

**How to prolong the life of the railway
coupler system and make it safe up to
the next overhaul period?**

*InnoTrans
PREVIEW*

Welcome!



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Presenter



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Global Support Manager Dellner Service

Moderator

Introduction

- Dellner Background
- Preventive Maintenance
- Condition Assessment
- Specifying a Customized Overhaul
- Carrying out Overhaul
- Benefits of Working with Dellner
- Questions & Answers
- Short survey



Dellner Background



Company **HQ** in Falun,
Sweden



22 production and
service subsidiaries in
16 countries



More than **1100**
employees



Global market leader in
producing
**Train Connection
Systems**



Products for all train
applications



Dedicated solutions for
train builder, operators
and maintainers



Excellent global after
sale support



Dellner Background



Train Connection Systems

INTERMEDIATE SYSTEMS:

- Gangways
- Semi-permanent couplers
- Dampers
- Crash Energy Management



FRONT SYSTEMS:

- Automatic couplers
- Foldable Albert couplers
- Data Transmission Products
- Adapters
- Coupler Protection Products
- Dampers
- Crash Energy Management

Automatic Coupler



Overhaul

Preventive Maintenance



60 to 120 day service interval



Annual service interval



“Heavy” maintenance not until the **8-10 year** overhaul interval



Typically the first and third overhaul are a “light overhaul” with more scope included at the 2nd overhaul (a.k.a. the “mid-life overhaul”)

Condition Assessment



Disassembly



The first step to start the condition assessment is to schedule the teardown and evaluation 1 year before overhaul is due to start.



Ideally two couplers can be provided which have condition representative of the majority of the fleet.



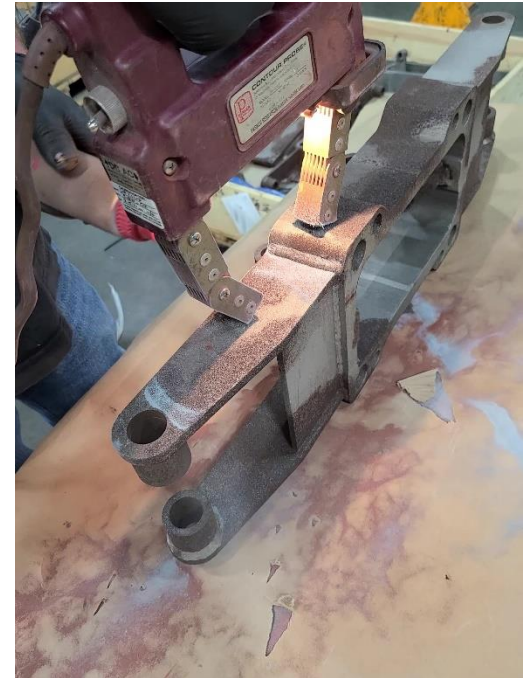
The coupler will be disassembled down to primary components.

Inspection



NDT

- Non-destructive testing is recommended to be performed as part of the condition assessment on the main load carrying components of the coupler.
- First the paint is stripped, and then mag-particle testing is used for ferrous parts, and liquid penetrant testing for non-ferrous parts.
- Checking for linear indications indicative of any cracks.
- Cracks are not common, but it is relatively inexpensive to perform and puts passenger safety first.



Functional Testing

Subassemblies with specific functional requirements would be tested if applicable:

- Pneumatic cylinders for electrical coupler actuation or automatic uncoupling.
- Electrical linear motors for the same functions.
- Valves, electrical heaters, etc.
- Regenerative crash energy management systems tested to ensure compliance.



Review report with customer



1. Executive Summary

Deliver performed an evaluation for overhaul of two automatic couplers, Deliver part number 1200044. These couplers were serial number 019 and 041 and were delivered in 2002. The purpose of this evaluation is to observe the condition of the couplers and identify the level of wear/damage to the equipment in order to specify an accurate overhaul strategy.

The evaluation consisted of the following procedures:

- Disassembly and cleaning
- Visual inspection for any damage or abnormal wear
- Mechanical inspection of critical features and wear surfaces
- Magnetic particle testing of critical parts for cracks
- Testing of the gas-hydraulic shock absorber
- Re-building the coupler in the as-received condition

Key observations:

- The ring springs in the buffer assemblies on both couplers were seized in a slightly compressed state, which was the cause of the play reported by Bombarter.
- No abnormal wear was observed, however some wear surfaces on some parts are beginning to approach the recommended replacement requirements. Mechanical inspection should be incorporated into the overhaul scope on these key components moving forward.
- Plastic and rubber items on the coupler are showing degradation and should be replaced.
- Nondestructive testing revealed linear indications in the coupler head, which could be indicative of a crack. This was noted.
- The gas hydraulic buffers are due for refurbishment.

Conclusions

Both couplers exhibited a loss of preload in the buffer assembly. This prevents the buffer from absorbing energy as intended and can produce decreased passage comfort and higher shock loading. The root cause of this was found to be that the ring springs were stuck in a slightly compressed state. Other rubber elements, such as the custom washers in the vertical support frame, and the rubber-spherical bearing in the pivot anchor, showed degradation and need to be replaced. This investigation is based on just two couplers from the fleet. It appears that the 10-year overhaul interval specified in the maintenance manual has not yet been performed. Routine overhaul is an essential part of maintenance to ensure that the couplers continue to operate in a safe and reliable manner. Overhaul should be carried out as soon as possible, and Deliner can provide a customized scope of work based upon the findings in this evaluation.



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2. Disassembly and Cleaning

The automatic couplers s/n 019 and 041 were received in the condition shown in Figure 1.



Figure 1: Photo of automatic coupler in received condition.

Both buffer assemblies were examined, and the reported play inside the buffer assembly inside the truck was investigated further. Overall, the paint system appeared to be holding up well, and there were no signs of severe corrosion. The couplers were relatively clean, and signs of grease could be seen at the grease fittings. The couplers were then disassembled down to primary components.

3. Visual Inspection

Visual inspection for any abnormal wear or damage was performed during and after disassembly. It was noted that both mechanical couplers are worn on the front face where the switch plunger makes contact. Photographs of this wear damage are included in Figure 2. This wear should be addressed by either weld repair, or a design upgrade to install a removable insert. Otherwise, the wear could result in transverse loading of the switch plunger or loss of function of the switch.



Figure 2: Photos of the wear in the front face of the mechanical coupler caused by the switch.



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When the MRP valve assembly was removed from the coupler, there was considerable wear on the tab of the seal holder which can be seen in Figure 3. This tab ensures that the seal holder and MRP remains secured in the coupler head. This should be replaced in the overhaul scope.



Figure 3: Wear on the tab of the seal holder.

Both buffer assemblies were examined, and the reported play inside the buffer was noticeable. Upon removing the buffer and ring spring assembly from the buffer tube, it was found that the ring springs were stuck in a compressed state. When struck with a rubber hammer from the side, they became 40% present on the buffer, which can be seen in Figure 4. During overhaul, ring springs should be replaced, and the corrosion on the buffer will have to be gently removed to allow for proper movement of the springs. Some buffers may need to have the part replaced.



Figure 4: Wear in the ring springs (left), as well as corrosion (right).

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4. Mechanical Inspection

Mechanical inspection was performed on the components of the automatic coupler to check for wear, with the results shown in Table 1.

Item No.	Description	Feature	Findings	Comments
18005-C	Coupler Head	Main bore	In tolerance	
		Front face wear	0.155 worn	see [1]
17680-C	Rotating Hook Plate	Opening	In tolerance	
		45mm bore	In tolerance	
		10mm bore	In tolerance	
15118-C	Coupling Link	Link wear	In tolerance	
18006-C	Main Pin	30mm bore	In tolerance	
175882-C	Bolt	Shaft Diameter	0.037 Oversize	see [1]
18110-C	Bearing Bracket	Face bore	0.037 Undersize	see [1]
180213-C	Thrust Pin	Thrust width	0.003 Oversize	see [1]
		Shaft Diameter	In tolerance	

Table 1: Mechanical inspection of Automatic Coupler components.

Detailed comments based on the mechanical inspection are as follows:
[1] These items are outside the tolerance for a new part, but are within the condemning limit for overhaul, meaning that they should be replaced. They are not to be re-used for another 8 years of service life.

5. Non-destructive Testing

Magnetic particle inspection per: to ASTM E1464 was performed on the following parts, with the results listed in Table 2. Additionally, the support bracket, which is aluminum, was tested with liquid penetrant and did not reveal any cracks.

Item No.	Description	Findings
18005-C	Coupler Head	see Figure 9
17680-C	Rotating Hook Plate	see Figure 9
15118-C	Coupling Link	see Figure 10
18110-C	Bearing Bracket	no cracks
180063-C	Buffer Tube	no cracks
180040-C	Bracket, Bear	no cracks
180040-C	Bracket, Bear	no cracks

Table 2: Magnetic particle inspection of Automatic Coupler components.

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7. Conclusions

The mechanical coupler head was in good overall condition, although the wear from the front face switch should be addressed by either weld repair, or by a design upgrade to implement a removable insert which will take the wear and can be easily replaced when needed.

The center-section of the coupler consists of a gas-hydraulic buffer and ring spring assembly inside the buffer tube. The ring springs were seized on both couplers, which could be a result of the lubrication ring springs should be replaced and any corrosion on the outside of the buffer should be removed. Any damage to the plating should be touched up with zinc-rich epoxy primer. The gas hydraulic buffers were tested by the OEM service center and found to still meet the required energy absorption. In order to guarantee this performance for another 10 years, they are recommended to be refurbished to replace the internal seals and hydraulic fluid.

The pivot anchor of the coupler showed aging in the rubber spherical bearing, which would be replaced during overhaul.

The vertical support and centering subassembly had damage on the rubber and plastic parts, which should have been replaced at the 10 year interval.

The electrical couplers were in good condition, with no damage or abnormal wear noticeable on the environment, is not uncommon to start to see degradation of the plastic conduit after 15-20 years in service, so replacing this should be considered for the upcoming overhaul. Additionally, Deliner would recommend replacing the contacts at this overhaul to prevent any electrical failures.

The pneumatic and electrical control subsystems showed typical wear for a coupler of this age, and considering the frequency of their contacts, as well as any possible other collisions with vehicles, couplers of this age of the equipment, it is recommended to perform NDT on the primary load-carrying components during overhaul.

Incorporating these recommendations into the next overhaul to start soon, along with typical overhaul scope of replacing bearings, spacers, plastic, rubber components, and fasteners, should allow the couplers to safely and reliably operate for another 10 years.

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Overhaul Specification



Bill of material identifies scope for every part



Overhaul description acts as the specification



Mandatory and On-Condition parts defined



Establish stock levels

Bill of Material

BOM LEVELS						Level	Where used No.	Where Used Rev	Where Used Description	Dwg Pos	Item No.	Item Description	Qty / Coupler	IPC Pos.	IBOM ID	Disassemble	Replace	Re-use	Mech. Inspection	Functional test	Strip Paint	NDT	Plating	Paint	Safety Critical	On Condition %	IBOM Revision		
0	1	2	3	4	5																								
						2	1000826	2	ELECTRIC COUPLER	29	5325008000	NUT M16M 8 A4	2	29	117		x												
						2	1000826	2	ELECTRIC COUPLER	30	5477053000	PLAIN WASHER	8	30	118		x												
						2	1000826	2	ELECTRIC COUPLER	31	5477064000	PLAIN WASHER	2	31	119		x												
						2	1000826	2	ELECTRIC COUPLER	32	5477084000	PLAIN WASHER	4	32	120		x												
						2	1000826	2	ELECTRIC COUPLER	33	5477105000	PLAIN WASHER A4 10.5X20X2	1	33	121		x												
						2	1000826	2	ELECTRIC COUPLER	34	5551061020	ROLL PIN FRP 6X20 A2 S.ST	2	34	122		x												
						2	1000826	2	ELECTRIC COUPLER	35	5582040020	COTTER PIN SP 4X20 A4	2	35	123		x												
						2	1000826	2	ELECTRIC COUPLER	36	5701106000	TREDO GROMMET M6 TM NR 106	8	36	124		x												
						2	1000826	2	ELECTRIC COUPLER	37	5701110000	TREDO GROMMET M10 TM NR 110	4	37	125		x												
						2	1000826	2	ELECTRIC COUPLER	38	5745024000	O-RINGTRESS DIA 2.4 NBR	1.03	38	126		x												
						2	1000826	2	ELECTRIC COUPLER	39	5490101000	LOCK WASHER VSKD 10	1	39	127		x												
						1	1000044	7	AUTO COUPLER GTW	2	1000865	DRAFT GEAR	1	2	128	x													
						2	1000865	2	DRAFT GEAR	1	1000848	STRUT	2	1	129	x													
						3	1000848	3	STRUT	1	1000849	SPRING CASING	2	1	130			x					x						
						3	1000848	3	STRUT	2	1000850	GUIDE SLEEVE	2	2	131			x								8%			
						3	1000848	3	STRUT	3	168466	JOINT HEAD	2	3	132		x												
						3	1000848	3	STRUT	4	5546804122	CUP SPRING 80X41X2,25	240	4	133		x												
						3	1000848	3	STRUT	5	1002236	ROD	2	5	134			x						x					
						3	1000848	3	STRUT	6	159093	DISC	2	6	135			x					x						
						3	1000848	3	STRUT	7	1002316	WASHER	2	7	136		x												
						3	1000848	3	STRUT	8	159921	CUSHION WASHER	2	8	137		x												
						3	1000848	3	STRUT	9	180171	CUSHIONING WASHER	2	9	138		x												
						3	1000848	3	STRUT	10	180172	WASHER	2	10	139		x												
						3	1000848	3	STRUT	11	5326022015	HEXAGON THIN NUT	2	11	140		x												
						3	1000848	3	STRUT	12	5345016000	NUT LOCK-KING M16 A4-80	2	12	141		x												
						3	1000848	3	STRUT	13	5657088000	RETAINING RING SB 88 (BR88)	2	13	142		x												
						2	1000865	2	DRAFT GEAR	2	1000864	BUFFER	1	2	143		x												
						3	1000864	1	BUFFER	1	1000764-C	HYDRAULIC BUFFER	1	1	144			x		x						x	4%		
						4	1000864	1	BUFFER	1	1000764-REFURB	HYDRAULIC BUFFER	1	1	145		x												
						3	1000864	1	BUFFER	2	1000833-C	BUFFER TUBE COMPLETE	1	2	146			x	x					x	x		2%		
						3	1000864	1	BUFFER	3	173275	RNG SPRING 250 KN	1	3	147		x												
						3	1000864	1	BUFFER	4	174863	SPHERICAL BEARING	1	4	148		x												

Overhaul Description

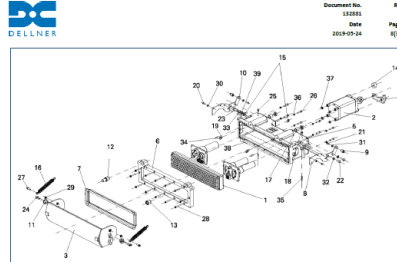
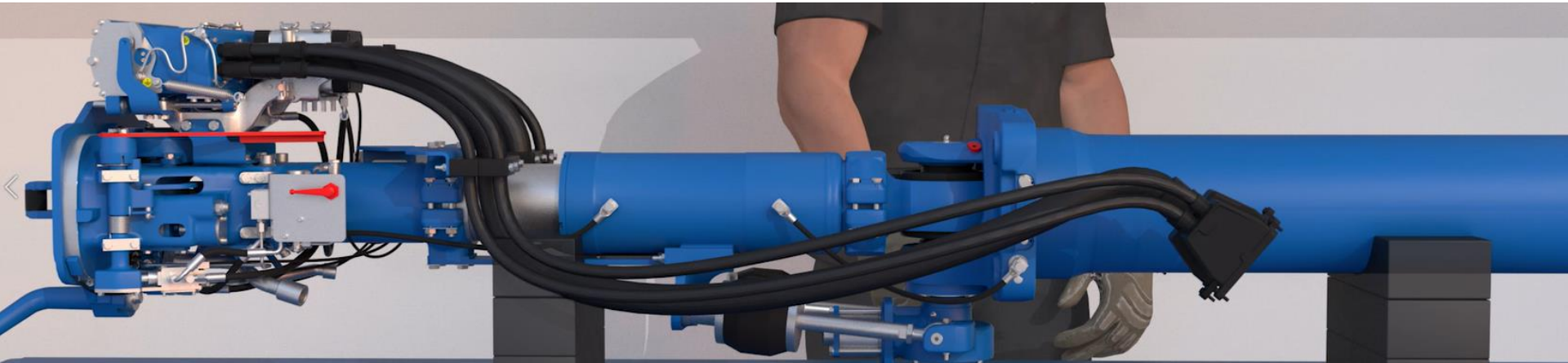


Figure 2. Electrical Coupler 1000826

Automatic Coupler



Overhaul

Mandatory vs On-Condition Parts



Mandatory Parts

Mandatory vs On-Condition Parts

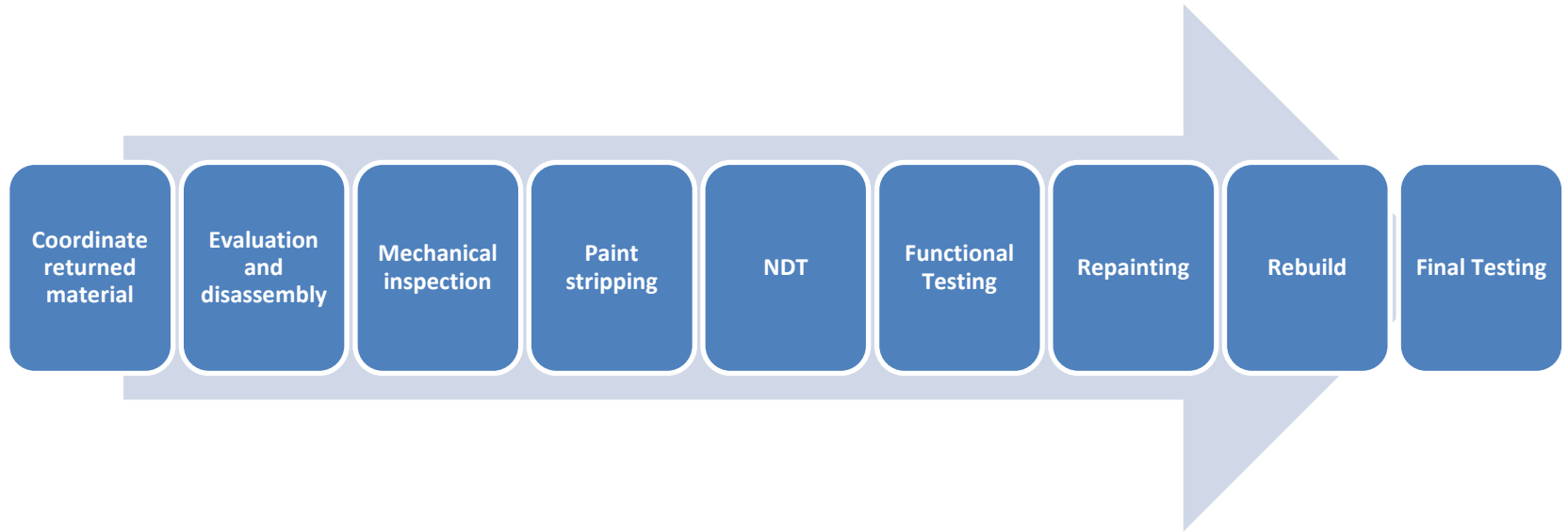


On-Condition Parts



Establish Stock Levels

Carrying out Overhaul



Coordinate Returned Material



B1503-FR

Fiche de réception clients ou filiales

Returned goods from customer or subsidiary

Information concernant la marchandise réceptionnée, quand le bien sera examiné / réparé / etc.
Information from goods **received** regarding when it will be examined / repaired / etc.

1. INFORMATIONS

Type de produit : Product	
Nom du projet /n° de garantie : Project name / warranty number .	
Número article : Part no.	
Quantité : Quantity	
Número Série : Serial no.	
Número de commande : Order number	
Description : Description	
Expéditeur : Sender	
Date de réception : Receiving date	
Emplacement de stockage : Storage place	
Récepteur : Receiver	

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B 1503 rev 4

RETURNERAT GODS FRÅN KUND ELLER DOTTERBOLAG RETURNED GOODS FROM CUSTOMER OR SUBSIDIARY

INFORMATION FRÅN GODSMOTTAGNINGEN ÅNGÅENDE GODS SOM SKALL UNDERSÖKAS /
REPARERAS / JUSTERAS ETC.
INFORMATION FROM GOODS RECEIVING DEPT. REGARDING GOODS THAT WILL BE
EXAMINED/REPAIRED/ADJUSTED ETC.

(DENNA BLANKETT LÄMNAS TILL ÅFTER SALES)
(THIS FORM SHALL BE GIVEN TO AFTER SALES)

Namn/Name (attention)	_____
Referens (project / warranty number)	_____
Benämning/Description (eg. coupler, draft gear etc.)	_____
Antal/Quantity	_____
Artikel nummer/Part no.	_____
Serie nummer / Serial no.	_____
Avsändare / Sender	_____
Hemkommet datum / Receiving date	_____
Lagerplats / Storage place	_____
Godsmottagare / Receiver	_____

B 1503-PL

RETURNED GOODS FROM CUSTOMER OR SUBSIDIARY ZWROT TOWARÓW POWIERZONYCH OD KLIENTA LUB JEDNOSTKI ZALEŻNEJ

INFORMATION FROM GOODS RECEIVING DEPT. REGARDING GOODS THAT WILL BE
EXAMINED/REPAIRED/ADJUSTED ETC.
INFORMACJE Z ODBIORU TOWARÓW POWIERZONYCH, KTÓRE NALEŻY ZWERYFIKOWAĆ / NAPRAWIĆ /
PRZEWADZIĆ RĘCZNIE I.TP.
(THIS FORM SHALL BE GIVEN TO AFTER SALES)
(NINIEJSZY FORMULARZ JEST PRZEKAZYWANY PO SPRZEDAŻY)

Name / Nazwa	_____
Referens / Numer referencyjny (project / warranty number) (numer projektu / gwarancja)	_____
Description / Opis (eg. coupler, draft gear etc.) (np. sprzęg, kociół itp.)	_____
Quantity / Ilość	_____
Part no. / Numer detalu	_____
Serial no. / Numer seryjny	_____
Sender / Nadawca	_____
Receive date / Data odbioru	_____
Store place / Lokalizacja	_____
Receiver / Odbiorca towarów	_____

Evaluation and disassembly



Mechanical Inspection





Paint Stripping



NDT Inspection Protocol

MBTA Green Line #8 Coupler

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Document Change Information

V00: Initial release.

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 Checked by:
 Updated:

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Document ID: 133372
 ©Date: 2019-06-13
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1 General

The following procedure outlines the components to be non-destructively tested during the overhaul of the MBTA Green Line #8 coupler equipment.

2 Component Preparation

- 2.1 Degrease and clean each component and document any general observations or anomalies.
- 2.2 Stamp the serial number of the mechanical coupler onto the components being tested.
- 2.3 Remove any paint, if applicable, according to USI 2137, Paint Removal During Overhaul.

3 Component Inspection

- 3.1 Conduct the non-destructive testing according to USI 3008, NDT Testing During Overhaul.
- 3.2 The reference illustrations in section 5 are meant to be used as an additional guide to highlight the areas on the components which should be examined.

4 Recording of Results

- 4.1 Indications found to not meet the acceptance criteria shall be marked on the part and the part shall be rejected.
- 4.2 A written test report shall be provided, indicating the serial number(s) of the parts tested and clearly identifying if they were accepted or rejected. Photographs shall be included in the report for any rejected parts, as well as a place for disposition by engineering.

5 Reference Illustrations

The following illustrations describe the part, part number and areas of the part to be magnetic particle inspected highlighted in yellow. Recommended areas to place the stamp for the serial number are also shown.



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5.1 Mechanical Coupler Head – Dellner P/N 169947-C

- Inspect the areas around the main pin bore and pinch bolt threaded flange as highlighted.

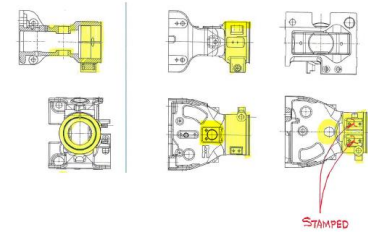


Figure 1 – Mechanical Coupler Head

5.2 Bearing Bracket – Dellner P/N 169983-C

- Inspect the areas around the pivot pin bore and mounting flange as highlighted.

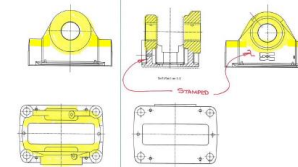


Figure 2 – Bearing Bracket

Repainting

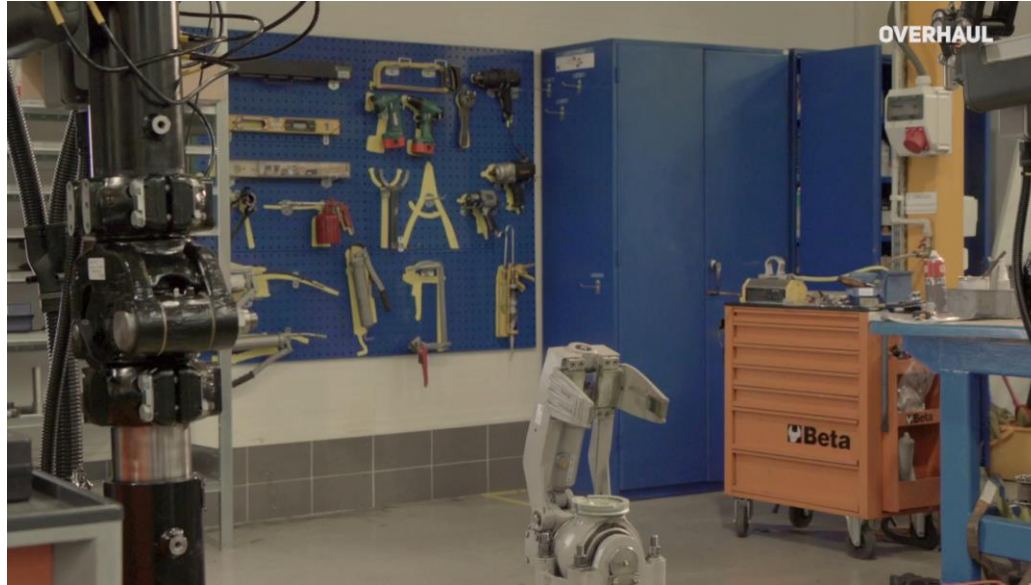
Before overhaul



After overhaul



Rebuild





Final pre-delivery testing

Quality doc package

USF 1003-1

CERTIFICATE OF CONFORMANCE

Customer Name: City of Charlotte AP
Customer Order Number: 17006664
Dellner Order Number: 000536103
Certification Date: 06-13-2019

Part Number	Description	Qty
1007146-04	AUTOMATIC COUPLER OVERHAUL SN: 004_035	2

Dellner, Inc. certifies that the product herein complies with contracted Customer Specifications and Dellner, Inc. quality standards. Material analysis and test reports are on file and will be made available upon Customer request.

DCUS Quality Approval: Peter Bowley



**Production / Preliminary Test
Serial delivery
Automatic coupler**

Document : D4-92161 Rev. 2 Serial no. : 004
 Coupler I.D.: Acc to type sign, item 18 on drawing nrc 1007146 Rev. J3
 DCAB project no. 0636/0698 Customer order no. : -

B101802 Page 1/3

- 1 Support adjusted to a 8.5" vertically /
Undersid justerad till 8.5" vertikalt
- 2 Mechanical and electrical function automatically and manually /
Mekanisk och elektrisk funktion automatiskt och manuellt
Control of mechanical and electrical coupling function by coupling and uncoupling the coupler.
Kontroll av mekanisk och elektrisk funktion genom koppling och losskoppling.
- 3 Checking of switches/Kontroll av givare
Function checked acc to circuit/pneumatic diagram
Pressure switch checked acc to circuit/pneumatic diagram
Limit switch checked acc. To circuit/pneumatic diagram
Funktionskontroll enligt kopplings-/pneumatiska schema
Funktionskontroll enligt kopplings-/pneumatiska schema
Gränsvärdskontroll enligt kopplings-/pneumatiska schema
- 4 Electric covers/ Elskåpshöl
The electric covers do not touch the contacts of opposite coupler
Elektriska skåpshöllemen kommer inte i kontakt med motsattstående kopplingskontakt
- 5 Linear actuator / Sällfilen
Proper and full stroke is achieved on linear actuator acc. to drawing 1007507
Korrekt och full slag erhålls från sällfilen enligt ritning 1007507.
- 6 Pinning bearing secured / Ledlager säkrat
- 7 Circuit test and cable connections according to B930 /
Översiktstest och kabelanslutningar enligt B930
Inspection card no B 930 filled in, signed and enclosed
Kontrollkort B 930 ifyllt och signerat
- 8 Ground stud free from paint and connected according to A1 415
Jordstiftet är fritt från färg och anslutet enligt A1 415
- 9 Special stickers and markings installed acc. drawing / Speciala
etiketter och märkning installerat enligt ritning.
DC-stickers mounted acc. to A1 0417
DC-etiketter monterade enligt A1 0417
- 10 Cables assembled according to drawing / photos / Kablar
monterade enligt ritning/foto

Result / Resultat	Sign
OK	<u>[Signature]</u>
OK	<u>[Signature]</u>
OK	<u>[Signature]</u>
OK	<u>[Signature]</u>
OK	<u>[Signature]</u>
OK	<u>[Signature]</u>
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OK	<u>[Signature]</u>
OK	<u>[Signature]</u>

**CLR
Testing & Inspection, Inc.**

3/16/2017 Report No. DEL-20171429-1
 Purchase Order # 5208908

Dellner, Inc.
 8334- H Arrowridge Blvd.
 Charlotte, NC, 28273
 Attn: John Russell

MAGNETIC PARTICLE INSPECTION REPORT			
Material type	CS	Part Size	Various
Standard: Customer information (No cracks)			
Procedure: CLR-SOP-MT-003 per ASTM E1444-11 Rev. 2			
METHOD			
<input checked="" type="checkbox"/> Dry	<input type="checkbox"/> Wet		
Particle Manufacturer:	Product:	Particle Batch No.	
<input checked="" type="checkbox"/> Megadyn	<input checked="" type="checkbox"/> BA Red Powder	100091	
	<input checked="" type="checkbox"/> LA Grey Powder	108027	
	<input checked="" type="checkbox"/> M7 Yellow Powder	114887	
Magnetic Field			
<input checked="" type="checkbox"/> Yes	<input type="checkbox"/> No		
	AC DC DC	Length/Inch: 2 Direction	
<input checked="" type="checkbox"/> Prober Probe (IDA-400)	5/2 10025	Field Verified by:	Pin Gauge
			Cal Date Date: 7-1-17
Quantity	Part Number	DESCRIPTION	RESULTS
	1007268	Coupler Head	Accepted
1	175718	Hook Plate	Accepted
1	151923	Coupling Link	Accepted
2	151945	Bridge Attachment	2 Accepted
1	1013462	Bearing Bracket	Rejected
1	1013467	Buffer Tube	Accepted
1	1008545	Camshaft Housing	Rejected
1	1008130	Support Arm	Accepted
2	1009884	Clamp	2 Accepted
1	1013676	Front Collar	Accepted
1	1007501	End Collar	Accepted

[Signature]
 Carlos Rodriguez
 AWS / CWI # 00049774
 ASNT - NDT Level II # 118071

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Ship to customer



Benefits of coupler overhaul with Dellner



One knowledge source

Upgrade or repair not replace



Minimize costs



Coupler's life time extension



Dellner engineering know-how



Flexible Concepts



Availability of Dellner genuine parts



Couplers updated to the latest technology



Highest quality service for all type of couplers



Dellner warranty

Questions & Answers

For further information please visit

www.dellner.com



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