# TECHNOLOGY MANAGEMENT

# SPECIFICATION

## TECHNICAL AUDIT CHECKLIST FOR IN-SERVICE AUTOMATIC DROPPING DEVICE (ADD) TYPE PANTOGRAPHS

## TYPE: SIEMENS
## 8WLO 308-8ZG29
## 8WLO 103-8ZG29

## WITH CARBON CONTACT STRIPS


| | | | |
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## 1.0 AMENDMENT HISTORY

| Amendment number | Section amended | Summary of amendments | Revision |
|---|---|---|---|
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## 2.0 ABBREVIATIONS AND DEFINITIONS

| | | | |
|---|---|---|---|
| BES: | Balance Engineering Supplies | OEM: | Original Equipment Manufacturer |
| KM11: | Pantograph static force recorder | ADD: | Automatic dropping device |

## 3.0 SCOPE

To provide the technical audit checklist that is used to assess conformance to specification of a:

- BES ADD pantograph with flat carbon contact strips on class 9E (S1 and S2) locomotives
- Siemens ADD pantograph with flat carbon contact strips on class 9E (S1 and S2) and 15E (S1 and S2) locomotives

In a manner that will ensure that:

- The requirements for the technical audit checklist are traceable to reference documents, including all nominal values and limits that must be conformed to
- Any additional measuring equipment and tools required for performing the technical audit are listed below
- All approved safety procedures including those mentioned in this document must be adhered to when performing any work on pantographs

## 4.0 REFERENCES

The requirements for the technical audit checklist were adapted from the following reference documents:

- The maintenance manual for the BES pantograph, Book 356; Reg. No. 86 00953/07
- BBD8092: The maintenance manual for the Siemens pantograph
- RT/TE/PRO/0006: Preliminary Maintenance Procedure
- RSE/TE/PRO/0097: Procedure: Method to conduct technical audit on pantographs

## 5.0 APPLICABLE PANTOGRAPH TYPES

The technical audit checklist is applicable to the following pantograph types:

BES pantographs

| Model: BES | Locomotive Class | Mounting Configuration | Contact strip material | Limitations |
|---|---|---|---|---|
| CC2685 | 9E (S1 and S2) | 4 Point | Flat carbon contact strips x 2 | None |

Siemens pantographs

| Model: Siemens | Locomotive Class | Mounting Configuration | Contact strip material | Limitations |
|---|---|---|---|---|
| 8WLO 308-8ZG29 | 9E (S1 and S2) | 4 Point | Flat carbon contact strips x 2 | None |
| 8WLO 103-8ZG29 | 15E (S1 and S2) | 4 Point | Flat carbon contact strips x 2 | None |

## 6.0 MEASURING EQUIPMENT AND TOOLS

The tools and measuring equipment that is required for technical audits on pantographs are listed in Procedure RSE/TE/PRO/0097. In addition, the specific types of equipment listed below are required:

- KM11
- Stop rope
- Calibrated mass pieces (1 x 8.5kg and 2 x 0.75kg)
- ADD safety bolt – (Siemens Pantograph with the base frame ADD only)

## 7.0 METHOD TO PERFORM THE TECHNICAL AUDIT

The Technical Audit Checklist with the requirements and specified limits to be used during a pantograph technical audit is given in Appendix A.

The detailed work procedure to verify the requirements set out in the pantograph technical audit checklist is given in Appendix B.

The method to conduct a technical audit as well as useful references pertaining to technical audits is given in Procedure RSE/TE/PRO/0097.

**END**

## APPENDIX A:
## AUTOMATIC DROPPING DEVICE (ADD) TYPE PANTOGRAPH CHECKLIST: BES AND SIEMENS

| **IN-SERVICE PANTOGRAPH** | **CARBON CONTACT STRIPS** |
|---|---|
| Pantograph serial number | |

| **REQUIREMENTS** | | | **LIMIT** | **No. 1 End** |
|---|---|---|---|---|
| **COLLECTOR HEAD SUB-ASSEMBLY** | | | | |
| Gap between end horn and carbon contact strip | | | Max. 3mm | mm |
| Minimum carbon allowed when measured from carbon carrier | | | Min. 2mm | mm |
| Insulator plates and end horns must have correct set and not be damaged/worn out | | | As per manual | |
| No sharp edges between the carbon and any part of the end horn that will cause fouling with the overhead contact wire | | | No sharp edges | |
| Carbon contact strips to be parallel to the overhead contact wire (even strip wear) and must be mounted parallel to the apex tube | | | Parallel | |
| No loose, badly chipped or cracks exceeding 3mm wide on the carbon contact strips that may cause a hook-up | | | Not loose/chipped<br>Max. 3mm cracks | |
| Replace all frayed shunt straps | | | Max. 20% | |
| All electrical connections to have contact paste applied and secured to the specified torque values | | | BES: 17-18Nm<br>Siemens: 30-34Nm | |
| **SECONDARY SUSPENSION SUB-ASSEMBLY** | | | | |
| All components that are replaced must be assembled correctly | | | As per manual | |
| **BES** | Deflection on left and right secondary suspension with 9,25kg mass applied | | Min.: 12mm<br>Max.: 21mm | Left mm<br>Right mm |
| **BES** | All lubrication points to be clean and lubricated sufficiently with the approved lubricant | | Visible soft grease | |
| **Siemens** | Distance between bottom of the carbon contact strip and top of apex tube measured at centre of the collector head without nominal static force applied | | Min.: 40mm<br>Max.: 60mm | mm |
| **FRAME SUB-ASSEMBLY** | | | | |
| All components that are replaced must be assembled correctly | | | As per manual | |
| Check the framework for any distortion over its total length (upper and lower arms) | | | Max. 10mm | mm |
| Replace all frayed shunt straps | | | Max. 20% | |
| All electrical connections to have contact paste applied and secured to the specified torque values | | | BES: 17-18Nm<br>Siemens: 35-40Nm | |
| Air cylinder rubber dust boot | | | Not torn/damaged | |
| **BES** | All lubrication points to be clean and lubricated sufficiently with the approved lubricant | | Visible soft grease | |
| **PRIMARY SUSPENSION SUB-ASSEMBLY** | | | | |
| **Siemens** | Fit ADD safety bolt prior to weight testing and KM11 testing* | | Fitted | |
| Attach stop rope to allow pantograph to rise to a maximum height of 2.3m prior to weight testing and KM11 testing* * | | | Fitted | |
| Weight test pantograph using calibrated mass pieces (1x8.5kg & 2x0.75kg) | | | As per manual | |
| Rising time (From housed position and starts moving upward to a height of 2.3m) | | | 6 to 10 seconds | |
| Lowering time (Measured from height of 2.3m and when pantograph starts moving downward to the housed position) | | | 5 to 8 seconds | |
| **C SHED** | **KM11** | Nominal static force over the working height range | 90 $\pm$ 5 N | N |
| | | Force difference between up and down directions | Max. 20N | N |
| **ADD AND AIR SYSTEM COMPONENTS** | | | | |
| ADD shear bolt/pin must not be bent, fractured or damaged in any way | | | No damage | |
| Check for air leaks in the system (cylinder, valve, pipes and ADD shear bolt/pin) | | | No air leaks | |

***** Siemens pantograph must have ADD safety bolt fitted prior to weight testing and KM11 testing. The ADD safety bolt must be removed upon completion of pantograph inspection.

* * Stop rope must be fitted prior to weight testing and KM11 testing. The stop rope must be removed upon completion of pantograph inspection.

## APPENDIX B:
## DETAILED WORK PROCEDURE

The detailed work procedure to verify the requirements set out in the pantograph checklist is given below.

**Collector head sub-assembly:**

Contact strips:

1. The thickness of each contact strip must be measured at the center of the strip as well as 300mm to the left and right of the center.
2. If the thickness of the contact strip is less than 2 mm, the strip must be removed and replaced with a new one.
3. If loose or badly chipped carbon contact strips that may cause a hook-up or cracks wider than 3mm are found on the carbon contact strips, the contact strips must be removed and replaced with new ones. This must be determined by visual inspection and any uncertainty must be brought to the line manager's attention for final decision.

End horns:

4. Any sharp edges between the contact strips and the end horn that can cause fouling with the overhead contact wire must be dressed (leveled).
5. The gap between the end horn and the contact strip must not be greater than 3mm.
6. The end horns must be checked for excessive wear on the running surfaces.

Shunt straps:

7. Shunt straps must be fitted to the collector head.
8. If a shunt strap is frayed more than 20%, the strap must be replaced with a new one.
9. All electrical connections must be tinned and approved electrical contact paste must be applied to the electrical contact surfaces.

BES pantograph

10. The M8 A2 stainless steel nuts of the electrical connections on the shunt straps must be secured to a torque value of 17 - 18Nm.
11. The end horns must be checked for the correct set by means of the appropriate jig and must not have excessive wear on the running surfaces.

Siemens pantograph

12. The M8 x 30 stainless steel nuts and bolts of the electrical connections on the shunt straps must be secured to a torque value of 30 – 34Nm.
13. Check for the correct set end horns and the cross bow on the end horn supporting the resilient mount must be recessed by 12mm where it is fixed to the end horn.
14. The insulating plate material on the end horns must be checked for damage and replaced if necessary.

**Secondary suspension sub-assembly:**

BES pantographs

15. The deflection of the secondary suspension unit must be measured by measuring the deflection of the plunger when placing a total mass of 9.25kg on the secondary suspension unit.
16. If the deflection is less than 12mm or more than 21mm, the secondary suspension unit must be replaced with a new one.
17. If a suspension unit is found with worn components, it must be removed and replaced with a new one.
18. The correct suspension units must be assembled; one suspension unit must be a swivel type fixture to the collector head, having a slotted hole with a loose bush and the other, a fixed type with a captive bush.
19. All the lubrication points must be thoroughly cleaned and lubricated with the approved lubricant. A total mass of 9.25kg must be placed on the secondary suspension unit when the lubricant is applied. As soon as the mass piece starts to move in the upward direction, the amount of lubricant applied is sufficient.

Siemens pantograph

20. The resilient mounts must be examined for external damage or perished rubbers and replaced if necessary.
21. Ensure that the resilient mounts are assembled on the trailing carbon end of the collector head with the pantograph knuckle leading.
22. Measure the distance at 300mm on either side of the centre of the collector head, from the bottom of the carbon strip, to the top of the apex tube with no force applied to the collector head. The distance must be between 40 – 60mm, if not; the resilient mounts must be adjusted.

### Frame sub-assembly:

23. Visually check that all components are correctly assembled as per manual (balance beam, push rod, thrust rod, rest, cam and cam adjustment screws & links).
24. Visually check the framework (upper and lower arms) using a straight edge (1 – 1.5m) for any distortion or external damage. If the distortion is more than 10mm, the pantograph must be removed and replaced with a new one.
25. The pantograph must be raised. Visually inspect the air cylinder for: alignment, securing, air leaks and rubber dust boot.

BES pantographs

26. All the lubrication points must be thoroughly cleaned and lubricated with the approved lubricant.
27. The M8 A2 stainless steel nuts of the electrical connections on the shunt straps must be secured to a torque value of 17 - 18Nm.

Siemens pantographs

28. The M10 x18 stainless steel nuts and bolts of the electrical connections on the shunt straps must be secured to a torque value of 35 – 40Nm.

Shunt straps:

29. If a shunt strap is frayed more than 20%, the strap must be replaced with a new one.
30. All electrical connections must be tinned and approved electrical contact paste must be applied to the electrical contact surfaces.

### Primary suspension sub-assembly:

31. Correctly attach a stop rope to ensure that the pantograph is able to rise to a maximum height of 2.3m above the pantograph rest position prior to weight testing and KM11 testing.
32. The pantographs must be weight tested with calibrated mass pieces (1x8.5kg and 2x0.75kg) for adjusting the pantograph nominal static force.
33. The pantograph static force must be measured with the KM11. The calculated nominal static force over the working height range must be 85 – 95N. The force difference between the rising and lowering directions must not exceed 20N.
34. The pantograph rising time must be measured from, when the pantograph starts moving upward to a height of 2.3m. (6 – 10s)
35. The pantograph lowering time must be measured from, when the pantograph starts moving downward from a height of 2.3m to the housed position. (5 – 8s)

Siemens pantograph

36. Ensure that the ADD safety bolt is correctly fitted prior to weight testing and KM11 testing.

### ADD and air system components:

37. Check and ensure that the ADD shear bolt/pin is not bent, fractured or damaged in any way.
38. Visually inspect and listen for any air leaks in the system. The air system must be checked from the locomotive roof air supply point and must include the air cylinder, air valve, air pipes and ADD shear bolt/pin.

***Note***: Should the pantograph be replaced, the newly fitted pantograph must be verified for conformance to specification in the same manner as set out in the detailed work procedure above.
Ensure that the ADD safety bolt and the stop rope are fitted prior to weight testing or KM11 testing and these must be removed from the pantograph upon completion of pantograph inspection.