VonRoll Tramways

June 13, 1997

SERVICE BULLETIN NUMBER 1997-004 ACTION REQUIRED

TO: ALL OPERATORS OF HALL SKI LIFT AND VON ROLL TRAMWAYS 2/3/4-PASSENGER CHAIRLIFTS

SUBJECT: FAILURE OF CHAIR HANGER - RECOMMENDED CORRECTIVE ACTION

REFERENCES:
SERVICE BULLETIN NUMBER 1994-001
SERVICE BULLETIN NUMBER 1997-001
SERVICE BULLETIN NUMBER 1997-003
INSTRUCTION IN-245
INSTRUCTION IN-32-278

ENCLOSURES:
INSTRUCTION IN-32-280
INSTRUCTION IN-32-281
INSTRUCTION IN-32-282

As a result of several reported failures of the chair hanger assembly on assemblies manufactured by Hall Ski Lift Company, various remedial actions are required to prevent future failures.

This service bulletin applies to all hanger assemblies utilized on 2/3/4-passenger fixed-grip chairlifts provided by Hall Ski Lift (between 1961 and 1983) and by Von Roll (beginning in 1983). Chairs are classified into one of three categories. Recommended corrective action is dependent on classification.

Classification of Hanger Assembly:

All chair hanger assemblies shall be classified into one of the following categories:

Category - 1: Those requiring inspection and repair or replacement
Category - 2: Those requiring inspection (initial and annual)
Category - 3: Those requiring annual inspection after ten years of service.

The classification of the hanger assembly is determined as follows:

Category- 1: If all of the following conditions are present, the chairs shall be classified as Category-1:

1) chairs manufactured prior to 1979, and
2) which are two or three passenger chairs with gusset style hanger and
3) which are used for winter operations (design speed in excess of 275 ft/min and/or temperatures below 32 degrees Fahrenheit), and
4) which are used on a chairlift with the unloading station located adjacent to the bullwheel ("bullwheel unloading").

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Category- 2: If the chair does not meet all of the criteria for Category-1 chairs, but meets either of the following criteria, the chair shall be classified as Category-2:

1) chairs manufactured prior to 1979, and/or
2) chairs which utilize the gusset-style connection

Category- 3: If the chairs are not otherwise classified as Category-1 or Category-2, they shall be classified as Category-3.

Corrective Action:

Once the proper classification of the chair hanger assembly is determined, the following action(s) are required:

Category-1: Prior to Operation at Less than 32 Degrees Fahrenheit or Within 6 Months (Whichever is Sooner):

Option-1:

1) Wet Fluorescent Mag-Particle Inspection of all chair hangers in accordance with IN-32-281. If any defects are noted, they shall be repaired in accordance with IN-32-282.
2) Addition of Reinforcement Gussets per IN-32-280
3) Reduce Sources of Severe Impact Loading by Maintaining Alignment of Haul Rope in Bullwheel, and replacing Bullwheel Liner as Required (applies to conventional and bullwheel unloading lifts) per IN-245 and IN-32-278. On chairlifts where there is a history or evidence of impact of the chair on the terminal support pedestal or evidence of impact of the gooseneck on the bullwheel flange as the grip/gooseneck enters the bullwheel (occurs if chair is swung outward from the lift centerline as the grip/gooseneck approaches the bullwheel), guides should be added in accordance with the recommendations in Service Bulletin 97-003, item 1, pages 3 and 4.
4) 20% Wet Fluorescent Mag-Particle Inspection Each Year per IN-32-281. If any defects are noted, 100% of the hanger assemblies on the subject chairlift must be inspected. All defects shall be repaired in accordance with IN-32-282.

Option-2:

1) Comply with the inspection and repair procedures defined in Service Bulletin 97-003

Option-3:

1) Replace Chair Hanger Assembly with new assembly manufactured using material with improved low temperature properties.

Category-2: Prior to Operation at Less than 32 Degrees Fahrenheit or Within 6 Months (Whichever is Sooner):

1) Wet Fluorescent Mag-Particle Inspection of all chair hangers in accordance with IN-32-281. If any defects are noted, they shall be repaired in accordance with IN-32-282.
2) Reduce Sources of Severe Impact Loading by Maintaining Alignment of Haul Rope in Bullwheel, and replacing Bullwheel Liner as Required (applies to conventional and bullwheel unloading lifts) per IN-245 and IN-32-278
3) 20% Wet Fluorescent Mag-Particle Inspection Each Year per IN-32-281. If any defects are noted, 100% of the hanger assemblies on the subject chairlift must be inspected. All defects shall be repaired in accordance with IN-32-282.

Category-3: Annual Inspections Beginning after Tenth Year of Operation:

1) 20% Wet Fluorescent Mag-Particle Inspection Each Year per IN-32-281. If any defects are noted, 100% of the hanger assemblies on the subject chairlift must be inspected. All defects shall be repaired in accordance with IN-32-282.
2) Reduce Sources of Severe Impact Loading by Maintaining Alignment of Haul Rope in Bullwheel, and replacing Bullwheel Liner as Required (applies to conventional and bullwheel unloading lifts) per IN-245 and IN-32-278

All testing and repair work shall be performed by qualified personnel who are competent to carry out the recommended procedures (refer to individual Instructions for qualification requirements and procedures). The operator shall implement a Quality Assurance Program to assure that each inspection or repair is carried out in accordance with the procedures recommended by Von Roll, or alternately, by an appropriately qualified engineer.

Please contact the Von Roll service department at 1-315-788-1280 if you have any questions.

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WELDING PROCEDURE CHAIR HANGER ASSEMBLY INSTALLATION OF REINFORCEMENT GUSSET

Introduction

This instruction covers the recommended procedures for installing reinforcement gussets onto certain 2 and 3 passenger chair hanger assemblies manufactured by Hall Ski Lift Company. Refer to Service Bulletin 1997-004 for applicability.

Welder Qualifications

All persons performing this weld procedure shall be qualified in accordance with the American Welding Society Structural Welding Code (ANSI/AWS D1.1-1994) or equivalent. Welder qualification shall be for all positions (3G + 4G), Plate-Groove Weld with Complete Joint Penetration (CJP), in the shielded metal arc welding process (SMAW) using E7018 series electrode.

Inspector Qualification

The welding inspector shall be experienced in the visual examination of welds to the requirements of ANSI/AWS D1.1-1994, section 9.25.1.

Welding Electrode

E7018 welding rod shall be used with a diameter of 3/32". Welding rod must be stored in a hermetically sealed container until ready for use. If welding rod has been exposed to moisture, it shall be dried in a 700 degree Fahrenheit oven for a period of at least 2 hours. If the electrode is exposed to the atmosphere for a period of greater than four hours before use, the electrode shall be re-dried before use.

Welding Machine

A Direct Current (DC) Welding machine shall be used with the electrode connected to the positive terminal (electrode positive or EP). The current shall be set at 90 amps.

Position

The welds shall be performed in the flat and horizontal position. In order to achieve this position, the hanger assembly may be removed from the chairlift, or alternatively, the grip loosened and the chair rotated 90 degrees towards the inside of the line such that the gusset is pointing vertically up. (see Figure-1)

Removal of Paint.

All paint in the vicinity of the surfaces to be welded shall be removed by burning with an torch. A propane torch is recommended to prevent inadvertent over heating (do not heat any area of the hanger tube or gusset beyond 800 degrees Fahrenheit). Once the paint has been burned-off, residue shall be removed using a wire brush.

Tacking

Reinforcement gusset, Von Roll Part Number 100597 shall be placed into position on each side of the hanger assembly (see Figure-2). Four tacks shall be placed as shown using 3/32" E7018 rod.

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WELDING PROCEDURE
CHAIR HANGER ASSEMBLY
INSTALLATION OF
REINFORCEMENT GUSSET

Pre-Heat

The hanger assembly and reinforcement gusset shall be heated to 350 degrees Fahrenheit in the vicinity of the weld using a torch. A propane torch is recommended to prevent inadvertent over heating (do not heat any area of the hanger tube or gusset beyond 800 degrees Fahrenheit). A 350 degree temperature stick shall be used to determine if assembly has reached the required temperature. Measurements shall be made in the locations shown on Figure-3.

Welding

The weld shall be performed as shown on Figure-4. The weld should be started at the location of tack #1 and proceed towards the end of the reinforcement gusset. The weld should then be placed beginning midway between tack #3 and tack #4 and proceed in the direction of tack #3. The weld should then be placed beginning at tack #2 and proceed towards tack #1. The weld should then be placed beginning at tack #4 and proceed towards tack #3. After completing all welding on the outer surface of the reinforcing gusset, a pass is made on the upper 1-1/2 inch of the inside of the gusset. This weld should continue to the end of the gusset and wrap around the end of the gusset.

The same process is repeated for the second reinforcement gusset. Pre-heat temperature should be verified before welding on the second gusset

When completed, the weld in the vicinity of the end of the gusset shall have a slightly concave shape, and be free of irregularities. If required, light grinding of the weld is allowed to achieve the desired shape.

Inspection

A weld inspector shall perform a visual inspection of all welds prior to painting (if necessary to prevent corrosion prior to inspection, a light coat of rust-resistant primer may be applied immediately after welding).

The welds shall have a slightly concave shape, undercut shall not exceed 1/64" in the upper 1-1/2" of the gusset (1/32" elsewhere), the weld shall be free of porosity. At the top of the gusset, the weld on the front and back should meet with no interruption. A smooth form is required to minimize notch effects in this critical area. Light grinding may be used to improve the shape of the weld.

Painting

A good rust inhibiting paint shall be applied after inspection is complete. Particular attention should be given to coating the inside surfaces of the gussets.

Documentation

All repairs shall be recorded and maintained in a permanent log. Chairs manufactured beginning in 1979 by Hall Ski Lift were assigned serial numbers. Chairs built prior to 1979 shall have a unique number permanently affixed to the hanger assembly by the operator.

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WELDING PROCEDURE
CHAIR HANGER ASSEMBLY
INSTALLATION OF
REINFORCEMENT GUSSET

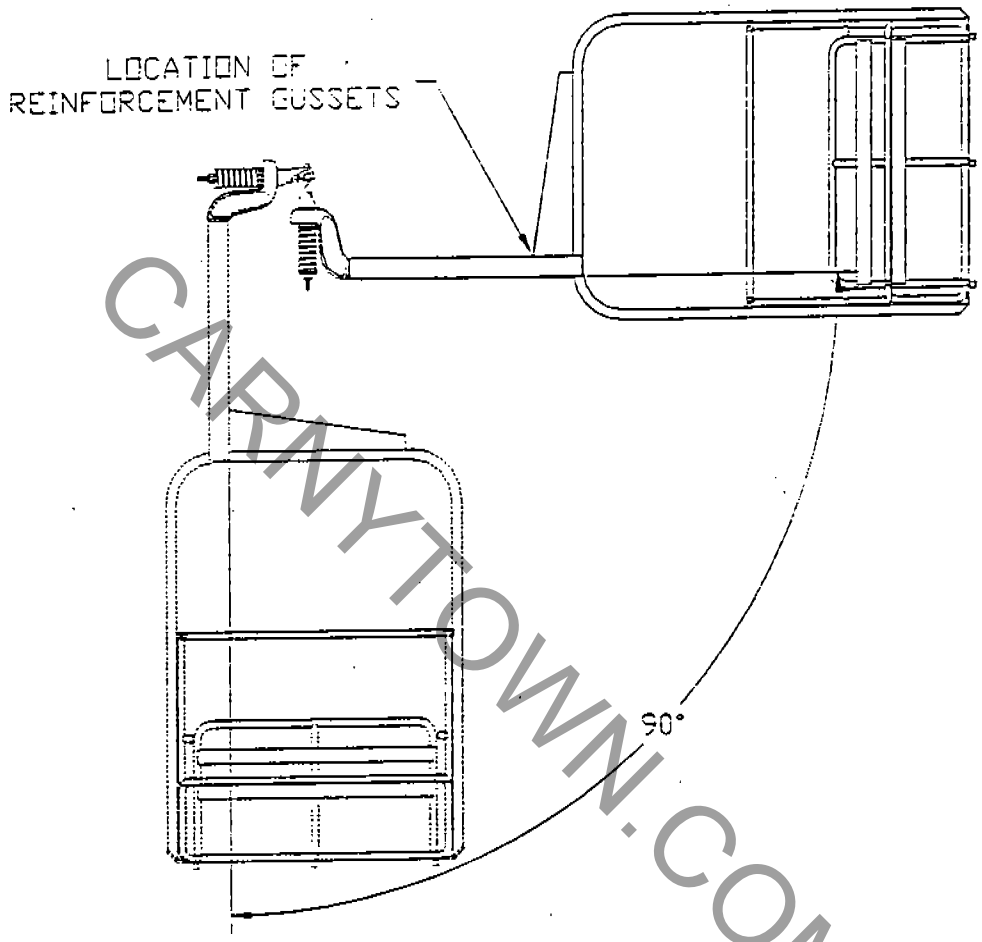

FIGURE-1
POSITION OF HANGER ASSEMBLY
FOR WELDING

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WELDING PROCEDURE
CHAIR HANGER ASSEMBLY
INSTALLATION OF
REINFORCEMENT GUSSET

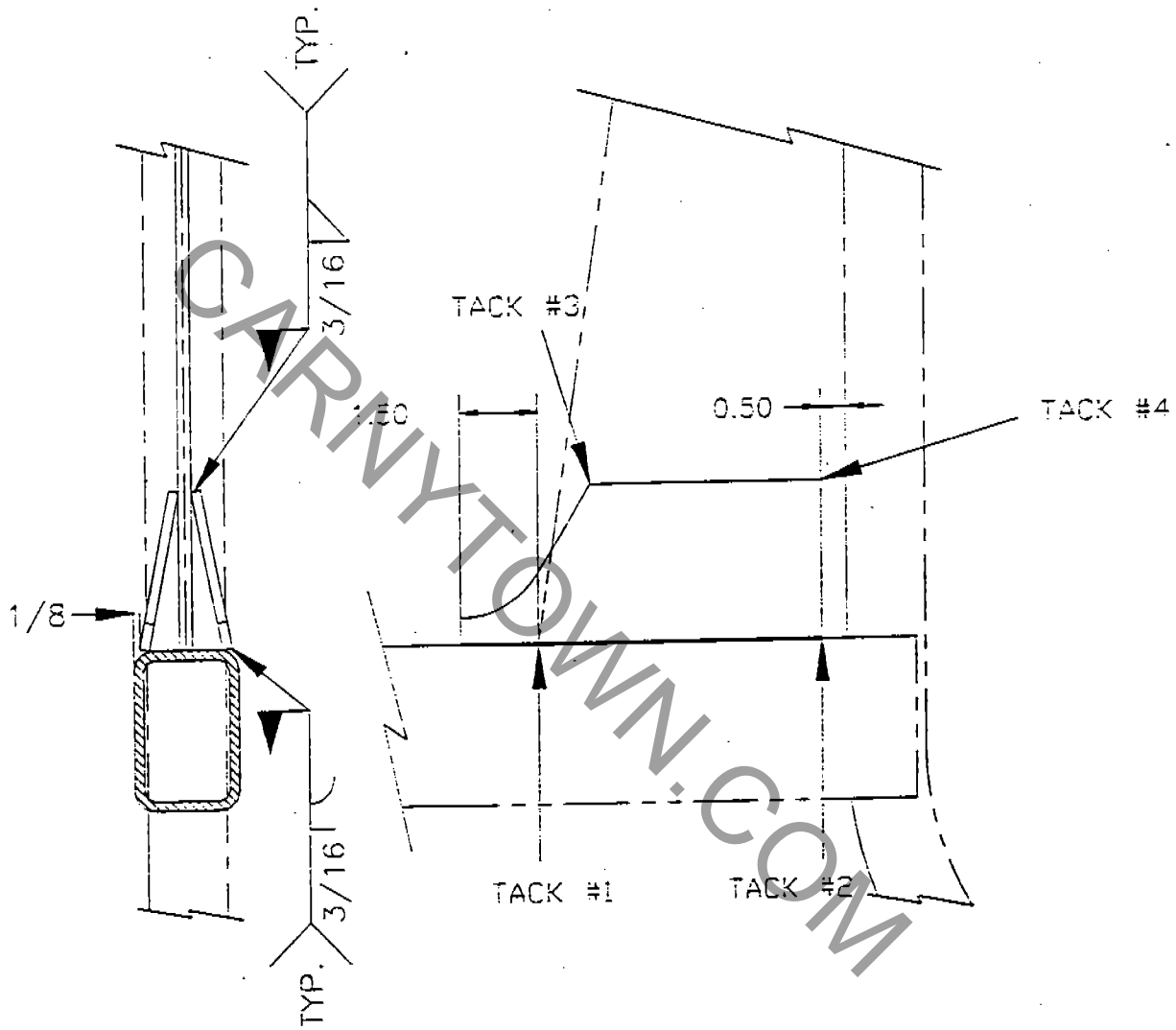

FIGURE-2
LOCATION OF GUSSET
AND TACK WELDS

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WELDING PROCEDURE
CHAIR HANGER ASSEMBLY
INSTALLATION OF
REINFORCEMENT GUSSET

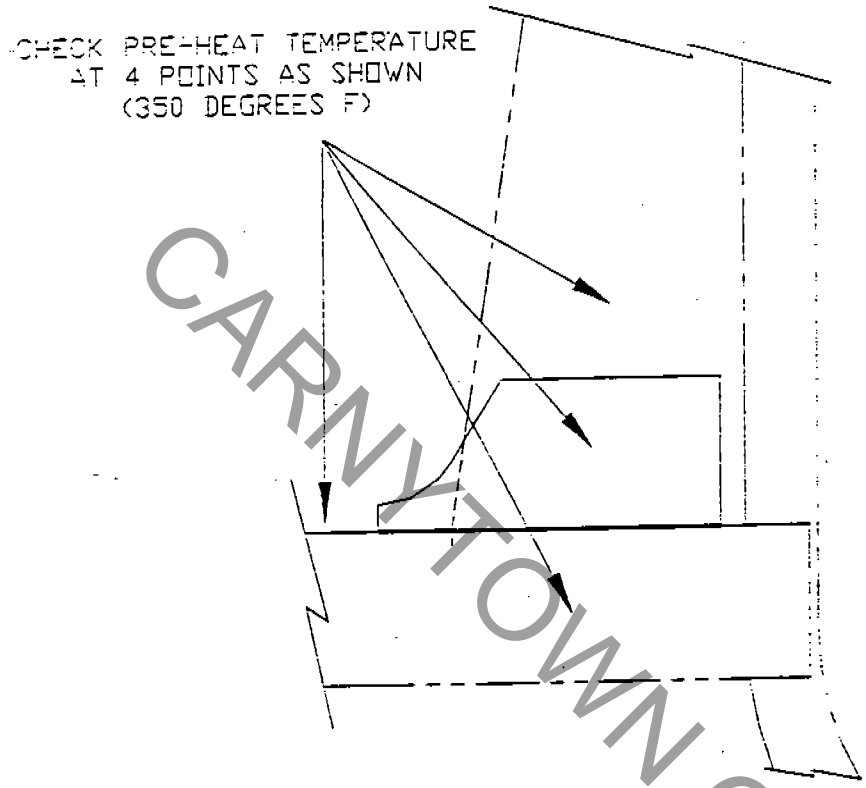

FIGURE-3
MEASUREMENT OF
PRE-HEAT TEMPERATURE

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WELDING PROCEDURE
CHAIR HANGER ASSEMBLY
INSTALLATION OF
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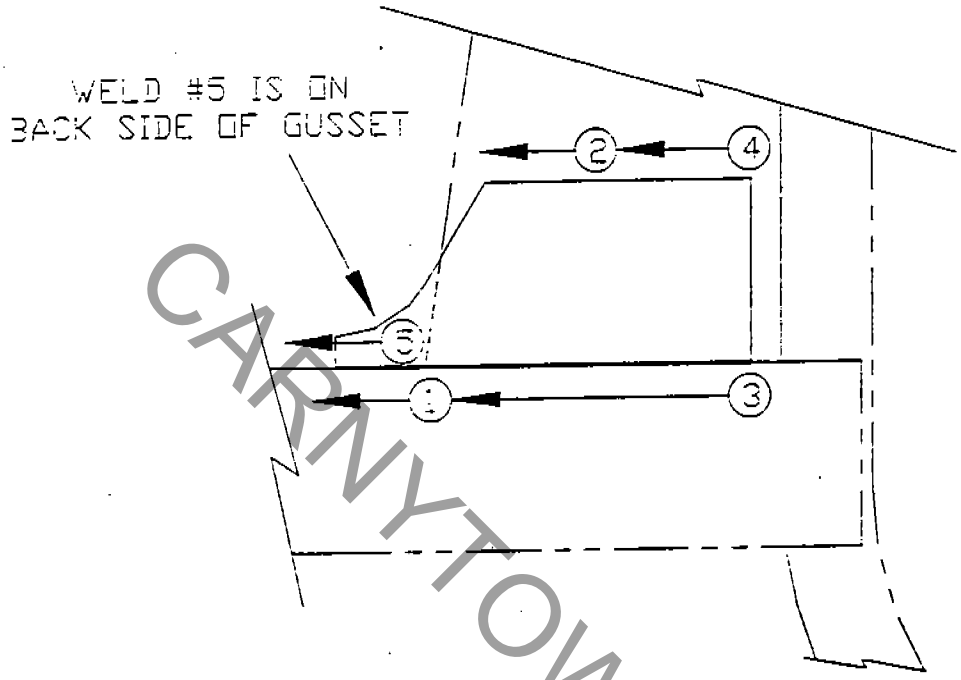

FIGURE-4
WELD SEQUENCE

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NDT INSPECTION OF CHAIR HANGER ASSEMBLY USING WET FLUORESCENT MAGNETIC PARTICLE METHOD

Introduction

This instruction covers the recommended procedures for inspecting critical welds on 2/3/4-passenger chair hanger assemblies manufactured by Hall Ski Lift Company and Von Roll Tramways. Refer to Service Bulletin 1997-004 for applicability and required interval.

Method

The wet bath fluorescent magnetic particle (WFMP) inspection technique per ASTM E-709 shall be used. For the types of cracks which might exist, this method is preferred over other methods (dry powder, dye penetrant, ultrasonic) as it is most sensitive for detecting small surface cracks.

Inspector Qualifications

Inspection shall be performed by a certified Level II or Level III Inspector (reference to ASNT TC-1A Recommended Practice) experienced with the WFMP technique and in accordance with accepted practice.

Area to be Inspected

All critical welds to the hanger tube as well as the hanger tube material in the immediate vicinity of the weld (1/2" from the weld) shall be inspected. This includes the welds which connect the hanger tube to the gooseneck assembly; and the welds which connect the gusset (2/3-passenger chairs only), or channel (2/4-passenger chairs only), or angled tubes (4-passenger chairs only) to the hanger tube. The lower end of the hanger tube, where it meets the bail tube is not considered critical and does not require NDT inspection.

Removal of Paint

All paint should be removed in the regions to be inspected. Paint may be removed by chemical stripping, or by burning with a torch and removing residue with a wire brush. A propane torch is recommended to prevent inadvertent over heating (do not heat any area of the hanger tube or gusset beyond 800 degrees Fahrenheit).

Ambient Light

The ambient light level must be low enough to permit adequate visibility of the fluorescent particles. If the inspection is to be performed outdoors during daylight hours, a tent should be used to reduce the light level.

Acceptance/Rejection Criteria

Any of the following conditions shall be classified as a defect:

1) Any relevant indication in the base metal of the hanger tube or in the weld metal. A relevant indication is any crack or discontinuity which exceeds 1/16" in length.
2) Undercut exceeding 1/64" on any weld which is aligned +/- 45 degrees or less from lateral axis of the tube (across the tube)
3) Undercut exceeding 1/32" on any weld which is not aligned within +/- 45 degrees or less from lateral axis of the tube (across the tube).

In the event any defects are noted, they shall be repaired in accordance with the procedures defined in IN-32-282

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NDT INSPECTION OF CHAIR HANGER ASSEMBLY USING WET FLUORESCENT MAGNETIC PARTICLE METHOD

Documentation

Results of inspection to be recorded and maintained in a permanent log. Chairs manufactured beginning in 1979 by Hall Ski Lift were assigned serial numbers. Chairs built prior to 1979 shall have a unique number permanently affixed to the hanger assembly by the operator.

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REPAIR OR REMOVAL OF DEFECTS IN CRITICAL WELDS CHAIR HANGER ASSEMBLY

Introduction

This instruction covers the recommended procedures for repairing defects in the weld or base metal of the hanger tube which are noted during required visual or NDT inspection (refer to IN-32-281 and IN-32-261).

Small cracks which are less then 1/4" in length and which are less than 1/32" deep may be removed by light grinding with a die grinder. The finished surface should be smooth and free of defects and irregularities. NDT inspection shall be repeated after grinding to verify removal of the defect.

Cracks which are greater than 1/4" in length or greater than 1/32" deep must be repaired by grinding out the defect/weld and re-welding.

Welder Qualifications

All persons performing this weld procedure shall be qualified in accordance with the American Welding Society Structural Welding Code (ANSI/AWS D1.1-1994) or equivalent. Welder qualification shall be applicable to the position in which the weld is to be performed (1G, 2G, 3G or 4G), Plate-Groove Weld with Complete Joint Penetration (CJP), in the shielded metal arc welding process (SMAW) using E7018 series electrode.

Inspector Qualification

The welding inspector shall be experienced in the visual examination of welds to the requirements of ANSI/AWS D1.1-1994, section 9.25.1.

Welding Electrode

E7018 welding rod shall be used with a diameter of 3/32". Welding rod must be stored in a hermetically sealed container until ready for use. If welding rod has been exposed to moisture, it shall be dried in a 700 degree Fahrenheit oven for a period of at least 2 hours. If the electrode is exposed to the atmosphere for a period of greater than four hours before use, the electrode shall be re-dried before use.

Welding Machine

A Direct Current (DC) Welding machine shall be used with the electrode connected to the positive terminal (electrode positive or EP). The current shall be set at 90 amps.

Removal of Paint.

All paint in the vicinity of the surfaces to be welded shall be removed by burning with an torch. A propane torch is recommended to prevent inadvertent over heating (do not heat any area of the hanger tube or gusset beyond 800 degrees Fahrenheit). Once the paint has been burned-off, residue shall be removed using a wire brush.

Surface Preparation

The defect and existing weld should be removed by grinding, beginning at the defect and extending at least one inch on each side of the defect. Care should be taken to prevent excessive grinding into the base metal of the hanger tube. Prior to welding, the surface should be free of paint or rust.

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REPAIR OR REMOVAL OF DEFECTS IN CRITICAL WELDS CHAIR HANGER ASSEMBLY

Pre-Heat

The hanger assembly shall be heated to 350 degrees Fahrenheit in the vicinity of the weld using a torch. A propane torch is recommended to prevent inadvertent over heating (do not heat any area of the hanger tube or gusset beyond 800 degrees Fahrenheit). A 350 degree temperature stick shall be used to determine if assembly has reached the required temperature. Measurements shall be made on each side of the weld to verify that the entire area to be repaired has reached the pre-heat temperature.

Welding

The weld shall be placed beginning at least one inch from the defect, and continuing one inch past the defect. If the defect was located at the toe of the weld on the gusset-to-hanger-tube connection, the weld must be wrapped around the end of the gusset. This can be accomplished by welding up each side of the gusset, starting at a point 1 inch from the end. The second should wrap the end of the gusset to assure that no discontinuity is present. The start and stop of the weld must flow evenly into existing weld. It is recommended that the hanger assembly is positioned such that the weld can be performed in the flat or horizontal position (1G or 2G).

Inspection

A weld inspector shall perform a visual inspection of all repairs prior to painting (if necessary to prevent corrosion prior to inspection, a light coat of rust-resistant primer may be applied immediately after welding).

The welds shall have a slightly concave shape, undercut shall not exceed 1/64" in the upper 1-1/2" of the gusset (1/32" elsewhere), the weld shall be free of porosity. At the top of the gusset, the weld on the front and back should meet with no interruption. A smooth form is required to minimize notch effects in this critical area. Light grinding with may be used to improve the shape of the weld.

Painting

A good rust-inhibiting paint shall be applied after inspection is complete. Particular attention should be given to coating the inside surfaces of the gussets.

Documentation

All repairs shall be recorded and maintained in a permanent log. Chairs manufactured beginning in 1979 by Hall Ski Lift (and Von Roll Tramways in 1983) were assigned serial numbers. Chairs built prior to 1979 shall have a unique number permanently affixed to the hanger assembly by the operator.

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1997 CHAIR HANGER ASSEMBLY PRICE LIST

		PRICE	DELIVERY**
1. REINFORCEMENT GUSSETS			
GUSSETS ONLY (2 REQUIRED PER CHAIR) - STAMPING		$2.35 EA	6 - 8 WEEKS
	FLAME CUT	3.45 EA	2 WEEKS
2. INSPECTION/REPAIR OPTIONS			
INSP. OF YOUR BAIL AND INSTALLATION OF REINFORCEMENT GUSSETTS BY VON ROLL AT OUR WATERTOWN FACILITY (DOUBLE OR TRIPLE BAIL) ACCORDING TO SERVICE BULLETIN 97-004.		79.00 EA	4 - 8 WEEKS
INSPECTION - INSPECTION AND REPAIR ACCORDING TO SERVICE BULLETIN 97-003.	DOUBLE -	97.50 EA	6 - 8 WEEKS
	TRIPLE -	112.50 EA	6 - 8 WEEKS
	QUAD -	119.50 EA	6 - 8 WEEKS
REPAIR OPTIONS:			
A) REPAIR WELD BETWEEN BAIL TUBE AND GUSSET OR BETWEENBAIL TUBE AND CHANNEL		30.00 EA	
B) REPAIR WORN BAIL TUBE (CAUSED BY RUBBING ON RAIL, REF SB-227)		16.00 EA	
C) INSTALL DRAIN HOLES IF NECESSARY		6.00 EA	
3. REPLACEMENT OPTIONS			
NEW BAIL - 2 PASSENGER	(1-1/2" GRIP JOURNAL)	329.00 EA	16 - 18 WEEKS
	(1-3/4" GRIP JOURNAL)	309.00 EA	16 - 18 WEEKS
3 PASSENGER		355.00 EA	16 - 18 WEEKS
4 PASSENGER		390.00 EA	16 - 18 WEEKS

** DELIVERY TIMES ARE ESTIMATES ONLY. ACTUAL DELIVERY WILL DEPEND UPON BACKLOG AT TIME OF ORDER.

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Von Roll

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April 25, 1997

SERVICE BULLETIN NUMBER 1997-003

- ACTION REQUIRED -

TO: ALL OPERATORS OF HALL 2/3/4-PASSENGER CHAIRLIFTS, WITH CHAIRS PRODUCED PRIOR TO 1982 (EXCLUDING CENTER POST 2-PASSENGER CHAIRS)

SUBJECT: FAILURE OF CHAIR HANGER

REFERENCE: SERVICE BULLETIN NUMBER 1997-001

Service Bulletin Number 97-001 was issued in January 1997 addressing the failure of Hall Ski Lift chair hangers and included several immediate actions required of all operators to prevent additional failures similar in nature to those observed.

The recommendations contained in Service Bulletin 97-001 were an interim measure intended to assure safe operation for the 1996/97 ski season.

Subsequent to the issue of Service Bulletin number 97-001, we have engaged a firm specializing in failure analysis to determine the cause of the failures and appropriate corrective action.

The recommendations provided in this Service Bulletin are intended to provide a long-term solution and supersede the corrective actions required by Service Bulletin 97-001.

Please note, the applicability of this Service Bulletin has been expanded to include any 2/3/4 passenger chair bail assembly manufactured by Hall Ski Lift prior to 1982.

Bail assemblies manufactured in 1982 and later utilized hanger tube material with acceptable low temperature properties. Prior to 1982, low temperature properties were not specified in the procurement of the hanger tube material, and thus there is no assurance as to the performance of these hangers at low temperatures. Furthermore, analysis of material from failed units indicates a carbon content consistent with poor low temperature properties (also consistent with the observed failure mode of brittle fracture at low temperatures). Since no documentation exists identifying the origin and properties of hanger tube material

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on units manufactured prior to 1982, the recommendations of this Service Bulletin should be followed to minimize the potential for brittle fracture at low temperatures. shall

The results of the investigation as to the cause of the failures revealed the following:

> The Failures are brittle fractures which occur because of "low temperature embrittlement", i.e., the metal becomes brittle and less able to absorb shock loads as the temperature drops. The tendency for fracturing is made more severe by three physical features:
>
> 1) Small cracks from corrosion and corrosion fatigue.
> 2) Notches resulting from welding.
> 3) Hardened zones that occur at the ends of the welds.
>
> The effect of the cracks, notches, and hardened areas is to cause stresses that are so large that the applied shock loads then result in a fractured hanger.
>
> The hanger fractures rapidly, in a single event, with no plastic deformation. A ductile material will absorb energy prior to fracture and cracks tend to propagate slowly. In a brittle material, the crack can propagate through the entire section instantly.

In order to reduce the likelihood of additional failures, the following actions are required:

- Eliminate potential for severe impact loading of hanger.
- Eliminate corrosion and cracks at the toe of the weld.
- Visually inspect weld for non-conformities.
- Stress relieve hanger
- Corrosion protection
- Periodic inspections

These actions shall be completed prior to the 1997-98 ski season or prior to operation at temperatures of less than 32 degrees Fahrenheit, whichever occurs first.

A detailed description of each of the above steps is provided below:

1) **Eliminate Potential for Severe Impact Loading of Hanger.**

On chairlifts where there is a history or evidence of impact of the chair on the terminal support pedestal, guides must be placed leading into the support pedestal such that a chair approaching the terminal will be gently deflected away from the support structure. When placing guides, it is important to verify proper interface of the chair with the guide as the chair is swung both laterally and longitudinally. **On some existing chairlifts, the existing guides may not prevent chair contact with the terminal support pedestal. If this condition is observed, the guide must be re-positioned or another guide added to prevent the chair from contacting the support pedestal.** The guide ~~should~~ shall have an angle from the longitudinal axis of the lift of no more than 30 degrees and shall extend far enough in front of the terminal that a chair cannot get caught on the end of the guide as it approaches the terminal under the most severe combination of lateral and/or longitudinal swing.

On chairlifts where there is a history or evidence of impact of the gooseneck on the bullwheel flange as the grip/gooseneck enters the bullwheel (occurs if chair is swung outward from the lift centerline as the grip/gooseneck approaches the bullwheel), provisions must be incorporated to provide a gentle transition onto the bullwheel flange. This ~~could~~ shall include an angled plate (no more than 10 degrees from the ~~horizontal~~) which is level with the flange of the bullwheel. If a chair is swung outward as it approaches the bullwheel, it will contact the angled plate which pushes the gooseneck downward before if comes into contact with the bullwheel flange. Please refer to figure (1):

Verify proper bullwheel alignment and condition of bullwheel liner in accordance with instructions IN-245 and IN-32-278.

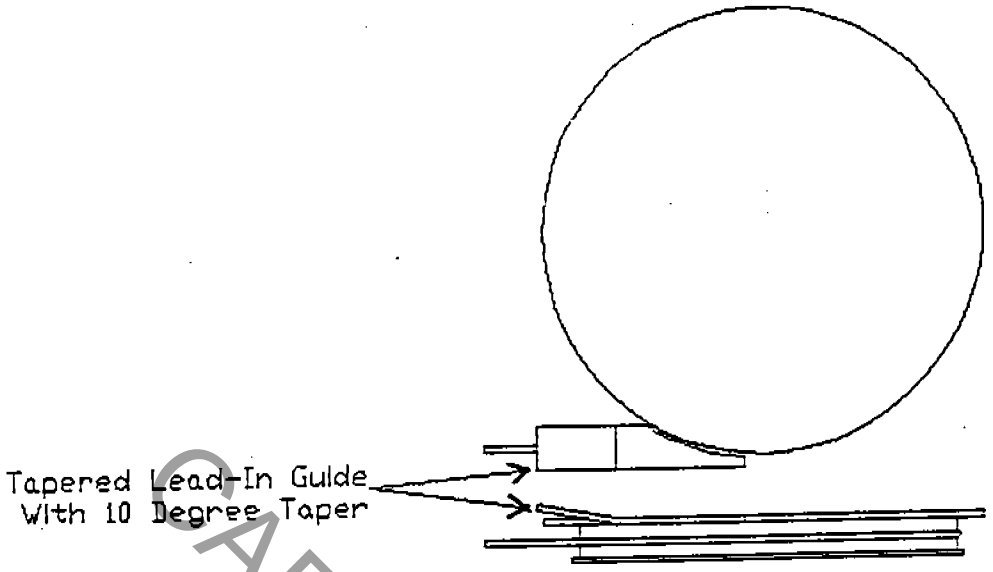


Figure (1)
Lead-In Guide Modification

2) **Eliminate corrosion and cracks at the toe of the weld.**

Inspect hanger tube in the vicinity of the toe of the weld using the wet bath fluorescent magnetic particle (WFMP) inspection technique per ASTM E-709. For the types of cracks which might exist, this method is preferred over other methods (dry powder, dye penetrant, ultrasonic) as it is most sensitive for detecting small surface cracks. Inspection should be performed by a certified Level II or Level III Inspector (reference to ASNT TC-1A Recommended Practice) experienced with the WFMP technique and in accordance with accepted practices.

Shall

Prior to the inspection, all paint and surface corrosion shall be removed.

If any cracks are observed, they shall be removed with a die grinder to a maximum depth into the hanger tube material of 1/32 inch. If grinding to this depth does not remove all indications of the crack, the hanger shall be removed from service. **No repairs are allowed.**

3) **Visually Inspect Weld for Non-Conformities.**

Qualified personnel to perform a visual inspection of all gusset-to-hanger tube welds in accordance with American Welding Society Structural Welding Code, D1.1-94, Section 9.25.1. Only the upper two inches of the gusset-to-hanger tube weld need to be inspected. In order to inspect this portion, all paint must be removed. shall

The following shall be cause for rejection:

- Undercut greater than 1/64 inch.
- Interruption at the toe of the weld.
- The weld bead shall be slightly concave with a smooth transition into the parent material of the gusset and the hanger tube; an irregular or convex bead is not acceptable.

If any of the above non-conformities are noted, the weld shall be repaired as follows:

- The area to be welded should shall be cleaned of paint, corrosion and any other foreign material. shall
- The existing weld should be removed by grinding, beginning at the toe of the weld and extending a minimum of two inches down each side. Grinding should remove the weld and some material from the gusset, but should shall not extend into the hanger tube greater than a depth of 1/32 inch. **Extreme care should be taken not to remove excessive material from the hanger tube.**
- The weld shall be performed in a flat position (see figure 2), beginning at least two inches from the toe, and continuing towards the toe and around the other side of the gusset without interruption (see figure 3). **Do not stop or interrupt the weld at the toe.**
- The start and stop of the weld must flow evenly into existing weld and shall be visually examined.
- Prior to welding, the hanger tube and gusset shall be pre-heated to 375°F +/- 25°F for at least four inches either side of the weld toe. The hanger tube and gusset should shall be well insulated for at least 12 inches on each side of the heated area to reduce the temperature differential across the area to be welded and to slow the rate of cooling. The heating can be done by either electric heating elements or by gas torches but good temperature control is important.

- Weld using 1/8 inch E7018 rod with stringer beads and less than one rod diameter weave. A DC welder shall be used with the current set at between 125 to 135 amps.
- Following the welding, the area shall be wrapped in insulation within ten seconds of completion of the weld and allowed to cool slowly.

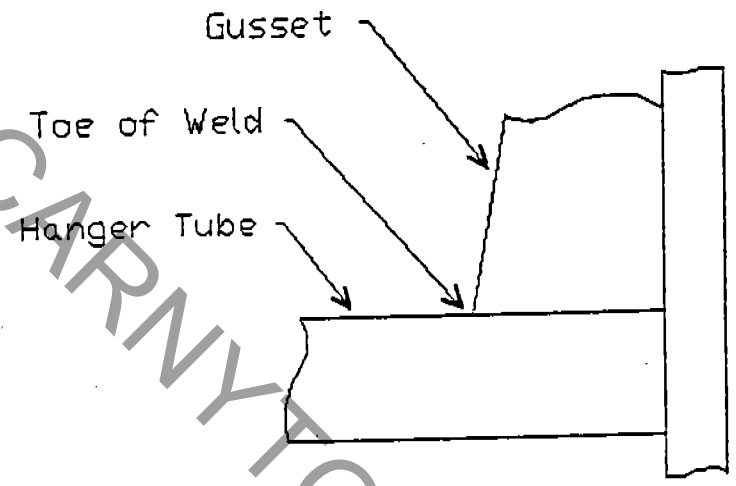


Figure (2)
Welding Position

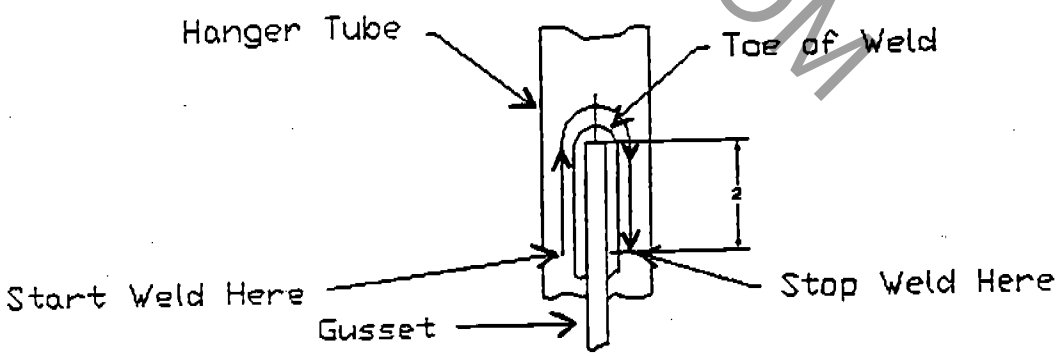


Figure (3)
Welding Pattern

4) **Stress Relieve Hanger**

All hanger assemblies shall be stress relieved. This applies to hangers that have been repaired as well as hangers with no noted defects. If no cracks or weld non-conformities are noted, there still exists a potential for embrittled zone adjacent to the weld. This embrittlement can cause significant stress concentrations leading to potential brittle fracture. In order to reduce the embrittlement and associated stress concentrations, the hanger assembly must be stress relieved by heating the entire hanger assembly to 1200°F +/- 50°F for 60 minutes with gradual cool down. This process will remove residual stresses associated with the welding resulting in greater ability to absorb shock loads associated with impacts.

5) **Corrosion Protection**

After stress relieving the hanger, a good rust-preventative coating should be applied.

6) **Periodic Inspections**

Periodic inspections of the critical region (hanger tube to gusset weld and immediate vicinity) shall be performed using WFMP method. Ten percent of hanger assemblies (or minimum of ten) shall be inspected annually. If any defects are noted, they should be corrected as noted above and 100 percent of all hangers on the same chairlift shall be inspected using the WFMP method. Alternately, all hangers may be inspected every six years. If annual inspections are performed, the operator shall keep adequate records to assure that a rotating sample is used and that all chairs are inspected within ten years. Serial numbers or other means of uniquely identifying each bail shall be permanently applied to all assemblies (if they are not already present).

Summary:

Based on the studies performed to date, we believe the above steps will eliminate additional failures of the nature observed.

These corrective actions do not significantly alter the properties of the hanger tube material or significantly improve low temperature toughness of the hanger tube material.

However, these steps will significantly reduce the stress concentration effects noted at the initiation site of the fracture on the samples which were studied. By reducing the stress concentrations, the likelihood of a brittle fracture is also reduced.

The best solution is to replace the bail assembly with an assembly made of materials with certified low temperature properties. This is the most reliable means of preventing brittle fracture.

Other methods may also be available to assure hanger integrity. In the course of our analysis, a variety of solutions were studied. While many of these solutions might reduce or eliminate the possibility of similar failures, they could cause problems in other areas of the bail assembly.

We do not recommend the addition of reinforcements. While adding a reinforcement might eliminate failures of the type observed to date, it could cause problems in other areas of the bail assembly.

Before any operator contemplates implementing a solution other than that identified in this Service Bulletin, they should consult with a qualified engineer who is competent to consider the effects of fatigue, stress concentrations, heat affected zones, low temperature properties, etc. An ill-conceived solution may increase the likelihood of hanger failure and endanger the public. shall

While we will continue to do everything we can to assist all operators of Hall Ski Lift chairlifts, it will not be possible for us to evaluate each operator's proposed solution.

If you have any questions regarding the implementation of the corrective actions addressed in this Service Bulletin, please contact our service department.

Sincerely,

VON ROLL TRAMWAYS INC.

Mark Bee, PE
President

VonRoll Tramways

January 6, 1997

SERVICE BULLETIN NUMBER 1997-001

- IMMEDIATE ACTION REQUIRED -

TO: ALL OPERATORS OF HALL 2/3-PASSENGER CHAIRLIFTS, WITH CHAIRS PRODUCED PRIOR TO 1976 (EXCLUDING CENTER POST 2-PASSENGER CHAIRS)

SUBJECT: FAILURE OF CHAIR HANGER

ENCLOSURE: SERVICE BULLETIN NUMBER 1994-001
SK 1994-001 - INDICATION OF FAILURE AREA
IN-32-261 - CHAIR HANGER INSFECTION CRITERIA
IN-245 - USE OF WEAR GAUGE FOR BULLWHEEL LINERS
IN-32-278 - BULLWHEEL LINER ALIGNMENT

We are aware of several incidents involving the failure of chair hangers on chairlifts supplied by Hall Ski Lift. Thus far, we have found common variables for these failures as follows:

1) All chairs were 2-passenger chairs and manufactured by Hall Ski Lift prior to 1976. (See SK 1994-001.)

2) All failures occurred at the unloading terminal beyond the unloading point (there have been no reported incidents of a failure on a loaded chair).

3) All failures occurred at low temperatures (less than zero degrees Fahrenheit).

4) All chairlifts were 'bullwheel unloading' type.

5) There may have been occurrences where excessive chair swing (possibly a result of a laterally deflected chair during unloading) caused high impact loading of the grip and hanger tube as the chair traveled around the bullwheel. This could also be caused by an improperly aligned bullwheel or a worn bullwheel liner.

Von Roll Tramways Inc.
753 West Main Street • P.O. Box 869
Wallkill, NY 12601 USA

Thus far, we have observed/concluded the following:

1) On a sample of chairs which we had inspected from one chairlift which had experienced a failure, there appeared to be several cases of minor defects in the weld where the gusset meets the hanger tube. These defects are either a weld discontinuity, a lack of fusion, an undercut, porosity, or a combination of these.

2) The hanger tube material conforms to the original material specifications. However, beginning in 1982, a new material has been specified for the hanger tube which has certified low temperature properties.

3) Although the highest stresses are higher up on the hanger tube, all failures have occurred at the location of the gusset weld.

4) We believe that on all of the failures reported to date, the following conditions existed:

   - A fatigue failure beginning at the defective weld.
   - Temperature near or below the nil ductility transition temperature for the hanger tube material.
   - Brittle fracture of the hanger tube associated with impact stresses from gooseneck/bullwheel flange contact as the chair travels around the bullwheel.

5) Chairs from a lift which had two failures, and have been inspected and repaired by VON ROLL, have not experienced additional problems.

6) Our preliminary conclusion is that eliminating the weld defects, and assuring proper rope/bullwheel alignment, will resolve the problem.

On new production chairs (either for new lifts or replacement units for existing chairs) we have incorporated the following changes:

1) Hanger tube material with certified low temperature and impact properties have been in use since 1982.

2) Weld procedures have been modified. The upper portion of the gusset is beveled and a continuous, full penetration weld is used on this portion. No interruption of the weld is allowed and the weld is performed in a flat position (gusset pointing up).

3) Beginning in 1976, all new 2-passenger chairs utilize a diagonal channel in lieu of a gusset. (please note that several of the old-style 2-passenger chairs have been produced since 1976 for customers that had the old-style chair.)

The following actions are recommended for all operators with Hall chairs manufactured prior to 1976:

1) Beginning immediately, perform a daily visual inspection of all hangers prior to opening for public operation. Qualified maintenance personnel shall observe each chair as it travels through the lower terminal, looking for any signs of cracking at the junction of the hanger tube and gusset.

2) Within five days, or prior to any operations at ambient temperatures of less than zero degrees Fahrenheit, verify proper bullwheel alignment and condition of bullwheel liner in accordance with instructions IN-245 and IN-32-278. If bullwheel liner wear is excessive, or the bullwheel is out of alignment, adjustments must be made immediately.

3) Qualified personnel to perform a visual inspection of all gusset-to-hanger tube welds in accordance with American Welding Society Structural Welding Code, D1.1-94, Section 9.25.1. Only the upper two inches of the gusset-to-hanger tube weld need to be inspected. In order to inspect this portion, all paint must be removed. In addition to examination for defective welds, any cracks observed in base metal of tube shall be cause for rejection. This inspection must be completed within thirty days, or immediately prior to operation at less than zero degrees Fahrenheit. If any defects are observed, the chair must not be used for carrying passengers until repairs can be made. The defective weld can be repaired in accordance with VON ROLL Instruction Number IN-32-277.

4) Upon completion of item 2 and 3, daily inspection (item 1) will no longer be required, and annual inspection in accordance with IN-32-261 shall be performed.

5) If you have experienced, or do experience in the future, any failures of a chair hanger tube, please report it immediately to VON ROLL on the attached report form. Your input is critical in defining both the severity of the problem, as well as identifying the contributing factors.

If you have any questions regarding the above, please contact the VON ROLL Service Department at 1-315-788-1280.

Sincerely,

VON ROLL TRAMWAYS INC.

Frank Bowers

Frank Bowers
Service Manager

FB:pls

Enclosures

JANUARY 5, 1994

SERVICE BULLETIN NO. 1994-001

IMMEDIATE ACTION REQUIRED

TO: ALL VON ROLL CUSTOMERS USING HALL AND VRT INC. 2-PASSENGER CHAIRS.

SUBJECT: 2-PASSENGER CHAIR HANGER INCIDENT

ENCLOSURE: CHAIR HANGER INSPECTION CRITERIA 2, 3, 4-PASSENGER CHAIRS IN-32-261

We have received a report from a Hall Chairlift operator that they have recently experienced two failures on the Hall 2-passenger chair hangers. The failures occurred where the hanger tube meets the gusset on the lower bail (see sketch SK 1994-001 which is enclosed). The cause of failure is being investigated at this time.

This type of failure could result in personal injury or death, and therefore, we would like to remind each operator of the need to rigidly adhere to the inspection criteria as defined in IN-32-261. If any anomalies are noted, please advise us immediately. Once we have determined the cause of these failures, we will advise all operators if any remedial action is required.

Yours truly,
VON ROLL TRAMWAYS INC.

Frank Bowers

Frank Bowers
Service Manager

FB:nd
Enc: IN-32-261
VRT Inc. SK 1994-001

Von Roll Tramways, Inc.
753 West Main Street • P.O. Box 869
Watertown, NY 13601 USA
Tel. (315) 788-1220. Fax (315) 788-1321

The #4447 gauge will aid you in observing the progress of wear of the #363 bullwheel liner and determine when the liner has reached the maximum limit of its useful life. Use of the #4447 gauge should be made a part of your regular maintenance service schedule, thus allowing you to predict when the liner will be worn to its maximum useful life enabling you to schedule its early replacement at a convenient time not adversely affecting the operating schedule of the lift. Refer to IN-198 for the proper procedure for replacing the bullwheel liner.

CAUTION: Failure to replace the bullwheel liner when it has reached its maximum allowable wear can result in excessive wear of the chair grips, cause excessive chair swing and possibly result in serious personal injury or property damage.

1. Place the arrow side of the gauge against the bullwheel liner as shown in Figure #1. Hold the edge of the gauge parallel to the liner as shown at "C" in Figure #1. The end of the gauge and the edge of the liner should be even as shown at "D" in Figure #1. The two corners of the gauge should make contact with the liner as shown at Points "A" and "B" of Figure #1.

Figure #2 illustrates a bullwheel liner which is not wearing evenly in the center of the liner indicated by the gauge touching the liner at Point "B" but not at Point "A".

2. The gauge should be inverted as illustrated in Figure #3. If the gauge still makes contact at Point "B" but not at Point "A", the groove is wearing toward the top of the liner and is an indication that the cable may not be tracking properly on the liner. If the gauge makes contact at Point "A" but not at Point "B" at both positions of the gauge the groove is wearing toward the bottom of the liner and is also an indication the cable may not be tracking properly on the liner. Possible causes are the bullwheel may not be level and/or the cable between the bullwheel and the idler sheaves may not be level, and should be corrected to allow the cable to track properly on the bullwheel liner.

In either of the two gauge positions, if the gauge makes contact with the liner as shown at Point "C", Figure #3 and does not contact the liner at Points "A" and "B", the liner groove is worn excessively deep and must be replaced.

3. The gauge should now be reversed so the edge away from the arrow is against the liner as shown in Figure #4. The end of the gauge and the edge of the liner should be even as shown at "D", The edge of the groove should not reach or be past Point "E".

Figure #5 shows a liner worn excessively off center and has reached its maximum allowable wear as indicated at Point "E". This liner must be replaced.

4. The gauge should be inverted as shown in Figure #6 and the liner must meet the requirements outlined in Step #3. Figure #6 illustrates a liner worn excessively wide as indicated at Point "E". This liner must be replaced.

5. Repeat the four gauging steps at least once on each of the remaining liner segments of the bullwheel.

NOTE: The bullwheel liner must meet the requirements of both sides of the gauge. As an example, the liner shown in Figure #6 would meet the requirements of the test illustrated in Figure #1 and outlined in Step #1. However, it does not meet the requirements of the test illustrated in Figure #4 and outlined in Step #3 and therefore must be replaced.

HALL SKI-LIFT COMPANY, INC.	USE OF THE #4447 WEAR GAUGE FOR #363 BULLWHEEL LINERS HALL CHAIRLIFTS	CK RH APV 4-1-85	SHEET 3 CONT'D. ON Fnl.

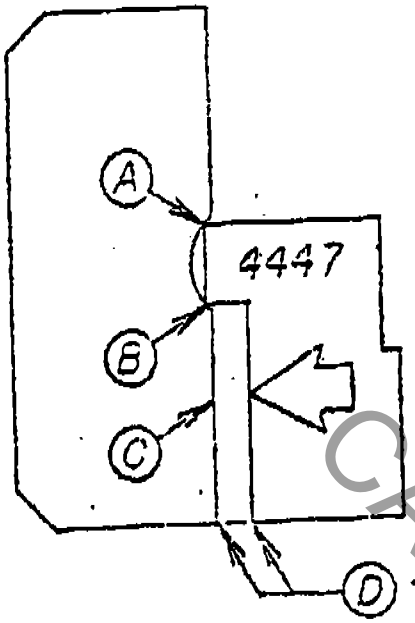


FIGURE 1

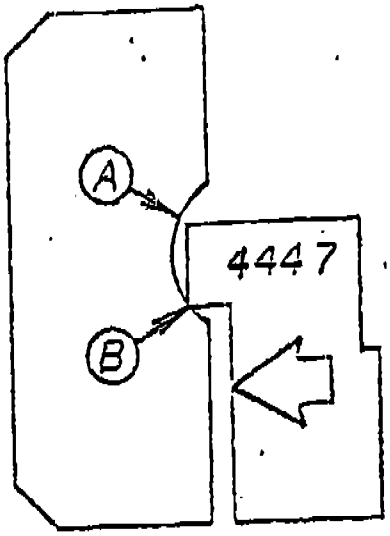


FIGURE 2

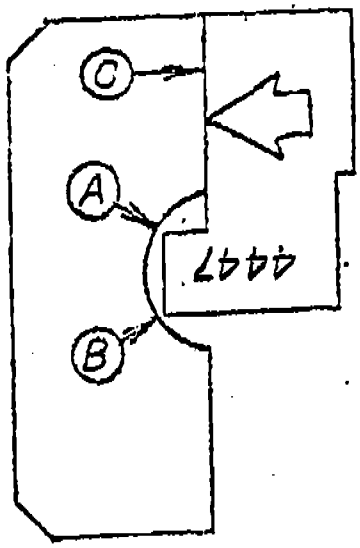


FIGURE 3

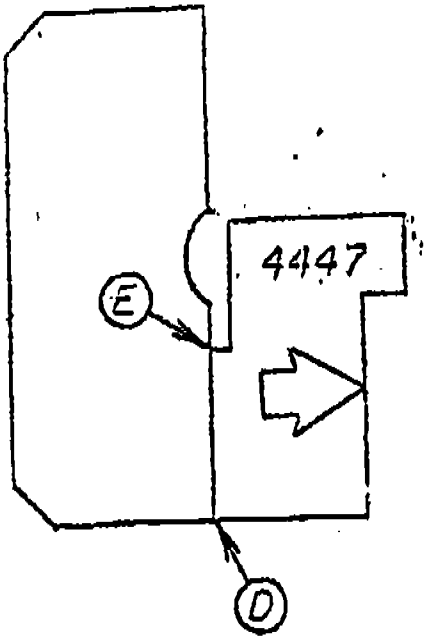


FIGURE 4

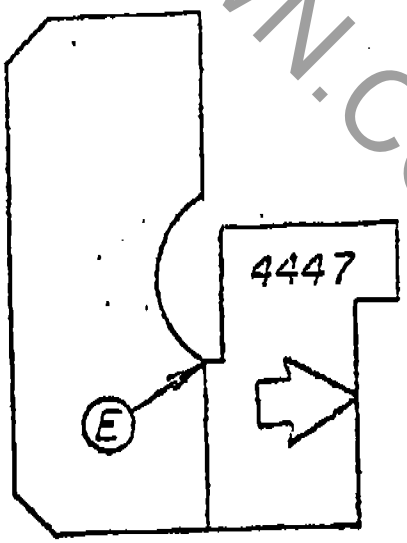


FIGURE 5

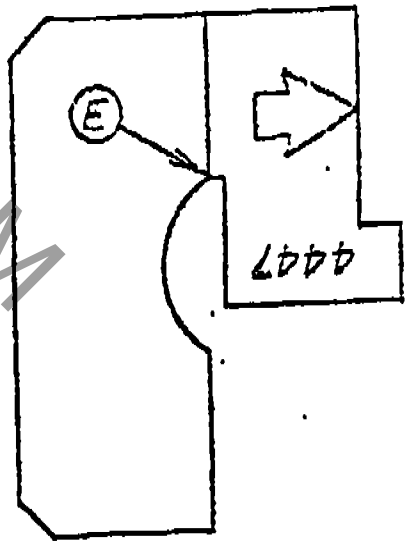


FIGURE 6

Von Roll Tramways Inc.
753 W. Main Street
P.O. Box 8639
Watertown, NY 13601
TELEPHONE: (315) 788-1280
FAX: (315) 788-1321

ALIGNMENT TOLERANCES
BULLWHEEL AND HAUL ROPE

FIXED GRIP CHAIRLIFTS

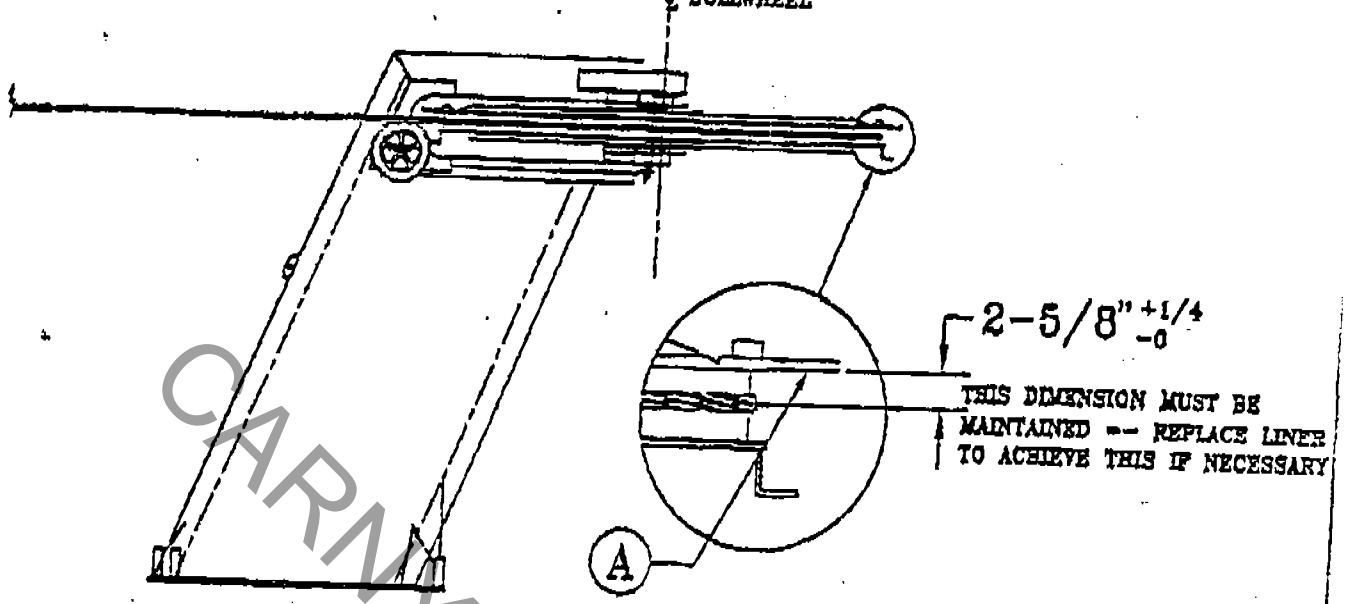
BY: LLW

DATE: 1-4-97

IN - 32-278

Sheet 1 of 1

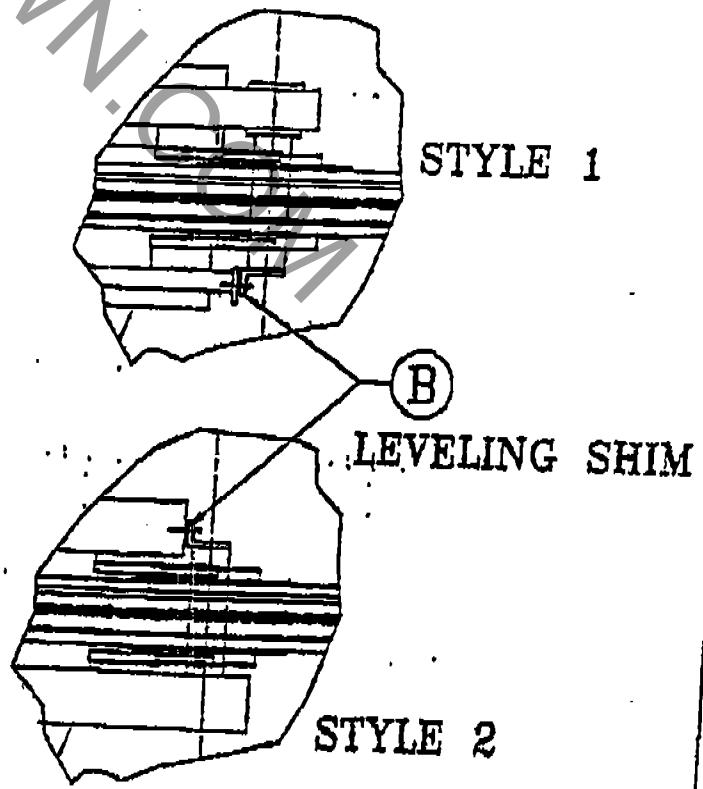
RETURN BULLWHEEL SHOWN -- DRIVE BULLWHEEL SIMILAR



BULLWHEEL SHALL BE LEVEL WITHIN 1 DEGREE OF TRUE HORIZONTAL.
INCOMING HAUL ROPE SHALL BE WITHIN ONE DEGREE OF PARALLEL WITH BULLWHEEL.
MACHINED SURFACE OF FLANGE ("A") SHALL BE USED FOR ALL MEASUREMENTS.
USE OF A TRANSIT OR OPTICAL LEVEL IS RECOMMENDED FOR THIS CHECK.

CHART OF ELEVATION DIFFERENCES
TO EQUAL ONE DEGREE SLOPE

HORIZONTAL DISTANCE	VERTICAL DIFFERENCE
10.0 Ft.	0.17"
11.0 Ft.	0.19"
12.0 Ft.	0.21"
25.0 Ft.	0.44"
30.0 Ft.	0.52"
35.0 Ft.	0.61"
40.0 Ft.	0.70"



IF UNSURE ABOUT CORRECTIVE ACTIONS, CONTACT THE SERVICE DEPARTMENT AT VON ROLL TRAMWAYS, INC. FOR ASSISTANCE.

753 W. Main St., P.O. Box 869
Watertown, New York 13601

Tel. (315) 788-1280 Fax (315) 788-1321

CRITERIA 2,3,4 PASSENGER CHAIRS

IN- 32-261

SHT 1 OF 4

This instruction defines the criteria and procedure for inspecting VRTS chair hangers. It applies to chair hangers supplied by Von Roll Transport Systems Inc. after Jan 1, 1989. It also applies to all chair hangers supplied by Von Roll Habegger of America, Inc. from March 4, 1983, till Jan. 1, 1989.

Because of the similarity of chair hangers manufactured by Hall Ski Lift Co., Inc., to those manufactured by VRTS, it may be acceptable to use this procedure for inspecting hangers manufactured by Hall Ski Lift Co., Inc. Contact the authority having jurisdiction to determine if this procedure is acceptable for inspection of your H.S.L. manufactured chair hangers.

We recommend you conduct a thorough, visual inspection, according to ANSI B77. 1-1982, of each and every chair hanger on your Von Roll Transport Systems chair lift prior to each operating season. Also, whenever certain chairs are subjected to unusual occurrences, such as dropping, striking objects, etc. These chairs must be inspected in the same manner. A record of the inspections shall be kept in the lift maintenance log, recording specific identification of the individual hangers, deficiencies found, further action taken, and the results. See Figure 1 for the location of the serial number. This inspection must be performed by a competent and responsible individual.

PROCEDURE:

Each hanger shall be visually inspected for all of the following possible deficiencies.

1. WELD PROBLEMS: Examine all welded connection for severe undercutting, porosity and indication of cracking. Cracked paint should be carefully removed to allow examination of the area beneath. Any suspected welds must be further tested.

2. DEFORMATION OR PHYSICAL DAMAGE: Examine the entire hanger assembly for abrasion or distortion, such as dents, scrapes, bends, etc. from contact with another object.

3. CORROSION: Examine the hanger assembly for rust, paying particular attention to connections and corner areas where moisture can collect. Blistered paint should be removed so the area beneath can be examined. If a light polishing does not remove all the rust,

Contact VRTS service department for further instructions.

4. PRESENCE OF WATER INSIDE TUBING MEMBERS: Water inside the tubing can freeze and cause the tubing to bulge. This expansion is usually accompanied by cracking of the paint in straight lines parallel to the length of the tube.

5. GOOSENECK BUSHING WEAR: Each VRTS chair is furnished with 2 bushings in the goosenecks. Determine the maximum inside diameter of each bushing using an inside micrometer or other suitable measuring device, Figure 2. Subtract the nominal inside diameter of a new bushing from the maximum inside diameter of both bushings. See chart accompanying Figure 2 for the correct nominal inside diameter of the bushing.

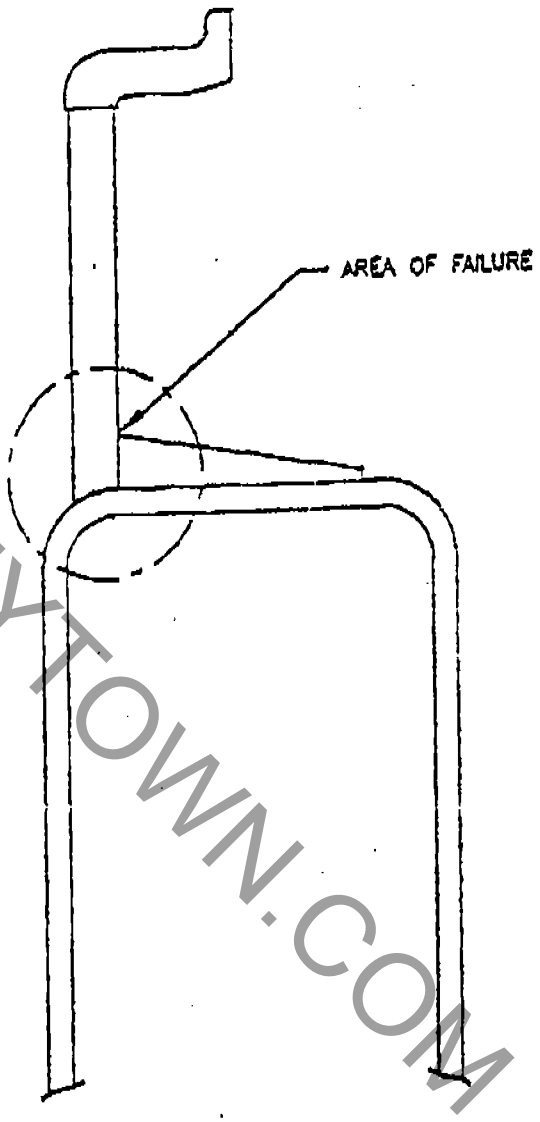
Z - X = MAXIMUM WEAR
X = NOMINAL INSIDE DIAMETER
X = MAXIMUM MICROMETER READING FOR BOTH BUSHINGS

The bushing is excessively worn and both bushings must be replaced with new bushings if the maximum wear of either bushing is equal to, or greater than, 0.010 inch. For hangers supplied with a single gooseneck bushing, take measurements at the locations shown in Figure 2, applying the formula to each end of the bushing separately.

6. CONNECTIONS: The threaded connections where the chair seat frame attaches to the chair hanger shall be examined for tightness, corrosion, distortion and missing parts. Any parts that are missing or distorted must be replaced with new parts equivalent to those supplied as original equipment. Loose parts must be tightened properly.

If any deficiency is found, the hanger shall be removed from service immediately and subjected to non-destructive testing by a competent non-destructive testing facility, to determine the full extent of the deficiency. In accordance with ANSI B77 .1-1982, a copy of the results from the non-destructive tests shall be provided to Von Roll Transport Systems, Inc. The effect of the deficiency on the overall integrity of the chair hanger must then be determined. Contact Von Roll Transports Systems, Inc., for replacement parts and/or acceptable repair procedures and recommendations for particular deficiencies.

Rev: 1
IN-32-261
6/19/89
MAF



2 PASSENGER CHAIR HANGER

INDICATION OF FAILURE AREA

VonRoll Tramways
VON ROLL TRAMWAYS, INC.
733 W. MAIN ST. WATERTOWN N.Y. 13601

JOB NO.

DWG NO. SK1994-

DATE 1/6/94

753 W. Main St., P.O. Box 869
Watertown, New York 13601

Tel. (315) 788-1280 Fax (315) 788-1321

CRITERIA 2,3,4 PASSENGER CHAIRS

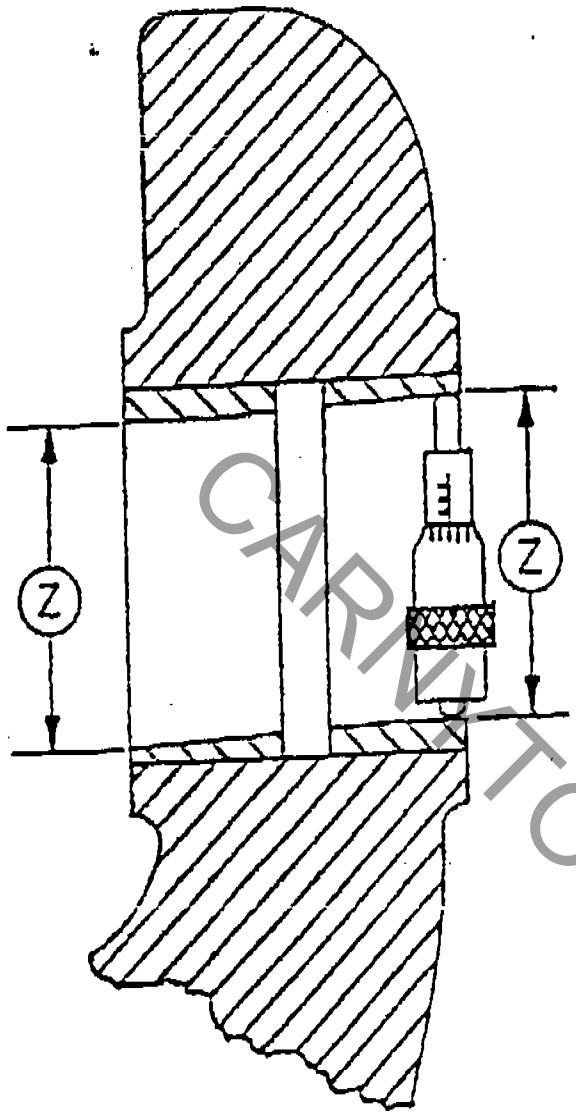


FIGURE 2.

Z-X=Wear

DIMENSION CHART

Grip Part No.	X
2983-E	1.750
4660	1.750
4660-AC	1.500
4660-AD	1.375
2984-E	1.750
4661	1.750
4661-AC	1.500
2985-E	1.750
4662	1.750
4662-AC	1.500
4008	1.750