



MINISTRY OF TRANSPORTS AND INFRASTRUCTURE  
ROMANIAN RAILWAY AUTHORITY - AFER

ROMANIAN RAILWAY INVESTIGATING BODY



## **INVESTIGATING REPORT**

on the fire occurred on the 17<sup>th</sup> of May 2011,  
on the range of CF Bucharest Regional Branch, between the railway stations  
Titu - Nucet, at the locomotive DA 60-0793-4 (belonging to SNTFC “CFR  
Calatori” SA Bucharest) hauling the passenger train no. 9432



Final EDITION  
18<sup>th</sup> of January 2012

## NOTICE

With reference to the accident occurred on the 17<sup>th</sup> of May 2011, on the running section Targoviste – Titu, between the railway stations CFR Titu – Nucet (km. 2+500), in the running of the passenger train no. 9432 (belonging to SNTFC “CFR Calatori” SA Bucharest) consisting on a fire in the engines box (the area of the engine of the ventilator PC2) at the locomotive DA 60-0793-4, Romanian Railway Investigating Body carried out an investigation, according to the provisions of the Government Decision no. 117/2010. Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this situation.

Romanian Railway Investigating Body considers necessary to take corrective measures in order to improve the railway safety and to prevent the accidents, so it included in the report a series of safety recommendations.

Bucharest, 18th of January 2012

*Approved by*  
Dragoş FLOROIU  
**Director**

I agree the compliance with the  
legal provisions on the  
investigation performance and  
drawing up of this Investigation Report,  
that **I submit for approval**

**Chief Investigator**  
Nicu PĂLĂNGEANU

**This approval is part of the *Report for the investigation* of the accident occurred on the 17<sup>th</sup> of May 2011, on the range of activity of CF Bucharest Regional Branch, the running section Targoviste – Titu (double line non-electrified), between the railway stations Titu – Nucet (km. 2+500) at the locomotive DA 60-0793-4 hauling the passenger train no. 9432.**

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## **I. PREAMBLE**

### **I.1. Introduction**

The fire occurred on the 17<sup>th</sup> off May 2011 in the running of the passenger train no. 9432, at the locomotive DA 60-0793-4 (structural subsystem-railway vehicle), is an accident according to the art. 7, paragraph (1), letter e) from the ***Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety***, approved by Government Decision no. 117/2010, hereinafter referred as ***Regulations*** in the investigation report.

Taking into account those above mentioned and according to the art. 19, paragraph (2) from the ***Law no. 55/2006 on the railway safety***, corroborated with the art. 48, paragraph (1) of the ***Regulations***, an investigation commission was appointed by Romanian Railway Investigating Body.

Through the investigation, the information on the respective accident was gathered and analyzed, the conditions were established and the causes determined.

Romanian Railway Investigating Body investigation did not aim to establish the guilty or the responsibility in this situation.

### **I.2. Investigation process**

Immediately after the occurrence of this accident, Romanian Railway Investigating Body was notified verbally and in written by the CNCF “CFR” SA – Regional Inspectorate for Traffic Safety Bucharest.

After checking the locomotive the investigation commission observed:

- at the outside of the locomotive box was no sign of thermal affectation;
- during the intervention of the military firemen 4 side windows were broken, two on each side;
  - in the driving stations was no sign of smoke or thermal affectation;
  - in the engines box were signs of thermal affectation in the bottom area of the engine of the ventilator PC2: unaffected thermally, the ventilator hood on the left (distribution 2) with the paint ***thermally affected***, on the bottom part;
    - flexible connection between the residues ramp MD and the collection tank, ***thermally affected***;
    - the argus tube between the MD and the heat switch unaffected thermally;
    - the argus tube between the heat switch and the battery of combined filters of oil unaffected thermally;
    - the rubber sleeves link between the MD and the oil filters ducts, under the floor, ***thermally affected***;
    - signs of ***thermal affectation*** under the floors from the engines box on the corridor next to the distribution 2 and to the injection pump no. 11;
    - Cover doses of electrical connection EMT 4, ***thermally affected***;
    - Yoke fixing the electric cables EMT 4 upper side ***thermally affected***;
    - Yoke fixing the electric cables EMT 4 bottom side unaffected thermally;
    - Yoke fixing in the dose and the cabled in the power installation associated to EMT 4 unaffected thermally;
    - The protection sleeves of the electric connections E and F from the dose MT 4 ***thermally affected*** at the upper side;

- The protection sleeves of the electric connections H and A from the dose MT 4 unaffected thermally;
- The connections of the power cables from the dose EMT 4, appropriately tighten, without sign of heating or thermal affectation;
- The bellows of the ventilation channel EMT 4 and EMT 5, unaffected thermally;
- The connection cables EMT 4, *thermally affected* at the upper side on a distance of 150 mm after the cover of the connection dose and unaffected on the rest of the distance to the input in the traction engine;
- Inspecting the EMT 4 through the access cover were found the collector, insulators, carbon brush-holder crown, the link connections of the auxiliary poles, the stator winding and the rotor bandage in appropriate condition, without signs of flames, unaffected thermally;

No deaths or injuries.

At the place of the railway accident were present the representatives of:

- Inspectorate for Emergency Situations “Basarabi I” of Dambovită County, Titu Firemen Detachment;
- Operative Department of Railway Transports Police;
- National Railway Company “CFR” SA;
- National Company of Railway Passenger Transport “CFR Calatori” SA.

Through the Decision no. 57-I from the 1<sup>st</sup> of November 2011 of the OIFR Director, according to the provisions of the art. 19, paragraph (2) of the *Law no. 55/2006 on the railway safety*, corroborated with the art. 48(1) of the **Regulations**, the investigation commission was appointed, consisting of:

- |  |                      |
|--|----------------------|
| ▪ Pălăngeanu Nicu – OIFR chief investigator                              | - main investigator; |
| ▪ Ștefan Ciochină – investigator   | - member;            |
| ▪ Viorel Cătănescu – regional inspector T – CF Bucharest Regional Branch | - member;            |
| ▪ Bogdan Timiș – central inspector T – SNTFC “CFR Calatori” SA           | - member;            |
| ▪ Iulian Neacșu – deputy head of depot Bucharest Calatori                | - member.            |

## **A. BRIEF PRESENTATION OF THE ACCIDENT**

### **A.1. Brief presentation**

On the 17<sup>th</sup> of May 2011, at 7:35 a.m. the locomotive DA 60-0793-4, hauling the passenger train no. 9432 on the range of activity of CF Bucharest Regional Branch, the running section Targoviste – Titu (double line non-electrified), between the flag station Dambovicioara and the flag station Podu Rizii, in current line at the km 2+500, occurred a fire in the engines box in the area of the electric connection dose of the traction engine no. 4.



Place of the accident

After stopping the train, failing to localize and extinguish the fire in the engines box, the locomotive driver called the emergency services at 112, asking for the intervention of the Inspectorate for Emergency Situations. The fire was completely extinguished by the firemen belonging to the Inspectorate for Emergency Situations “Basarabi I” of Dambovita County, TiTu Firemen Detachment at 8:40 a.m.

The intervention of the firemen was performed in current line between the flag station Dambovicioara and the flag station Podu Rizii at the km 2+500, then the locomotive DA 60-0793-4 was towed by the locomotive aid DA 60-1522-2, directed from the railway station Titu.

The locomotive DA 60-0793-4 belongs to SNTFC “CFR Calatori” SA (Ploiesti locomotives depot) and was driven/served by locomotive driver in simplified driving.

The place of the accident is located in the area of the km 2+500 between the flag station Dambovicioara and the flag station Podu Rizii on the running section Targoviste – Titu (double line non-electrified) line in alignment and gradient of 3.27 ‰ in the running direction.

The area of the railway accident is located on the running section Targoviste – Titu, belonging to CNCF “CFR” SA – CF Bucharest Regional Branch.

## A.2. Causes of the accident

### A.2.1. Direct cause

The fire occurrence was due to insulation piercing of the power cables H and F of the traction engine no. 4, placed outside the connection dose of the power cables, which led to the melt of the insulation of these cables, the occurrence of electric discharges between them and their insulation ignition.

#### Contributing factors

The piercing was due to the occurrence of over-voltages of switching caused by the train heating installation type INDA and the electric traction engines, given a minimum admitted value of the insulation resistance of the power cables associated to the traction engine no. 4.

### A.2.2. Underlying cause

None.

### A.2.3. Root causes

None.



### **A.3. Severity level of the accident**

According to the provisions of the *Regulations for the investigation of the accidents and incidents, for the development and improvement of Romanian railway and subway safety*, approved by Government Decision no. 117/2010, it is categorized as accident, according to the provisions of the art. 7 paragraph (1) letter e.

### **A.4 Safety recommendations**

The safety recommendations aim to solve the next issues:

1. Development of a study on the occurrence of switching over-voltages caused by the train heating installation type INDA and the traction engines together, to establish the protection methods of the power circuits, in order to prevent the occurrence of similar cases.

The addressees of the safety recommendations are the Romanian Railway Safety Authority and the National Company of Passenger Railway Transport “CFR Calatori” SA.

This investigation report will be sent to the Romanian Railway Safety Authority, to the National Company of Passenger Railway Transport “CFR Calatori” SA and to the National Railway Company “CFR” SA.

## **B. INVESTIGATING REPORT**

### **B.1. Description of the accident**

On the 17<sup>th</sup> of May 2011, at 7:35 a.m. the locomotive DA 60-0793-4, hauling the passenger train no. 9432 on the range of activity of CF Bucharest Regional Branch, the running section Targoviste – Titu (double line non-electrified), between the flag station Dambovicioara and the flag station Podu Rizii, in current line at the km 2+500, a fire occurred with a strong smoke release in the engines box in the area of the motor group ventilator PC2.

After stopping the train in h. Dambovicioara the locomotive driver noticed in the engines box a strong smoke release towards the station II. The locomotive driver tried to enter the engines box to intervene with the fire extinguishers in the locomotive equipment, but because of the smoke too strong from the engines box he gave up.

The locomotive driver contacted the guard to insure the coaches with the hand brake, then they released the locomotive and they put an appropriate distance, to prevent the fire expansion to the coaches. The locomotive driver announced the fire at the emergency number 112 around 7:35 a.m. The fire was extinguished at 8:40 a.m.

At 7:35 a.m. the current line Targoviste – Titu was closed and at 8:40 a.m. from the railway station Titu was directed the locomotive DA 1522 that towed the fired locomotive (60-0793-4) in the railway station Titu.

No injuries.

At 9:08 a.m. the current line Targoviste - Titu was reopened.

The place of the accident is located in the area of the km. 2+500, on the running section Targoviste - Titu (double line non-electrified), between the flag station Dambovicioara and the flag station Podu Rizii, **line** in alignment and with gradient of 3.27 ‰ in the running direction.

The current line Targoviste - Titu is not electrified and the running of the trains is made on the agreement over the phone, in the railway station Titu is used an installation type CR3.

### **B.2. Circumstances of the accidents**

#### **B.2.1. Involved parties**

2.1.1 The involved staff belongs to SNTFC “C.F.R. Calatori”- S.A – Ploiesti locomotives depot.

2.1.2 The locomotive DA 60-0793-4 is the property of SNTFC “C.F.R. Calatori” SA – Ploiesti Depot and is maintained by staff belonging to Locomotives Repairs Section Ploiesti, belonging to SC “CFR – SCRL Brasov” SA.

2.1.3 The railway infrastructure on which the accident occurred belongs to CN CF „CFR” SA – CF Bucharest Regional Branch and is maintained by the staff from the section L 4 Titu.

2.1.4 Installations signaling, centralization and blocking (SCB) between the railway station Titu and the railway station Targoviste are managed by CNCF “CFR” SA - CF Bucharest Regional Branch and are maintained by the staff belonging to Section CT 2 Bucharest.

2.1.5 The installation of railway communications from the railway stations Titu and Targoviste is managed by CNCF “CFR” S.A. - CF Bucharest Regional Branch and is maintained by the staff belonging to SC TELECOMUNICATII CFR S.A.

The investigation commission questioned the driver of the locomotive DA 60-0793-4 and took statements from the guard and the conductor of the train 9432 who were involved in localizing the fire and from the staff who served the train.

### **B.2.2. Forming and equipment of the train**

The train no. 9432 was composed of the locomotive DA 60-0793-4 and 2 coaches, the driving being provided by locomotive driver in simplified driving.

The locomotive belongs to the railway undertaking SNTFC “CFR Calatori” SA.

The safety and vigilance equipment (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI) in the equipment of the locomotive were not affected by the fire, were sealed and in operation.

### **B.2.3. Railway equipments**

The involved railway infrastructure, respectively the current running line between the railway station Titu and the railway station Targoviste, is managed by CN CF “CFR” SA – CF Bucharest Regional Branch and is maintained by staff from the section L 4 Titu.

The current line is in alignment, built with rail type 49, on reinforced concrete sleepers T13.

The running speed of the line Targoviste - Titu is of 100 km/h for the passenger trains.

The current line is not electrified.

### **B.2.4. Means of communication**

The communication between the driver and the movement inspectors was ensured through radio-telephone equipments.

## **B.3. Consequences of the accident**

### **B.3.1. Deaths and injuries**

None.

### **B.3.2. Material damages**



- at the locomotive, according to the estimate no. 134/15.06.2011 of Ploiesti Sud Depot amounted to **3 419.54 lei**;
- train delays, 88 minutes, according to the document Serv. Dispatch no. 31 Mn/3/308/2011 amounted to **423.96**;
- at the lines – none;
- at the installations – none;
- at the environment – none;
- **Total** **3843.5 lei**;

### **B.3.3. Consequences of the accident in railway traffic**

The current line, on the distance Titu – Nucet was closed for railway traffic between 7:35a.m. and 9:08a.m. for the intervention of ISU staff and the train shunt in the railway station Titu.

#### **Train delays:**

None.

### **B.4. External circumstances**

On the 17<sup>th</sup> of May 2011, at the time of the railway accident occurrence the visibility was good, clear sky, no wind and the air temperature was of about 10<sup>0</sup> C.

The accident occurred in the area of the Km. 2+500 in alignment on line with rail type 49, sleepers BA type T13, path with joints, in alignment with gradient of 3.27 ‰, double line non-electrified.

The visibility of the light signals was in accordance with the specific regulations in force.

### **B.5. Investigation course**

#### **B.5.1. Summary of the involved staff statements**

##### **B.5.1.1. Summary of the railway undertaking staff and witnesses statements**

- **The locomotive driver** who drove the locomotive DA 60-0793-4 on the 17<sup>th</sup> of May 2011 stated as follows:

- he drove in normal conditions on the section Pietrosita – Dambovicioara without entering any protection;
- he performed complete inspection at the locomotive in the railway station Targoviste and he did not find anything special at the locomotive;
- he mentions that stationing in the railway station Targoviste remained into operation MD, the train heating installation, the RTF station and the ventilation
- at the complete inspection performed he did not find oil and diesel losses at MD;
- after stopping in the flag station Dambovicioara around the kilometer 2+500 he found a smoke release in the engines box towards the station II;
- he tried to enter the engines box to intervene with the fire extinguishers, but he failed because of the too strong smoke;
- he contacted the guard who had arrived next to the locomotive to insure the train and release the locomotive from the train;
- failing to intervene in the fire extinguishment, he called 112 and asked for the intervention of the firemen;

- he insured the locomotive and he switched off the MD then he notified the neighbor railway station
- the firemen arrived and intervened on the fire to stop the smoke release
- he mentions that on the distance Fieni-Targoviste he was accompanied by an instructor belonging to SNTFC “C.F.R. Calatori”- S.A, and by an inspector SC belonging to the National Railway Company “CFR” SA- CF Bucharest Regional Branch – Regional Center of Operation, Maintenance and Repairs Bucharest.
- he mentions that on the distance Pietrosita- Titu he performed the inspection of the locomotive in the railway station Targoviste, complete inspection after insuring the locomotive with the direct hand brake and automatic brake, he performed the inspection in the engines box and outside inspection of the locomotive where he found that the locomotive was fine.
- **The guard** who was on duty at the train 9432 on the 17<sup>th</sup> of May 2011, stated as follows:
  - after the train stopped in the flag station Dambovicioara he went down to the platform to track the loading/unloading of the passengers and to transmit the signal “train start”, he notices there was strong smoke release from the locomotive hauling the train;
  - he contacted the train driver, he insured the train with the hand brakes, then he released the locomotive from the train;
  - the firemen arrived to intervene for stopping the smoke release from the locomotive, then the locomotive aid arrived to tow the train to the railway station Titu;
  - on the distance Targoviste – Dambovicioara he was not informed by the locomotive driver about the inappropriate operation of the locomotive;
- **The train conductor** who was on duty at the train 9432 on the 17<sup>th</sup> of May 2011, stated as follows:
  - after the train stopped in the flag station Dambovicioara he went down at the platform to track the loading/unloading of the passengers and to transmit the signal “train start”, moment when he noticed there was strong smoke release from the locomotive hauling the train;
  - he proceeded to insure the train with the hand brakes, then he announced the passengers that the train had problems;
  - on the distance Targoviste – Dambovicioara he was not informed by the locomotive driver about the inappropriate operation of the locomotive;
- **The locomotive driver instructor** who was in the driving cabin of the locomotive of the train 9432 on the 17<sup>th</sup> of May 2011, stated as follows:
  - he traveled in the driving cabin of the locomotive DA 793 hauling the train 9432;
  - he mentions that he traveled on the section Fieni – Targoviste Sud;
  - on the entire running distance he did not notice smoke release, smell of hot insulation or any protection to enter into operation;
  - from the discussions with the locomotive driver he was not informed that the locomotive would have problems;
  - he traveled on the train locomotive because he was going to duty and the driver is in the practical instruction group;
  - no inspection was performed in the engines box on the distance Fieni – Targoviste Sud because the time does not allow the performance of such inspection;
- **The inspector of sector SC-M** who was in the driving cabin of the locomotive of the train 9432 on the 17<sup>th</sup> of May 2011, stated as follows:
  - He got from the railway station Targoviste into the driving cabin of the locomotive of the train 9432;
  - In the stop point Dambovicioara the train driver opened the side window on his side to take from the guard the signal of leaving from the respective stop point;
  - After opening the window the train driver communicates him that from the locomotive towards the coaches was coming out a thick smoke;
  - The train driver contacted the train party to release the locomotive and to put distance between this and the coaches;

- Since he got into the locomotive cabin and to Dambovicioara the train driver did not enter the engines box;
- On the distance he traveled the driver did not announce that he had problems with the locomotive or that a protection had entered;
- On the traveled distance the train did not have non-itinerary stops;
- He can't precise if the train heating installation was in operation.

### **B.5.2. Safety management system**

In carrying out their responsibilities and duties the infrastructure manager, CNCF "CFR" SA, and the railway undertaking SNTFC "CFR Calatori" SA had established and implemented their own safety management system ensuring the control of the performed activity risks.

### **B.5.3. Norms and regulations. Sources and references for the investigation**

In the investigation of the railway accident one took into account:

- minutes concluded by the commission on spot with reference to the condition of the rolling stock, lines and equipments.
- photos taken immediately after the railway accident by the members of the investigation commission;
- statements of the fired locomotive driver, of the guard and of the train conductor who served the train 9432;
- minutes concluded by the members of the investigation commission after the occurrence of the accident;
- documents on the locomotive maintenance and repair, provided by the responsible with its maintenance;
- inspection and interpretation of the technical condition of the elements involved in the accident;
- questioning of the staff in charge with the operation of the involved rolling stock;

### **B.5.4. Work of the rolling stock**

#### **B.5.4.1. Data found on the locomotive DA 60-0793-4:**

**5.4.1.1. Data resulted from the checks performed by the investigation commission and by the repairs staff from Ploiesti Sud Depot and recorded in minutes (pieces of the investigation file) and photos (taken by the investigation commission)**

As a result of the checks performed by the investigation commission at the locomotive, one found out (according to the minutes no. T1/711/18.05.2011; T1/715/19.05.2011 and T1/729/20.05.2011):

#### **PV of the 18<sup>th</sup> of May 2011**

- Locomotive box: intact paint unaffected thermally, with the side windows broken during the intervention of the military firemen (2 side windows on each side);
- Locomotive roof: intact paint unaffected thermally;
- Locomotive bogies: with signs of dust and oil products deposits, unaffected thermally;
- Locomotive shoes: do not show changed color, unaffected thermally;
- Driving stations: without signs of smoke and unaffected thermally, with complete and operational devices;
- Devices block engines box: unaffected thermally, complete, operational and sealed;
- Engine block D1 and D2: unaffected thermally, slight signs of MD cooling water losses;

- Main air tank and the adjacent pneumatic installation: with intact paint unaffected thermally;
- Floor engines box: complete, fixed properly, unaffected thermally;
- Engine group ventilator PC1: with intact paint, unaffected thermally;
- Locomotive fire extinguishers in the engines box PC2 – distribution 1 (4 pieces), sealed unused, without signs of thermal affectation;
- Panel measuring and control devices (manometers and thermo-manometers): complete and operational, without signs of thermal affectation;
- Hydrostatic pump: without signs of oil losses and the connection pipelines with intact paint, unaffected thermally;
- Main oil ramp MD: without losses, without signs of thermal affectation;
- Raw filters and fine filter of fuel: without losses, unaffected thermally;
- The combined oil filter: without losses, with the cover unaffected thermally;
- Train heating block INDA: with intact paint, unaffected thermally;
- Auxiliary and additional diesel tanks and the water tank: with intact paint, unaffected thermally;
- The electric machines auxiliary services: without signs of short-circuit, grounding, with intact paint, unaffected thermally;
- Engine group ventilator PC2: unaffected thermally, the ventilator hood left side (distribution 2) with the paint ***thermally affected***, on the bottom side;
- Flexible hose input in the diesel flow-meter of the installation ICL with the outside rubber shell ***thermally affected*** on the side towards PC2, flexible hose output ICL and connections of the flow sensor unaffected thermally;
- The diesel return pipe on the bottom side of the diesel engine, ***thermally affected***;
- The flexible hose return pipe (found in the area next to the vapor aggregate) detached from the reinforcements and ***thermally affected*** on the entire length, less in the fixing area in the reinforcement at the bottom side. The hose end associated to the fixing in the upper reinforcement shows in section the appropriate diameter to fix in the reinforcement and the end associated to the fixing in the bottom reinforcement shows enlarged diameter;
- Flexible connection hose of the return pipe from the pump no. 12 broken from the return pipe of diesel and felt on the residues collection ramp;
- Flexible connection hose between the residues ramp MD and the collection tank, ***thermally affected***;
- The argus tube between MD and the heat switch, unaffected thermally;
- The argus tube between the heat switch and the battery of oil combined filters unaffected thermally;
- The rubber sleeves link between MD and the oil filters pipe lines, under the floor, ***thermally affected***;
- Signs of ***thermal affectation*** under the floors in the engines box on the corridor towards the distribution 2 to near the injection pump no. 11;
- Cover electric connection doses EMT 4, ***thermally affected***;
- Fixing yoke electric cables EMT 4 upper side ***thermally affected***;
- Fixing yoke electric cables EMT 4 bottom side unaffected thermally;
- Fixing yoke in the dose and the cables from the power installation associated to EMT 4 unaffected thermally;
- The protection sleeves of the electric connections E and F from the dose MT 4 slightly ***thermally affected*** t the upper side;

- The protection sleeves of the electric connections H and A from the dose MT 4 unaffected thermally;
- The connections of the electric cables from the dose EMT 4, properly tighten, without signs of heating of thermal affectation;
- The billows of the ventilation channel EMT 4 and EMT 5, unaffected thermally;
- Connection cables EMT 4, *thermally affected* at the upper side on a distance of 150 mm after the cover of the connection dose and unaffected on the rest of the distance to the input in the traction engine;
- Checking the EMT 4 through the access cover were found the collector, the insulators, the coal brush-holder crown, the connections linking the auxiliary poles, the stator winding and the rotor bandage in proper condition, without signs of flames, unaffected thermally;

#### **PV of the 19<sup>th</sup> of May 2011**

- Covers of the electric connection doses EMT 1, 2, 3, 5, 6 clean, in appropriate condition, unaffected thermally;
- Fixing yokes electric cables EMT 1, 2, 3, 5, 6 clean, in appropriate condition, unaffected thermally;
- The protection sleeves of the electric connections EMT 1, 2, 3, 5, 6 clean, in appropriate condition, unaffected thermally;
- The coverings applied over the fireproof insulation of the power cables at EMT 1, 2, 3, 5, 6 clean, in appropriate condition, unaffected thermally;
- The connections of the power cables from the doses EMT 1, 2, 3, 5, 6 properly tighten, without signs of heating or thermal affectation;
- The bottom side of the locomotive box shows in the area next to the ventilation hole EMT 4 left side the paint thermally affected;
- The ventilation bellows EMT 1-6 in appropriate condition, unaffected thermally;
- The clean condition of the bogies appropriate, without signs of thermal affectation;
- The connection cables EMT 1, 2, 3, 5, 6 clean, in appropriate condition, unaffected thermally;
- The supply cables traction engines from the power installation of the locomotive clean, in appropriate condition, unaffected thermally;
- The battery accumulators niches and the battery accumulators clean, in appropriate condition;
- The insertion cables of the battery accumulators clean, properly fixed;
- Checking the electro-motor to operate the transfer and pre-lubrication pumps through the access covers were found the collector, the insulators, the brush-holder crown, the coal brushes, in appropriate condition, without signs of flames or inappropriate operation, unaffected thermally;
- Checking the electro-motor for the forced ventilation PC II through the access covers were found the collector, the insulators, the brush-holder crown, the coal brushes, in appropriate condition, without signs of flames or inappropriate operation, unaffected thermally;
- Condition of the supply wiring electro-motor transfer and pre-lubrication pumps on the pipe that goes from the wiring channel from the corridor of the distribution I towards the electro-motor shows insulation *thermally affected on 80 %* of the length; No signs of short-circuit or grounding on the wires length.

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- Checking the electro-motor through the access covers were found the collector, the rotor bandage, the brush-holder crown, the coal brushes, in appropriate condition, without signs of flames or inappropriate operation, unaffected thermally;

- The rotor of the electro-motor turns easily at manual operation, without blocking tendencies;
- Condition of supply wiring in the terminals board of the electro-motor appropriate, appropriate attaching in lugs and tightening in terminals, no signs of short-circuit or grounding in the terminals board;
- The pressure relay pos. 100 of the ventilator PC II in appropriate condition, without signs of heating or thermal affectation, appropriate wiring;
- The ventilator propeller left side (distribution II) properly fixed, without strokes on the engine axis, without signs of friction on its surface;
- The ventilator propeller right side (distribution I) properly fixed, without strokes on the engine axis, without signs of friction on its surface;
- The upper cover of the ventilator housing left side does not show signs of friction of the propeller at the inside, does not show signs of thermal affectation at the inside or outside;
- The upper cover of the ventilator housing right side does not show signs of friction of the propeller at the inside, respectively does not show signs of thermal affectation at the inside or outside;
- The ventilator housing right side (distribution I) does not show the paint affected thermally inside or outside;
- The ventilation housing left side (distribution II), towards the bellow of the traction engine no. 4, shows the paint *thermally affected* at the outside and influenced inside, on its bottom side;

#### **B.5.4.1.2. Data found from the analysis of the documents asked from the railway undertaking**

- the locomotive DA 60-0793-4 was built in 1972;
- the last planned repair was RGg in May 2003;
- the locomotive is due to repair type RR since May 2007 ;
- the last inspection was type R2 performed on the 13<sup>th</sup> of April 2011 in Ploiesti Depot by SCRL -Brasov - Ploiesti Section;
- the last inspection type PTH3 was performed in Ploiesti Sud Depot, on the 14<sup>th</sup> of May 2011 ;

### **B.6. Analysis and conclusions**

#### **B.6.1. Analysis of the fire occurrence**

On the distance Targoviste- the flag station Dambovicioara the locomotive DA793 ran normally, the train heating installation being in operation and without being signaled the entry into operation of any protection in the train heating block. After stopping in the flag station Dambovicioara, according to the service book, the train staff founds a smoke release at the locomotive in the area of the bogie no. 2.

At the checks performed it was found that the smoke release followed by flame occurred between the ventilator motor PC2 associated to the traction engines 4, 5, 6 and the shield of the diesel engine.

The fire was initiated in the area next to the outside of the electric dose of the traction engine 4, between the cables H and F.

The piercing led to the melt of the insulation from the cables of the traction engine 4 and form of the electric discharges between the power cables H and F.

The fire expansion was due to the residues accumulations of oil products on the power cables insulation.

The traction engine no. 4 and the ventilator motor PC2 after dismantlement do not show signs of short-circuit, cuts or local melting to initiate the fire.



The housing of the ventilator motor PC2 was checked by dismantlement without being found signs of friction generating sparks.

The metallic parts in the area of the diesel engine and ventilator motor PC2 show signs of thermal affectation, without degradation of the structural strength.



**Photo 1. – Dose EMT4**



**Photo 2. – Dose EMT4**





**Photo 3. – Connections dose EMT 4**



**Photo 4. – Connections dose EMT4**





**Photo 5. – Connections dose EMT4**

## **B.7. Causes of the accident**

### **B.7.1. Direct cause**

The fire occurrence was due to insulation piercing of the power cables H and F of the traction engine no. 4, placed outside the connection dose of the power cables, which led to the melt of the insulation of these cables, the occurrence of electric discharges between them and their insulation ignition.

### **B.7.2. Contributing factors**

The piercing was due to the occurrence of over-voltages of switching caused by the train heating installation type INDA and the electric traction engines, given a minimum admitted value of the insulation resistance of the power cables associated to the traction engine no. 4.

### **B.7.3. Underlying cause**

None.

### **B.7.4. Root causes**

None.

## **C. Safety recommendations**

The safety recommendations aim to solve the next issues:

1. Development of a study on the occurrence of switching over-voltages caused by the train heating installation type INDA and the traction engines together, to establish the protection methods of the power circuits, in order to prevent the occurrence of similar cases.

The addressees of the safety recommendations are the Romanian Railway Safety Authority and the National Company of Passenger Railway Transport “CFR Calatori” SA.

This investigation report will be sent to the Romanian Railway Safety Authority, to the National Company of Passenger Railway Transport “CFR Calatori” SA and to the National Railway Company “CFR” SA.

According to the provisions of the Law no. 55/2006 on the railway safety, Romanian Railway Safety Authority will monitor the implementation of these recommendations.

Investigation commission:

- |                    |                     |        |
|--------------------|---------------------|--------|
| ▪ Nicu Pălăngeanu  | - main investigator | .....; |
| ▪ Ciochină Ștefan  | – member            | .....; |
| ▪ Timiș Bogdan     | – member            | .....; |
| ▪ Neacșu Iulian    | – member            | .....; |
| ▪ Cătănescu Viorel | – member            | .....; |