



INVESTIGATING REPORT

on the fire occurred on the 21st of July 2011, on the range of
CF Bucharest Regional Branch, between the railway stations CFR Peris – Buftea,
at the locomotive EB 91 53 0 425-210-8 (belonging to SC Grup Feroviar Roman SA
Bucharest) in the composition of the freight train no. 70852



Final edition
The 25th of October 2011

NOTICE

With reference to the railway accident occurred on the 21st of July 2011, in the running of the freight train no. 70852 (belonging to SC Grup Feroviar RomanSA Bucharest), towed with the locomotive 91 53 0 425-210-8, consisting of a fire in the engines box, in the area of the flattening self for the traction engine no. 1, on the running section Ploiesti Triaj – Chitila, between the railway stations CFR Peris – Buftea (km. 26+700), 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, October 2011

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 21st of July 2011, on the range of activity of CF Bucharest Regional Branch, the running section Ploiesti Triaj – Chitila, between the railway stations CFR Peris – Buftea (km. 26+700), in the running of the freight train no. 70852 (belonging to SC Grup Feroviar RomanSA Bucharest), consisting of a fire at the locomotive EB 91 530 425-210-8.

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I. PREAMBLE

I.1. Introduction

The fire occurred on the 21st of July 2011 in the running of the freight train no. 70852, at the locomotive EB 91 53 0 425-210-8 (structural subsystem – railway vehicle), is an accident covered by the art. 7, paragraph (1), letter (e) 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 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 about it by CNCF “CFR” SA – Traffic Safety Regional Inspectorate of Bucharest.

After moving to the railway station CFR Peris, it observed the following consequences:

- the freight train no. 70852 was running from the railway station CFR Ploiesti Est to the railway station CFR Chitila, being towed with the locomotive EB 91 53 0 425-210-8;
- the locomotive was taken out form power, the elements in the composition of the roof equipment of the locomotive circuit breaker, had the position corresponding to the circuit breaker disconnection and the pantographs were in the position “down”;
- the graduator was in the position “zero”;
- the circuit train heating “disconnected”;
- the switch of the accumulators battery (HBA) was in the position “disconnected”;
- the switch of the power system from the contact line “AC – DC” positioned on AC system 25Kv(M);
- the switches to isolate the traction engines in the proper position of operation with all the connected engines;
- the main circuit protection relays were mounted in sockets corresponding to the following conditions:
 - the maximal relays Q 1 – 4 for “ MT overload protection” were not in action;
 - the relay QRM for “ MT overload protection” was in action;
 - the relay QOP for “Protection grounding circuits of force, in action;
- the driving station 1 had the lining and the insulation burned, the RTF station type Motorola, the ammeters for current MT, the voltmeters for voltage in LC and MT, the speedometer, the INDUSI and VACMA ringer, thermally affected;
 - the side access doors in station I and in the engines box were deformed and had the insulation burned;
 - the front windows of the driving station I were cracked;
- in the driving station 2 were deposits of soot on the ceiling, on the side walls and on all parts and devices in the station;

No deaths and injuries.

At the accident place were present the representatives of:

- Romanian Railway Investigating Body;
- Romanian Railway Safety Authority;
- CF Bucharest Regional Branch;
- SC Grup Feroviar RomanSA Bucharest.

Through the Decision no. 63 from the 21st of July 2011 of the Romanian Railway Investigating Body 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:

- Cristian Bobe – Head of Railway Accidents Investigation Service – OIFR - main investigator
- Ciochină Ștefan – investigator Department of Railway Accidents Investigation and Divergences Settlement - OIFR - member
- Crăciun Stelian - Head of Traffic Safety Service SC GFR SA - member
- Tătulea Dumitru - Head of Locomotive Repair Service SC GFR SA - member
- Rădută Alexandru -inspector specialist T SC GFR SA - member
- Cătănescu Viorel – regional inspector SC CF Bucharest Regional Branch - member.

A. BRIEF PRESENTATION OF THE ACCIDENT

A.1. Brief presentation

On the 21st of July 2011, the freight train no. 70852, towed with the locomotive EB 91 53 0 425-210-8 driven and served by locomotive driver in simplified system, having in composition 36 wagons, 144 axles of which empty 92 and loaded 52, GT 1495 tons, length 541 m, was running on the section Ploiesti Est - Chitila.

From the railway station CFR Ploiesti Est, the freight train no. 70852 left at 5:10a.m. and through the railway station CFR Peris passed at 6:01a.m. Between the railway stations CFR Peris – Buftea, at a train speed of about 35-40 km/h, the locomotive driver smelled burnt insulation, reason for which he took action of rapid brake of the train, the train being stopped at km. 26+700.

The locomotive driver lowered the locomotive pantograph, handled the “current order” button in the off position, handled the switch of the accumulators’ battery in the “disconnected” position and entered the engines box to identify the source from which the smell of burnt insulation came.

After having checked the engines box and the outside of the locomotive, the locomotive driver found that the smell and the smoke were coming from the area of traction engines no. 1 and no. 2.

Further the locomotive driver together with the guard tried to intervene to eliminate the release of smoke using all the extinguishers in the locomotive equipment. Given the presence of the open fire and the emptying of the content of the fire extinguishers in locomotive equipment, around 6:10 a.m. they asked for the specialized intervention of the firemen, calling 112.

Given the information received by the locomotive driver from the representative of the firemen formation who was moving to the place of the accident regarding the fact that the specialized intervention teams could not get to the respective place because of the train configuration, the locomotive driver announced the traction operator and the IDM from the railway station Peris about the necessity of directing a locomotive aid to withdraw the train in an accessible area for the firemen formation.

At 7:35a.m., the freight train no. 70852 was withdrawn from current line in the railway station CFR Peris using the locomotive aid DA 1503 (belonging to SC Grup Feroviar Roman SA), being shunt at 7:45a.m. at line 5 (non-electrified) in the railway station. Under these conditions the firemen formation intervened managing to localize and extinguish the fire.

There were no deaths or injuries in this accident.

The area of the occurrence of the railway accident is on the running section Ploiesti Triaj – Chitila, belonging to CNCF “CFR” SA - CF Bucharest Regional Branch.

A.2. Causes of the accident

A.2.1. Direct cause

The fire was started by the occurrence of a short-circuit between the turns of the flattening self of the traction engine no. 1 as a result of the breakthrough of the flattening self insulation, followed by the ignition of the electric cables insulation. By thermal influence occurred also the damage of the flattening self corresponding to the traction engine no. 2, the phenomenon being followed by the propagation to the combustible parts (insulation, wiring) in the area of the traction engines MT1 and MT2.

A.2.2. Underlying causes

None.

A.2.3. Root causes

None.

A.3. Severity level

According to the provisions of the *Regulations*, the event is categorized as accident, in accordance with the art. 7, paragraph (1), letter e.

A.4 Safety recommendations

None.

This investigation report will be sent to Romanian Railway Safety Authority, to SC Grup Feroviar RomanSA Bucharest and to the National Railway Company “CFR” SA.

B. INVESTIGATING REPORT

B.1. Description of the accident

On the 21st of July 2011, the freight train no. 70852, towed with the locomotive EB 91 53 0 425-210-8 driven and served by locomotive driver in simplified system, having in composition 36 wagons of which 13 wagons loaded with wastes and wire (placed on safety) and 26 empty wagons, 144 axles of which empty 92 and loaded 52, GT 1495 tons, length 541 m, was running on the section Ploiesti Est - Chitila.

From the railway station CFR Ploiesti Est, the freight train no. 70852 left at 5:10a.m. and through the railway station CFR Peris passed at 6:01a.m. Between the railway stations CFR Peris – Buftea, at a train speed of about 35-40 km/h, the locomotive driver smelled burnt insulation, reason for which he took action of rapid brake of the train, the train being stopped at km. 26+700.

The locomotive driver lowered the locomotive pantograph, handled the “current order” button in the off position, handled the switch of the accumulators’ battery in the “disconnected” position and entered the engines box to identify the source from which the smell of burnt insulation came.

After having checked the engines box and the outside of the locomotive, the locomotive driver found that the smell and the smoke were coming from the area of traction engines no. 1 and no. 2.

Further the locomotive driver together with the guard tried to intervene to eliminate the release of smoke using all the extinguishers in the locomotive equipment. Given the presence of the open fire and the emptying of the content of the fire extinguishers in locomotive equipment, around 6:10 a.m. they asked for the specialized intervention of the firemen, calling 112.

After informing the firemen formation about the place where was stationing the freight train no. 70852, they were informed that the specialized intervention teams could not get to the respective place because of the train configuration. Given this, the locomotive driver announced the traction operator and the IDM

from the railway station Peris about the necessity of directing a locomotive aid to withdraw the train in an accessible area for the firemen formation.

The area of the occurrence of the railway accident is on the running section Ploiesti Sud – Bucharest North Gr. B, belonging to CNCF “CFR” SA - CF Bucharest Regional Branch.

Intervention plan of the rescue and emergency services

- in the presence of the opened flame and emptying the content of the fire extinguishers in locomotive equipment, around 6:10a.m. the locomotive driver called 112 asking for the intervention of the Inspectorate for Emergency Situations;

- as recorded in the Register of RC provisions of the railway station CFR Peris it results that at 6:37a.m. the locomotive driver of the train no. 70852 announced through the portable radio-telephone station in the guard equipment that at the locomotive EB 210 belonging to SC Grup Feroviar RomanSA Bucharest had occurred a fire, on the running wire II between the railway stations CFR Peris - Buftea and that at 6:10a.m. the firemen were announced at 112 by the locomotive driver;

- at 6:38a.m. the running wire II between the railway stations CFR Peris - Buftea was closed for railway traffic, this being occupied by the freight train no. 70852;

- at 6:42a.m. was turned off the running wire II between the railway stations CFR Peris – Buftea according to the endorsement DEF;

- given that after informing the firemen formation about the place where was stationing the freight train no. 70852, the locomotive driver was informed that the specialized intervention teams could not get to the respective place because of the train configuration, the locomotive driver announced the traction operator and the IDM from the railway station Peris about the necessity of directing a locomotive aid to withdraw the train in an accessible area for the firemen formation.

- at 6:54a.m. the isolated locomotive DA 1503 (belonging to SC Grup Feroviar RomanSA Bucharest) was directed from the railway station CFR Buftea to the railway station CFR Peris, running on wire I between the railway stations CFR Peris – Buftea as train no. 79731 and arrived in the railway station CFR Peris at 7:05a.m.;

- after handing by the movement inspector of the running order to the locomotive driver who was driving the locomotive DA 1503, at 7:11a.m. the isolated locomotive DA 1503 was directed on current line closed (running wire II between the railway stations CFR Peris – Buftea), to the back of the freight train no. 70852 which was stopped at km. 26+700;

- at 7:45a.m. the freight train no. 70852 was withdrawn in the railway station CFR Peris, being shunt at line 5 non-electrified;

- starting from 7:57a.m. was turned off also the contact line corresponding to the lines 3 and 4 from the railway station CFR Peris and the running wire II between the railway stations CFR Peris – Crivina;

- after the intervention of the specialized forces belonging to the Inspectorate for Emergency Situations – Section Snagov, around 9:10a.m. the fire was extinguished;

- starting from 8:13a.m. was re-put under voltage the contact line corresponding to F2 Peris – Buftea according to the endorsement DEF;

- starting from 8:30a.m. was re-put under voltage the contact line corresponding to the running wire II between the railway stations CFR Peris – Buftea and the running wire II was reopened to the electric traction traffic;

- starting from 9:16a.m. was re-put under voltage the contact line corresponding to the lines 3 and 4 from the railway station CFR Peris and to the running wire II between the railway stations CFR Peris – Crivina.

B.2. The accident circumstances

B.2.1. Involved parties

2.1.1 The locomotive driver who drove/served the locomotive EB 91 53 0 425-210-8 and the guard on duty at the freight train no. 70852 belong to SC Grup Feroviar RomanSA Bucharest.

The locomotive EB 91 53 0 425-210-8 is the property of SC Grup Feroviar RomanSA and is maintained by the staff of Locomotives Section Brazi belonging to SC Grup Feroviar Roman SA Bucharest.

2.1.2 The railway infrastructure on which the accident occurred belongs to the National Railway Company “CFR” SA.

2.1.3 Installations signaling, centralization and blocking (SCB) between the railway stations CFR Peris – Buftea are managed by the National Railway Company “CFR” SA and maintained by its staff.

2.1.4 The installation of railway communications on the involved locomotive is the property of SC Grup Feroviar Roman SA and is maintained by the staff of Locomotives Section Brazi belonging to SC Grup Feroviar Roman SA Bucharest.

B.2.2. Forming and equipments of the train

On the distance Ploiesti Est – Chitila, the freight train no. 70852, having in composition 36 wagons of which 13 wagons loaded with wastes and wire (placed on safety) and 26 empty wagons, 144 axles of which empty 92 and loaded 52, GT 1495 tons, length 541 m.

The locomotive EB 91 53 0 425-210-8, involved in the occurred accident belongs to the railway undertaking SC Grup Feroviar Roman SA.

The safety and vigilance equipment (DSV), the equipment for the point control of the speed and hitchhiking (INDUSI) of the locomotive equipment were in normal working condition.

B.2.3. Railway equipments

The involved railway infrastructure, respectively the running lines between the railway stations CFR Peris and Buftea is managed by CNCF “CFR” SA and is maintained by the own staff.

The line between the railway station Peris and Buftea is electrified and in the area of the kilometer 26+700 is in level and alignment.

B.2.4. Means of communication

The communication between the locomotive staff and the movements inspectors was ensured through radio-telephone equipments.

B.3. Accident consequences

B.3.1. Deaths and injuries

None.

B.3.2. Material damages

After the fire, damages resulted as follows:

- at the locomotive was not made an assessment for determining the amount of the damage, as the locomotive is insured and at the time of completion of the investigation report this is accessible by the representatives of the insurance company;
- train delays – 17 passenger trains of 286 minutes, amounting to 1276.11 lei;
- at the lines – none;
- at the installations – none;

- at the environment – none.

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

As a consequence of stopping the freight train no. 70852 in current line on the running wire II Peris – Buftea, the running wire II was closed for railway traffic from 6:38a.m. to 8:30a.m. and the contact line corresponding to the lines 3 and 4 from the railway station CFR Peris and the running wire II between the railway stations CFR Peris – Crivina was turned off from 7:57a.m. to 9:16a.m.

A number of 17 trains were delayed, of a total of 286 minutes.

B.4. External circumstances

On the 21st of July 2011, at the time of the occurrence of the railway accident, the visibility was good, clear sky, no wind and the air temperature was about 25 C.

The accident occurred in the area of the km. 26+700, the line being in level and alignment, double line and electrified.

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

B.5. Investigation course

B.5.1. The summary of the of the involved staff statements

B.5.1.1. The summary of the railway undertaking staff statements

The investigation commission questioned the employees involved in driving/serving the involved locomotive.

The locomotive driver who served the locomotive EB 91 53 0 425-210-8 on the 21st of July 2011 stated as follows:

- he took in transit the locomotive EB 91 53 0 425-210-8 at 4:00a.m. and he left at 5:10a.m. from the railway station Ploiesti Est towards Chitila;
- normal running conditions on the section Ploiesti Est - Peris;
- after passing through the railway station Peris he smelled burnt insulation, he stopped the train to enter the engines box;
- after having checked the engines box and the outside of the locomotive, the locomotive driver found that the smell and the smoke were coming from the area of traction engines no. 1 and no. 2.
- he acted to locate the beginning of the fire and acted with the means in the equipment to eliminate it;
- he called the firemen formation at 112 around 6:10a.m.;
- a locomotive aid was sent and towed the train in the railway station Peris at line 5.

The guard stated as follows:

- after passing through the railway station Peris he smelled burnet insulation;
- the locomotive driver entered the engines box where he smelled burnt insulation, then he descended to the opposite post under the locomotive at MT1 and MT2 he found smoke and then he intervened with the fire extinguishers in the equipment;
- he called the emergency service around 6:10a.m.;
- he ensured the train;
- the locomotive aid DA 1503 was sent to tow the train in the railway station because the firemen could not get there because they did not have access road;
- he shunted the train in the railway station Peris at line 5, he released the locomotive, he ensured it and then the firemen intervened.

B.5.2. Safety management system

At the date of the incident occurrence, the railway undertaking SC Grup Feroviar Roman SA Bucharest has established its own safety management system, having the safety certificate part A no. UE RO 1120100014 delivered by ASFR on the 6th of April 2010 valid until the 10th of April 2012.

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;
- technical specification “Electric locomotive LE 4130 kW, series 25100/150/200” – code ST 001-2007;
- technical specification “Intermediate revisions RI, revisions of the equipments on the roof Rac, planned revisions RT, Rev. G, Rev. Gex and accidental repairs at the electric locomotives of 4130 kW” – code G.3.1.a.-V;
- locomotive team statements;
- 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;
- documents of land release.

B.5.4. Work of the rolling stock

B.5.4.1. Data found on the locomotive EB 91 53 0 425-210-8:

B.5.4.1.1. Data resulted from the checks made on the 28th of July 2011 by the investigation commission and the maintenance and repair staff of the Locomotive Section Brazi in SC GFR SA and recorded in minutes (part of the investigation file) and photos (taken by the investigation commission).

Following the checking of the investigation commission at the locomotive, one found out:

The investigation commission performed the check and the detailed examination of the technical condition of the locomotive after the occurrence of the accident, necessary to establish the conditions and to identify the causes that led to the fire ignition at the electric locomotive of 4130 KW, series EB no. 91530425-210-8 belonging to SC Grup Feroviar Roman SA Bucharest, during which were found the following:

- the mechanism on the roof of the circuit breaker in disconnected position and the subassemblies in the engines box (block of pneumatic command, control wiring, connectors) were thermally affected due to the thermal influence during the fire;
- the pantograph in down position;
- the graduator was handled in “0” position; the operation mode during the operation previous to the fire occurrence was in automatic regime, the switch key being in the appropriate position for this regime;
- the train heating circuit was disconnected, the locking mechanism of the electro-pneumatic contactor was in blocking position, without action key, the train heating installation not being used at the freight train towed by SC GFR SA Bucharest;
- the switch of the accumulators battery (HBA) was in disconnected position;
- the accumulators battery pack was mounted on the locomotive in 2009, being placed in the driving cabin 1, next to the outbreak being found degradations (jaw cracked, deformed, affected serial registration connected) from the thermal damage during the fire;
- the switch of the supply system from the contact line AC – DC in the position of AC 25 kV (M);
- the switches traction engines insulation were in the appropriate position for operating with all the engines connected;
- protection relays main circuits all the relays provided in the electric scheme are mounted in the appropriate sockets and have the following conditions:
 - maximal relays Q 1- 4 (overload protection MT 1- 4) were not in action and checking on stand at SC ELECTROPUTERE SA Craiova were registered values that fall within the limits prescribed;
 - the relay QRM (overload protection of the traction rectifiers RM-1, RM-2) was in action, as indicated by the position of the proper indicator with latching;

-the relay QOP (protection against mass making of force circuits) was in action as indicated by the position of the proper indicator with latching;

-checking on portable stand (without dismantling), the following relays: QLM (overload circuit 25KV), QRM (overload protection of the traction rectifiers), QM0 (protection mass making), QOP (protection against mass making of force circuits), Q30M (voltage validation relay LC), the values were falling within the limits prescribed;

- the winding of the flattening self of the traction engine no. 1 at the end placed to the ventilation channel of the engine, on a portion of about 180 mm of the column length had burned insulation, reddish on the entire turns circumference, which indicates the turns insulation piercing and the occurrence of a short-circuit between the turns, the rest of the column has the insulation charred, black;



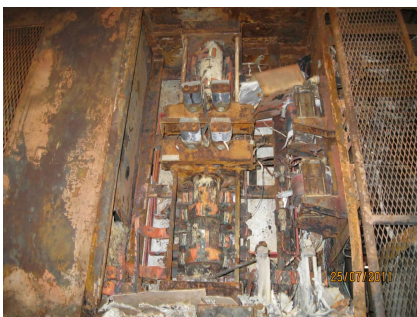
- the winding of the flattening self of the traction engine no. 2 had charred insulation, black; on a portion of about 100 mm of the column length (next to the burnt section of the self of the traction engine no. 1) had reddish insulation;



- the antilock resistances (RAP 1-2) had the wiring and the supply connection thermally affected by the fire;
- the field weakening resistances (RS1-2) had the wiring and the supply connection thermally affected by the fire;
- the main compressor resistances (R101) and auxiliary services (R192) had the wiring and the supply connection thermally affected by the fire;
- the field weakening contactors placed in the block from the driving cabin I (S1.1- S1.4 and S 2.1-S 2.4) had the insulators, the supply wiring, the fire chambers, the main and auxiliary contacts thermally affected by the fire;
- the electric motor of the auxiliary compressor is affected by the thermal influence during the fire;



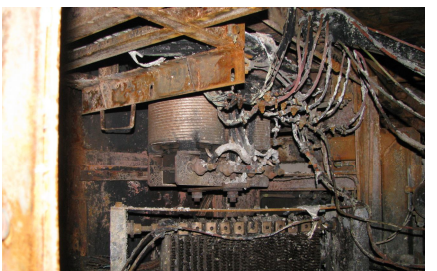
- the drive inverter (J21) and the switch selector (TR30-traction-braking) had the supply wiring, the connecting rods, the main and auxiliary contacts fix and mobile and also the actuator cylinder thermally affected by the influence during the fire;



- the roller selves for the fans electric motors (RM1 and RM2), with winding, supply wiring, stand

support completely destroyed by the thermal influence during the fire;

- the additional resistance of the voltage voltmeter MT1 (RUM 1) was removed from the holder and thermally affected;



- the block of command devices station 1 (automatic fuses, battery switch, battery diodes, switches, compressor pressure relay, sockets) affected by the thermal influence during the fire;

- the block of command devices auxiliary services (contactors, fuses, switch, relays, wiring), thermally affected by the fire;



- antiskid block (electro-pneumatic contactors, relays, resistors, antiskid selector -JAP) thermally affected by the fire;
- the power and control wiring from station 1 up to the area of the high voltage chamber was completely thermally affected by the fire and in the area of the central block, the devices block 1 and the command block was partially thermally affected by the fire;
- copper pipes for air supply of the devices control system (pantograph, circuit breaker, contactors, drive inverter) were thermally affected and deformed by the fire;
- the solenoid station 1 (VEPTM), command chamber, wiring, valve and air supply pipes of the pantograph, completely thermally affected by the fire;
- at the traction engine no. 1 (MT1), the insulation of the stator poles, of the rotor winding and the interlocks of the serial registration of the electromotor, at the upper side were burned by falling inside the collector chamber of the burnt materials above the engine, and the brush holders were thermally affected by the fire at the upper side;



- at the traction engine no. 2 (MT2), the insulation of the stator and the interlocks of the the serial registration of the electromotor, at the upper side, are thermally affected by falling inside the collector chamber of the burnt materials above the engine;
- at the traction engines MT 1, MT2, MT3 and MT4 were not found specific signs of abnormal functioning in operation (flames, missing bandage, overheating, etc);
- at the electromotor of the cooling fan for the traction engines of the bogie 1 were found the following components affected by thermal influence of the fire:
 - 2 pieces of insulators of brush holders support had the insulation material melted and fell from the brush holder crown;
 - 2 pieces of insulators of brush holder support had the insulation material thermally affected, but fixed on the brush holder crown;
 - the rotor (bandage and insulation), the collector, the windings insulation (the main and auxiliary poles), the interlocks of the serial registration of the poles were thermally affected by the fire;
 - the electromotor housing and the turbines housing were thermally affected by the fire;
 - the ventilation channel and the connection bellows for MT 1 and MT 2 were thermally affected by the fire;

- the load contactors of the graduator had the extinguishing chambers cracked and blocked by the thermal effect during the fire, effect that led also to the melt and flow of molten materials on the mounting brackets; the insulating support of the contactors, at the upper side was thermally affected by the fire; the main contacts (contact surfaces) were not welded, had no sign of melting or ridges, having only specific signs of the thermal effect during the fire;



- devices in the central block:
 - the line contactors L1-L4, the braking contactors F, C23, C31-33 (the extinguishing chambers, the support of the extinguishing chamber and the insulator support of the main mobile contact) were thermally affected by the fire; the main and auxiliary contacts (the contact surfaces) were not welded, had no sign of melting or ridges, having only specific signs of the thermal effect during the fire;



- insulation selectors MT1-2 (HM 51) and MT 3-4 (HM 52) were damaged by the thermal effect during the fire;
- the line contactors (L1-2), the braking control contactors (CR 1-12) had soot deposits resulted during fire;
- the main and auxiliary contacts (the contact surfaces) had normal aspect, the extinguishing chambers being thermally

affected by the fire and the command wiring in the block was covered with soot soaked in water; the high voltage chamber and the main transformer:

- the protection sleeve of the insulator A33 of entry in the main transformer was thermally affected by the fire (charred), the link connection between the roof and the insulator and also the insulator were thermally affected by the fire.
- the insulator A34 between the traction transformer and the load contactors were thermally affected by the fire;
- there could not be performed measurements of the characteristic parameters of the main transformer windings, the, the input/output terminals being thermally affected by the fire. The oil level in the tank of the main transformer is within the minimum/maximum parts on the level indicator viewfinder and has revealed no oil leak from the main transformer;
- there were performed physico-chemical analyzes of the oil from the main transformer tank, the values obtained falling within the limits prescribed;
- the graduator switching resistance (RPGR) was fallen from the support insulators that melted from the thermal effect during the fire and the resistance elements of cast iron were broken from the mechanical shock produced by its falling and hitting the cover of the graduator pneumatic servomotor;
- the bushing for the voltage measurement transformer in LC (CEL), had the porcelain skirt affected (broken) by the sudden cooling during the fire extinguishment with water;
- the measuring transformer CEL was thermally affected by the fire;
- the grounding device was thermally affected by the fire;
- the relays and the command resistances were thermally affected by the fire;
- the chargers blocks of the MT (RM1-2) were thermally affected by the fire, showing pierced diodes on different columns and branches of the deck, by the appearance of a top of current intensity, which led to their successive damage and on two columns of the same arm of the charging deck were pierced all the diodes;

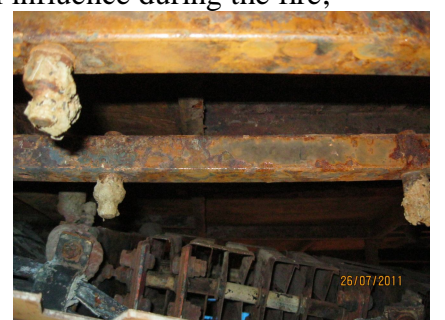


- some terminals (connected) of the diodes had deposits of melt material that was coming from the aluminum fins of the auxiliary charger coolers placed above the charging blocks of the traction engines;
- some terminals (connected) of the diodes were interrupted by the appearance of a current



top from successive breakthrough on the two columns of the charging deck branch;

- the auxiliary charger for auxiliary services of 1500V and 215 V had the support insulators melt, being fallen on the chargers RM1-2 and the diodes and the terminals (connected) were affected by the thermal influence during the fire;
- the fans flattening self MT had the insulation affected by the thermal influence during the fire;
- the field weakening resistance from the traction electromotor 1 was affected by the thermal influence during the fire;
- the main compressor electromotor had the wires and the collector thermally affected by the fire;
- the terminal board and the wires associated to the charger were affected by the thermal influence during the fire;
- the panel of the braking system PBL2 had the wires and the solenoids thermally affected by the fire;
- the protection cover of the pneumatic servomotor was affected by



the thermal influence during the fire;

➤ in the driving cabin station I:

- the trim and the insulation were burnt;
- the RTF station (Motorola), the marks for current MT, the speedometer, the INDUSI and DSV ringer, the service books, the plugs were thermally affected by the fire;
- the side access doors in the engines box were deformed and with insulation burnt by the fire;
- the front windows were cracked by the thermal effect during the fire;



➤ in the driving cabin station II were

- deposits of soot on the walls, ceiling, windows and also on all the parts and the devices associated to the equipments and installations inside the cabin;
- the circuit breaker DBTF had the pneumatic command block, the command wiring and the connector thermally affected during the fire and the protection cover deformed;
- the sheet covers from the devices block, the protection panels from the high voltage chamber and the devices block were



deformed and those of aluminum were melted by the thermal effect during the fire;

- the roof in the area of the driving cabin station I, had the sheet deformed in the area of the pantograph supports by the thermal effect during the fire;
- the paint on the inside and outside lateral walls and on the roof was affected by the thermal influence during the fire;
- the air filters (of aluminum) placed on the side walls were melted by the thermal effect during the fire.

B.5.4.1.2. Data resulted from the analysis of the documents asked from the railway undertaking

- the electric locomotive of 4130 kW series LE no. 91530425210-8 was made in 1965, the normal operation period being of 55 years according to the technical certificate no. 2050/2008;
- the last repair type RG was performed on the 4th of April 2000 at SNCF, EIMM OULLINS;
- the last overhaul type “RT” was performed on the 24th of May 2011 at the Locomotives Section Brazi.
- the last overhaul type PTAE was performed at the Locomotives Section Brazi belonging to SC GFR SA, on the 14th of July 2011;
- the electric locomotive LE 4130 kW, series 25100/150/200 qualifies for use in the domain of railway transport; in this regard on the 3rd of December 2007 delivered by the Romanian Railway Authority the railway technical agreement series AT no. 617/2007, being extended on the 15th of January 2009, valid until the 2nd of December 2011;
- according to the provisions of the Annex no. 4 to the Technical specification code ST 001/2007 – “Electric locomotive LE 4130 kW, series 25100/150/200”, after the locomotive maintenance works (overhauls type RT, general overhaul, general extended overhaul) is provided to be performed “repair with elevation” (RR) after running a number of 1.550000 km with a tolerance of 15 %;
- the electric locomotive of 4130 kW series LE no. 91530425210-8 was registered on the 23rd of July 2008, being delivered in this regard the Certificate of registration series CI no. 8591/2008, valid until the 27th of May 2020.
- From the 4th of April 2000 when was performed the last planned repair type RG and to the date of the fire occurrence, the locomotive no. 91530425210-8 ran a number of 1.046.023 km.



B.6. Analysis and conclusions

B.6.1. Analysis of the fire occurrence

At the flattening safe associated to the traction engine no. 1, in the area placed towards the ventilation channel, occurred the piercing of the windings insulation, resulting the short-circuit of the windings. Given that the initially affected area was of relative small dimensions compared to the rest of the coil, the self continued to work without significant influence on the power electric circuit of the locomotive, but the magnetic flux generated by the load current in the middle induced additional currents in the short-circuited windings, increasing the temperature of the wire till the ignition of the insulation.

So, through the induction effect in closed winding occurred the overheating of the self in its totally, followed by the ignition of the wiring insulation.

The short circuit occurred between the windings of the flattening self was due to an accidental technical cause, under normal operating conditions of the locomotive.

By thermal influence occurred also the thermal damage of the flattening self associated to the traction engine no. 2, the phenomenon being followed by the propagation to the combustible parts in the area of the traction engines MT1 and MT2, the fire propagation occurring by the burning of the wiring insulation of the command and power circuits.

The piercing of the windings insulation of the flattening self did not have immediate effect, detectable by the protection circuits of the locomotive, because the self construction, with adjacent windings in a single layer, do not favors the occurrence of overloads in the power circuit. Under these conditions, the tension between two windings being reduced, the short circuit determined by the piercing of the insulation had a local effect, unnoticed by the main circuit, but sufficient for the ignition of the insulating material of the windings cover in the composition of the flattening self coil.

The thick insulating layer between the self coil and the iron core delayed the entry into action of the protection against making mass, the necessary time for burning the insulating material being higher, which given that the tension between two windings is reduced led to a local effect unnoticed by the main circuit, but sufficient for the ignition of the insulating material.

Measurement of the functional parameters and the check of the flattening self of the traction engines are performed at the repairs type RR, RG. At the technical inspections of locomotive maintenance performed during the period between two repairs, it is not provided to be performed measurements or flattening self checks, not being covered in the technical specification “Intermediate inspections RI, inspections of the equipments on the roof Rac, planned inspections RT, Rev. G, Rev. Gex and accidental repairs at the electric locomotives of 4130 kW” – code G.3.1.a.-V.

B.7. The accident causes

B.7.1. Direct cause

The fire was started by the occurrence of a short-circuit between the turns of the flattening self of the traction engine no. 1 as a result of the breakthrough of the flattening self insulation, followed by the ignition of the electric cables insulation. By thermal influence occurred also the damage of the flattening self corresponding to the traction engine no. 2, the phenomenon being followed by the propagation to the combustible parts (insulation, wiring) in the area of the traction engines MT1 and MT2.

B.7.2. Underlying causes

None.

B.7.3. Root causes

None.

C. Safety recommendations

None.

This investigation report will be sent to Romanian Railway Safety Authority, to SC Grup Feroviar Roman SA Bucharest and to the National Railway Company “CFR” SA.

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- Rădută Alexandru -inspector specialist T SC GFR SA - member
- Cătănescu Viorel – regional inspector SC CF Bucharest Regional Branch - member.