Fall from heights (ladders / platforms / roof)	<input type="checkbox"/>
	Struck by falling object or ejected material	<input checked="" type="checkbox"/>
	Confined space entry	<input type="checkbox"/>
	Fire/explosion	<input checked="" type="checkbox"/>
	Contact with live electrical parts	<input checked="" type="checkbox"/>
	Contact with hot or cold parts	<input type="checkbox"/>
		<input type="checkbox"/>
		<input type="checkbox"/>

Likelihood (50/50)	4 - Unlikely	4	4	4	5	5
	5 - Very Unlikely	4	5	5	5	5

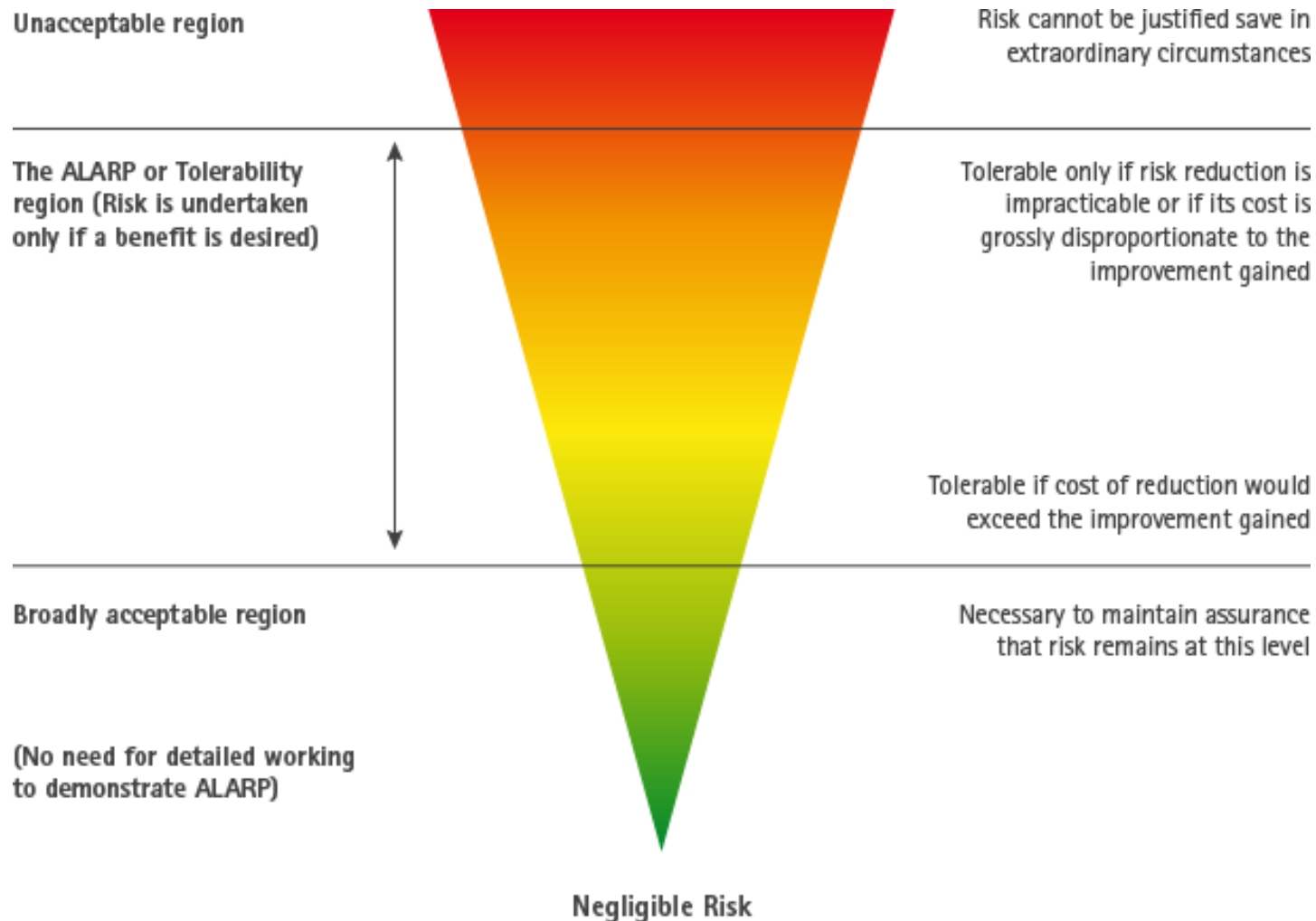
PI Chart Example

 Engineers		SAFE WORK METHOD STATEMENT		
		TASK:	TRENCHING	
		MWE Doc No:	710-603	


9. Risk Matrix		Consequences					RD(S)	RISK RANKING (No control measures)			CONTROL MEASURE(S)	RISK RANKING (with control measures)		
Likelihood		1 - Extreme	2 - Major	3 - Moderate	4 - Minor	5 - Insignificant		L	C	Level		L	C	Level
	1 - Very Likely	1	1	1	2	2	Incident	3	2	3	<ul style="list-style-type: none"> Only park in designated areas on-site or in public car-parks Obey street signage at all times Parking fines are at the responsibility of the driver Do not obstruct any driveways, access ways or emergency access gates / areas. Lock and secure vehicle at all times, if vehicle is to be left unattended If required to park on road edge, park on level ground, give maximum clearance to road where possible, minimize vehicles parking on edge. 	4	2	4
	2 - Likely	1	1	2	3	4	Days							
	3 - Possible (50/50)	2	3	3	4	5	king / vandalised site							
	4 - Unlikely	4	4	4	5	5								
	5 - Very Unlikely	4	5	5	5	5	Briefed daily carried out in rail corridor 1 officer or briefing	2	3	2	<ul style="list-style-type: none"> Ensure all staff receive the Supervisors Pre Work Briefing daily and are signed on. Ensure that all staff entering the rail corridor have been briefed by a Protection Officer and signed on Ensure that all persons have relevant Certificate of Competency carried on them whilst working Ensure that relevant permits are obtained prior to entering corridor and conducting any works 			

		<ul style="list-style-type: none"> No permits
--	--	--

As Low as Reasonably Practical



Risk Score Calculation – NSCA

 Engineers	SAFE WORK METHOD STATEMENT	
	TASK:	TRENCHING
	MWE Doc No:	710-603

ITEM No.	JOB STEP (in sequence)	HAZARD(S)	RISK RANKING (No control measures)			CONTROL MEASURE(S)	RISK RANKING (with control measures)		
			L	C	Level		L	C	Level
2	Parking Vehicle (carparks, side of road, local roads, etc)	<ul style="list-style-type: none"> Traffic accident / incident Obstructing driveways Unauthorised parking Vehicle damaged / vandalised Obstruction to public 	3	2	3	<ul style="list-style-type: none"> Only park in designated areas on-site or in public car-parks Obey street signage at all times Parking fines are at the responsibility of the driver Do not obstruct any driveways, access ways or emergency access gates / areas. Lock and secure vehicle at all times, if vehicle is to be left unattended If required to park on road edge, park on level ground, give maximum clearance to road where possible, minimize vehicles parking on edge. 	4	2	4
3	Briefings	<ul style="list-style-type: none"> Employees not briefed daily regarding works carried out Employees entering rail corridor without protection officer or briefing No permits 	2	3	2	<ul style="list-style-type: none"> Ensure all staff receive the Supervisors Pre Work Briefing daily and are signed on. Ensure that all staff entering the rail corridor have been briefed by a Protection Officer and signed on Ensure that all persons have relevant Certificate of Competency carried on them whilst working Ensure that relevant permits are obtained prior to entering corridor and conducting any works 			



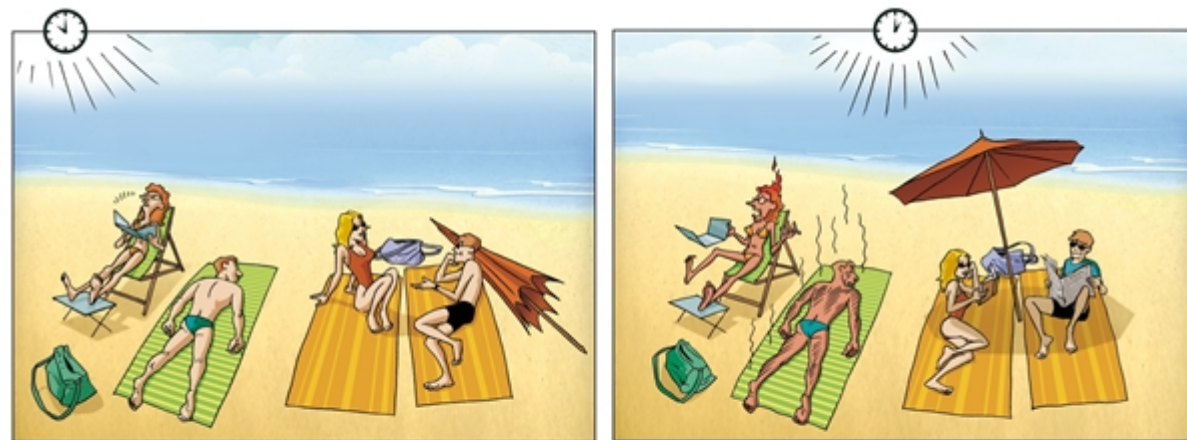
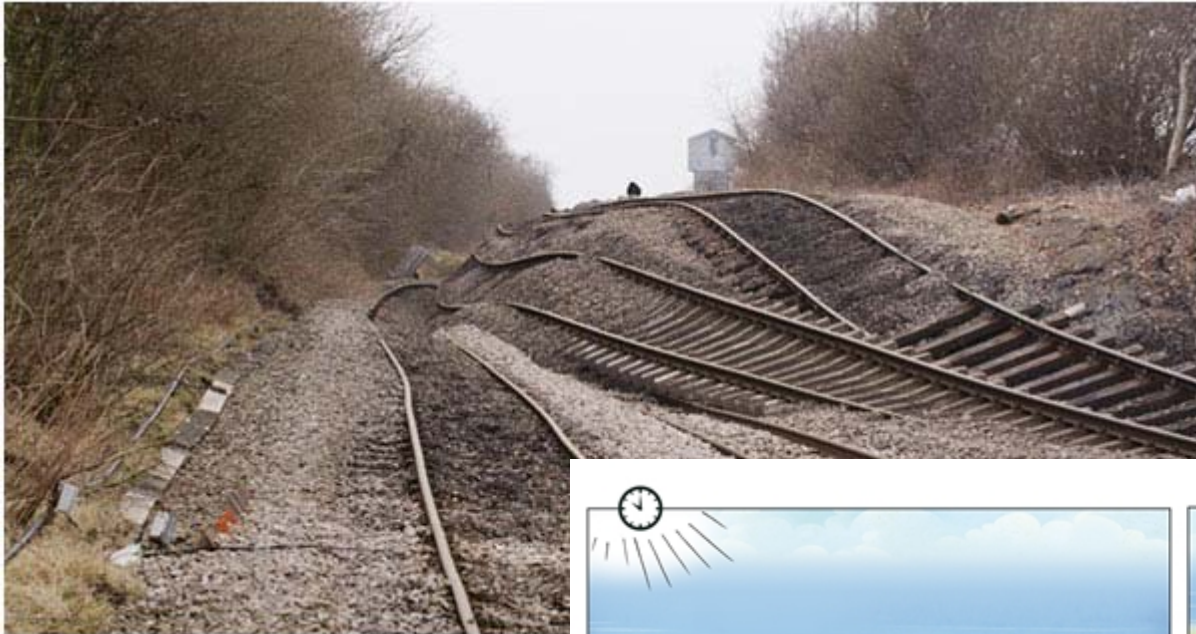
Riskex-Risk-Score



Riskex-Cost-Justification

source: <http://www.safetyrisk.com.au/risk-assessment-form-templates/>

Hazard Report / Incident Report



$$\text{RISK} = \text{HAZARD} \times \text{EXPOSURE}$$

PROJECT REVIEW

POST ASSESSMENT OF RISKS

What is a Project Review?

A meeting where a team looks back on a past period of work so that they can **learn** from their experience and apply this learning to future projects.

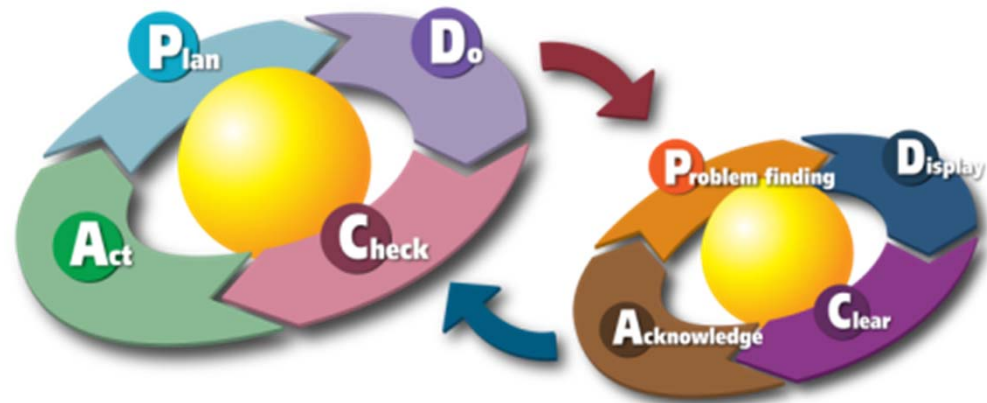
Primary Goal:

Create preventive actions on future Risks

Why Project Review?

- Reflection is a key step in **learning** from experience.
- Project Reviews help teams to focus on **process improvement** and build **ownership**.
- Reviews build community and improve cross **communication**.

- **How often would you do it?**



Source: Karn G. Bulsuk (<http://karnbulsuk.blogspot.com>)

Review in Your Project

- Not consider yet to do one?
- At the end of the project, in case of accident?
- Every major milestone?
- Every month or more often?



Image courtesy: www.idea.gov.uk

The Prime Directive



Regardless of what we discover, we understand and truly believe that everyone did the best job they could, given what they knew at the time, their skills and abilities, the resources available, and the situation at hand.

- Norm Kerth

Preparation & Roles

Quality Manager:

- Review previous actions
- Plans and guides meeting: timing, rules, exercises
- Captures outputs: minutes, photo, intranet
- Listen, Observe, Unpack information

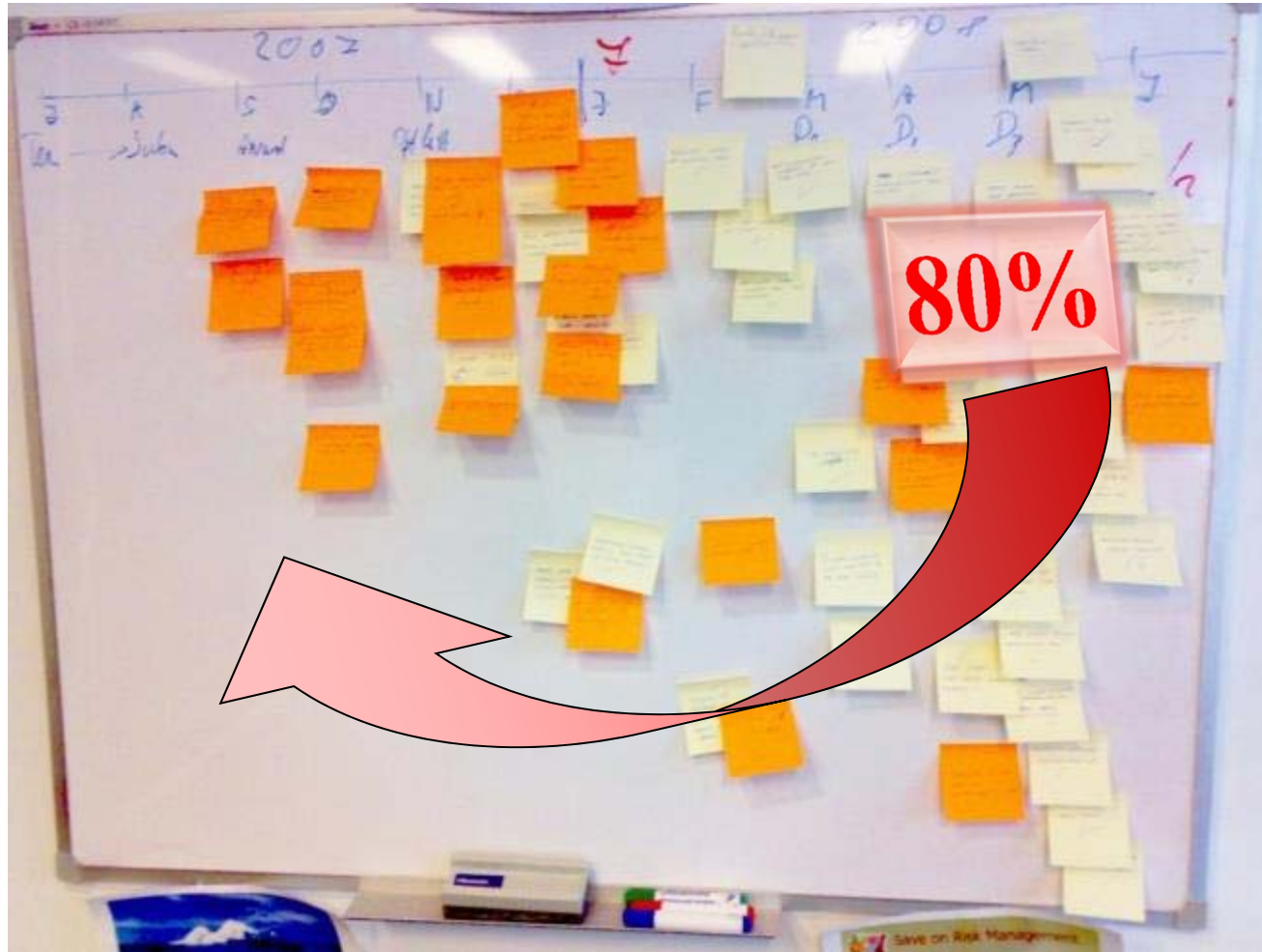
Team:

- Share experiences
- Make new commitments

Product / Project Manager:

- Sets goal and expectations
- Supports recommendations

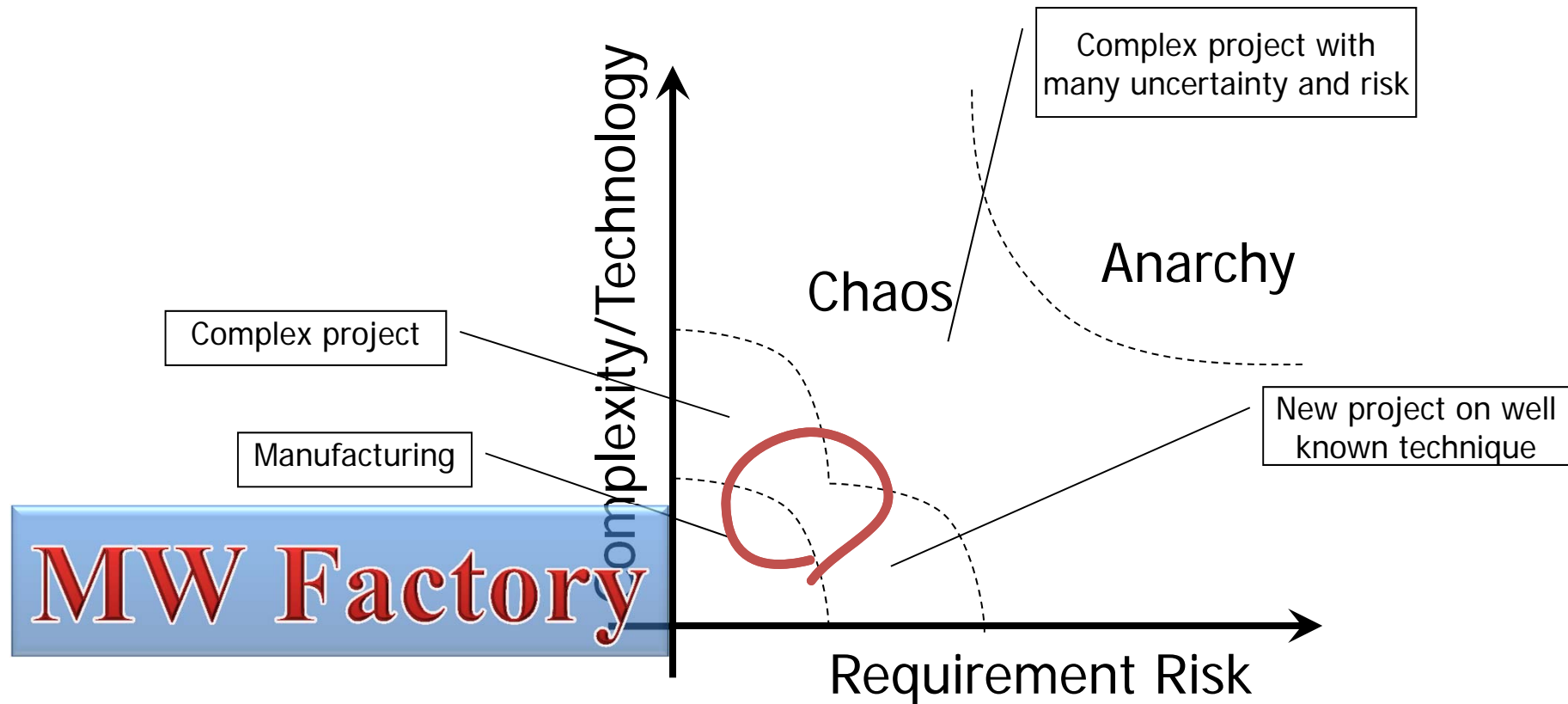
Project Phase Review – Rail



END SUMMARY - RAILWAY

- ✓ Railway Signalling works – with Case Studies
- ✓ Project Review – with Case Study

Project Risk Level Assessment



MW A/C PANEL OVERHAUL CASE STUDY

- ✓ Contracting Risk Management
- ✓ Procedures – Quality Checks for Risk Reduction
- ✓ In Details – Wire preparation
- ✓ Corrective Action Report (CAR)

Business Preparation

- Business Analysis – Business Risk
- Risk Assessment
- Risk Analysis – how to handle the risks
- Reduce/Eliminate risk - Plan




source:
<http://digitalbloggers.com/normalguy/im-too-scared-to-change/>



source: <http://postmasculine.com/how-to-be-confident-around-women/>

Project Risk Assessment Register

- At Proposal/Contracting phase



Project Risk Assessment Register

Project No:

11035

Project Name:

QR Air Conditioning units refurbishment

Date	Risk No.	Description of risk(what is it and how can it occur)	Likelihood rating	Consequence rating	Risk Rating	Status (new or review)	Actions	Task Owner (Responsible Officer)
5-Jul	Delivery	Frame delivery delays	1	3	1	new	arrange delivery of a number (say 20) of old units from QR to be stripped, powder coated and refurbished prior to new frames arrival	
5-Jul	Delivery	Carbon Tax implications Unknown 1/7/2012 (20%)	2	3	2	new	Order or fix the price for major parts before July Request prices from different suppliers to cut price	
5-Jul	Procurement	Increased foreign exchange	3	4	4	review	Australian \$ is low now, fix orders and prices before July	
5-Jul	Delivery	Increased transportation costs to Australia and locally	4	3	4	review	past 1 year showed an international ~5% increase in prices, and about the same for Australia (recent study is in the risk folder) transport cost decreased in the past 1 year as we have reached to pack 6 units in one transports and received an increasing discount, from ~\$130/unit to ~\$80/unit	
	Smoking in the workplace	Smoking in the workplace results in health damage to the smoker, other employees and potential legal claims					Smoking in the Workplace Policy Management to monitor to avoid excessive smoking breaks	
	Electrical systems	Personnel electrocuted, potential fire or explosion from poor maintenance or design					Hazard Identification & Risk Assessment Job Safety Analysis & Work Instruction Electrical Safety Hand and Power Tools	

Risk Negotiation at Contracting

1. Goal: Replicate an old control panel with new design
2. Business Analysis – Risk Assessment
3. Production – Tools/Environment Risk
4. Estimate on unforeseen risk & cost factors
5. Clarification of warranty terms & conditions
6. Clarification of Responsibilities
7. Risk / Cost negotiation



PROCEDURES

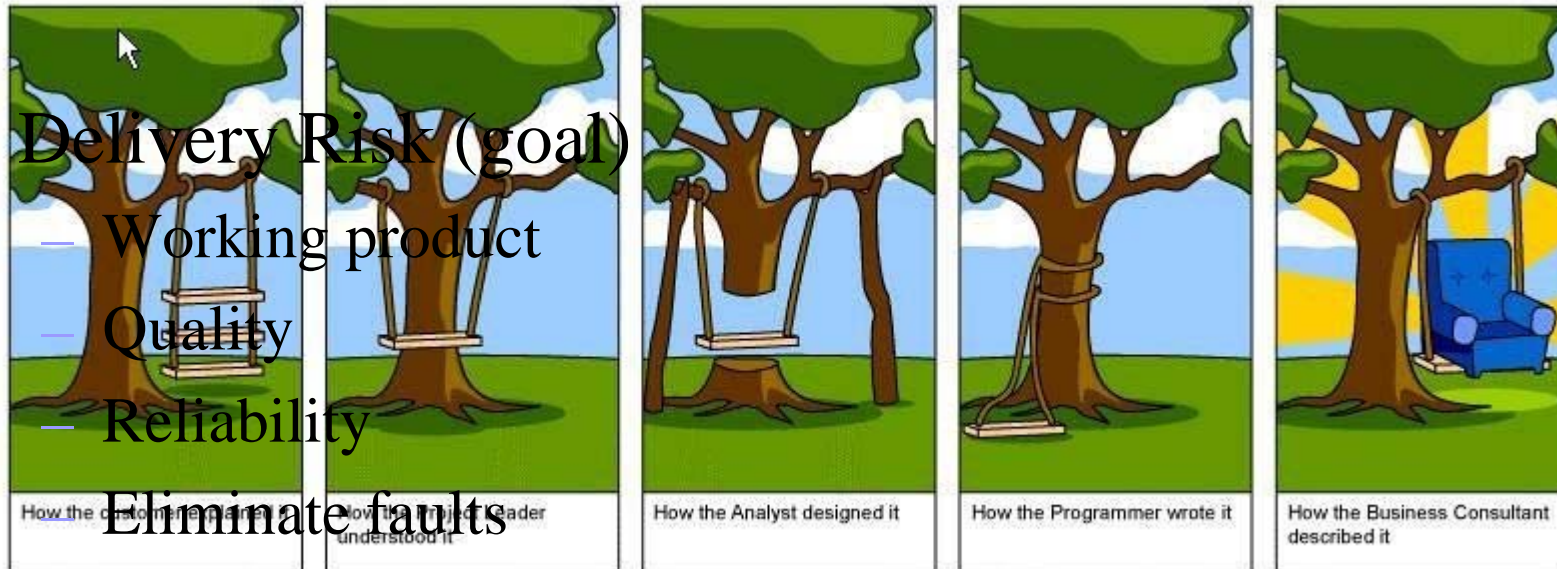
QUALITY CHECKS FOR RISK REDUCTION

Risks in Project Delivery

- **Delivery Risk (goal)**

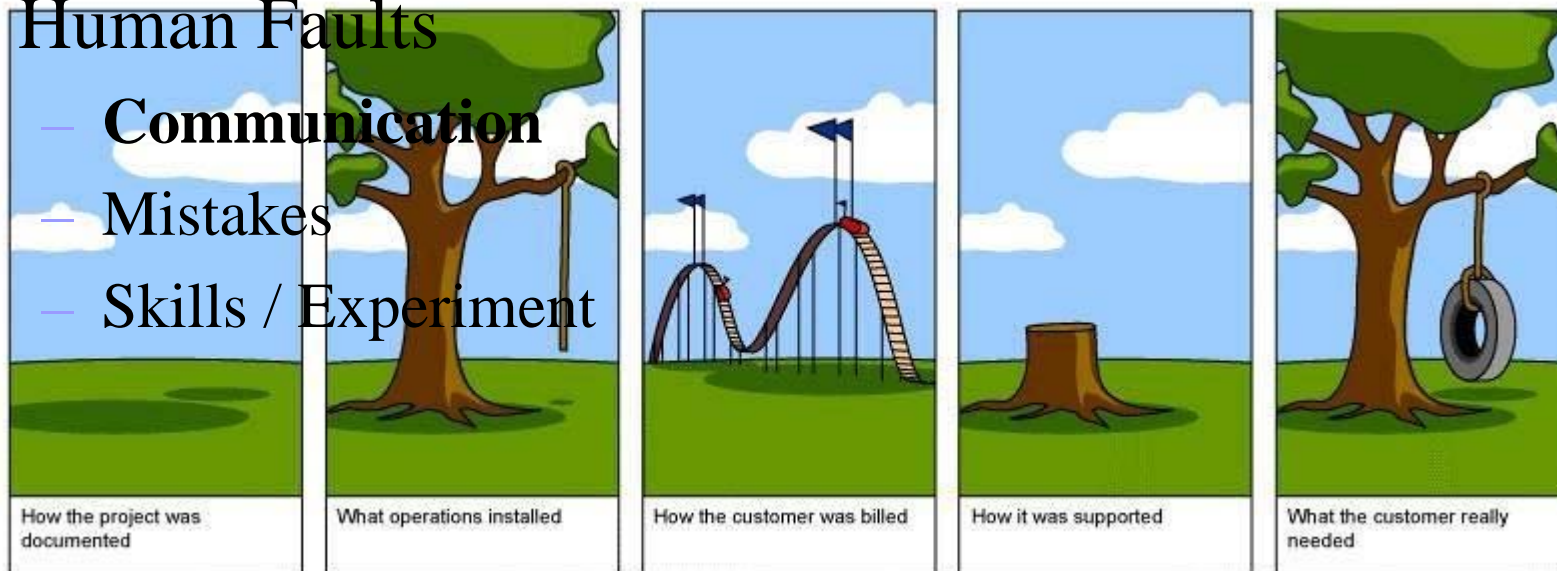
- Working product
- Quality
- Reliability

Eliminate faults



- **Human Faults**

- Communication
- Mistakes
- Skills / Experiment



Product Milestones

- The
- lea
- Qu
- wo

mw Engineers Revision: 7 December 2012

Unit 1135/ *QR*

Document Checklist for QR project

Documents to be collected & checked before packaging:

No.	Description	Result	Date	Rectify By
1.	Preparation Checklist (keep original)	<input checked="" type="checkbox"/>		
2.	Wire Preparation (keep original)	<input checked="" type="checkbox"/>		
3.	Wiring Schedule (keep original)	<input checked="" type="checkbox"/>		
4.	Plug/Socket Connections Table (QR / copy to keep)	<input checked="" type="checkbox"/>		
5.	Circuit Diagrams (Bell & IR test) (QR / copy to keep)	<input checked="" type="checkbox"/>		
6.	Transformer Test Record & Certificate (QR / copy to keep)	<input checked="" type="checkbox"/>		
7.	EMU AC Panel Test Certificate (QR / copy to keep)	<input checked="" type="checkbox"/>		
8.	Quality Checklist - Final Check List (QR / copy to keep)	<input checked="" type="checkbox"/>		

Date: *24/02/13*

Checked by: *[Signature]*

1. Take photos at the end before packaging ☒

2. After packaging put "Top only / Fragile" and "EMU 25+ only" labels on packaging ☐

Date: _____

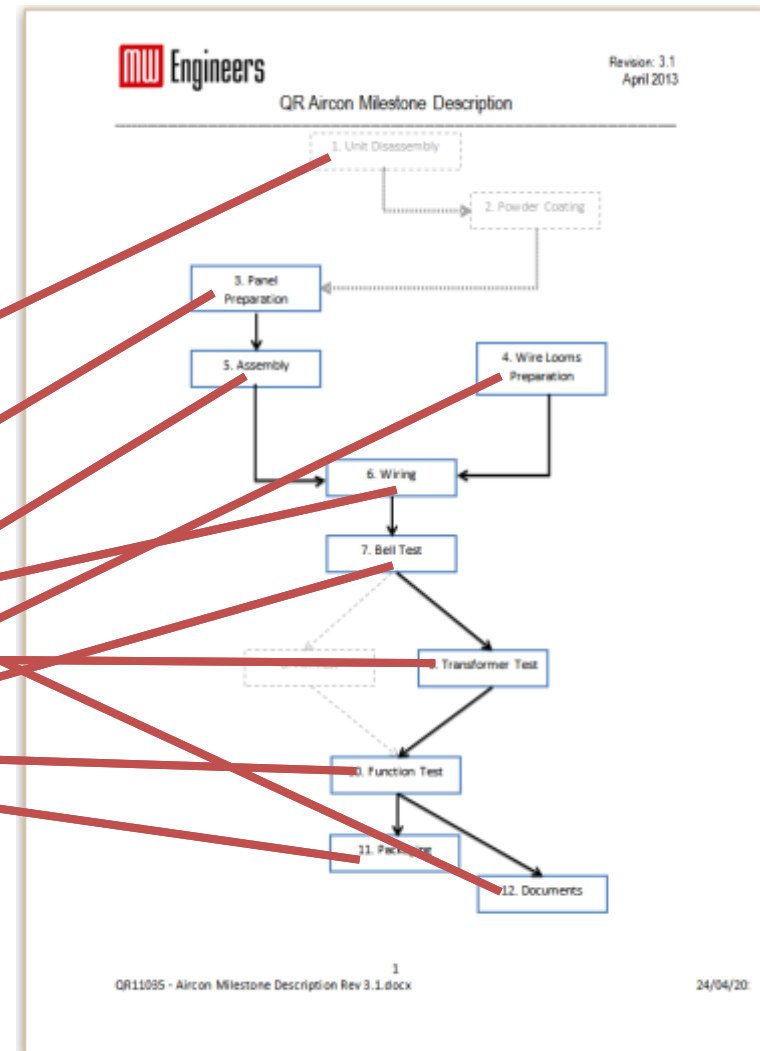
Checked by: _____

Checklist - QR11035 - Document Checklist Rev 724/03/2013

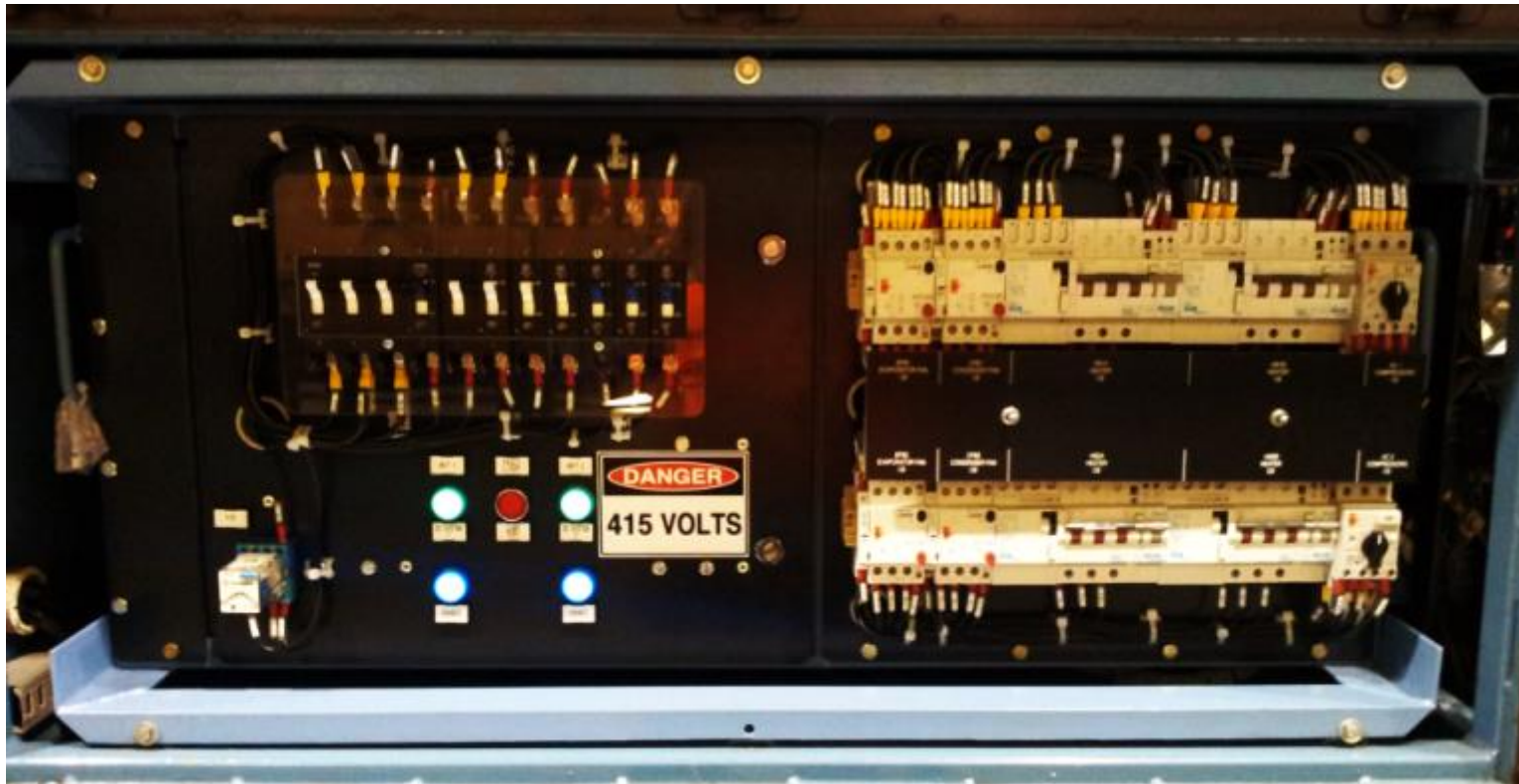
Transformer test & procedure for QR AC Rev 1.docx

Checklist - QR11035 - Final Checklist Rev 1.1.docx

Page 1 of 1



Q Documents - Sample



Adaption – a Key to Success

- Learning cycles
- Technical issues
- Client requests
- All Risk Management



- 5 milestones => 12
- 10s of check => ~100 points
- 5w => 3 days wiring
- 200h => 40h full production

1 out of 180 had failure
(2+ years in service)

WIRE PREPARATION MILESTONE

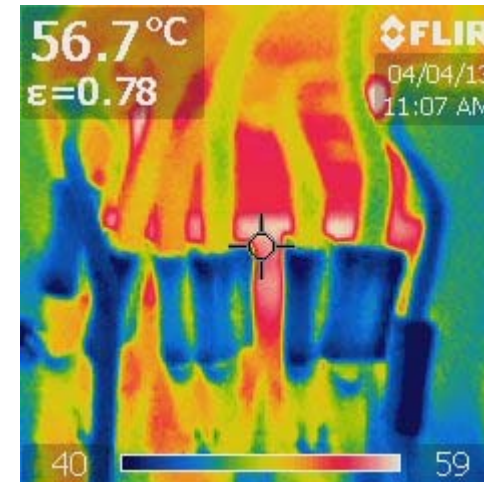
Risk - Tools

- Tools register
- Goals: check & calibrate every tools
- Check final quality: strength of the crimp
- Before a tool is used
- Every day



Wire preparation

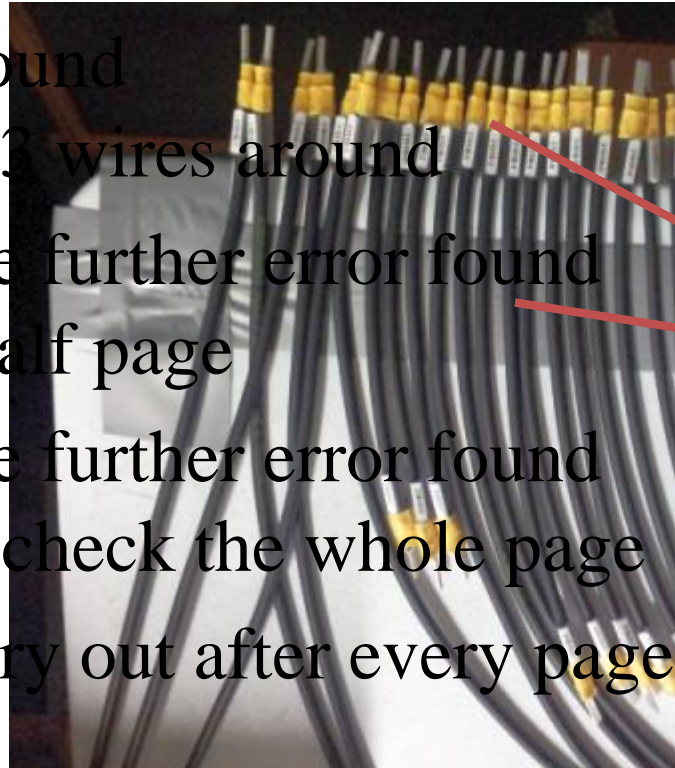
- 270 wires/unit, 2x130 units
- Production quality check
 - Cable type
 - Length [mm]
 - Label / direction
 - Proper lug / stripping / crimping / direction



Wire No	Size	Lug's Part-No. A	P A	Lug's Part-No. B	P B	Act Len	Completed by	Issue	Rectify by
122-11	1.5mm ²	PC1 25DG	R	FB 1 25-3DG	R	330	BK		
122-12	1.5mm ²	FS1 25-4DG	L	FB 1 25-3DG	R	1450	BK		
122-13	1.5mm ²	FS1 25-4DG	L	FS1 25-4DG	L	75	BK		
122-14	1.5mm ²	FS1 25-4DG	L	FS1 25-4DG	L	735	BK		
120-14	1.5mm ²	PC1 25DG	R	FS1 25-4DG	L	1315	BK		
120-12	1.5mm ²	FB 1 25-3DG	R	FS1 25-4DG	L	1125	BK		
120-13	1.5mm ²	FB 1 25-3DG	R	FB 1 25-2DG	L	728	BK		
120-11	1.5mm ²	PC1 25DG	L	FB 1 25-2DG	L	160	BK		

Method Used for Quality Control

- Visual inspection
- Check every 10 wire on average
- If any error found
 - check ± 3 wires around
- If one or more further error found
 - check half page
- If one or more further error found
 - need to check the whole page
- Checks to carry out after every page



QR: 1135 / 52 Wire Preparation version: 11/10/2012

Rev: 8.2

Wire No	Size	Log's Part No. A	P	Log's Part No. B	P	Act Len	Completed by	Issue	Rectify by
122.11	1.5mm ²	R	H	R	H	1450	10/10/12		
122.12	1.5mm ²	R	H	R	H	1450	10/10/12		
122.13	1.5mm ²	R	H	R	H	1450	10/10/12		
122.14	1.5mm ²	R	H	R	H	1450	10/10/12		
122.15	1.5mm ²	R	H	R	H	1450	10/10/12		
122.16	1.5mm ²	R	H	R	H	1450	10/10/12		
122.17	1.5mm ²	R	H	R	H	1450	10/10/12		
122.18	1.5mm ²	R	H	R	H	1450	10/10/12		
122.19	1.5mm ²	R	H	R	H	1450	10/10/12		
122.20	1.5mm ²	R	H	R	H	1450	10/10/12		
122.21	1.5mm ²	R	H	R	H	1450	10/10/12		
122.22	1.5mm ²	R	H	R	H	1450	10/10/12		
122.23	1.5mm ²	R	H	R	H	1450	10/10/12		
122.24	1.5mm ²	R	H	R	H	1450	10/10/12		
122.25	1.5mm ²	R	H	R	H	1450	10/10/12		
122.26	1.5mm ²	R	H	R	H	1450	10/10/12		
122.27	1.5mm ²	R	H	R	H	1450	10/10/12		
122.28	1.5mm ²	R	H	R	H	1450	10/10/12		
122.29	1.5mm ²	R	H	R	H	1450	10/10/12		
122.30	1.5mm ²	R	H	R	H	1450	10/10/12		
122.31	1.5mm ²	R	H	R	H	1450	10/10/12		
122.32	1.5mm ²	R	H	R	H	1450	10/10/12		
122.33	1.5mm ²	R	H	R	H	1450	10/10/12		
122.34	1.5mm ²	R	H	R	H	1450	10/10/12		
122.35	1.5mm ²	R	H	R	H	1450	10/10/12		
122.36	1.5mm ²	R	H	R	H	1450	10/10/12		
122.37	1.5mm ²	R	H	R	H	1450	10/10/12		
122.38	1.5mm ²	R	H	R	H	1450	10/10/12		
122.39	1.5mm ²	R	H	R	H	1450	10/10/12		
122.40	1.5mm ²	R	H	R	H	1450	10/10/12		
122.41	1.5mm ²	R	H	R	H	1450	10/10/12		
122.42	1.5mm ²	R	H	R	H	1450	10/10/12		
122.43	1.5mm ²	R	H	R	H	1450	10/10/12		
122.44	1.5mm ²	R	H	R	H	1450	10/10/12		
122.45	1.5mm ²	R	H	R	H	1450	10/10/12		
122.46	1.5mm ²	R	H	R	H	1450	10/10/12		
122.47	1.5mm ²	R	H	R	H	1450	10/10/12		
122.48	1.5mm ²	R	H	R	H	1450	10/10/12		
122.49	1.5mm ²	R	H	R	H	1450	10/10/12		
122.50	1.5mm ²	R	H	R	H	1450	10/10/12		
122.51	1.5mm ²	R	H	R	H	1450	10/10/12		
122.52	1.5mm ²	R	H	R	H	1450	10/10/12		
122.53	1.5mm ²	R	H	R	H	1450	10/10/12		
122.54	1.5mm ²	R	H	R	H	1450	10/10/12		
122.55	1.5mm ²	R	H	R	H	1450	10/10/12		
122.56	1.5mm ²	R	H	R	H	1450	10/10/12		
122.57	1.5mm ²	R	H	R	H	1450	10/10/12		
122.58	1.5mm ²	R	H	R	H	1450	10/10/12		
122.59	1.5mm ²	R	H	R	H	1450	10/10/12		
122.60	1.5mm ²	R	H	R	H	1450	10/10/12		
122.61	1.5mm ²	R	H	R	H	1450	10/10/12		
122.62	1.5mm ²	R	H	R	H	1450	10/10/12		
122.63	1.5mm ²	R	H	R	H	1450	10/10/12		
122.64	1.5mm ²	R	H	R	H	1450	10/10/12		
122.65	1.5mm ²	R	H	R	H	1450	10/10/12		
122.66	1.5mm ²	R	H	R	H	1450	10/10/12		
122.67	1.5mm ²	R	H	R	H	1450	10/10/12		
122.68	1.5mm ²	R	H	R	H	1450	10/10/12		
122.69	1.5mm ²	R	H	R	H	1450	10/10/12		
122.70	1.5mm ²	R	H	R	H	1450	10/10/12		
122.71	1.5mm ²	R	H	R	H	1450	10/10/12		
122.72	1.5mm ²	R	H	R	H	1450	10/10/12		
122.73	1.5mm ²	R	H	R	H	1450	10/10/12		
122.74	1.5mm ²	R	H	R	H	1450	10/10/12		
122.75	1.5mm ²	R	H	R	H	1450	10/10/12		
122.76	1.5mm ²	R	H	R	H	1450	10/10/12		
122.77	1.5mm ²	R	H	R	H	1450	10/10/12		
122.78	1.5mm ²	R	H	R	H	1450	10/10/12		
122.79	1.5mm ²	R	H	R	H	1450	10/10/12		
122.80	1.5mm ²	R	H	R	H	1450	10/10/12		
122.81	1.5mm ²	R	H	R	H	1450	10/10/12		
122.82	1.5mm ²	R	H	R	H	1450	10/10/12		
122.83	1.5mm ²	R	H	R	H	1450	10/10/12		
122.84	1.5mm ²	R	H	R	H	1450	10/10/12		
122.85	1.5mm ²	R	H	R	H	1450	10/10/12		
122.86	1.5mm ²	R	H	R	H	1450	10/10/12		
122.87	1.5mm ²	R	H	R	H	1450	10/10/12		
122.88	1.5mm ²	R	H	R	H	1450	10/10/12		
122.89	1.5mm ²	R	H	R	H	1450	10/10/12		
122.90	1.5mm ²	R	H	R	H	1450	10/10/12		
122.91	1.5mm ²	R	H	R	H	1450	10/10/12		
122.92	1.5mm ²	R	H	R	H	1450	10/10/12		
122.93	1.5mm ²	R	H	R	H	1450	10/10/12		
122.94	1.5mm ²	R	H	R	H	1450	10/10/12		
122.95	1.5mm ²	R	H	R	H	1450	10/10/12		
122.96	1.5mm ²	R	H	R	H	1450	10/10/12		
122.97	1.5mm ²	R	H	R	H	1450	10/10/12		
122.98	1.5mm ²	R	H	R	H	1450	10/10/12		
122.99	1.5mm ²	R	H	R	H	1450	10/10/12		
122.100	1.5mm ²	R	H	R	H	1450	10/10/12		

Quality Check – Fails?

QR 1135/ 47 Wire Preparation version: 11/10/2012 Rev. 6.2

Wire No.	Size	Log's Part No. A	P A	Log's Part No. B	P B	Aut Len	Completed by	Issue	Revised by
122-11	1.5mm ²		R			1400	AC		
122-12	1.5mm ²		R			73	AC		
122-13	1.5mm ²		R			73	AC		
122-14	1.5mm ²		R			73	AC		
122-15	1.5mm ²		R			73	AC		
122-16	1.5mm ²		R			73	AC		
122-17	1.5mm ²		R			73	AC		
122-18	1.5mm ²		R			73	AC		
122-19	1.5mm ²		R			73	AC		
122-20	1.5mm ²		R			73	AC		
122-21	1.5mm ²		R			73	AC		
122-22	1.5mm ²		R			73	AC		
122-23	1.5mm ²		R			73	AC		
122-24	1.5mm ²		R			73	AC		
122-25	1.5mm ²		R			73	AC		
122-26	1.5mm ²		R			73	AC		
122-27	1.5mm ²		R			73	AC		
122-28	1.5mm ²		R			73	AC		
122-29	1.5mm ²		R			73	AC		
122-30	1.5mm ²		R			73	AC		
122-31	1.5mm ²		R			73	AC		
122-32	1.5mm ²		R			73	AC		
122-33	1.5mm ²		R			73	AC		
122-34	1.5mm ²		R			73	AC		
122-35	1.5mm ²		R			73	AC		
122-36	1.5mm ²		R			73	AC		
122-37	1.5mm ²		R			73	AC		
122-38	1.5mm ²		R			73	AC		
122-39	1.5mm ²		R			73	AC		
122-40	1.5mm ²		R			73	AC		
122-41	1.5mm ²		R			73	AC		
122-42	1.5mm ²		R			73	AC		
122-43	1.5mm ²		R			73	AC		
122-44	1.5mm ²		R			73	AC		
122-45	1.5mm ²		R			73	AC		
122-46	1.5mm ²		R			73	AC		
122-47	1.5mm ²		R			73	AC		
122-48	1.5mm ²		R			73	AC		
122-49	1.5mm ²		R			73	AC		
122-50	1.5mm ²		R			73	AC		
122-51	1.5mm ²		R			73	AC		
122-52	1.5mm ²		R			73	AC		
122-53	1.5mm ²		R			73	AC		
122-54	1.5mm ²		R			73	AC		
122-55	1.5mm ²		R			73	AC		
122-56	1.5mm ²		R			73	AC		
122-57	1.5mm ²		R			73	AC		
122-58	1.5mm ²		R			73	AC		
122-59	1.5mm ²		R			73	AC		
122-60	1.5mm ²		R			73	AC		
122-61	1.5mm ²		R			73	AC		
122-62	1.5mm ²		R			73	AC		
122-63	1.5mm ²		R			73	AC		
122-64	1.5mm ²		R			73	AC		
122-65	1.5mm ²		R			73	AC		
122-66	1.5mm ²		R			73	AC		
122-67	1.5mm ²		R			73	AC		
122-68	1.5mm ²		R			73	AC		
122-69	1.5mm ²		R			73	AC		
122-70	1.5mm ²		R			73	AC		
122-71	1.5mm ²		R			73	AC		
122-72	1.5mm ²		R			73	AC		
122-73	1.5mm ²		R			73	AC		
122-74	1.5mm ²		R			73	AC		
122-75	1.5mm ²		R			73	AC		
122-76	1.5mm ²		R			73	AC		
122-77	1.5mm ²		R			73	AC		
122-78	1.5mm ²		R			73	AC		
122-79	1.5mm ²		R			73	AC		
122-80	1.5mm ²		R			73	AC		
122-81	1.5mm ²		R			73	AC		
122-82	1.5mm ²		R			73	AC		
122-83	1.5mm ²		R			73	AC		
122-84	1.5mm ²		R			73	AC		
122-85	1.5mm ²		R			73	AC		
122-86	1.5mm ²		R			73	AC		
122-87	1.5mm ²		R			73	AC		
122-88	1.5mm ²		R			73	AC		
122-89	1.5mm ²		R			73	AC		
122-90	1.5mm ²		R			73	AC		
122-91	1.5mm ²		R			73	AC		
122-92	1.5mm ²		R			73	AC		
122-93	1.5mm ²		R			73	AC		
122-94	1.5mm ²		R			73	AC		
122-95	1.5mm ²		R			73	AC		
122-96	1.5mm ²		R			73	AC		
122-97	1.5mm ²		R			73	AC		
122-98	1.5mm ²		R			73	AC		
122-99	1.5mm ²		R			73	AC		
122-100	1.5mm ²		R			73	AC		

QR1135/ 47

Wiring Schedule

version:

24/01/2013

Rev. 6.3

Wired by:

Wire No.	Size	Length m/m	Point A	P A	Point B	P B	Aut Len	Completed by	Issue	Revised by
122-11	1.5mm ²	1400	AC							
122-12	1.5mm ²	73	AC							
122-13	1.5mm ²	73	AC							
122-14	1.5mm ²	73	AC							
122-15	1.5mm ²	73	AC							
122-16	1.5mm ²	73	AC							
122-17	1.5mm ²	73	AC							
122-18	1.5mm ²	73	AC							
122-19	1.5mm ²	73	AC							
122-20	1.5mm ²	73	AC							
122-21	1.5mm ²	73	AC							
122-22	1.5mm ²	73	AC							
122-23	1.5mm ²	73	AC							
122-24	1.5mm ²	73	AC							
122-25	1.5mm ²	73	AC							
122-26	1.5mm ²	73	AC							
122-27	1.5mm ²	73	AC							
122-28	1.5mm ²	73	AC							
122-29	1.5mm ²	73	AC							
122-30	1.5mm ²	73	AC							
122-31	1.5mm ²	73	AC							
122-32	1.5mm ²	73	AC							
122-33	1.5mm ²	73	AC							
122-34	1.5mm ²	73	AC							
122-35	1.5mm ²	73	AC							
122-36	1.5mm ²	73	AC							
122-37	1.5mm ²	73	AC							
122-38	1.5mm ²	73	AC							
122-39	1.5mm ²	73	AC							
122-40	1.5mm ²	73	AC							
122-41	1.5mm ²	73	AC							
122-42	1.5mm ²	73	AC							
122-43	1.5mm ²	73	AC							
122-44	1.5mm ²	73	AC							
122-45	1.5mm ²	73	AC							
122-46	1.5mm ²	73	AC							
122-47	1.5mm ²	73	AC							
122-48	1.5mm ²	73	AC							
122-49	1.5mm ²	73	AC							
122-50	1.5mm ²	73	AC							
122-51	1.5mm ²	73	AC							
122-52	1.5mm ²	73	AC							
122-53	1.5mm ²	73	AC							
122-54	1.5mm ²	73	AC							
122-55	1.5mm ²	73	AC							
122-56	1.5mm ²	73	AC							
122-57	1.5mm ²	73	AC							
122-58	1.5mm ²	73	AC							
122-59	1.5mm ²	73	AC							
122-60	1.5mm ²	73	AC							
122-61	1.5mm ²	73	AC							
122-62	1.5mm ²	73	AC							
122-63	1.5mm ²	73	AC							
122-64	1.5mm ²	73	AC							
122-65	1.5mm ²	73	AC							
122-66	1.5mm ²	73	AC							
122-67	1.5mm ²	73	AC							
122-68	1.5mm ²	73	AC							
122-69	1.5mm ²	73	AC							
122-70	1.5mm ²	73	AC							
122-71	1.5mm ²	73	AC							
122-72	1.5mm ²	73	AC							
122-73	1.5mm ²	73	AC							
122-74	1.5mm ²	73	AC							
122-75	1.5mm ²	73	AC							
122-76	1.5mm ²	73	AC							
122-77	1.5mm ²	73	AC							
122-78	1.5mm ²	73	AC							
122-79	1.5mm ²	73	AC							
122-80	1.5mm ²	73	AC							
122-81	1.5mm ²	73	AC							
122-82	1.5mm ²	73	AC							
122-83	1.5mm ²	73	AC							
122-84	1.5mm ²	73	AC							
122-85	1.5mm ²	73	AC							
122-86	1.5mm ²	73	AC							
122-87	1.5mm ²	73	AC							
122-88	1.5mm ²	73	AC							
122-89	1.5mm ²	73	AC							
122-90	1.5mm ²	73	AC							
122-91	1.5mm ²	73	AC							
122-92	1.5mm ²	73	AC							
122-93	1.5mm ²	73	AC							
122-94	1.5mm ²	73	AC							
122-95	1.5mm ²	73	AC							
122-96	1.5mm ²	73	AC							
122-97	1.5mm ²	73	AC							
122-98	1.5mm ²	73	AC							
122-99	1.5mm ²	73	AC							
122-100	1.5mm ²	73	AC							
122-101	1.5mm ²	73	AC							
122-102	1.5mm ²	73	AC							
122-103	1.5mm ²	73	AC							
122-104	1.5mm ²	73	AC							
122-105	1.5mm ²	73	AC							
122-106	1.5mm ²	73	AC							
122-107	1.5mm ²	73	AC							
122-108	1.5mm ²	73	AC							
122-109	1.5mm ²	73	AC							
122-110	1.5mm ²	73	AC							
122-111	1.5mm ²	73	AC							
122-112	1.5mm ²	73	AC							
122-113	1.5mm ²	73	AC							
122-114	1.5mm ²	73	AC							
122-115	1.5mm ²	73	AC							
122-116	1.5mm ²	73	AC							
122-117	1.5mm ²	73	AC							
122-118	1.5mm ²	73	AC							
122-119	1.5mm ²	73	AC							
122-120	1.5mm ²	73	AC							
122-121	1.5mm ²	73	AC							
122-122	1.5mm ²	73	AC							
122-123	1.5mm ²	73	AC							
122-124	1.5mm ²	73	AC							
122-125	1.5mm ²	73	AC							
122-126	1.5mm ²	73	AC							
122-127	1.5mm ²	73	AC							
122-128	1.5mm ²	73	AC							
122-129	1.5mm ²	73	AC							
122-130	1.5mm ²	73	AC							
122-131	1.5mm ²	73	AC							
122-132	1.5mm ²	73	AC							
122-133	1.5mm ²	73	AC							
122-134	1.5mm ²	73	AC							
122-135	1.5mm ²	73	AC							
122-136	1.5mm ²	73	AC							
122-137	1.5mm ²	73	AC							
122-138	1.5mm ²	73	AC							
122-139	1.5mm ²	73	AC							
122-140	1.5mm ²	73	AC							
122-141	1.5mm ²	73	AC							
122-142	1.5mm ²	73	AC							
122-143	1.5mm ²	73	AC							
122-144	1.5mm ²	73	AC							
122-145	1.5mm ²	73	AC							
122-146	1.5mm ²	73	AC							
122-147	1.5mm ²	73	AC							
122-148	1.5mm ²	73	AC							
122-149	1.5mm ²	73	AC							
122-150	1.5mm ²	73	AC							
122-151	1.5mm ²	73	AC							
122-152	1.5mm ²	73	AC							
122-153	1.5mm ²	73	AC							
122-154	1.5mm ²	73	AC							
122-155	1.5mm ²	73	AC							
122-156	1.5mm ²	73	AC							
122-157	1.5mm ²	73	AC							
122-158	1.5mm ²	73	AC							
122-159	1.5mm ²	73	AC							
122-160	1.5mm ²	73	AC							
122-161	1.5mm ²	73	AC							
122-162	1.5mm ²	73	AC							
122-163	1.5mm ²	73	AC							
122-164	1.5mm ²	73	AC							
122-165	1.5mm ²	73	AC							
122-166	1.5mm ²	73	AC							
122-167	1.5mm ²	73	AC							
122-168	1.5mm ²	73	AC							
122-169	1.5mm ²	73	AC							
122-170	1.5mm ²	73	AC							
122-171	1.5mm ²	73	AC							
122-172	1.5mm ²	73	AC							
122-173	1.5mm ²	73	AC							
122-174	1.5mm ²	73	AC							
122-175	1.5mm ²	73	AC							
122-176	1.5mm ²	73	AC							
122-177	1.5mm ²									

Risk on Quality – Rectification Cost



Revision: 5.1
November 2013

Plug/Socket Connections Table for QR project

P/N: QRAC-12 Done by: _____ date: ____/____/2013
S/N: 1135/_____ Checked by: _____ date: ____/____/2013

Wire No	Point A	Cannon plug point SYS1	Cannon plug point SYS2	Check B M/F	Issue	Rectify by
1109B-5	X2.52	12				
E-40	Earth Strip 3	1				
R5	X2.55	11				
R9	X2.59	24				
AN-23	X2.23	13				
1109R-5	X2.50	14				
1109W-5	X2.51	2				
R3	X2.53	10				
1137-27	X2.19	23				
1127-5	X2.15	30				
1128-5	X2.17	25				
R7	X2.57	15				
R1	X2.51	3				
1110R-5	X2.32	22				
1110W-5	X2.33	29				
1110B-5	X2.34	31				
E-32	Earth Strip 2	26				
1115-23	X2.9	16				
1105W-2	X2.39	9				
1105B-2	X2.40	21				
E-31	Earth Strip 4	28				
1107R-5	X2.41	27				
1107W-5	X2.42	17				
1107B-5	X2.43	4				
1103R-5	X2.26	8				
1103W-5	X2.27	20				
1103B-5	X2.28	19				
E-30	Earth Strip 1	18				
1105R-2	X2.38	5				
1113-6	X2.3	7				
MO-309	X2.1	6				
2109B-5	X2.55	12				
E-36	Earth Strip 8	1				
R6	X2.56	11				
R10	X2.510	24				
AN-33	X2.24	13				
2109R-5	X2.53	14				
2109W-5	X2.54	2				
R4	X2.54	10				
2137-17	X2.20	23				
2127-5	X2.16	30				
2128-5	X2.18	25				
R8	X2.58	15				
R2	X2.52	3				
2110R-5	X2.35	22				
2110W-5	X2.36	29				
2110B-5	X2.37	31				
E-35	Earth Strip 7	26				
2115-23	X2.10	16				
2105W-2	X2.45	9				
2105B-2	X2.46	21				
E-34	Earth Strip 9	28				
2107R-5	X2.47	27				
2107W-5	X2.48	17				
2107B-5	X2.49	4				
2103R-5	X2.29	8				
2103W-5	X2.30	20				
2103B-5	X2.31	19				

- The later phase an error found, the more it costs to rectify
- Spark @ Function test
- Destroyed parts: \$2k
- Root Cause Analysis
- Bell test problem?
- Extension: "flower test"

Risk on Quality – Rectification Cost 2

- 1 pin shorter
- Disassembly, rectify
- Broke end clamp...
- Whole plug into parts
- Reassembly
- Reproduction
- Retest



CORRECTIVE ACTION REPORT

CAR Examples

- General reporting also for Incident/Accident/Near hit
- Design issue – isolation
- Cable tie – OHS
- Locknut instead of Loctite

Engineers INCIDENT / ACCIDENT / NEAR HIT / CORRECTIVE ACTION REPORTING Revision: 4
Sept 2012

The Controlled copy of this document is on the computer network.
Printed copies are only current for the date on the bottom of the page.

TYPE: ☐ Injury ☐ Disease ☐ Property Damage ☐ Environmental ☐ Theft ☐ Quality ☐ Audit / As.
☐ Near Hit ☐ Incident ☐ Customer Complaint ☒ Product Failure ☐ Corrective Action

☐ Attached: photos, medical report, repair quotes, WorkCover notification, failure report, customer complaint, audit report, Police report, client notification, ICAM investigation report Report Number: GR012

When did it occur: Date: 17/08/2012 Time: 11:30 am/pm Where did it occur: HW WORKSHOP

Name of injured, Near Hit or Person making report: Reported to: Whom was reported

Witnesses Names: (If any) (If any)

Describe WHAT happened and WHERE it happened – What's the problem, what went wrong?

WHILE PERFORMING TESTING OF OUR AIRCON UNIT, I FOUND THAT "NEARLY EIGHT
DOZEN LENGTH LEADAGE MODULE" HAD A HISSING SOUND. I COULD NOT OPEN THE CONTACTS OF
RED NORTH SWITCH (NHP THERMAL). I THEN MANUALLY TURNED OFF THE SWITCH AND
CONNECTED POWER TO THE LINE SIDE FROM THE TEST BATTERY. THE LINE SIDE TERMINAL
AND LINE SIDE TERMINAL RESISTANCE WERE AT 0.2 OHM FOR 3 PHASES.
NOTE: AFTER PRESSING TEST SWITCH, THE MANUAL SWITCH TURNED OFF AND A "CLICK"
CAN HEARD FROM INSIDE UNIT.

HOW did the incident happen? (Be specific - what was the failure?) Why?

IT MIGHT BE THE DESIGN OF THE MANUFACTURER, RED NORTH SWITCH MAY ONLY
WORKS AS A "TRIGGER". HOWEVER, ON THE CIRCUIT DIAGRAMS AND SYMBOLS POINT ON
THE ITEM, IT SHOWS THERE ARE 3 ISOLATION POINTS IN THE ITEM. BY IT

Immediate Action taken: (What was done to solve the immediate problem, make safe?)

IT STILL CAN SAFELY TRIP ASSOCIATED CIRCUIT BREAKER DUE TO IT TO GUARTEE
THE CIRCUIT.

IMMEDIATE ACTION ADVISED.

Labour hours taken: Equipment used: Materials used:

Proposed Corrective Action: (What should be done to avoid it happening again? Improvement suggestion and follow up comments:
(How can procedures be changed for the future and how effective was the corrective action?)

MAY NEED CONSULT ENGINEER WHO DESIGNED THE DESIGN OF MANUFACTURE
OF THIS ITEM.

Name of person assigned to fix: Date completed and closed:

Incident/Accident/Near Hit/Corrective Action Print date: 20/09/2012 Page 1 of 2

END SUMMARY - MANUFACTURING

- ✓ Contracting Risk Management
- ✓ Procedures – Quality Checks for Risk Reduction
- ✓ In Details – Wire preparation
- ✓ Corrective Action Report (CAR)