AMB Chairlift Chair Failures

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4 June 2026

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AMB Chairlift overview

- 10 Chairlifts on AMB – Approximately 1600 chairs
- Chair failure is a reportable incident under Reg 23.4 (n)

Tumela	15E Footwall	Surface - 4 level
	15E Sub Incline	4- 10 level
	15E 6-20	6- 10 level
	30W Footwall	Surface - 4 level
	28W Sub Incline	4- 8 level
Dishaba	44E Footwall	Surface - 4 level
	44E Sub Incline	4- 9 level
	50E Footwall	Surface - 4 level
	50E Sub Incline	4- 7 level
	62E Footwall	Surface - 5 level

(n) **CHAIRLIFTS**

(i) Fracture or failure of any part or safety device of a chairlift installation which may have endangered persons or may have caused damage to such chairlift installation.

Chairlift Chair /Carrier | Failure and Interventions (2020 –2025)

12 March 2020
First carrier failure at 15E

15E – Sub-Incline Chairlift – Failure 1:

- Fatigue fracture initiating at the weld toe on the downpipe/seat-post region (loaded chair).

03 Apr 2020
NDT frequency reduced from Annually to 4-monthly

System Response Implemented

Maintenance Intervention:

- Intervention applied: NDT (MPI) frequency reduced to 4-monthly (i.e., inspections became more frequent).

12 Apr 2020
Imp Labs metallurgical analysis of 1st failure

IMP Labs Metallurgical Analysis Results:

- Lab results confirms fatigue loading failure, with no metallurgical or material deficiency.

27 Jul 2020
Monthly carrier visual inspection implemented

Additional Tactics Employed :

With the monthly EMRT rope inspection the chairs visually inspected for cracks.

SAP Job card amended.

August 2020
Engagement held with OEM

Discussion Points:

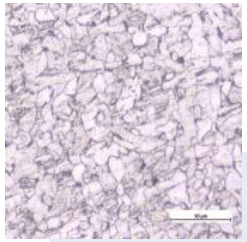
- Failures in industry
- Fatigue design life
- Serialisation
- QCP

15 Dec 2020
Second carrier failure at 30W

28W Sub-Incline Chairlift) Failure 2 :

- Failure identified: Similar fatigue fracture pattern to Failure 1 (unloaded chair).

02 Feb 2021
IMP Labs Metallurgical Analysis of 2nd Failure



IMP Labs Metallurgical Analysis Results:

- Confirms that this was the 4th industry failure seen by IMP Labs
- Fatigue failure, similar to failure 1
- No base material deficiency

30 Jul 2021
Independent Pr Eng. conduct strain gauge tests

Results 13 Sep '21:

- With standard nominal loading, fatigue life of ~1,15 to 3,48 years

Chairlift Chair /Carrier | Failure and Interventions (2020 –2025)

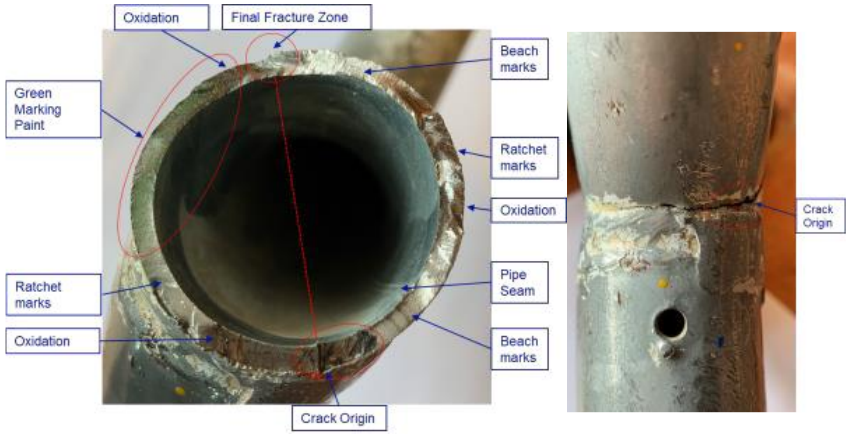
27 Sep 2021
Third carrier failure at 30W

→

29 Sep 2021
Reliability Improvement Plan
(Structural Intervention)

→

03 Nov 2023
Structural Improvement & Redesign
(DMPR Communique)



30W Surface Chairlift – Failure 3:

- Failure mode similar to the first two failures

NDT Date : 20 Aug 2021

Reliability Improvement Program (Structural Intervention):

Intervention applied: Chairlift Carrier Reliability Improvement Roadmap issued, consolidating failures and formally defining:

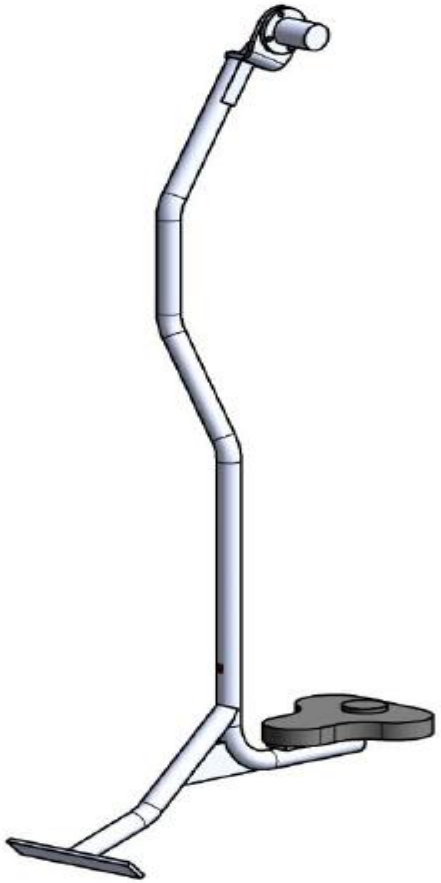
- Increased inspection (monthly NDTs proposed),
- Interim safety strapping/secondary retention concept,
- Serialization and data capture,
- Design review (hybrid Sareco/Scharf direction),
- Fleet replacement planning.
- Manufacturing QCP review & improvement
- OEM Chair Redesign Review

This marks the transition from “controls” to a formal improvement strategy.

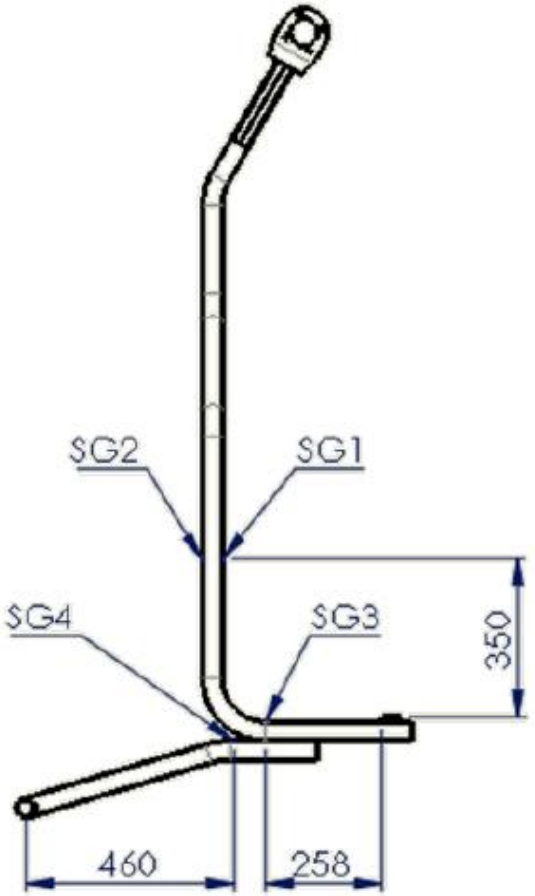
DMPR engagement on Structural Improvement (Chair Redesign) :

- Structural improvement: After failures, a design review and change was completed with OEM involvement, resulting in a new hybrid carrier design (Sareco + Scharf hybrid).
- Evidence lists due-diligence actions including 3rd-party evaluation/FEA, design compliance to SANS 273:2018, load testing, and a risk assessment for safe introduction/use.

Chair design changes



Legacy chair



New hybrid chair

MPI Guideline Developed – Rev1

Magnetic Particle Inspection Guidance on Chairlift Chair

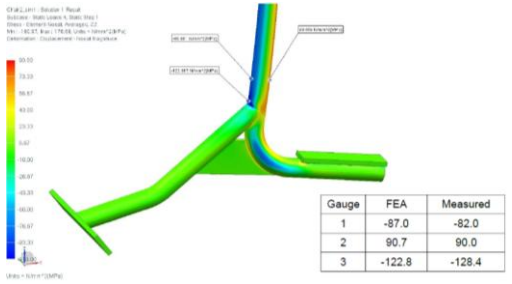
MPI Guidance

Magnetic Particle Inspection shall be conducted in line with the Amandelbult MPI procedure with the following additional guidance:

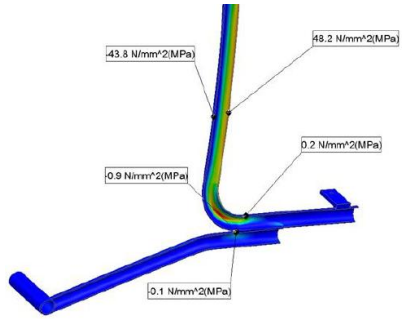
Surface preparation:
- The critical inspection areas should be cleaned from dirt and excessive layers of contrast paint. A single layer of contrast paint is thin enough to not impair detection sensitivity; however multiple layers of contrast paint can reduce sensitivity and periodic cleaning of this layer is therefore recommended.

Magnetization equipment:
- Indirect magnetization with permanent magnets are preferred due to practicality of placement of magnets on chair geometry, this method has been proven effective on typical cracks on chairlift carriers.
- Direct magnetization with ACFM yoke are allowed since this has proven effective on chairlift carriers also.

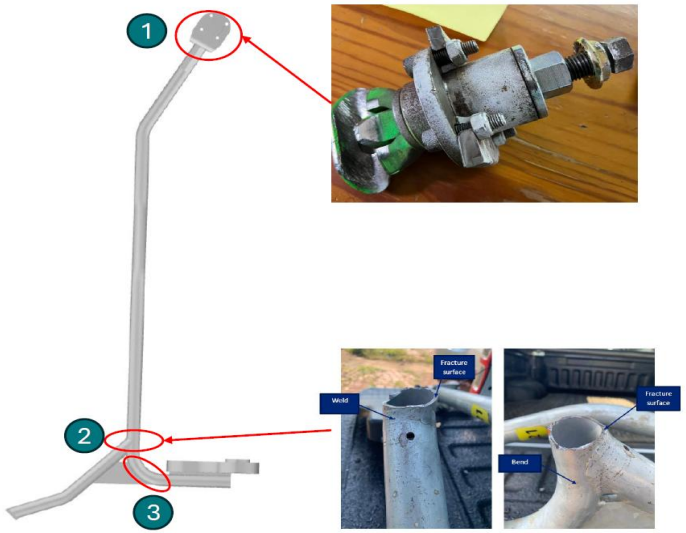
Detection media:
- White contrast paint with black magnetic particles in an oil based suspension is recommended for testing in brightly lit areas such as surface chairlift landings (500 Lux or more)
- Fluorescent magnetic media are preferred in areas with low light levels (20 Lux or less) such as underground landings where illumination levels can be reduced by switching off lights



Gauge	FEA	Measured
1	-87.0	-82.0
2	90.7	90.0
3	-122.8	-128.4



Legacy Chair Design

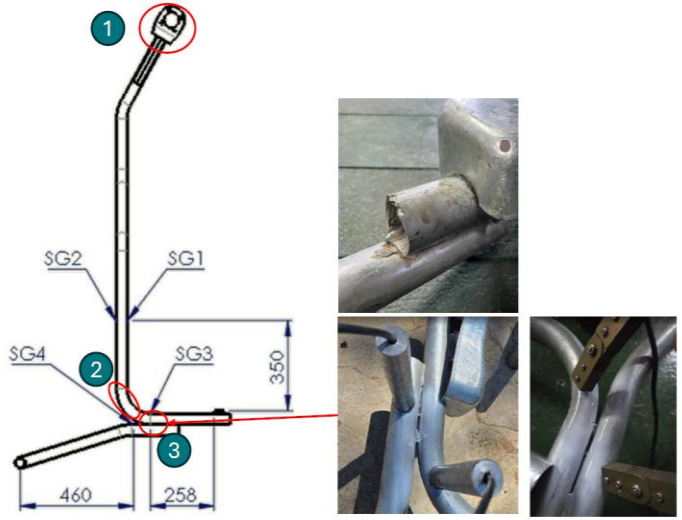


1 Rope grip mounting flange:
- inspect for cracks originating from bolt holes – crack originates at bolt hole and propagates to outer edge of flange
- Inspect fillet welds between pipe and flange/support angle/gusset plates

2 Footrest pipe weld
- inspect for cracks originating from weld root – critical area
- Weld propagates from weld in a transverse direction to the pipe

3 Main pipe bend towards seat
- Inspect area for cracks originating in high stress area – crack propagates in a transverse direction to the pipe

Hybrid Chair Design V1.0



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2 Main pipe bend towards seat
- Inspect area for cracks originating in high stress area – crack propagates in a transverse direction to the pipe

3 Footrest pipe weld
- inspect for cracks originating from weld root – critical area – **Chair must be placed on it's side to inspect effectively, inspect both sides**
- Weld propagates from weld in a transverse direction to the pipe

ACFM or permanent magnet may be used, place across area as shown to pick up transverse crack

Chairlift Chair /Carrier | Failure and Interventions (2020 –2025)

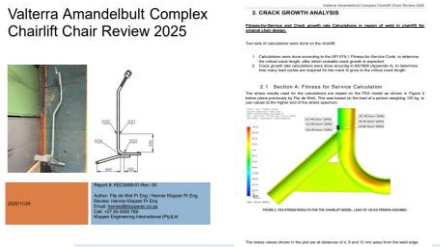
04 May 25
Fourth carrier failure at 15E

4/15 Chairlift – Chair detaches from carrier :

No Failure since Sep ’21

- Failure mode is similar to the initial failure.
- Immediate controls applied: NDT scheduled for the following day across remaining chairs; failure linked to legacy design.

Apr – Nov ‘25
Strain Gauge Comparison Test



Independent PrEng Services Reengaged: In collaboration with Principal Mech Eng. :

- Re-evaluate previous fatigue life calculation for hybrid chairs
- Conduct strain gauge measurements on 15 SI Chairlift and 30 West Chairlift to compare stress cycles.
- Calculate the critical crack length, as well as crack growth rate to validate required NDT frequency. 4months for 6mm
- Investigation initiated and funded by Amandelbult

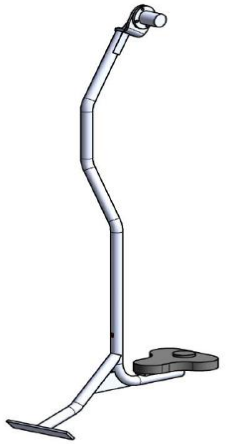
28 Jul 25
Fifth carrier failure at 15E

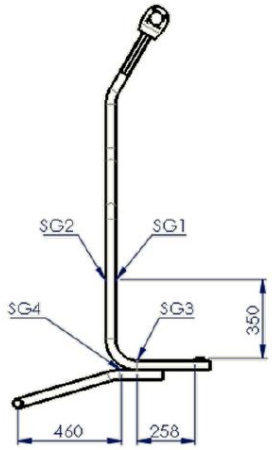
15E – 15SI Chairlift – New-design chair seat failure at Weld:

Failure Concern :

- New seat design to mitigate chair failure failed, 15 months in service
- NDT had been done 5 days earlier with no defects recorded,

Chair Failures





Repeat failure

- 1 December 2025 chair failure whilst employee boarded the chair
- NDT's conducted 12 days prior the incident
- Explored alternative NDT methods
  - White contrast with permanent magnet
  - Phased array
  - X-Ray
  - Fluorescent particles with AC yoke
- DMPR investigation and instruction issued

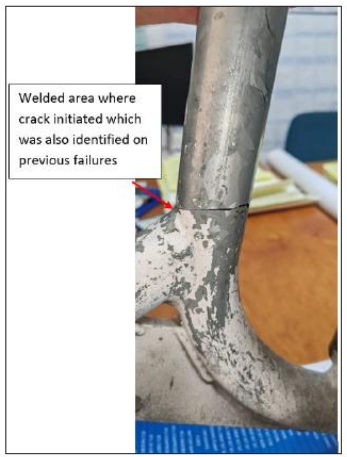


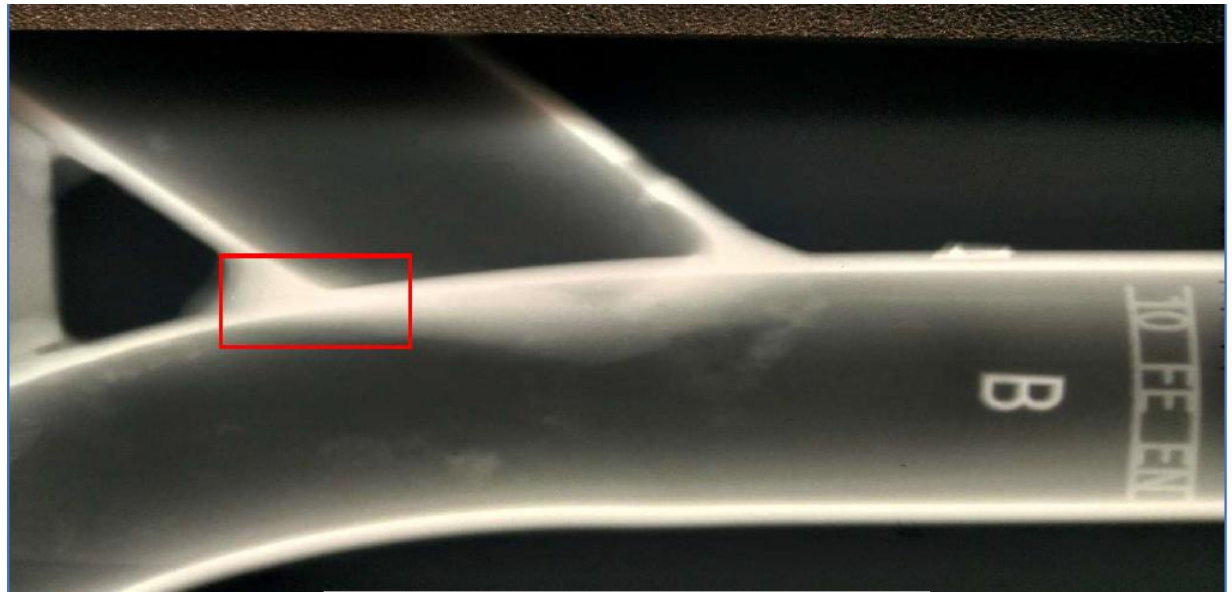
Figure 1: Failure Zone at Tubular Frame Weld
Shows the welded interface where the crack initiated, consistent with previous failures on similar chair designs.

Figure 2: Rust and Water Ingress at Crack Origin
Internal corrosion and rust streaking confirming long-term crack propagation and moisture penetration inside the tubular frame.

NDT - X-Ray tests

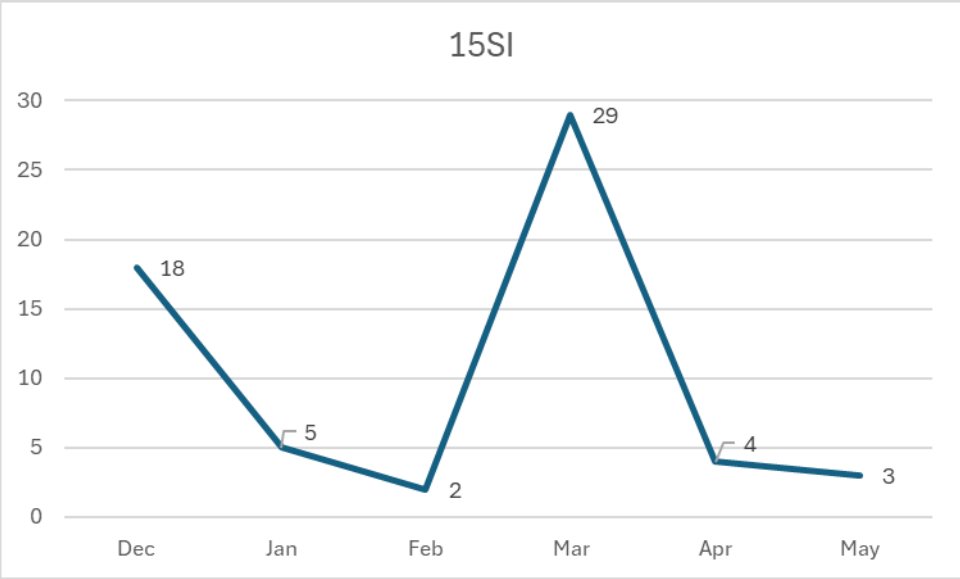
- Samples of chairs tested
- Defects observed:
  - Poor fabrication practices
  - Poor welding quality

Pipe cut short – filled with welding



Lack of Fusion

NDT - Fluorescent particle with AC yoke



- First fluorescent with AC yoke test done in Dec25 – 18 chairs failed
- To date – 61 chairs discarded on specific chairlift

Fig 17: Chairlift No: 112
Crack like indications noted.

Fig 3: Chairlift No: SI/43
Crack like indications noted.

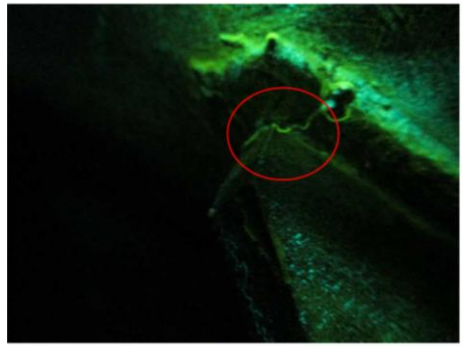


Fig 4: Chairlift No: Carrier SI/149
Crack like indications noted.

Fig 16: Chairlift No: 46
Cold lap indications noted.

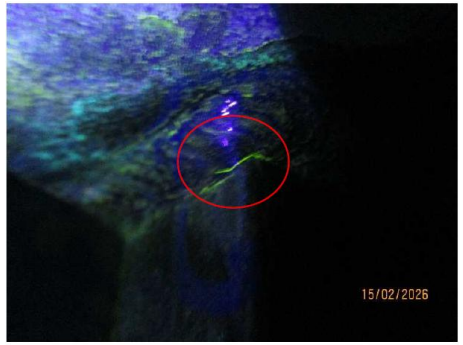


Fig 1: Chairlift No: FW/60
Crack like indications noted.

MPI Guideline Developed – Rev2

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UNCLASSIFIED

To Amandelbult Mining Engineering and Maintenance

From Christiaan Weilbach – Principal Mechanical Engineer

Date 17/12/2025

Subject Guideline for Non-Destructive Testing of Chairlift Carriers Revision 2

1. Introduction

Chairlift Carriers are required to be inspected periodically to ensure that they are in a safe condition. Part of the periodic inspection requirements is non-destructive testing (NDT) through Magnetic Particle Inspection (MPI) to identify early onset of fatigue cracks.

This technical note is to provide guidance to NDT technicians when conducting MPI on chairlift carriers to increase effectiveness of the process. This Revision 2 is an update to the guideline, following practical evaluation of the various MPI methods to select the most effective method for the application. Investigation into the available NDT methods is currently being led by the OEM, and any relevant learnings will be incorporated into future revisions of this guideline.

2. Guidance

MPI's shall be conducted in accordance with the Amandelbult procedure AMB-TEC-ENG-PRO-001 Magnetic Particle Inspection with the following additional recommendations:

2.1. Surface preparation:

The critical inspection areas should be cleaned from dirt and excessive layers of contrast paint. A single layer of contrast paint is thin enough to not impair detection sensitivity; however multiple layers of contrast paint can reduce sensitivity and periodic cleaning of this layer is therefore recommended.

2.2. Magnetization equipment:

Direct magnetization with an AC yoke has proven the most effective on typical cracks on chairlift carriers.

Indirect magnetization with permanent magnets is not recommended.

2.3. Detection media:

White contrast paint with black magnetic particles in an oil-based suspension is recommended for testing in brightly lit areas such as surface chairlift landings, where no practical means of lowering the light levels are available.

Fluorescent magnetic media are preferred in areas with low light levels, such as underground landings where illumination levels can be reduced by switching off lights. Although guidance is

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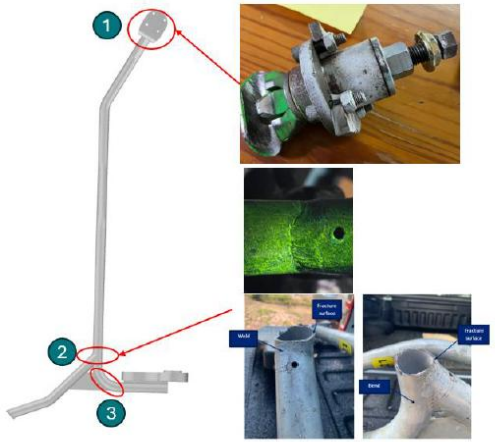
provided here, it remains the prerogative of the NDT inspector to select the detection media best suited for the environment where the testing will be performed.

2.4. Legacy (Old Scharf) Chair Design

The following critical positions should be inspected with emphasis on welded and bolted connections:



1. Rope grip mounting flange:
   - Inspect for cracks originating form bolt holes – crack originates at bolt hole and propagates to outer edge of flange
   - Inspect fillet welds between pipe and flange/support angle/gusset plates
2. Footrest pipe weld
   - Inspect for cracks originating from weld root – critical area
   - Weld propagates from weld in a transverse direction to the pipe
3. Main pipe bend towards seat
   - Inspect area for cracks originating in high stress area – crack propagates in a transverse direction to the pipe

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2.5. Hybrid Chair Design

The following critical positions should be inspected with emphasis on welded and bolted connections:

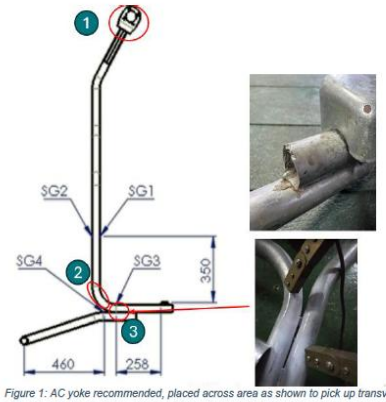
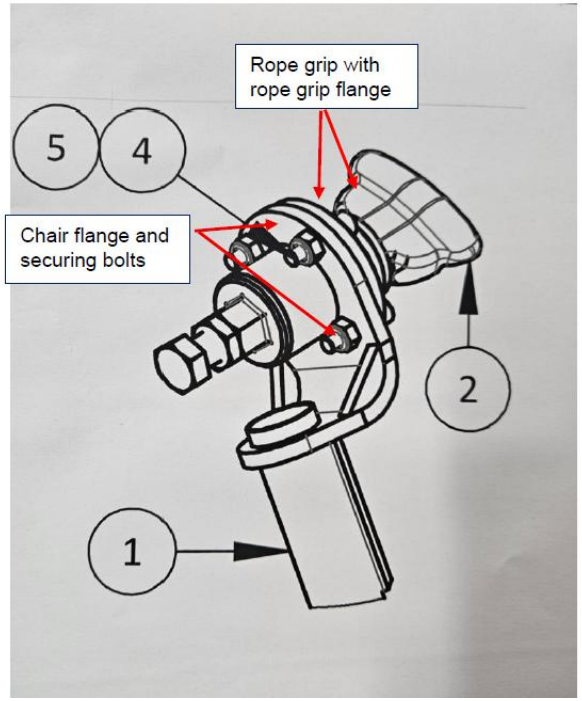


Figure 1: AC yoke recommended, placed across area as shown to pick up transverse crack

1. Rope grip mounting flange:
   - Inspect for cracks originating form bolt holes – crack originates at bolt hole and propagates to outer edge of flange
   - Inspect fillet welds between pipe and flange/support angle/gusset plates
2. Main pipe bend towards seat
   - Inspect area for cracks originating in high stress area – crack propagates in a transverse direction to the pipe
3. Footrest pipe weld
   - Inspect for cracks originating from weld root – critical area – Chair to be placed on its side to inspect effectively, inspect both sides
   - Weld propagates from weld in a transverse direction to the pipe

Rope Grip attaching flange failure

- 24 March 2026 chair failure at rope grip area
- Visual inspection on all chairs for cracks at the rope grip area – None identified
- Inspected the rope grip bolts to be tight – 5 chairs identified with some loose bolts
- Removal of the chair from the rope grip for access for proper NDT



5 chairs with loose bolts

NDT on rope grip area

Executive Summary:
This report presents the inspection results of the 15 East Sub-incline chairlift rope grip attachment NDT as listed below.

- Fluorescent Magnetic Particle Testing
- Visual inspection

Recommendation:

- It is recommended that the chairlift chairs that failed the NDT inspection be removed from service.

Limitations:

- The presence of a galvanized coating on the chairlift chairs may adversely affect the sensitivity of the Magnetic Particle Inspection (MPI) process, as the coating can mask surface indications and reduce magnetic flux leakage at discontinuities.

Inspection Summary:

- Total chairs tested: 179
- Total chairs to be monitored: 0
- Total chairs that failed: 21

- Total stretcher carriers tested: 4
- Total stretcher carriers to be monitored: 0
- Total stretcher carriers that failed: 1

- Total buckets tested: 1
- Total buckets to be monitored: 1
- Total buckets that failed: 0

- See report for details.

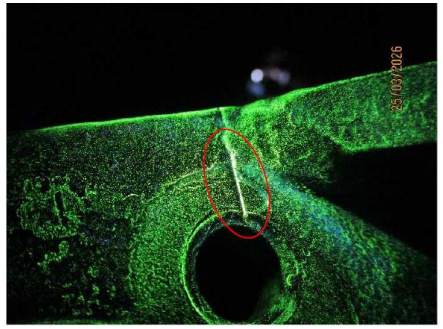


Fig 19: Chairlift No: SI/98
Crack like indications noted.

Fig 20: Chairlift No: SI/21
Crack like indications noted.

Fig 3: Chairlift No: SI/106
Crack like indications noted.

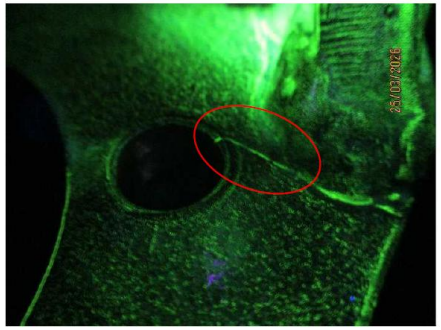


Fig 5: Chairlift No: SI/18
Crack like indications noted.

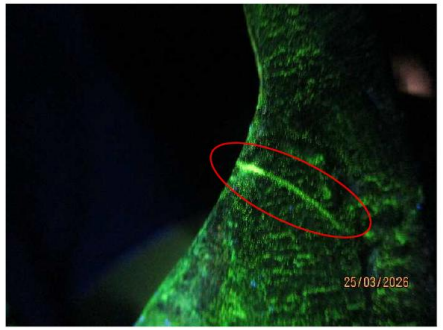


Fig 9: Stretcher Carrier No: SI/141
Crack like indications noted.

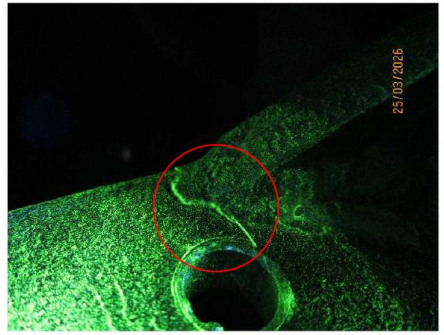


Fig 2: Chairlift No: SI/112
Crack like indications noted.

Fig 15: Chairlift No: SI/17
Crack like indications noted.

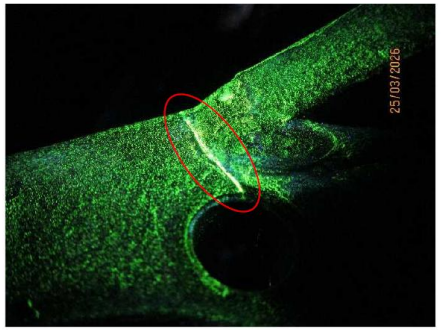
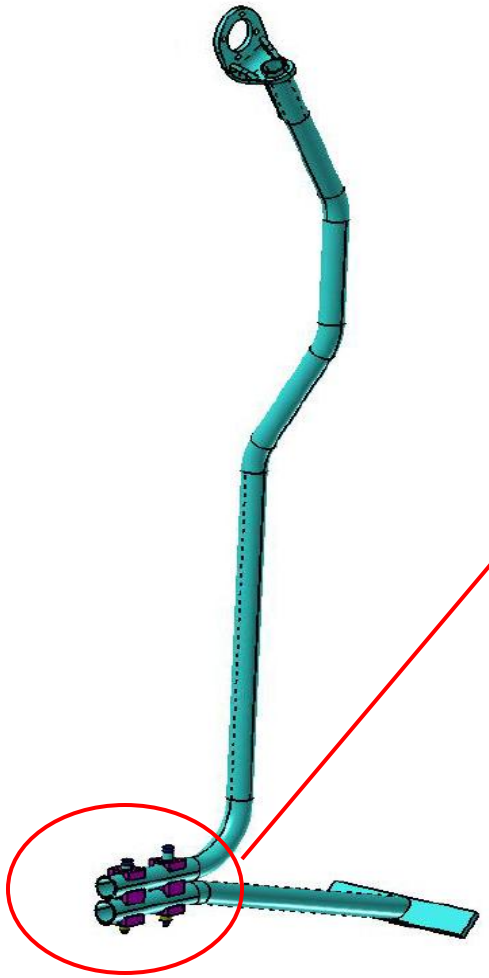


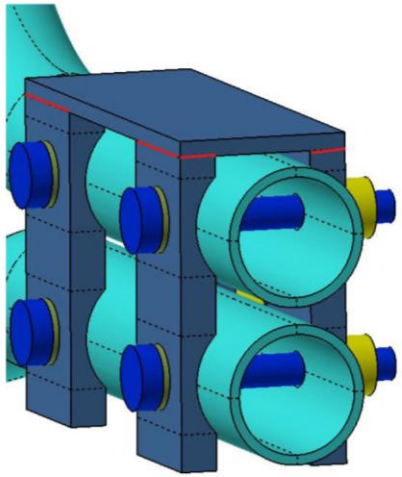
Fig 16: Chairlift No: SI/90
Crack like indications noted.

5 chairs with loose bolts

Lessons learnt

- Poor support and ownership from the OEM
- Poor fabrication quality
- Reviewed OEM chair manufacturing QA/QC
- Increased NDT frequency
- Fluorescent particle with AC yoke is the most effective NDT method
- Have NDT guide and ensure it is followed by the service provider and on mine team
- Periodically removal of the rope grip for better access when conducting NDT on that area
- Current chair fatigue life not sufficient and requires a re-design - welding on the chairs introduce high stress concentration areas





Bolted design - no welding

Thank you

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