#130070

ERL MAINTENANCE SUPPORT SDN BHD

(Company No. 498574-T)

E-MAS

Effective Railway Operations; Reliable System Maintenance

ROLLING STOCK DEPARTMENT

IN-HOUSE TECHNICAL INSTRUCTION

DISMOUNTING & MOUNTING WHEEL-SET INNER RING

R00.OMR.M91120.BT.0005.B

Release

	Name	Dept./Position	Date	Signature
Released:	Norazman	RST HoD	06.01.16	
Checked:	Mohamad	RST QEMR	06.01.16	
Author:	Mohd Nurul	RST Tech. Exec.	06.01.16	

Amendments or additions to this procedure must be indicated with a vertical black line in the adjacent left margin.

Change Record and Configuration Control

Revision	Date	Modification	Name
B	06-Jan-16	Updated to new RST Technical Instruction template. All the main contents are remain unchanged	Mohd Nurul
A	28-Jan-08	New - to supersede the existing procedure (DOCS ref. no. R00.OMR.M12980.CX.0001.A) in order to comply with the current company requirement.	Md Zainullah

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1 Purpose

This technical instruction describes the steps involving the use of Induction Heater for the purpose of dismantling axle bearing inner ring. The Manual by the manufacturer (Liefert GmbH), refer Attachment 1 - Manual Ring Heater, Instructions for using the PSI 15-400/350-150 Inductor LEIFERT INDUCTION, (R00.OMR.M91121.NB.1001.A) is to be read together with this technical instruction.

The assembling of axle bearing inner ring is carried out using the Industrial Oven. Refer to VÖTSCH Heating & Drying Cabinet Operating Instruction, D11.OMR.M82300.NA.1001.A.

With the introduction of the induction heater, effective immediately, the procedure for Removal of Bearing Rings Using Liquid Nitrogen - G00.OMR.M91000.BT.0001.* is no longer valid.

2 Scope, Distribution & Access

The scope covers the dismantling and assembling of inner ring of the train axles. The distribution and access shall be available for all RST and could be viewed and retrieved via EDMS and RST Portal [http://express50/ E-MAS_Portal/RST.html]. The hardcopy of this procedure is available in RST foreman room for reference. The full access for editing this document is only granted to RST MGT.

3 Procedure

This procedure is established in order to ensure all safety requirements are adhered at all times including actions to be taken to prevent the wheel-set to move during dismantling and assembling of inner ring processes.

The step-by-step guidance will ensure the chances of axle surfaces to develop scratches is reduced or eliminated.

4 Safety Precaution.

The safety precautions shall be adhered accordingly at every time to prevent injury and damage to the wheel-set and machineries.

4.1 General - Safety Precaution

- Wheel-set shall be secured with wheel choke to prevent rolling or movement of wheel-set during dismantling and assembling processes.
- Thermal resistance hand glove shall be used at all times when handling the heated inner rings.
- Thermal resistance hand glove should be free of any oil or grease traces, in order to have good grip/handling on the heated inner rings.
- The inner rings and axle end should be cleaned and free of oil or grease traces before continuing the dismounting or mounting process.

- The maximum allowable temperature for inner ring is not more than 150°C. Higher temperature will permanently change the material property.

4.2 Induction Heater – Safety Precaution

- The frequency adjustment controls may never be used by a person with a pacemaker or electrical implants. The distance between any such person and the inductor and the frequency generator controls and its Induction coil must always be >3 metres.
- Metal objects that are anywhere close to the inductor will get hot. Great care needs to be taken with implants, watches and rings.
- When the inductor is in operation the safety distance of > 0.5 meters must be observed at all times.
- Extra care should be taken during centering the Induction Coil to prevent scratches on the axle surfaces.
- Before switching on the START button, ensure that there is a bearing inner ring placed and centered in the induction coil. Refer to the drawing in page 6.
- To have an equal heating in the bearing inner ring, the position of the bearing inner ring must always be in the center of the induction coil.
- If the centering screws remain tight during the heating procedure, the expansion of the coil could lead to tension and could damage the inductor. Therefore the centering screws must be loosening approx. by quarter turn.

4.3 Industrial Oven – Safety Precaution

- Fire Hazard
  - Keep the industrial Oven free from any combustible objects and materials.
  - Keep the working space and equipment, exhaust air line, etc clean.
- The door is within the higher temperature region; do not touch it when the Industrial Oven is in operational.

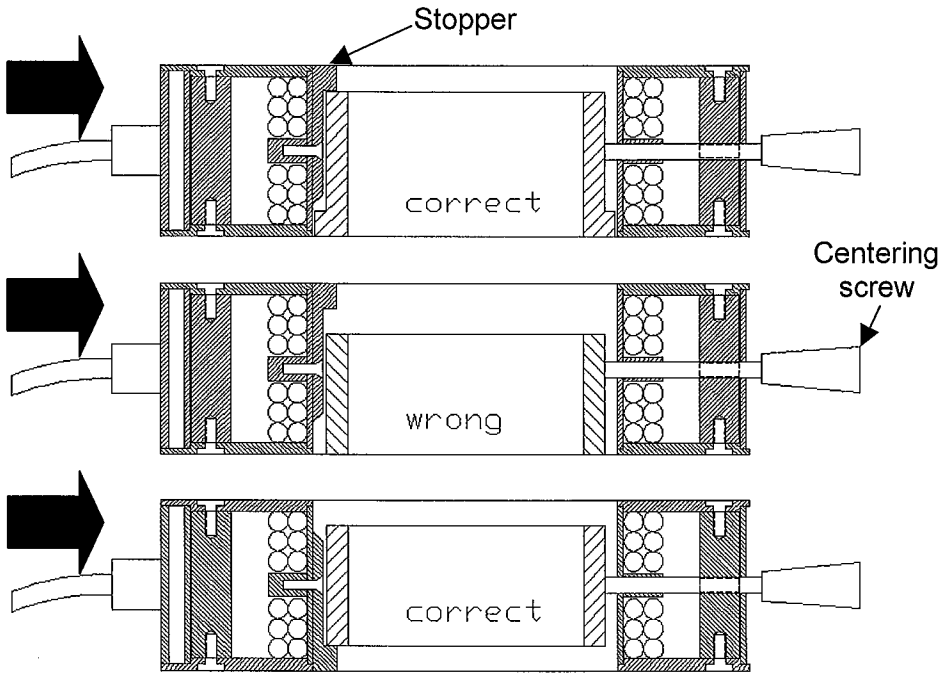
5 Dismounting of Bearing Inner Ring using Induction Heater

The purpose of the heating procedure is to heat the surface as quickly as possible before the temperature is transferred into the shaft. For dismounting processes, the machine manufacturer has set a pre-determined heating power at 15kW. Follow below steps for dismounting the inner rings:

- Select the selector to **Dismount**
- Select the selector to **Time**
- Set the time to **15** seconds

- Place the induction coil on the bearing inner ring until it rest on the coil. See below figures:

Inner side ring is correctly positioned in the induction coil. Observe the stopper.
Outer side ring is wrongly positioned in the induction coil. Observe the stopper.
Outer side ring is correctly positioned in the induction coil. Observe the stopper.



- Center the inner ring position in the induction coil by adjusting the centering screws.
- Loosen the centering screws by a quarter turn.
- Press the green Start button to start up the frequency generator.
- While the frequency generator is operating, always maintain a safety distance of 0.5 meter from the induction coil.
- Once the frequency generator has completed its time cycles of 15 seconds, it will be switched off automatically.
- Remove the Induction coil by holding its centering screws.
- Bearing inner ring is now ready to be dismount from the axle end.

5.1 Continuous dismounting process

- After successfully or unsuccessfully dismounting the bearing inner ring, the axles have to be cool down to 55°C, before continuing with the next dismounting process. If the axles are not cool down accordingly, the temperature of inner ring could increase to more than 160°C and resulting to permanent defect on the material property.
- Bearing inner ring heated above than 160°C is considered not fit for service and therefore shall be scrapped.

- Temperature on the bearing inner ring being heated is measured with the probe supplied by Liefert GmbH. Additional temperature monitoring on the temperature increase/settlement is measured using the infrared thermometer.

6 Mounting of Bearing Inner Ring using Industrial Oven

Although the induction heater is designed for dismounting and mounting of inner ring, the induction coil provided is too small for the labyrinth ring and therefore heating of the labyrinth ring could only be done with the Industrial Oven.

With the industrial oven, all the components (2 inner rings and 1 labyrinth ring) were heated at the same time and fixed to the axle continuously. Whilst it is still hot, the hydraulic puller/press machine will be used to ensure all the components are secured firmly on its seat.

Process of heating:

a. Set the temperature to 150°C on the panel.

b. Allow the industrial oven to reach the selected temperature for 15 ~ 20minutes in order to allow heat is distributed evenly.

c. The sequence of mounting is described below;
   - Insert the heated Labyrinth Ring to the axle
   - Insert the inner side bearing ring to the axle
   - Insert the outer side bearing inner ring to the axle.
   - Press with Hydraulic Puller/Press machine to ensure all 3 components are secured at its seating.
   - To ensure labyrinth ring and inner rings are firmly seated, the pressure is to be increase so as to obtain a pressure force of 400kN.

7 Summary

The induction-heating ring is suitable for the dismounting of the inner rings, as it appears to be likely to reduce the chances of scratching the axles during dismounting processes. Due to the fact that all axles dismounted have various degrees of scratches, it cannot be concluded if the dismounting of inner bearings on scratch free axle would produce no scratches. Therefore extra care must be applied when mounting and dismounting the inner rings.

Dismounting of labyrinth ring will be with Hydraulic Puller.

The inner ring that is unable to be dismounted using induction heater will be force out with Hydraulic Puller.

The industrial oven is suitable for mounting of labyrinth ring and the inner ring. Whilst the labyrinth ring and inner ring are still warm, it should be press with hydraulic puller to ensure all components are firmly seated.

To ensure the procedure is being adhered accordingly, a record for each axle indicating

- ✓ The inner ring temperature during mounting or dismounting.
- ✓ Physical condition of the inner ring i.e. discoloration, scratches etc.
- ✓ Physical condition of the axle i.e. scratches free or with scratches.
- ✓ The axle serial no. and the diameter i.e. 118mm or 120mm.

Sample of the checklist use for recording purposes is as attachment 2 and 3.

Appendices

Appendix 1: Manual Ring Heater - To mount and dismount bearing inner rings (Instructions for using the PSI 15-400/350-150 Inductor), R00.OMR.M91121.NB.1001.A.

Appendix 2: VÖTSCH Heating & Drying Cabinet Operating Instruction, D11.OMR.M82300.NA.1001.A.

Attachment

Attachment 1: Manual Ring Heater - To mount and dismount bearing inner rings (Instructions for using the PSI 15-400/350-150 Inductor), R00.OMR.M91121.NB.1001.A.

Attachment 1

LEIFERT INDUCTION

SYSTEME FÜR INDUKTIVES ERWÄRMEN

Manual Ring heater

To mount and dismount Bearing inner rings

Instructions for using the PSI 15-400/350-150 Inductor

Preliminary warning

Safety Precautions

The frequency adjustment controls may never be used by a person with a pacemaker other electrical implants. The distance between any such person and the inductor and the frequency generator controls and its Induction coil must always be >3 metres.

Metal objects that are anywhere close to the inductor will get hot. Great care needs to be taken with implants, watches and rings.

When the inductor is in operation the safety distance of > 0.5 metres must be observed at all times.

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1.0 Time and Temperature Functions

The induction coil is used to heat the bearing inner rings inductively. It has a switch for selecting between two operating modes:

Time mode: After the operator has started the Machine, the timer will also start up. After the pre-set time has elapsed, the machine will switch off automatically. The Temperature control switch is **not** in operation. The commands from the control and the alarm will be completely ignored. The temperature sensor and the control switch are used for displaying the current temperature.
(See the picture)

Temperature mode: The Temperature function is for determining a temperature using the sensor and for checking the control. The Machine will switch off if the Temperature is reached, and if required the control keeps it Temperature. (Used by Mounting) After the pre-set time has elapsed, the inductor will switch off automatically. (See the picture)

The Time mode will operate always when the switch is in either position. The inductor will switch off automatically after the pre-set time has elapsed, whatever the position of the switch.

1.1 Procedures to mount and dismount Inner rings

The mount and dismount switch is used to pre-determine the heating power. (Mount P= 4kW and dismount P= 15kW)

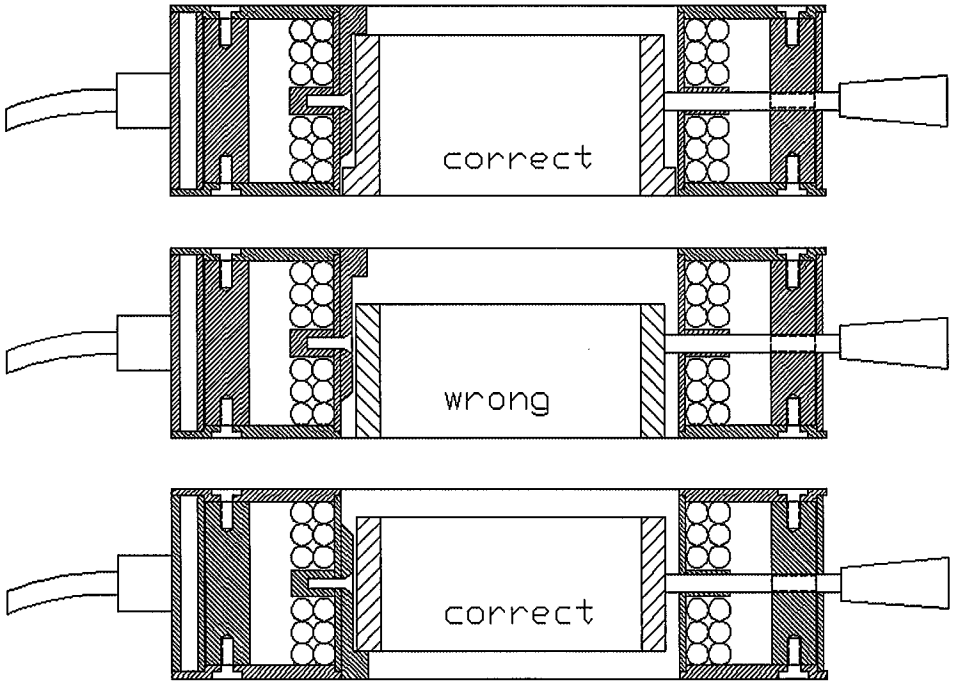
To mount
For this mounting procedure the bearing inner ring will be pre-heated with a power of 4 kW. The final temperature will depend on the time needed to pre-heat and the mass of the bearing inner ring. The heating required to install the Bearing inner ring must be carried out with due regard for the hardened shell and so a low power must be used. (See the picture of mount switch)

To dismount
The dismount procedure must be carried out with high power (P= 15kW) an operating Temperature for the induction coil as possible. The purpose of the heating procedure is to heat the surface as quickly as possible before the temperature is transferred into the shaft.
In this case we only heat the bearing inner ring and not the shaft.
Now you can easily take the bearing inner ring from the shaft.
(See the picture of dismount switch)

1.2 Using the inductor

The three centring screws are used to centre the Bearing inner ring in the middle of the inductor. After the centring has been completed, you must then loosen the screws by approximately ¼ turn. You must be able to turn the inductor on the Bearing inner ring!
Just *lightly* adjust the screws on to the Bearing inner ring!!
(NOT strong)

Warning:
If the screws remain tight during the heating procedure, the expansion of the coil could lead to tension and, possibly, damage the inductor.



The Bearing inner ring stops inside the induction coil are for positioning at the right depth. To have an equal heating in the bearing inner ring, the position of the bearing inner ring must always be in the middle of the induction coil as shown on the drawings above.

1.3 Dismounting a bearing inner ring

Generator settings

Mount / dismount switch:	**dismount**
Time / Hold:	**Time**
Set time to:	**15 seconds** 1)

1) User determines times.

- Place the induction Coil on the bearing inner ring until it comes to rest on the coil. **(see drawing page 5)**
- Centre the induction coil by adjusting the centring screws.
- Loosen the centring screws by a ¼ turn. (NOT tight)
- Press the green Start button to Start up the frequency generator.
- While the frequency generator is operating, always maintain a safety distance of ½ metre from the induction coil.
- The frequency generator has completed its time cycles of 15 seconds and will be switched off automatically.
- Take the Induction coil by its centring screws and take off the induction coil including the bearing inner ring.

Warning: If you removed the heated bearing inner ring, make sure you directly loosen the centring screws and take the heated bearing inner ring out of the Induction coil.

1.4 Mounting a bearing inner ring

Generator settings

Mount / dismount switch:	**Mount**
Time / Hold:	**Time**
Set timer to:	**30 seconds** 1)

1) User determines times.

- Place the induction Coil on a flat surface, and place the bearing inner ring inside the coil. **(see drawing page 5)**
- Centre the bearing inner ring by using the centring screws.
- Loosen the centring screws completely.
  (Do **NOT** tighten the bearing inner ring)
- Press the green Start button to Start up the frequency generator.
- While the frequency generator is operating, always maintain a safety distance of ½ metre from the induction coil.
- The frequency generator has completed its time cycles of 30 seconds and will be switched off automatically.
- Now take the bearing inner ring out of the Induction coil by hand and mount it on the shaft.

2.0 The induction coil

The induction coil is made to heat the Bearing inner rings with the following dimensions:

1) External Ø 142 mm, width 60.5 mm
2) External Ø 142 / 153 mm, width 73 mm

The induction coil is tailored made for use in combination with the frequency generator. Also the used power is exactly designed for your application. The generator may only be connected to the induction coil which is supplied with it.

Note: Before switching on, you must ensure that there is a workpiece in the inductor.

The maximum operating temperature of the inductor is = 150°C, and for a brief period 180 °C.

Note: The inductor cables must be checked at regular intervals for damage.

Warning:

When the machine is operation a minimum safety distance of > 0.5 metres from the inductor must be maintained at all times.

Any person with a pacemaker or other electrical implants must maintain a distance of > 3 metres from the inductor and frequency controls.

3.0 The frequency generator

3.1 Technical specifications

Type	: PSI 15-400/350-150
Effective power	: 15 KW
Output frequency	: 10 - 25 KHz
Mains voltage	: 415 v / 50 Hz
Mains voltage	: 18 kVA
Mains rated current	: 24 A
Fuse mains	: 32 A
Connection	: Plug, 5 poles
Dimensions W x D x H	: 550 x 500 x 480 mm
Weight	: 35 kg

3.2 Signals

The three green LED signal indicate the internal power supply. The six red LED lights signal an internal switch-off of the frequency generator due to malfunction.

The LED lights signals are meaning the following:

Permanent green light:
You may switch the induction coil on.

Permanent red light:
The Frequency generator is malfunctioning. The problem may be the result of the switch setting (only when operating on Hold) or as a result of a fault in the electronics (red LED).
If red LED is burning, contact the service department of the Manufacturer.

Red flashing light:
The System is operating.

Red and green flashing lights:
The machine is working in Temperature Hold mode and has reached It's Temperature. The temperature is now in the pre-set range.

4.0 The temperature sensor

The magnetic sensor supplied with the System operates with a type K thermo element. The magnetic sensor should always be placed on that position where the highest temperature will be reached on the work piece. (Place temperature probe on flat surface on inner ring)
The sensor is designed for a maximum temperature of 240°C.

5.0 Cooling

The frequency generator is air-cooled. The air will be transferred through a filter on the rear of the frequency generator and then expelled through an exit filter.

6.0 Maintenance

The air filters at the rear of the frequency Generator must be replaced when dirty. The induction coil and his connections cables must be checked at regular intervals and replaced if the insulation is damaged.