Industrial Maintenance Roundtable NSW
Common Interest Workgroup (CIWG) Report
from Meeting on March 29th 2007

Rotables Management Best Practice








This document is compiled from discussions during the NSW IMRt Common Interest Workgroup (CIWG) on Rotables Management Best Practice.

Document Compiled by Peter Todd - NSW Facilitator IMRt

Rotables Management Best Practice

Attendance List

Name	Organisation
Dave Goodwin	Bluescope Steel
Jimmy Johnstone	Bluescope Steel
Atul Patel	BOC
Chris Butler	CSR Bradford Insulation
Greg Moore	Hunter Water
Warren Huby	Newcrest
Andrew Graham	Newcrest
Gary Sanders	Newcrest
Shane Cox	Northparkes Mines
Jason Wythes	Northparkes Mines
Shane Noakes	Northparkes Mines
John Strickland	OneSteel
Charlie Findley	Orica
Matt Anstey	Orica
Duncan Romoser	Qenos
Mike Rayner	Rio Tinto Coal Australia
Peter Todd	SIRF Roundtables
Jeff Oehlman	Sydney Water

Introduction

The NSW Industrial Maintenance Roundtable (IMRt) held a Common Interest Work Group (CIWG) meeting on Rotables Management Best Practice. This meeting was held as a number of NSW IMRt key members suggested Rotables Management was a significant improvement opportunity. A Rotable is an equipment item or component that if removed from service may be repaired and returned to stores as a serviceable spare. There can be significant cost savings and improvements in operational reliability if good practices in rotable management can be successfully implemented and sustained. The benefits from rotable management good practice include reduced stock-outs, reduced inventory levels, reduced repair turnaround time, reduced early failures, and improved equipment life through defect elimination.

The NSW IMRt is also holding a series of CIWG meetings on Best Practice for Maintenance & Reliability of a range of common generic equipment such as process pumps, motors and gearboxes. It was thought beneficial that the Rotables Management CIWG meeting was held before the Generic Equipment CIWG's as this will be a common issue

The IMRt is a maintenance networking organisation coordinated by SIRF Roundtables (SIRF Rt) www.sirfrt.com.au . This report gives feedback to meeting attendees and other interested parties. The meet included the development of a comparison matrix, which is shown on the following pages. This matrix was filled out by attendee organisations to enable comparisons to be made between organisations on the issues discussed.

Rotables Management	OneSteel	Rio Tinto Coal Aust	Orica	Bluescope Steel
What CMMS/ Inventory management system is used for rotables?	SAP ☺	Ellipse	SAP ☺	SAP R3 (Still learning) ☺
What are your most important equipment types for Rotable Management?	Electric Motors, Gearboxes, Pumps, Cutter Blades ☺	Elect Motors, Gearboxes, Shovel/ Dragline Buckets, Service Exchange OEM's	Turbine Rotors, Gearboxes, Pumps, Valves ☺	Turbines, Gearboxes, Electric Motors, Hydraulic Components, Many unique component to steelmaking ☺
What identification/tagging systems do you use for rotables?	Limited Green tags for finished items ☹	Same "Repairable" tag used going out & coming back	Nil ☹	Red/ Green tag System Bar coding at warehouse ☺
Who are your best overhaul service providers (in-house-external)?	Both - Selection is based on in-house work load, Capacity vs Performance ☺	All work done is external	In-house - Very Good Outside - Alstom Power, IPS (Deewhy), Varley Eng (Tomago) ☺	Motors/ Brakes in-house All other Rotables external ☺
How do you specify Strip & Inspect/Overhaul requirements?	Changing from Job Procedure to Requirements specification 😐	Writing overhaul Specs (ongoing)	RFQ Some engineering specifications (mainly for larger turbine/ Compressor components) 😐	All parts are initial Strip/Inspect Specs exist for most repairables 😐
What QA is carried out on rotables at Suppliers/ at receipt by stores/ at installation?	Largely based on supplier AS accreditation with some auditing ☺ ☹ 😐	We have a team of 2. QA done at a vendor. Management level. "Squeaky Wheel"	Some ITP's during overhauls & Replacements mainly during major outages. Maintenance Routines - Check Sheets/ Task Lists 😐	Vendor repair/ Final Inspection is final check prior to storing 😐
What information do you specify for overhaul reports?	Very limited but being developed by Reliability Group ☹>☺	Documented "Instructions to Service Provider" - Condition, Photos, RCA Cont improvement	Dimensional checks 😐	Some items have specific repair scope 😐
What approaches are use to ensure rotable items are stored correctly?	Limited development of storage specifications ☹	Nil	Storage oil and preservatives used - SoftSeal, Denso etc. Nitrogen used for Turbine Rotors ☺	When item Catalogue Number is created the storage requirements are specified. Vast majority of BSL Spares are undercover. Also supplier advice ☺
What systems are used to manage costs from Rotables?	Often users watch. Annual material reviews 😐	Documented quote Requirement - HoursXrate, List of parts, subcontract details	Could use SAP. No Timeline to conduct audit ☹	Assessment of Quotes from vendor. Repair cost history in SAP 😐
How are reliability improvement ideas implemented and change control managed?	Improvement teams ☺	Formal Meetings CI register updated at weekly meetings	Plant Modification System- Detailed electronic system - multiple sign off - acceptance checks on completion ☺	Each Business unit has Reliability Engineers as well as section maintenance. Change management on Documentum ☺
How are suppler inspections managed?	Not sure. Have not been involved	Dedicated team but insufficient resource	Again on more critical components only quality inspectors ☺	IMO & Performance reviews. Vendor visit assessments are used - Check lists fro vendor visits (An improve opportunity) 😐
What Rotable Management KPI's are used?	Adherence to delivery reporting. Missing material reports ☺	On Time Delivery Work in progress Reports Cost savings provided	None used at present 😐	KPI's are on repairer not on individual jobs - DP, Quality non conformances, Improvement ideas, customer surveys 😐

Rotables Management	Newcrest Mining	CSR Bradford	Qenos	Sydney Water	HWC Northparkes
What CMMS/ Inventory management system is used for rotables?	Pronto ☹	SAP ☺	SAP ☺	Maximo	Ellipse
What are your most important equipment types for Rotable Management?	Gearboxes, Electric motors ☺	Electric Motors, Pumps ☺	Pumps, Electric Motors, Gearboxes, Valves (safety)	Pumps, Motors, Valves	Sewer pump, Motors, Telemetry
What identification/tagging systems do you use for rotables?	Disposal Repairable 😐	For Repair" tag 'OK to Use' tag 😐	Some items stamped - Most with only a location ID 😐	Quality system	None, Serial No's
Who are your best overhaul service providers (in-house-external)?	External (no in-house facilities) 😐	Both - depends on resources ☺	Safety Valves - Tyco Some items in-house Pumps - ? ☺	Walters Maintenance Prolec All work external	No in-house capacity
How do you specify Strip & Inspect/Overhaul requirements?	Poorly scripted S&I sheets Poor process ☹	Not specified besides 'Repair' ☹	Valves & Motor - Overhaul Spec Pumps -Strip/ Inspect/ Quote 😐	Quotes Inspections carried by staff	No formal system
What QA is carried out on rotables at Suppliers/ at receipt by stores/ at installation?	Site visits Vendor inspections & QA 😐	None ☹	Some site visits Most supplier review is SH&E related 😐	Vendor site inspection not formal	Visual inspection by HWC
What information do you specify for overhaul reports?	Very little at this time ☹	None Specified ☹	Quote on repair ☹	Reports on CD with Pics electronic Written report	Limited - Accept supplier format
What approaches are use to ensure rotable items are stored correctly?	Tradesman responsibility. Only applier to major components 😐	Gearboxes filled (onsite) with preserving oil, Motors Rotated 😐	Limited 😐	Stored in critical inventory store by staff. Overseen by operations	Limited spares kept
What systems are used to manage costs from Rotables?	Review of Quotations Comparisons to other similar work ☺	Mp system in place ☹	☹	Managed by coordinators & operations. Review of previous work done (database)	-
How are reliability improvement ideas implemented and change control managed?	Engineering change process Reliability engineering Business improvement process ☺	No system in place for either ☹	AD-Hoc ☹	Within meetings held by client	Ad Hoc
How are suppler inspections managed?	Site inspections 😐	Currently do not inspect vendor site ☹	Limited inspections ☹	Site inspections & off site meetings	As required
What Rotable Management KPI's are used?	Nil ☹	None ☹	☹	KPI's used - Downtime, Unit of work, turnaround time, outage report, supplier progress report	Some high level Mainly for internal processes

Issues for Discussion

The below list of items were identified for discussion in the Meeting.

- Tags from Tagging System information for rotable management
- Procedures/processes for management/tracking of repair/overhaul of rotables
- Procedures/processes for management of scope/cost for repairs/overhauls
- Procedures/processes for management of priority/completion dates
- Example of strip & inspect reports and overhauls feedback reports
- Examples of overhaul procedures
- Procedures/processes for Quality Assurance of repair/overhaul of rotables
- Experiences with reliability increase by modifications/improvement during repair/overhaul
- Procedures/processes for inspect during repair/overhaul of rotables
- Experience on in-house vs outsourcing for repair/overhaul of rotables
- Procedures/processes for auditing/assessing repair/overhaul suppliers
- Experiences with computer and other systems to help manage/track rotables
- What KPI's do you use to help manage rotables

Management of Rotables

IMRt Member - Issues with Rotables Management

Discussions with NSW IMRt key member contacts had identified a number of real life problems with keeping track of rotables. Some examples of worst case experiences were:-

- A maintenance planner went looking for a rotable gearbox that was required for installation. It was found under a tree where it had sat unrepaired for a number of years after it was removed from service.
- A shift fitter complained that there were no rotable valves of a specific type in the store. When investigated it was found there were more than half a dozen of the unrepaired valves in the back of the fitter's truck, which he had neglected to return to the store to enable repair.
- A critical rotable motor was required for urgent installation and was eventually located in the yard of a motor repair shop, where it had been for over two years with no one following up on the required repair (lost within the system).
- A rotable pump was identified as having serious problems and was scheduled for replacement. After the pump from the spares system was installed, it was found that the spare pump had not been repaired and was in worse condition than the pump that had just been removed.
- A complex drive system was removed due to a specific wear issue and sent to be overhauled. The item was stripped measured/checked and all the bearings were replaced on reassembly at great expense. The only thing that was not repaired was the specific wear issue that the item was removed for.

Other issues mentioned by members where the costs associated with repair of rotables and the problem of early failure of repaired rotables due to poor repair QA or storage issues.

Tracking of Rotables

A number of members were using tagging systems that identified rotable equipment and distinguish its status within the rotable repair and storage process. Examples of tags from PWCS were tabled. The system for these particular tags was that rotables items that were not installed were tagged for either FOR REPAIR or SERVICEABLE.

Figure 1 Port Waratah Coal Services Rotable Tags

A number of attendee members used FOR REPAIR tags. These tags identify the key information related to the item, such as Work Order Number and Purchase Order Number and date, to reduce the chance the item might get lost or confused with another item. Another information field that is useful to have on a FOR REPAIR tag is why the item was removed,

symptoms of the problem, known faults or similar to indicate to the repairing organization any special focus for the repair activity. With the PWCS tags this type of field is included in the SERVICEABLE TAG as it is also useful for the person managing the installation of a Rotable to know the history, especially if the Rotable has not been repaired (removed and assessed as serviceable). Newcrest included an R prefix on the item numbers if it was a repaired item rather than new.

Qenos used location codes on some specialized rotables such as Safety Valves where the item was setup for a specific application (pressure setting) and would have to be readjusted and tested if it had to be used for another location with the same physical valve. There may be a number of application where the same equipment items is setup differently for different locations and so it needs to be identified what the current setup of the item is.

Bluescope Steel is using a Bar Coded tagging system for their stores. This system is working successfully with Bar Coded Sticky Tags applied onto a galvanized plate that is cable tied onto the item when an item comes into the store. There are some minor problems with loss of tags but this is not a significant issue. The tags are generated new each repair cycle rather than retained on equipment in service.

Questions were asked about the use of Bar Coding and Radio Frequency devices to identify individual equipment items while in-service and during repair and storage. None of the attendee organisations were using Bar Coding or any of the more advanced systems to identify in-service items of equipment. Sydney Water had considered bar coding but the number of items required to be identified was thought too big and the worry of missing bar codes too difficult to manage. Other comments backed up the difficulty of maintaining bar codes on equipment in heavy industry environments. Newcrest Mining was using the Data Dot system for equipment security/theft control. It was suggested that the same system could be used for spares management but was suggested to start on high value rotable items first.

Individual Equipment Item Tracking

Most CMMS systems allow tracking the equipment history. This enables the identification of the location and repair/overhaul history of a particular rotable. The identification is usually done through serial numbers stamped or solidly attached onto the item. The original manufacturer’s serial number is typically used. The PWCS SERVICEABLE TAG in Figure 1 allows the collection of the old and new equipment serial numbers when a Rotable Item is installed.

Even though most CMMS systems allow the tracking of full equipment history, it is unusual for the functionality to be used. Most sites systems only focus on the equipment location and not on the identity of the equipment in the location. This was suggested to be due to the extra workload that it places on maintenance planners to consistently collect and record the required data over an extended period of time. If a system is started for a maintenance section it is easy to fall into disuse with changes in planning personnel. OneSteel suggested that they were considering the use of their CMMS for rotable tracking but only for higher cost/criticality items such as large gearboxes and motors. There was a suggested need to have some rules to define what items are worth tracking. There were a number of comments about

the need to identify the criticality of rotable equipment. Sydney Water is interested in rotable tracking systems and is attempting to use this functionality in Maximo CMMS. The issues they have are around numbering the equipment items and difficulty in getting the data collection & recording problems under control.

Another less formal approach to tracking items is to record Item Serial Numbers of equipment on work orders and then doing text searches for the serial numbers to identify item history.

Management of Repairs/Overhauls

Northparkes use work orders to identify what spares and materials are booked out on repairs/overhauls. Suppliers are linked into the CMMS and use the system. Tracking repair costs requires that discipline is used to record all cost to the work order.

Newcrest use OEM's such as Westrack and Atlas Copco to carry out the majority of Rotable overhauls and have had a very good experience with this. The repair/overhaul report supplied by Westrack is high quality and is supplied electronically.

Sydney Water has not had such a positive experience with OEM repair/overhauls. As they do some in-house as well as outsource some overhauls they can compare and have found that OEM's are more expensive. Sydney Water did have QA Inspectors that visited repair/overhaul suppliers. Since they have been eliminated there has developed a significant variation in the standard of repair/overhauls. There is an opportunity to better promote to management the benefits of reliability improvement opportunities such as better rotable management.

BOC perform many of the repair/overhauls in-house and has a rotating equipment specialist that has responsibility for this process. Typically OEM parts are used but due to cost and availability some parts are made locally with occasional reliability problems occurring.

When Qenos out-sources overhauls they include a repair specification. There are QA test specified on some items. Specifications are generic to specific equipment types. Some overhauls are strip and inspect to define the repair scope while other are just overhauls to a specification. In-house repairs are carried out as well but are generally not full overhauls. There is typically not a good repair history available for items.

Orica carries out overhaul of pumps in-house and has a reliability improvement program. For example oil seals have been converted to Viton to improve life. Orica has a good modification/change control system to help manage these changes. Orica uses inspection and test plans to manage QA issues especially for repairs associated with major outages.

The Bluescope attendees to the meeting where from the central procurement section. The steelworks have a huge range of rotable items from small gearboxes to $1M turbines. Most repair/overhauls are carried out by a core group of suppliers mostly from the Wollongong, Sydney and Newcastle areas. Recent had a major change in systems from SAP R2 to R3 and are still getting used to the new system. Most items go through a Strip & Inspect process and

even if the item is to be scrapped it is always returned to site. It is found more efficient to have the central procurement group go to visit the external suppliers rather than all the local maintenance personnel attempting to see visit the suppliers.

OneSteel used to give repair/overhaul suppliers repair procedures. Now it tries to give repair specifications focusing on the required condition of the item on return. Have a specification for pump overhauls. Whether an item goes through a Strip & Inspect or just goes for an overhaul is determined case by case. OneSteel have a number of preferred vendors so that relationships can be built up and the suppliers learn what is expected.

The attendee from RTCA (Rio Tinto Coal Australia) was from a recently formed a dedicated group that now has the responsibility for management of QA for repair/overhaul of equipment from outside suppliers. This approach is used as local maintenance personnel who are responsible for the rotables have not got the time to visit the service providers or develop repair/overhauls specifications. The approach being used comes from a practice that was developed by Rio Tinto in Western Australia over a number of years. The approach focuses of having repair/overhaul specifications that determine the required condition that the item must be returned in. The group has written a few specifications so far including a generic repair/overhaul specification. Specifications should include QA measurement such as bearing housing ovality measurements defined in data sheets and included in the specification (often suppliers have there own forms). Building these specifications requires significant input from a number of different sources. Specifications are generic to equipment types with appendix to cover non generic issues. The experience is that good repair/overhaul management is a significant reliability improvement opportunity. They can help eliminate equipment standard failure modes by building better relationship with the vendors and collecting their detailed observation data that can help identify problems and improvement opportunities. The approach also allows building proper business cases for improvement effort/expense.

Hunter Water has many in-service pumps and all overhauls are out-sourced, about 90% of which goes to one service provider. The maintenance history for the pump repairs and overhaul has not been well maintained. There are some good SCADA systems that allow collection of equipment starts and run hours. The attendee from Hunter Water previously worked as an engineering supervisor for a repair/overhaul workshop. It was not typical to be given a good overhaul specification and usually had to probe customers to determine what the repair/overhaul requirement was. These activities are a significant opportunity for RCA of equipment problems.

Newcrest uses the rule that a repair/overhaul is carried out if the cost is less than 70% of a new items. Newcrest have their personnel visit repair/overhaul suppliers to view and discuss work in progress, even if that requires long distance travel. Repair/overhaul suppliers are encouraged to assist with reliability improvements. An example is special submerged arc hard facing zones implemented to improve wear resistance.

There is a significant choice between replacing an equipment items rather than doing a repair /overhaul. There is usually a lot more choice between supplier and equipment specification if

an item is being replaced. Sometime the choice is driven by the urgency of supply delivery time requirement. It may be quicker to buy a replacement rotable if it is an off the shelf item. In other situations buying a new replacement has a long delivery time and a repair/overhaul, no matter how expensive, is the only viable option. In some situations a replacement items tends to have a higher reliability but if various failure modes have been eliminated or minimised a repair/overhauled item may have higher reliability.

A common theme was the requirement to limit the number of repair/overhaul suppliers for specific types of equipment. The supplier can then build their experience on this type of equipment and build a better understanding of the customers requirements. They can also have a significant input into building of the repair/overhaul specifications. Were there is a need for specialised measurement, QA testing systems and/or engineering resources, a service provider that has a regular supply of work can better justify this investment. Building personal relationships with the repair/overhaul supplier allows easier communication of requirements and generates more ownership of repair/overhaul quality issues and ensures the delivered item is more likely to be fit for purpose. The comment was made that vendor workshop personnel often love to have someone call in to discuss issues with work in process.

A key issue for management of rotable items is getting useful Strip & Inspect and overhaul reports from vendors. The ideal is to get electronic information including photos that can be stored as equipment history. The specification given to the suppliers should give the expectations for reporting requirements. The performance of a particular repair/overhaul supplier is often determined by the particular people and culture of the site. High staff turnover at the repairer's workshop can be a cause of concern. An example was given of the higher quality of reporting from the Wollongong David Brown gearbox workshop compared to their Newcastle workshop. The detail that is reported should include breakdowns of cost, quantity of parts used, machining costs and labour use for verification of cost effectiveness and for future comparisons. The more detail given on quotes and reports the more transparency and trust there is that you are not getting ripped off. With a history of this information it allows benchmarking. Some suppliers don't want to give these details but those who will, make better suppliers and are more likely to achieve efficiency and quality improvement over time. This type of data allows you to measure and control variation.

It was suggested that were Strip & Inspect work is carried out it tends to be easier to get the same supplier to do the repair/overhaul work. RTCA uses a system of getting three quotes from the strip and inspect report. A few of the larger organisations such as OneSteel and Sydney Water had some internal workshop resources. The major advantage of an internal workshop is that it is easier to coordinate and prioritise activities and also easier to carry out RCA investigations with building relationships with workshop personnel easier. You can also compare internal and external costs for similar or identical items. Sydney Water has noted when it started to outsource a significant percentage of its overhauls that cost went up $1,000 per item, which has now progressed to $3,000 extra. OneSteel often supplies parts for out-sourced repairs/overhauls rather than pay significantly higher mark-up rates from suppliers.

QA of repairs and overhauls was discussed. The worst case scenario was suggested that a supplier water blasts and paints an item such as a hydraulic valve and return as repaired. The

ideal is that the supplier performs Condition Monitoring or Performance Testing before an item is returned. Sydney Water indicated that they get tank test carried out on overhauled pumps to verify there condition.

There were a number of comments around the need for good change control systems that are timely and not too onerous. They must ensure that shopfloor ideas can be encouraged and implemented in an effective way. Document management was considered to be important and also to ensure that any modifications go through the required change control process and changes are updated on the drawings. It is important that workshops don't retain and reuse old drawings where there is a chance that they have been updated making the old drawing outdated. It was suggested that new drawings should be sent out with orders.

There was discussion around the role of central and local reliability engineers who have responsibility for setting priorities for improvement effort that includes setting standards and specification for off-line repairs/overhauls, associated QA, transport requirement and storage requirements. This role has the need for high quality maintenance equipment history data to be collected with good data on spares and rotables to help with inventory level decisions. Better inventory management was considered a significant opportunity.

One of the issues with management of rotables is the number of separate groups that can be involved in the repair/overhaul process. Typical groups would be maintenance planning, site maintenance crews, supply/procurement organisations, transport companies, repair service providers and stores organisations. The rolls and responsibility of theses groups related to rotables can vary. Also there is the likelihood of Silo effects with its limiting effect on communication and cooperation that have to be countered.

Storage of Rotables Items

OneSteel previously had storage issues with electric motors. They have now implemented motor circuit analysis CM in storage and a program of motor turning. The suggestion was made that large motors should be stored with their internal heater circuits operating to reduce moisture entry.

Sydney Water also has a program for inspecting and rotating its critical spares. They also have a management program around their emergency generators and diesel system to ensure they will operate when required.

Northparkes Mines have a recurring work order to rotate its spare large fans and gearboxes. There is also a specification implemented for using special preservative oil for gearboxes.

Rio Tinto Coal has the aim that when spares are returned from repair/overhaul suppliers they ready for long term storage. Theses requirements have to be a part of the overhaul specification.

Some of the protection systems discussed include the Enviropeel (thick spray on coating that sets like a think plastic), Tectle and other gearbox protection oils from Castrol and Shell,

Softseal green film protection system and Underwraps (a PVC bag/sheet that shrink wraps around components with an internal protective fluid film for protection).

Orica has high quality storage systems around major security spares such as turbine rotors that involves using nitrogen to seal and protect. Smaller items such as pumps etc have no special storage requirements implemented.

Orica don't have technical people in their store so they do not do quality inspection of received items. This was generally the case for most attendee organisations and it was thought best that QA checks be done at the suppliers.

There was discussion around some stores system (eg SAP 4.6) can help to enforce quality inspections of specific received items before they are stored. This would be worthwhile where the risk of quality problems is considered high or if there has been a history of QA problems. These inspections could be by local engineering or site personnel or by external specialists such as metallurgists. An example given of a problem that was found by inspection was a pump that had the incorrect diameter impellor.

Spares Management

Sydney Water have a large number of spares in service and classify groups of pumps together that are compatible and can be used to replace a failed item even if the replacements performance or efficiency is not ideal. They also have setup standards for many spares such as submersible pumps for items such as cable length, so a few types of rotable spares can be used in a wide range of applications. Sydney Water has an opportunity to improve spares management by improving the communication between its engineering teams and trades teams. They have an issue where the security on there maintenance data is set high for reasons of KPI security but this has the effect of making it difficult for maintenance people to update specification and equipment data.

Hunter Water has historically not kept spares of pumps, as each pump station location has redundancy. The only spares have tended to be items that have been made redundant. This can create a reactive environment especially under the pressure of trying to maintain no environmental discharges in wet weather. They also have standards for base plates and cable lengths for submersible pumps to allow quick changeover from a small group of spares types.

Orica has a system for sharing critical spares between their global sites. RTCA has run into problems where spares where shared between sites that have different lubrication specification. This issues need to be managed.

It is important to have KPI's for suppliers and one of the key ones is their ability to match the Required/Agreed delivery dates, "Stop the supplier delivery date bullshit". RTCA use a -3+3 automatic Quadran expedite system that is initiated 3 days before delivery is due and requests a fax back report if the delivery within 3 days is not achieved. Another approach used is to request a standard weekly work in progress report where the supplier has to identify what jobs have had their progress slip against the required delivery date.

Other Supplier KPI's used by Bluescope are number of Non-Conformances, Success in solving Non-Conformances, surveys of front line customers (suppliers need 75% approval). Another recommended approach is to have semi-formal visits to workshops with a standard check list that focuses of quality as well a safety and environmental issues.

Appendix

Bluescope Steel Example Documents shown on the following pages.

- Quality System Form – AC Motor Assessment Document
- Quality System Form – AC Motor No Load Test Document
- Rockwell Automation – Probable Cause Report
- Berendsen-Bluescope Steel Cylinder Repair Quotation
- Arrow Electrical – AC Repair Quotation Form

ARROW ELECTRICAL

Quality Endorsed Company

Australian Standard

QUALITY SYSTEM FORM

STAMP "QUOTE ONLY" IF QUOTE REQUIRED — QUOTE ONLY

STAMP "PROCEED" OR "SCRAP" WHEN AUTHORISED — PROCEED

STAMP "COMPLETED" — COMPLETED

AC MOTOR ASSESSMENT DOCUMENT

J/N LM100244

CUSTOMER BLUESCOPE CUSTOMER REF 4900002086

DATE 21-3-06 EQUIPMENT 150AOSOB MANUFACTURE WEG SERIAL No BK93155

FRAME S280S FOOT-~~FLANGE~~ FOOT/FLANGE RPM 1480

VOLTS 415 AMPS 149 KW 90 WINDING _____ ROTOR _____

EYE BOLT: MISSING ~~YES~~/NO, DAMAGED ~~YES~~/NO, COLLARED YES/~~NO~~, REPLACE ~~YES~~/NO

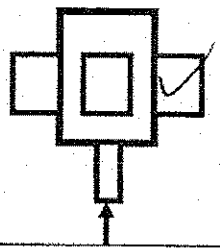
COUPLING FITTED: YES/NO, CABLE ENTRY TERMINAL BOX LOOKING FROM DE ~~LH~~, RH, ~~FSP~~.

GENERAL CONDITION VERY VERY DIRTY 1005810

MISSING PARTS _____

DAMAGED PARTS _____

		STATOR	ROTOR
MEGGER No 613	A TO EARTH	200M Ω	A TO EARTH
MEGGER 1000 VOLTS	B TO EARTH	200+M Ω	B TO EARTH
	C TO EARTH	200+M Ω	C TO EARTH
AMP TEMP °C 22	A-B	200+M Ω	A-B
	B-C	200+M Ω	B-C
	C-A	200+M Ω	C-A
METER No 313	A	0.01 Ω	A
PHASE RESISTANCE	B	0.01 Ω	B
	C	0.01 Ω	C



√ POSITION OF J/BOX

BRAKE TO EARTH:	RESISTANCE OHMS	RECTIFIER PASS/FAIL

THERMAL PROTECTORS CONTINUITY TEST 306 Ω (MUST NOT EXCEED 2.5 VOLTS)

ROTOR BAR TEST - YES/~~NO~~ PASS/~~FAIL~~ HIGH: 27.9 LOW: 27.8 (MAX OF 3% VARIATION)

ECCENTRICITY - DE 0.00 ODE 0.00 IN/MM MAX. RUN OUT NOT TO EXCEED .004"/0.1 mm

SHAFT CONDITION - DE - PASS/~~FAIL~~ ODE - PASS/~~FAIL~~ THREAD CONDITION – DE /ODE PASS/FAIL

SHAFT DIAMETER - DE 80 ~~IN~~/MM ODE 75 ~~IN~~/MM

TAPER GAUGE CHECK – DE PASS/FAIL ODE PASS/FAIL

KEYWAY CONDITION - DE PASS/~~FAIL~~ ODE PASS/~~FAIL~~

KEYSIZE - DE 50 X 22 X 8 ~~IN~~/MM ODE 45 X 20 X 7 ~~IN~~/MM

PHOTO TAKEN – ~~YES~~/NO STAMP MOTOR FRAME "X" = DE "—" = ODE YES/NO

FAN CONDITION – PASS/~~FAIL~~ FAN SEAT DIAMETER 75 ~~IN~~/MM

BEARING SIZE – DE NU319 STD / C 3 ODE 6316 STD / C 3 INNER _____ STD / C ___

BEARING SEAT DIAMETER DE 95 ~~IN~~/MM ODE 80 ~~IN~~/MM

ENDSHIELD BORE DIAMETER DE 200 ~~IN~~/MM ODE 170 ~~IN~~/MM

SEAL SIZE – DE _____ NDE - _____

STATOR WINDING CONDITION - PASS / ~~REWIND~~ LEADS – PASS / ~~REPLACE~~

ROTOR WINDING CONDITION - PASS/REWIND LEADS – PASS / REPLACE

STATOR ~~DIP~~/ SPRAY / VPI ROTOR – DIP / SPRAY / VPI

~~SLIP RINGS~~ – REPAIR / REPLACE / MACHINE

ALL PARTS IDENTIFIED WITH JOB NUMBER: YES/~~NO~~

REASON FOR FAILURE - 19" CLASS R/H

COMMENTS - ALL PARTS GRIT BLASTED

REPLACEMENTS/REPAIRS: 'A' CLASS OH, BEARINGS

ASSESSED BY - Karl

CHECKED BY - M.

QUOTATION: ~~YES~~/NO DATE: 22/3/07 E/M / FAX / PH QUOTED BY: [signature]

PROCEED: YES/NO SCRAP: YES/NO SCRAP RETURN TO CUSTOMER: YES/NO

ARROW ELECTRICAL

Quality Endorsed Company

Australian Standard

QUALITY SYSTEM FORM

AC MOTOR NO LOAD TEST DOCUMENT

DATE: 27 - 3 - 07

COMMENTS: _____

		STATOR	ROTOR
MEGGER No 513			
MEGGER 1000 VOLTS	A TO EARTH	400 M Ω	A TO EARTH
	B TO EARTH	1400 + MΩ	B TO EARTH
	C TO EARTH	1400 + MΩ	C TO EARTH
AMP TEMP °C 24	A-B	1400 + MΩ	A-B
	B-C	1400 + MΩ	B-C
	C-A	1400 + MΩ	C-A
METER No 513	A	0.01 Ω	A
PHASE RESISTANCE	B	0.01 Ω	B
	C	0.01 Ω	C

BRAKE WINDING TO EARTH:	RESISTANCE: OHMS

THIS SECTION TO BE COMPLETED IF NOT CARRIED OUT DURING ASSESSMENT

BROKEN ROTOR BAR TEST – YES/NO. HIGH: _____ LOW: _____

ECCENTRICITY – DE _____ ODE _____ BRAKE AIR GAP - _____ MM

20 MIN – NO LOAD TEST

PHASE CURRENT A 46.5 AMPS B 38.9 AMPS C 38.8 AMPS

MOTOR SPEED 1485 RPM OUTPUT OF GEARBOX _____ RPM

BEARING TEMPERATURE @ 10 MIN DE 26 °C NDE 28 °C

@ 20 MIN DE 29 °C NDE 32 °C

REMARKS: _____

ASSEMBLED BY - K. M. CHECKED BY _____

TESTED BY - G. D.

Status: Form 12342 - Archived
Current Step: This form has been Archived by Jimmy Johnstone

Customer Details
You may select up to three Customers. Enter a Surname and press tab or click on the search button to select a Customer.

Surname	Full Name	Phone	
Gasparinni	Vince Gasparinni	+61 2 4275 7522 Ext: 4544	
Johnstone	Jimmy Johnstone	+61 2 4275 3562	Clear
			Clear

Supply Return Details

Material Number	10058170
Equipment Number (if used)	150A0508
Item Description	MOTOR, AC: 90KW D280S 4P FT
Department	SLABMAKING
Cost Centre	10780500
Work/Standing Order	20035551
Work Order Created By	GASPARRINI VINCENZO
Contact Person	VINCE GASPARRINI
Contact Phone Number	42754544
Pickup Point	L19M
Quantity	1.000
Item Condition	○ Usable ◉ Unusable / Requires Repair
Pickup Is Required By	13 Mar 2007
Date To Be Repaired By	
Is this a Breakdown?	☐
Special Transport Required	
Does this Item contain Hazardous Material?	○ Yes ◉ No
What is Hazardous Material? MSDS?	
Brief Scope Of Damage/Repair (include relevant DRG numbers. Maximum 1000 characters)	Motor has very noisy bearings requires overhaul. NEW 150A0333
Select IMO	Jimmy Johnstone
Allocated To Driver	☑
Comments(Maximum 1000 characters)	DE INSTALLED. OK FOR IDC TO PICK UP. JJ Res 422523 In IDC 13/03 DM REQ # 2000150829. JJ. o/n 4900002086. JJ 541 TO BE DONE. JJ (DONE). JJ

Click here to attach a document

List of Attached Documents:

There is no attachment associated with this form.

Australian Remanufacturing Centre
Rockwell Automation Australia LTD
37 Chapman Street Blackburn,
Victoria, 3130
Australia. **Tel: +61 3 9896 0300** **Fax: +61 3 9890 7857**

Rockwell Automation

ATT: EXCELL

Probable Cause Report P/o# X0253 14

Customer: GMS Replenishment Stock

Report Date: 28/11/2005

Call No: R1008967

Order No: 4759811

Serviced by: T TUAN

Catalogue: 8960911

Unit Exchanged: NO

Date Code: -

1000037583

As Received Condition..

CLEAN, NO VISIBLE EXTERNAL DAMAGE

Series: - **Serial No: A/10625** **Firmware Revision: 6** **Hardware Revision: -**

What happened to your remanufactured unit:

1. **Your product was verified and tracked by a unique barcode serial number from the time it was received at our ISO9002 certified facility.**
2. **Warranty validation, previous repair history and symptoms from the customer were reviewed.**
3. **Visual inspection for physical damage, contamination, revision levels and initial power device checks were completed.**
4. **Your unit was thoroughly cleaned using the appropriate method, based on the product type.**
5. **Product Updates/Revisions - Rockwell Automation may determine that hardware and/or firmware changes which upgrade/improve overall performance or functionality are useful.**
6. **Replaced Component(s) (if necessary). Rockwell Automation uses only components that meet or exceed rigid Rockwell Automation quality standards. Rockwell Automation maintians copyrights of its intellectual property contained in its firmware. This copyright prohibits anyone from making unauthorised copies.**
7. **Full functional testing and/or full load testing (where applicable) were performed, as specified by Rockwell Automation design engineers. Engineering specified environmental and functional tests were performed as applicable.**
8. **Performed a Final inspection. A technician or inspector reviews the product updates, product revisions, enhancements, testing procedures and components installed.**
9. **Your product was placed in a specialty engineered container with an anti-static foam insert and depending upon the product, in an anti-static bag.**
10. **Upon completion, the unit was inspected and repackaged with 12 month warranty.**

Contact Details

Client Name: _____ **Phone No:** _____

Company: _____ **Fax No:** _____

For any queries pertaining to this report, please quote Call Number: R1008967

Australian Remanufacturing Centre

Rockwell Automation Australia LTD

37 Chapman Street Blackburn,
Victoria, 3130
Australia. **Tel: +61 3 9890 0300** **Fax: +61 3 9890 7857**

Rockwell Automation

Probable Cause Report

Components Replaced..

Sub Assy No	Component	PCB Ref	Incident Information
-	SWITCHING BOARD	-	COMPONENT FAULTY - REASON UNKNOWN
-	CASING	-	PHYSICAL DAMAGE
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-
-	-	-	-

Technicians Comments..

FAULT : WONT RUN MOTOR . REPLACED SWITCHING BOARD , COMM BOARD AND CASING . TESTED WITH MOTOR , TESTED OK

SERVICE DOCUMENTS USED (If applicable for this particular service)

Test Instruction: N/A **Work Instruction: N/A** **Repair Instruction: N/A**

OUTGOING ITEM DETAILS AND REVISON LEVELS

Series: - **Serial No: A/10625** **Firmware Revision: 6** **Hardware Revision: -**

Probable Cause Summary..

Probable Cause of item(s) Failure

FAULTY DRIVE DUE TO COMPONENTS FAULTY . THIS MAY DUE TO WEAR AND TEAR .

Probable cause accuracy is based on examination of the product and information accompanying the returned product. Rockwell Automation Australia LTD is not responsible for conclusions resulting from missing or incomplete data.

For any queries pertaining to this report, please quote Call Number: R1008967

Berendsen-BlueScope Steel Cylinder Repair Quotation

BlueScope Order	4900000508	Drawing Number	341065	Bore MM	280
Berendsen No	50072679			Stroke Lt	500
Cylinder Key	62A 1001102	Type	Hydraulic	Rod Dia	200
Suffix:	B	Cylinder Type	MILL		

Conditions	Work Performed	Quoted Price
1) Predismantling: Pressure Testing	☑	0.00
2) Dismantling: Inspection Report and Quote	☑	0.00
3) Reassemble:	☑	0.00
4) Rod Rechrome:	☑	
6) Rod Replace:	☐	
8) Replace Gland Bush:	☐	0.00
9) Hone Barrel	☐	
11) Strip, Hone and Rechrome Barel:	☑	
13) Replace Barrel:	☐	
15) Replace Trunnion:	☐	0.00
16) Reweld and Machine: Trunnion Pins	☐	0.00
17) Repair Piston: Bronze Overlay	☐	0.00
18) Replace Piston:	☐	0.00
19) Recondition: Cushion Spigot and Bore	☐	0.00
20) Reweld and Remachine: Endcap Spigot	☐	0.00
21) Seals and "O" Rings:	☑	0.00
22) Reweld and Remachine End Cap Spigot and O Ring Groove:	☐	0.00
23) Replace Tie Rod:	☑	
25) NDT Welds and Piston Ro	☑	0.00
26) Labour Hours	121.13	7,873.00
27) Other Work — BARREL SPIGOT REPAIR		0.00
28) Other Work — PISTON - WELD & M/C WEAR BAND GROOVE		0.00
29) Other Work — BARREL O/D MOUNTING SPIGOT - WELD & M/C		0.00
30) Other Work — FASTNERS & FITTINGS REPLACE		0.00
31) Other Work — SPOT FACE & TAP PORTS TO STANDARD		0.00
32) Other Work — GLAND BUSHES AND HOUSINGS POLISH		0.00
33) Other Work — MATERIALS		3,509.00
34) Other Work — SUBLET		2,275.00
35) Other Work — FACILITATION		171.00
36) Other Work — DATABASE		40.00
37) Other Work — FREIGHT		10.00
38) Other Work		0.00

Date Submitted for Approval :	31/08/2006	Quotation Value	$13,878.00
Estimated Working Days to Complete Repair from receipt	2	Cylinder Replacement Value	$21,975.00

BHP Authority to Proceed : _____ Dated : _____

ARROW ELECTRICAL

AC REPAIR QUOTATION FORM

TO: BLUESCOPE STEEL
ATTN: Jimmy Johnstone

DATE: 22/03/2007
FROM: Ray Gear

BLUESCOPE FAX No 02 4275 7327
BLUESCOPE REF: 4900002086

ARROW FAX No 02 4226 3904
ARROW REF:LM100244

EQUIPMENT No:150A0508 MANUFACTURER : WEG MODEL No : D280S/M
SERIAL No:BK93155 WINDING: SC KW:90 VOLTS: 415
RPM: 1480 MATERIAL No: 10058170

REWIND

ASSESSMENT	
DISMANTLE	
WINDING DETAILS	
BURNOUT OVEN	
REMOVE WINDINGS	
CORE TEST	
LAMINATION REPAIR	
REWIND	
VARNISH	
ASSEMBLE	
TEST	
PAINT	

OVERHAUL

ASSESSMENT	X
DISMANTLE	X
CLEAN	X
CHECK HOUSINGS	X
CHECK BEARING SEAT	X
OVERHAUL STATOR	X
OVERHAUL ROTOR	X
STATOR LEAD REPAIR	
VARNISH STATOR	X
ASSEMBLE	X
TEST	X
PAINT	X

BEARINGS
DE NU 319 C3
NDE 6316 C3

ROTOR

REBAR	
OVERHAUL SLIP RINGS	
SKIM SLIP RINGS	
OVERHAUL BRUSHGEAR	
REPLACE BRUSHGEAR	
VARNISH	
BALANCE	
TEST	

MECHANICAL

REPAIR BROKEN FOOT	
BALANCE ROTOR	
REPLACE SEAL	X
REPLACE BEARINGS	X
REPLACE GASKETS	X
GRIT BLAST	X

OTHER REPAIRS / REPLACEMENTS: Assess, Grit blast, Wash stator, Wash parts, Paint parts, Varnish stator, Replace gasket, Replace bearings, Replace seal, Assemble Test, Paint.

ASSESSMENT COST $490 + GST. REPAIR COST LESS ASSESSMENT $1433 + GST.

VALUE OF REPAIR $1923 + GST. REPLACEMENT COST: $4959 + GST

COMPLETION DATE :30/03/2007.

109 AUBURN STREET WOLLONGONG NSW AUSTRALIA 2500
PHONE : 02 4227 3088 FAX : 02 4226 3904
E – MAIL rgear@arrow-electrical.com.au