R E P U B L I C OF B U L G A R I A
NATIONAL AIR, MARITIME AND RAILWAY TRANSPORT, ACCIDENTS INVESTIGATION BOARD (NAMRTAIB)

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FINAL REPORT

of

Investigation of railway accident – fire in locomotive № 91520043309-1, serviced fast train №8632 between the stations Svoboda – Tchyrpan on 25.08.2024

Sofia 2024

OBJECTIVE OF INVESTIGATION AND EXTENT OF RESPONSIBILITY

The National Air, Maritime and Railway Transport Accidents Investigation Board (NAMRTAIB), which is an independent investigation body on safety performs the investigation of significant accidents, accidents and incidents. The National Board is within the Council of Ministers (CM) of the Republic of Bulgaria, and aims to find the circumstances and causes that led to the accidents and incidents occurrence in order to improve the safety and to avoid such in future as the priority is given to avoiding significant accidents.

The investigation, which the NAMRTAIB performed is independent from any judicial investigation, and does not include the determination of fault or responsibility.

The investigation is performed in accordance with the requirements of DIRECTIVE (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway transport safety, the Railway Transport Act (RTA), Ordinance No59 dated 5.12.2006 on the rail transport safety management, as well as per Agreement dated 11.04.2023 on the interaction during investigation of accidents and incidents in the air, maritime and railway transport between the Prosecutor's Office of the Republic of Bulgaria, Ministry of Interior, and the National Air, Maritime and Railway Transport Accidents Investigation Board.

The Investigation reports follow the requirements of REGULATION (EU) 2020/572 of the Commission dated 24 April 2020 on the reporting structure for railway accident and incident investigation reports.

TABLE OF CONTENTS

ABBREVIATIONS, USED IN THE REPORT

TDRC – Train Dispatching Radio Connection
HTU – Higher Transport School „Todor Kableshkov“ – Sofia
MAS – Main Air Switch of the locomotive
TOS – Train Operation Schedule
BDZ PP EOOD – “BDZ Passenger Transport” EOOD -State enterprise for passenger transport
SE NRIC – State enterprise „National railway Infrastructure Company “(railway infrastructure manager)
RS – Railway section – division of the Railway Infrastructure Manager
RTA – Railway Transport Act
TOU – Traffic organization unit at the Railway Infrastructure Manager
km – Kilometre along the rail track
OCL – Overhead contact line (catenary)
SPR – Small periodic repair
FT – Fast train
ORDINANCE No 58 – on the rules for the technical operation, train traffic and signalling in the rail transport
Ordinance № 59 – Ordinance on the rail transport safety management
NAMRTAIB – National Air, Maritime, and Railway Transport Accidents Investigation Board (Safety Investigation Body of the Republic of Bulgaria)
NSA-RAEA– Railway Administration Executive Agency, National Safety Authority in the rail transport of the Republic of Bulgaria
TF – Task Force appointed by the railway infrastructure manager
SE – Signalling equipment
SABS – Semi-automatic block system
RRS – Rail Rolling Stock
FEI – Fire-extinguishing installation
FAI – Fire-alarming installation
TWMS – Train work management system
REDU – Regional energy-dispatching unit
RD MoI – Regional Division at the Ministry of Interior
RS FSaCP – Regional Service Fire safety and civil protection at MoI
ECM – Entity in Charge of Maintenance
EMA – Emergency Medical Assistance
SMS – Safety Management System
TI – Technical Inspection of a locomotive
TOSAMD – Train operation and station activity management Division (division of SE NRIC)
DCCM – Device for communications, connections and messages in stations
PTC – Professional Training Centre at Holding BDZ EAD
PRQC – Professional re-qualification centre at SE NRIC

1. Summary

1.1. Brief description of the event.

On 25.08.2024, at 16:50 p. m., a fast train No. 8632 consisting of 4 coaches, 165 tons, 101 meters with an electric locomotive No. 91520043309-1, operated by a locomotive driver 1-st person and a locomotive driver 2-nd person and a transport crew, train chief and conductor, departed from Varna station. The train run daily on the TOS in the direction Varna - Karnobat - Plovdiv and back. Personnel and rolling stock of the railway undertaking „BDZ-Passenger Transport“ EOOD operated the train. The train increased the travelling time with a stay of 21 min. at Syndel station to meet FT No2613 and at Yunak station by 9 min. by meeting PT No30155. FT No. 8632 passed Svoboda station without stopping at 22:15 p.m. for Tchyrpan station with a delay of 66 minutes.

During the movement of the train before the neutral insert in the Tchyrpan - Svoboda interstation at km 62+250 the locomotive driver removed the working pantograph of the locomotive, run at inertia and at km 61+890 he raised the working pantograph. The locomotive driver first person looked back at the train and saw smoke and fire coming out of the rear of the locomotive. He immediately turned off the MAS and the train continued to move by inertia, stopping at km 60+560 in front of the entrance semaphore at Tchyrpan station. After the train stopped, the locomotive driver, first person activated the fire extinguishing system from the locomotive cabin. The locomotive driver, second person, uncoupled the locomotive from the coaches and began extinguishing the fire with portable fire extinguishers from the locomotive. Three fire extinguishers from the train coaches were also used, but without a result.

The train conductor called the national emergency number 112 and informed about the fire.

At 22:40 p.m., the traffic manager on duty at Tchyrpan station was notified by the train dispatcher at TOU-Plovdiv about the fire in the locomotive of FT No. 8632.

At 22:45 p.m., the train manager and the conductor evacuated the passengers from the train and buses transferred them to the train's final destination station - Plovdiv.

At 22:50 p.m., the first specialized fire truck arrived at the scene of the accident.

At 22:55 p.m., the power dispatcher at REDU Plovdiv turned off the voltage in the overhead contact line at Tchyrpan station and the Belozem - Tchyrpan and Tchyrpan - Svoboda interstation.

At 00:15 a.m. the train dispatcher closed the Svoboda - Tchyrpan interstation to the movement of all trains and vehicles with the exception of auxiliary vehicles.

At 00:40 a.m. two more specialized fire trucks arrived at the scene of the accident.

At 02:34 a.m., an employee of the RS FSaCP reported that the fire in the locomotive was extinguished and voltage could be applied to the overhead contact line.

At 02:47 a.m., switching was carried out at the Belozem, Tchyrpan and Svoboda stations and voltage was applied to the overhead contact line in the Svoboda - Tchyrpan interstation.

At 03:30 a.m., auxiliary locomotive No. 91520044066-6 departed from Tchyrpan station to pull the burning locomotive and the train of FT No. 8632 from the section and at 03:50 a.m. the train was moved to Tchyrpan station.

In the Svoboda - Tchyrpan interstation, the train traffic was suspended from 00:16 a.m. to 04:10 a.m. on 26.08.2024.

At 04:10 a.m. the train dispatcher at the Plovdiv Railway Station opened the Svoboda - Tchyrpan interstation for the movement of all trains and vehicles at the scheduled speed.

At 04:20 a.m. the senior train dispatcher at the Plovdiv Railway Station assigned a work-service train (WST) No. 80392 to transport the train of FT No. 8632 with the burned locomotive No915200433091 in an inoperable condition. At 05:26 a.m. the train departed for Belozem station.

No passengers or staff were injured; material damage was caused to the locomotive and material damage to the railway infrastructure.

Fig. 1.1. Fired locomotive № 91520043309-1, serviced FT № 8632

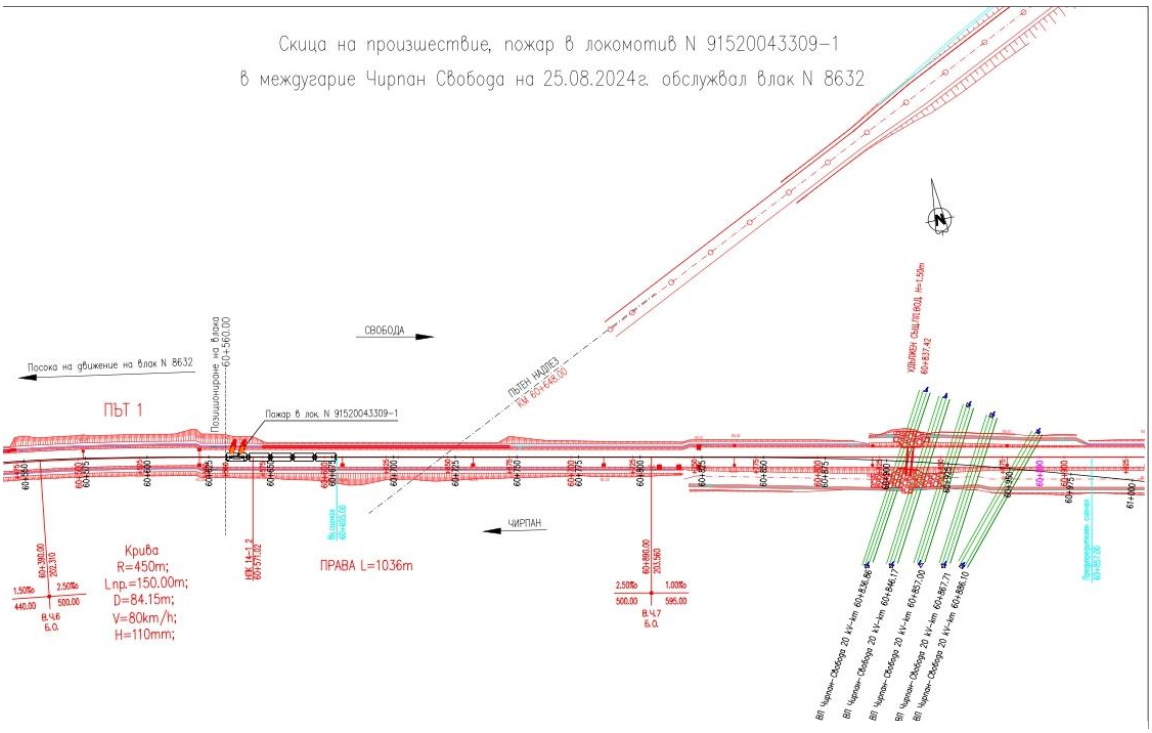


Fig. 1.2. Scheme of the location where fire occurred in locomotive № 91520043309-1, serviced FT № 8632

1.2. Location and time of the event occurrence.

Between the stations Svoboda and Tchyrpan at 22:36 p.m. a fire broke out in electric locomotive No. 91520043309-1, serving FT No. 8632. The train was stopped by the locomotive driver in the interstation at km 60+560, in front of the entrance signal at Tchyrpan station to extinguish the locomotive.

1.3. Factors determining and contributing the event.

A determining factor for the occurrence of the accident is the prolonged movement of the locomotive, respectively the train, in the inertia mode without cooling of the rectifier unit of the second group.

A contributing factor for the occurrence of the accident is the prolonged independent operation of the engine-compressor without cooling of the rectifier of the second traction group of the locomotive.

1.4. Direct causes and consequences of the event.

Probable cause for the fire during movement in locomotive No. 91520043309-1, serving FT No8632, was the thermal overheating of the power unit 221, supplying the compressor motor 235. The auxiliary rectifier 221, supplying the compressor motor, was not cooled at that time, since the fans were turned off when the train was moving along the route.

When the driver activated the FEI, it did not work. This contributed to the spread of the fire and caused material damage. Due to the heavy smoke in the engine compartment, extinguishing with manual fire extinguishers was not possible.

The consequences of the event were significant burning and destruction of the main rectifiers, as well as the auxiliary rectifiers of the fan motors and the compressor motor of the locomotive.

Material damage was caused to the newly laid railway track in the interstation area.

1.5. ***Safety recommendations and addressees to which they are addressed.***

In order to improve the safety in the rail transport, the Chairperson of the Investigation Commission at NAMRATIB proposes to the Railway Administration Executive Agency (RAEA) the following safety recommendations adapted to SE NRIC and BDZ PP EOOD.

- Recommendation 1, proposes that SE NRIC and BDZ PP EOOD familiarize the interested personnel with the contents of this report;
- Recommendation 2 proposes that BDZ PP EOOD undertake the replacement of electrolytic capacitors of the R-C groups with dry-type capacitors of locomotives series 44 and 45;
- Recommendation 3 proposes that BDZ PP EOOD install technical means (thermostats) for temperature control of rectifier groups 020 and 022 of locomotives series 44 and 45;
- Recommendation 4 proposes that BDZ PP EOOD restore the power supply of the electronic control unit of the auxiliary machines Y_2 from its own transformer 222, in accordance with the design schemes of the manufacturing plant for series 44 and 45;
- Recommendation 5 proposes that BDZ PP EOOD organize and carry out major repairs of the locomotives of series 44 and 45, which have expired operational resources and are needed in operation;
- Recommendation 6 proposes that BDZ PP EOOD increase control and accountability for the implementation of planned and necessary repairs.

1. Investigation

2.1. Decision for starting the investigation.

Decision to initiate a safety investigation was made by the member of Management Board of the NAMRTAIB in the Republic of Bulgaria, leading the investigation of railway accidents and incidents as per art. 22, paragraph 3 of Directive (EU) 2016/798 of the European Parliament and the Council. Given the severity of the accident and its impact on the railway safety, the investigation was focused on establishing the causes and the analysis, aimed at preventing other accidents of a similar nature.

2.2. Motives for the decision to initiate the investigation.

The member of the Management Board of the NAMRTAIB, leading the railway investigation section, took the decision to initiate the investigation based on art. 20, paragraph 2 (a) and (c) of Directive (EU) 2016/798, art. 115к, paragraph 1, item 2 of RTA, and art. 76, par. 1, item 2 of Ordinance No 59 dated 5.12.2006.

The investigation was initiated in view of the circumstances and risks endangering the life and health of the staff and passengers on the train from the fire that occurred in electric locomotive No91520043309-1, serving FT No. 8632 on 28.05.2024 during the time of train movement in the Svoboda - Tchyrpan interstation.

2.3. Scope and restrictions of the investigation.

The scope of the investigation included and analysed the organizational and human factor, the Safety Management System related to the repair and maintenance, including the risk assessment with registered hazards of the traction rolling stock in the railway company "BDZ-Passenger Transport" EOOD and the related regulations.

Restrictions and delays during the investigation were not allowed, due to the rapid establishment of the circumstances and causes for the fire in the locomotive.

2.4. Competences of the persons, involved in the investigation.

In accordance with the requirements of Art. 22, paragraph 1 of Directive 2016/798, the Safety Investigation Commission is headed by the member of the Management Board of the NAMRTAIB, the head of the railway investigation department. The members of the commission are independent external experts - qualified persons from higher transport educational institutions, experts in the field of human and organizational factors from health institutions with qualifications in the railway infrastructure and the rail rolling stock.

2.5. Communication and consultations with the persons and entities, involved in the event.

The Commission determined the parameters of the investigation and coordinated its actions with the Task Force, which was appointed by the railway infrastructure manager. Its composition includes heads of divisions and transport safety authorities of the two entities (BDZ PP EOOD and SE NRIC). The Task Force collected all documents and samples, written statements of the personnel of the entities, records from the recording devices of locomotive No. 91520043309-1, which served FT No. 8632 on 28.05.2024. The materials and documents were provided to the head of the safety investigation commission at the NAMRTAIB. The investigation commission conducted an interview with the train personnel (locomotive driver I, locomotive driver II and the train chief) and the management of the Plovdiv Locomotive Depot. It was familiarized with the statements of the persons involved in the accident. Additional information was requested and provided from BDZ PP EOOD on the repairs and maintenance of the locomotive. Interviews were conducted with the safety authorities of both entities, with the management of the railway entities BDZ PP EOOD and SE NRIC.

2.6. Extent of cooperation from the participating entities.

During the investigation, the participating entities BDZ PP EOOD and SE NRIC provided full cooperation and the necessary set of all requested necessary materials and documents. Full access was provided to the burned locomotive No. 91520043309-1 at the Plovdiv Locomotive Depot for inspections, measurements and expert assessments.

2.7. Methods and techniques of investigation and analysis.

On 25.08.2024 at 22:39 p.m., the member of the Board of the NAMRTAIB with competence to investigate railway accidents received a verbal notification on the mobile phone from the duty dispatcher of BDZ PP EOOD about a fire in locomotive No. 91520043309-1, servicing FT No. 8632 on the Svoboda - Tchyrpan interstation.

At 22:54 p.m., a written notification followed by SMS on the mobile phone from the duty senior dispatcher in the Central Dispatching Directorate of the Railway Infrastructure Manager (SE NRIC) with the following text:

„From 22:30 p.m., train No 8632 of BDZ-PP occupies the Svoboda - Tchyrpan interstation due to a fire in the locomotive. Notified by phone 112 and RS "SABS". Following the instructions given by the member of the Board of the NAMRTAIB with competence to investigate railway accidents to the representatives of BDZ PP EOOD and SE NRIC, they organized and conducted inspections with representatives of the pre-trial investigation from the Ministry of Interior Tchyrpan. Protocols of the performed inspections were drawn up.

On 26.08.2024, the train dispatcher at the Plovdiv Railway Station ordered the traffic manager on duty at Thcyrpan station to organize the movement of the work-service train No. 80392 in the composition of FT No. 8632 with the burned locomotive with a route to the Plovdiv station from Belozem station.

On 27.08.2024 at 18:00 p.m., the investigating body of the Ministry of Interior Tchyrpan gave written permission to carry out emergency recovery activities and release the burned locomotive for movement to the Plovdiv Locomotive Depot (place of residence).

On 27 and 28.08.2024, the Safety Investigation Commission of the NAMRTAIB went to the Plovdiv Locomotive Depot, where it carried out the first inspections of the burned locomotive No91520043309-1 and received the speedometer tape removed from the locomotive's recording device. Together with the investigation body of the Ministry of Interior Tchyrpan, inspections of the burned locomotive No. 91520043309-1 were carried out.

On 28.08.2024, the Chairman of the Investigation Commission at the NAMRTAIB requested the data recorded in the electricity meter of the burned locomotive regarding the voltage parameters in the overhead contact line around the time of the fire. The data were downloaded by experts at the EDD at the SE NRIC and submitted to the Chairperson of the Investigation Commission at the NAMRTAIB.

In the period 02÷05.09.2024, the Investigation Commission at the NAMRTAIB, together with the investigative body of the Ministry of Interior Tchyrpan, conducted inspections of the burned locomotive No. 91520043309-1 at the Plovdiv Locomotive Depot. Interviews were conducted with the locomotive crew that operated the locomotive on 25.08.2024, and the transport crew, train chief and conductor of FT No. 8632. An investigation was launched together with the managers of the Plovdiv Locomotive Depot to establish the circumstances and causes. The Commission conducted a comprehensive inspection of the engine compartment of the burned locomotive together with the investigative body of the Ministry of Interior Tchyrpan. The burned units were dismantled and removed from the engine compartment, on which additional inspections and measurements were carried out to establish their technical condition. Data on the types of repairs carried out on the locomotive were downloaded from the locomotive passport.

On 05.09.2024, the Investigation Commission at the NAMRTAIB received, in the presence of the Task Force, the collected documents and materials regarding the fire that occurred during movement in locomotive No. 91520043309-1, which served FT No. 8632 on 25.08.2024.

In the period 11÷12.09.2024, the Investigation Commission at the NAMRTAIB at the Plovdiv Locomotive Depot conducted a second interview with the locomotive driver who operated locomotive No. 91520043309-1 to clarify further the circumstances. An external expert, a member of the Investigation Commission at the NAMRTAIB, will decipher the data from the speedometer tape about the movement of the locomotive, respectively the train during the fire.

The investigation commission at the NAMRTAIB continued the investigation of the accident until the causes were established and a final report was prepared.

2.8. Difficulties faced during the investigation.

During the time of the Investigation Commission at the NAMRTAIB did not encounter any difficulties. The representatives of the Task Force and the safety authorities of the railway infrastructure and the railway undertaking/carrier provided full cooperation to the Investigation Commission.

2.9. Interaction with the judicial authorities.

In accordance with the Agreement on cooperation with the bodies of pre-trial proceedings, effective from 11.04.2023, the Ministry of Interior of Tchyrpan has initiated pre-trial proceedings for the accident. An exchange of materials and documents took place between the parties, while respecting the independence of the safety investigation body.

2.10. Other important information for the investigation context.

During the movement of FT No. 8632, serviced by locomotive No. 91520043309-1 on 25.08.2024, the locomotive's cooling fans were constantly turned on, which led to a significant increase in the temperature in the compartment and that caused overload and overheating in the auxiliary rectifier unit 221.

3. Description of the event

3.1. Information on the event and the context.

3.1.1. Description of the type of event.

On 25.08.2024, FT No. 8632 consisting of 4 coaches, 16 axles, 165 tons, 101 meters and with electric locomotive No. 91520043309-1, serviced by a locomotive driver 1st person and a locomotive driver 2nd person and a transport crew, train chief and conductor. The train departed from Varna station at 16:50 p.m. in the direction of Plovdiv station. During movement, the train increased its travel time by staying 21 min. at Syndel station to make a connection for passengers to transfer from a delayed FT No2613, at Yunak station it stays 9 min. to meet with PT No. 30155, to Velitchkovo station it increased the bypass by 12 min. due to temporary temperature speed reductions introduced by Shumen Railway Station. The train increased the bypass by 6 min. due to temporary temperature speed reductions introduced by the Burgas Railway Station between the Daskotna - Lyulyakovo railway stations. Due to construction and repair works on the rail track to Bezmer station, the bypass was increased by 6 minutes due to introduced speed reductions.

FT No8632 at 22:15 p.m. with a delay of 66 minutes, passed without stopping at Svoboda station to Tchyrpan station with a regular exit signal. The movement of trains between Svoboda station and Tchyrpan station was ensured on a single railway line by telephone. The train, according to the TOS, run daily from Varna station to Plovdiv station. Rolling stock and personnel of the railway entity „BDZ-Passenger Transport“ EOOD serviced it.

During the movement of the train before the neutral insert in the Tchyrpan - Svoboda interstation at km 62+250 the locomotive driver 1st person lowered the working pantograph of the locomotive, passed by inertia and then at km 61+890 he raised the working pantograph. Through the side window of the locomotive the locomotive driver 1st person looked back and saw smoke and fire coming out of the rear side of the locomotive. He immediately turned off the MAD and continued to move by inertia, stopping at km 60+560, about 200 meters before the entrance semaphore at Tchyrpan station. The goal was to facilitate the evacuation of passengers and the access of specialized vehicles of the RS FSaCP and EMAS. After stopping the train, the locomotive driver, first person, activated the fire-extinguishing system from the locomotive cabin. The locomotive driver, second person, disconnected the burning locomotive from the coaches and started to extinguish the fire with portable fire extinguishers from the locomotive and coaches.

At around 22:40 p.m., the train chief of FT No. 8632 notified the national emergency number 112 about the fire that had broken out.

The train chief and the conductor notified and took the passengers traveling in FT No. 8632 to a safe place, after which they were transferred by buses along the train route.

The locomotive driver, first person, notified the train dispatcher of passenger transportation of BDZ-PP EOOD about the fire that had broken out in the locomotive.

At around 22:40 p.m., the traffic manager on duty Tchyrpan station was notified by the train dispatcher at the Plovdiv - Stara Zagora section about the fire that had broken out in the locomotive of FT No. 8632.

At 22:45 p.m., the senior train dispatcher at the Plovdiv Railway Station informed the energy dispatcher at the REU Plovdiv about the fire that had broken out in the locomotive of FT No. 8632 at the Svoboda - Tchyrpan interstation.

At 22:50 p.m., the first specialized fire truck of the RS FSaCP arrived at the scene of the accident at the burning locomotive.

At 22:55 p.m., the energy dispatcher at the REU Plovdiv turned off the voltage at Tchyrpan station and the Belozem - Tchyrpan and Tchyrpan - Svoboda interstation.

At 00:10 a.m. the train conductor entered form II-76 in the dispatch order log at Tchyrpan station and requested an auxiliary locomotive to remove the train from the interstation.

At 00:15 a.m. the train conductor, with an order of 00:16 a.m., closed the interstation Svoboda - Tchyrpan to the movement of all trains and vehicles, with the exception of auxiliary vehicles.

At 00:40 a.m. two more specialized fire extinguishing vehicles arrived at the scene of the accident.

At 02:34 a.m., the employee from the RS FSaCP notified the energy dispatcher from the REU Plovdiv that the fire in the locomotive had been extinguished and voltage could be supplied to the overhead contact line.

At 02:47 a.m., after switching operations were carried out at the Belozem, Tchyrpan and Svoboda stations, and voltage was supplied to the Svoboda - Tchyrpan interstation.

At 03:30 a.m., auxiliary locomotive No. 91520044066-6 departed from Tchyrpan station for the interstation and at 03:50 a.m., FT No. 8632 was withdrawn from the interstation to Tchyrpan station.

At 04:04 a.m., the TWG from the Stara Zagora railway section entered in the dispatch order log at Tchyrpan station that the rail track at km 60+625 was aligned with the gauge. The movement of trains and vehicles was ensured at the speed according to the schedule.

Train traffic was suspended on the Svoboda - Tchyrpan interstation from 00:16 a.m. to 04:10 a.m. on 26.08.2024.

At 04:10 a.m., by order of the train dispatcher at the Plovdiv Central Railway Station, the Svoboda - Tchyrpan interstation was opened for the movement of all trains and vehicles at the scheduled speed.

At 04:20 a.m., the senior train dispatcher at the TOU Plovdiv assigned work-service train No80392 to transport the train of FT No. 8632 with the burned-out locomotive No. 91520043309-1, which departed for Plovdiv station at 05:26 a.m.

The movement route of FT № 8632 was along part of the main lines 2, 3 and 8, Varna – Karnobat– Stara Zagora – Plovdiv (fig. 3.1).

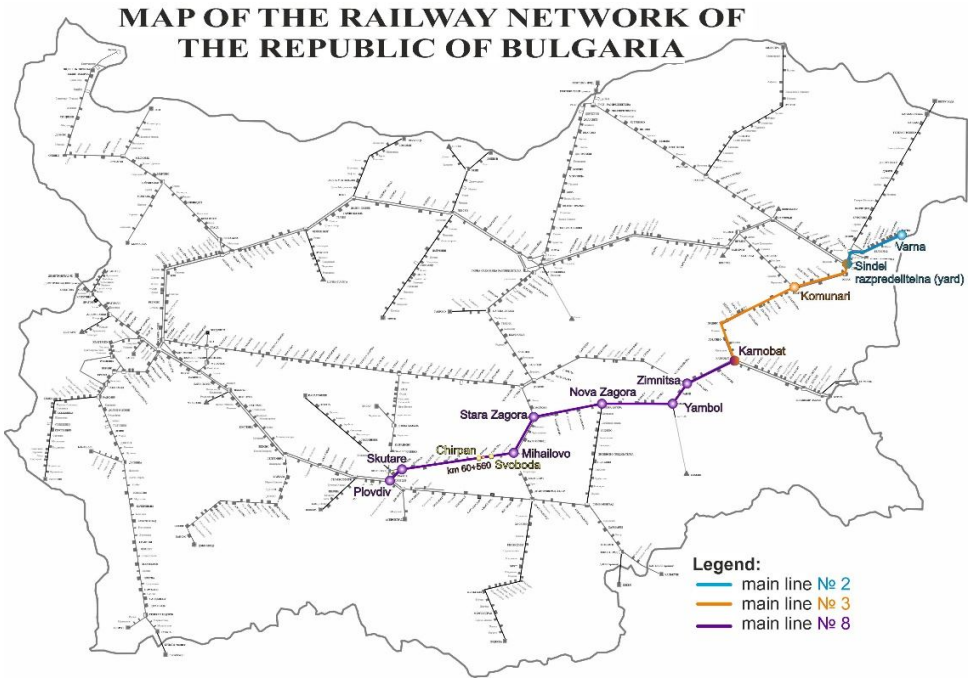


Fig. 3.1. Map of the route of movement of FT № 8632

3.1.2. Date, punctual time and location of the event.

On 25.08.2024 at 22:20 p.m. FT No. 8632 was moving in the Svoboda - Tchyrpan interstation in the direction of Plovdiv station. At 22:36 p.m. the locomotive driver, after seeing fire and smoke in the rear part of the locomotive, stopped the train in the interstation at km 60+560 (Fig. 3.2).

Fig. 3.2. Route of FT № 8632 and the place of the accident

- Origin station of FT № 8632 (Varna);
- Main stations along the train alignment;
- Final destination station of FT № 8632 (Plovdiv);
- Place of the accident (km 60+560);
- Track, which FT № 8632 has passed;
- Track, which FT № 8632 was about to pass;

3.1.3. Description of the event location:

3.1.3.1. Location of the place of the accident (fig. 3.3).

Geographic width: 42°12'21.12"N

Geographic length: 25°21'13.69"E

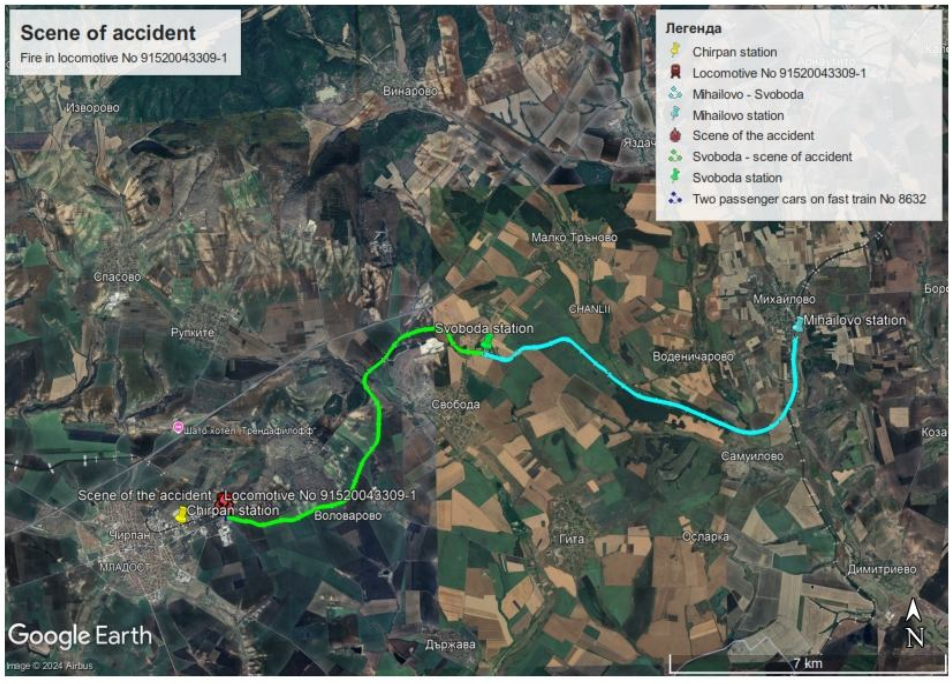


Fig. 3.3. GPS location of the accident at km 60+560

3.1.3.2. Meteorological and geographic conditions at the time of the event on 01.12.2023.

- In the dark part of the day – 22:36 p.m. (under data of the speedometer of the locomotive);
- Air temperature: 27ºC;

- Wind speed and direction approximately 7 km/h from northeast;
- Weather – clear with insignificant cloudiness;
- Average relative humidity 48 %;
- No registered rains.

3.1.3.3. Performance of construction activities on the site or in vicinity.

In the Orizovo - Mihailovo section under the Operational Programme "Transport and Transport Infrastructure" is being carried out "Modernization of the railway section under the project Rehabilitation of the railway line Plovdiv - Burgas, Phase 2". The contractor of the project is DZZD "EURO RAILWAY INFRASTRUCTURE". The repaired section is the Svoboda - Tchyrpan interstation with a length of 11,507 meters, in the section of the 8th main line, connecting the eastern with the southern railway network. The laid rail track is a new construction, continuously welded track with rails type U 60, sleepers type ST-6 and fastening SKL-12.

3.1.4. Fatalities, injuries, material damages:

3.1.4.1. Employees of the railway infrastructure manager or railway undertaking.

None

3.1.4.2. Other persons officially related to the place of the accident.

None.

3.1.4.3. Passengers.

None

3.1.4.4. External persons.

None

3.1.4.5. Freights, luggage and other property.

None.

3.1.4.6. Rolling stock, infrastructure and environment.

- Damages caused to locomotive № 91520043309-1 – fired engine compartment;
- Damages caused to passenger coaches – none;
- Account for caused damage to locomotive № 915200 43309-1 amounting to 35 095,37 BGN;
- Damages caused to the rail track – 10 086,42;

Including 12 unfit reinforced concrete sleepers ST-6;

- 36 meters of unfit rails type U 60;
- contaminated 18 meters of ballast prism;
- 4 aluminium -thermite welding;
- Neutralization of 150 meters of rail track;
- Damages caused to the overhead contact line – none;
- Damages caused to the signalling equipment – none;
- Damages caused to the environment – none;
- Total caused damages: 45 181,79 BGN.

3.1.5. Description of other consequences, including the event impact on the usual activity of the participants.

In the period from 22:36 p.m. on 25.08.2024 to 04:10 a.m. on 26.08.2024, the railway infrastructure manager and the railway undertakings generated additional costs for changing the train operation schedule and capacity on the section.

- Deviated trains of railway undertakings – none;
- Cancelled trains – 5 – 880,10 BGN;
- Assigned trains of the railway undertakings – none;
- Delayed passenger trains – 14 – 3447,50 BGN;
- Delayed freight trains – 3 – 536,20 BGN;

- Costs for rehabilitation means – none;
- Total other costs: 4863,80 BGN.

3.1.6. Identity of the participants and their functions.

Railway infrastructure:

- The SE National Railway Infrastructure Company holds a valid safety certificate, which guarantees safe operation and maintenance of the railway infrastructure and adjacent facilities. The Company provides equal and non-discriminatory access to all licensed and certified railway undertakings for the transport of passengers and cargo on the railway infrastructure of the Republic of Bulgaria.

Personnel of SE NRIC in relation to the accident:

- Traffic manager on duty in Svoboda station;
- Traffic manager on duty in Tchyrpan station;
- Traffic manager/ train dispatcher in TOU Plovdiv

Railway undertaking:

• BDZ PP EOOD has a license and a Single safety certificate, which guarantees performing of safe railway services for passenger transport along the railway network of the Republic of Bulgaria. BDZ PP EOOD is a national carrier under contract with the State.

Personnel of BDZ PP EOOD involved in the accident:

- Engine driver, locomotive first person of locomotive № 91520043309-1 of FT № 8632;
- Engine driver, locomotive second person of locomotive № 91520043309-1 of FT № 8632;
- Head of train FT № 8632.

3.1.7. Description of the respective parts of the railway infrastructure and signalling system:

3.1.7.1. Type of the track, railway switch, rail crossing etc.

In direction of movement of FT № 8632 the mileage decreased, the rail track is in an excavation, in transitional curve L=150 meters with inclination 2,5 ‰ in a downhill.

Svoboda station is a transition station with three acceptance-departure tracks and one track for loading and unloading activities (fig. 4).

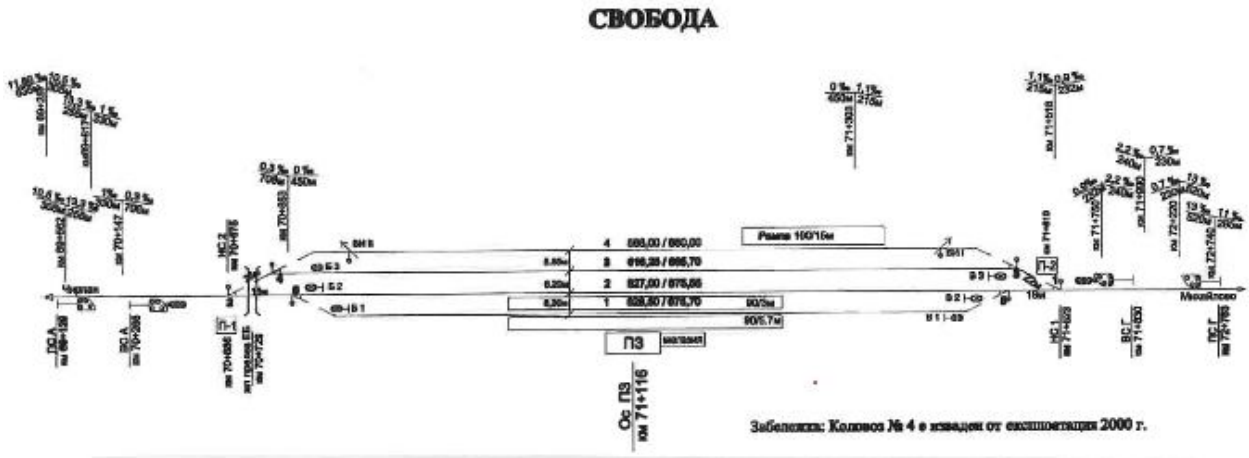


Fig. 3.4. Scheme of Svoboda station

Tchyrpan station is a transition station, at the time of the performed repair activities is with three acceptance-departure tracks (fig. 3.5).

Fig. 3.5. Scheme of Tchyrpan station and SP Tchyrpan West

3.1.7.2. Interstation block system, station interlocking, type of signalling.

Interstation block system

The Svoboda – Tchyrpan interstation is equipped with automatic block system (ABS) without passing signals with axle counters - at the time of the accident, the ABS was disabled due to repair work performed at Tchyrpan station, train movement is ensured by telephone;

Interlocking

Svoboda Station is equipped with a RRI type H-68 MRC - operational;

Tchyrpan Station is equipped with a "Temporary Control Panel" due to construction and repair activities at the station - operational.

Type of signalling

The entrance and exit semaphores at both stations are under the usual signalling at Svoboda station - working, at Tchyrpan station – working;

3.1.7.3. Train protection systems.

The Svoboda and Tchyrpan stations do not have train protection systems. The stations are equipped with a train dispatching radio connection (TDRC), with the help of which radio communications are carried out: the locomotive driver with the traffic manager on duty, with the train dispatcher, with individual stations and with the trains in the respective railway section - functional.

3.1.8. Other information referring the event.

3.1.8.1. Train documents of FT № 8632 at „BDZ-Passenger transport" EOOD.

The train documents „Way-bill", „Brake Mass Certificate", and „Accompanying sheet" (fig. 3.6 ÷ 3.11) are in conformity with the downloaded data from the locomotive recording device.

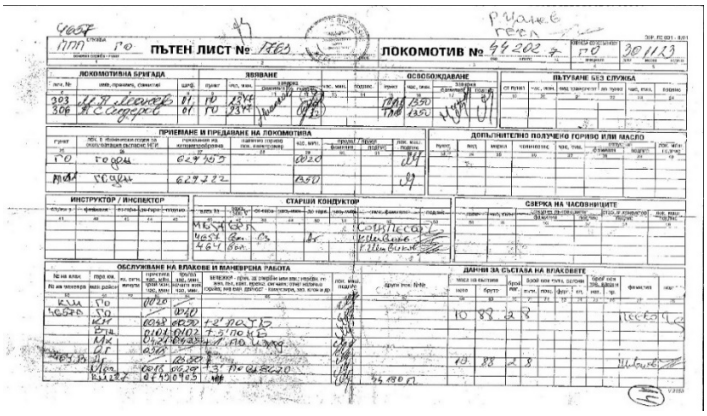


Fig. 3.6. Way-bill of locomotive №91520043309-1 – front part

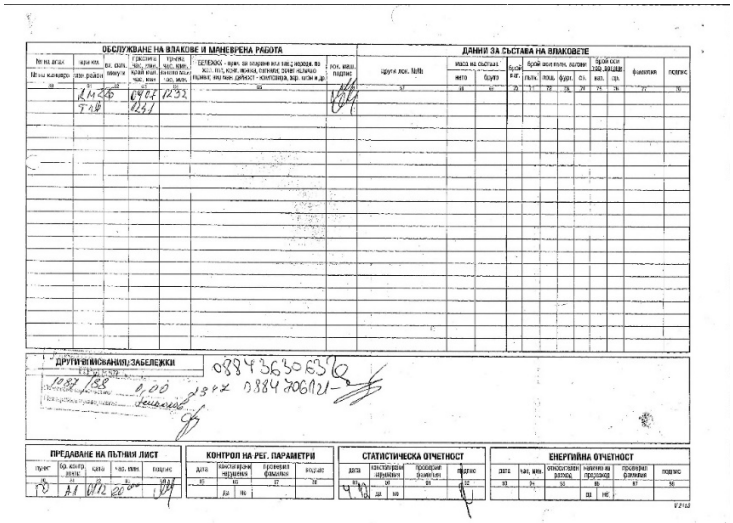


Fig. 3.7. Waybill of locomotive № 91520043309-1 – rear part

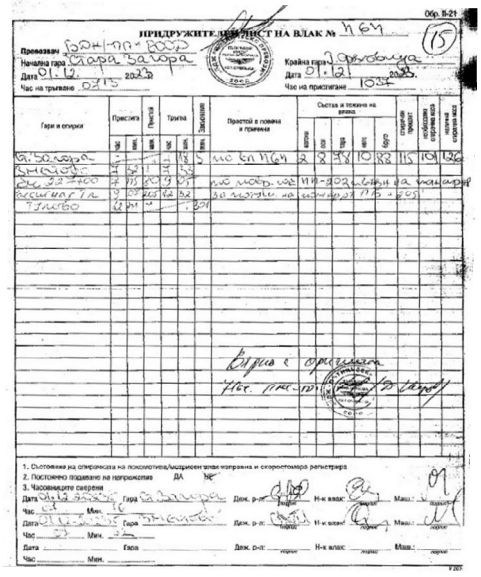


Fig. 3.10. Accompanying sheet of FT № 8632 – front part

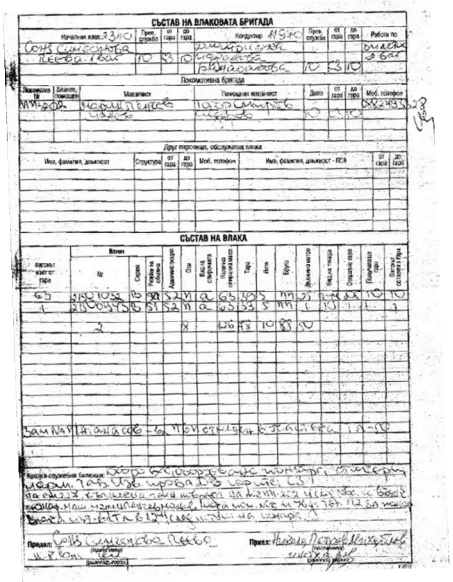
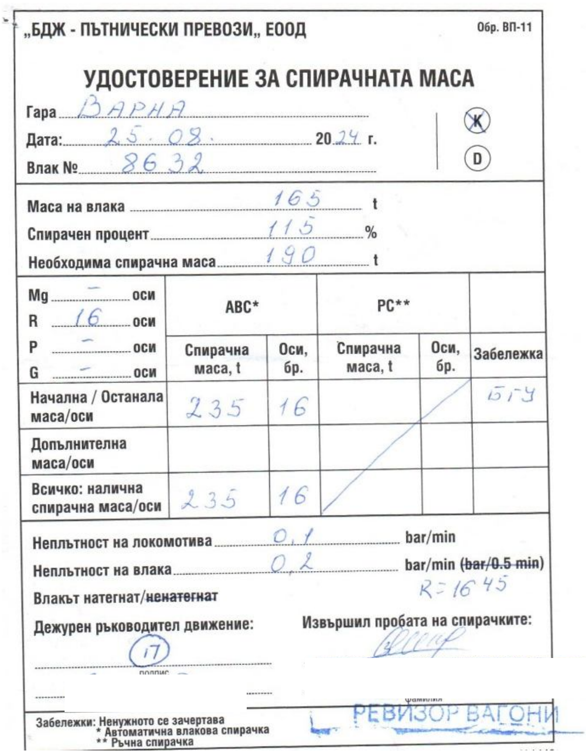


Fig. 3.11. Accompanying sheet of FT № 8632 – rear part



„БДЖ - ПЪТНИЧЕСКИ ПРЕВОЗИ„ ЕООД Обр. ВП-11

УДОСТОВЕРЕНИЕ ЗА СПИРАЧНАТА МАСА

Гара Варна
Дата: 25.08. 2024 г.
Влак № 8632

Маса на влака 165 t
Спирачен процент 115 %
Необходима спирачна маса 190 t

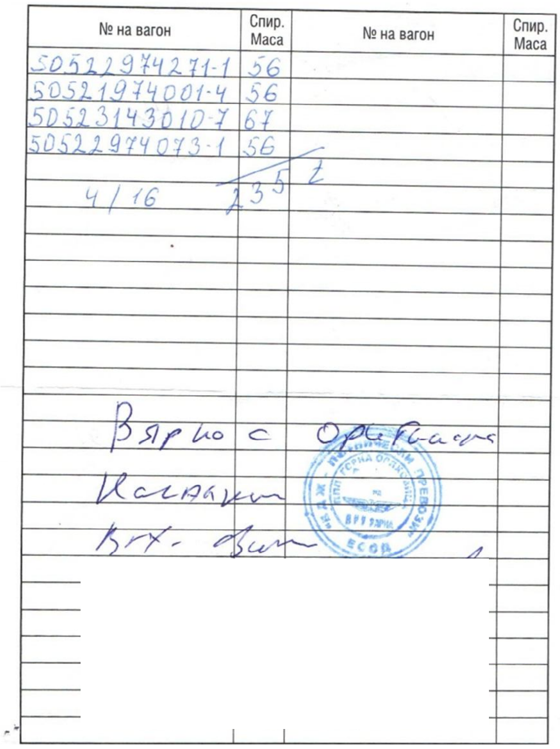
Mg – оси, R 16 оси, P – оси, G – оси	ABC*		PC**		
	Спирачна маса, t	Оси, бр.	Спирачна маса, t	Оси, бр.	Забележка
Начална / Останала маса/оси	235	16			БГУ
Допълнителна маса/оси					
Всичко: налична спирачна маса/оси	235	16			

Неплътност на локомотива 0,1 bar/min
Неплътност на влака 0,2 bar/min (~~bar/0.5 min~~)
Влакът натегнат/~~ненатегнат~~ R=1645
Дежурен ръководител движение: Извършил пробата на спирачките:

Забележки: Ненужното се зачертава
* Автоматична влакова спирачка
** Ръчна спирачка

РЕВИЗОР ВАГОНИ

Fig. 3.8. Brake Mass Certificate of FT №8632, issued in Varna station – front part



№ на вагон	Спир. Маса	№ на вагон	Спир. Маса
50522974271-1	56		
50521974001-4	56		
50523143010-7	67		
50522974073-1	56		
4/16	235 t		

Fig. 3.9. Brake Mass Certificate of FT №8632, issued in Varna station – rear part

3.2. Factual description of the occurred.

3.2.2. Immediate sequence of events that led to the accident, including:

3.2.2.1. Actions that the involved in the event persons undertook.

At around 22:20 p.m. during the movement of FT No. 8632 with locomotive No. 91520043309-1, controlled from the first cab of the locomotive in the Svoboda – Tchyrpan interstation, before the neutral insertion of the overhead contact line, the locomotive driver first person lowered the locomotive's pantograph and after passing it raised the pantograph. The locomotive driver first person saw through the side window of the locomotive that smoke and fire were coming out of the rear part of the locomotive. He turned off the MAS and the locomotive battery, the train continued to move by inertia. At that time, the locomotive driver looked for a convenient place to stop in order to ensure access for the specialized vehicles of FSaCP Tchyrpan. At 22:36 p.m., the locomotive driver stopped FT No. 8632 in the inter-station at km 60+560. The locomotive driver first person activated the fire extinguishing installation from the locomotive cab. The locomotive driver, second person, took the available portable fire extinguishers and began to extinguish the locomotive from the outside. The transport crew had delivered three more fire extinguishers from the coaches, which were also sprayed, but without success.

The locomotive driver contacted the dispatcher in Sofia at BDZ PP EOOD on his mobile phone and informed him of the fire in the locomotive;

At around 22:40 p.m., the train chief of FT No. 8632 notified the relevant services via the national emergency number 112.

The train chief and the conductor informed and took the passengers travelling in FT No. 8632 to a safe place, after which they were transferred by buses along the train route.

The locomotive driver notified the train dispatcher for passenger transport at BDZ-PP EOOD about the fire in the locomotive.

At around 22:40 p.m., the traffic manager on duty at Tchyrpan station was notified by the train dispatcher at the Plovdiv - Stara Zagora section about the fire that had broken out in the locomotive of FT No. 8632.

At 22:45 p.m., the senior train dispatcher at the TOU Plovdiv informed the energy dispatcher at the REU Plovdiv about the fire that had broken out in the locomotive of FT No. 8632 at the Svoboda – Tchyrpan section.

At 22:50 p.m., the first specialized fire truck of the RS FSaCP arrived at the scene of the accident at the burning locomotive.

At 22:55 p.m., the energy dispatcher from the Plovdiv REU turned off the voltage at Tchyrpan station and the Belozem - Tchyrpan and Tchyrpan - Svoboda interstation.

At 00:10 a.m., the train chief entered form II-76 in the dispatch order log at Tchyrpan station and requested an auxiliary locomotive to remove the train from the interstation.

At 00:15 a.m., the train dispatcher, with an order of 00:16 a.m., closed the Svoboda - Tchyrpan interstation for the movement of all trains and vehicles, with the exception of auxiliary vehicles.

At 00:40 a.m., two more specialized fire vehicles arrived at the scene of the accident.

At 02:34 a.m., the employee from the RS FSaCP notified the energy dispatcher from the REU Plovdiv that the fire in the locomotive had been extinguished and voltage could be supplied to the overhead contact line.

At 02:47 a.m., after switching operations were carried out at the Belozem, Tchyrpan and Svoboda stations, and voltage was supplied to the Svoboda - Tchyrpan interstation.

At 03:30 a.m., auxiliary locomotive No. 91520044066-6 departed from Tchyrpan station for the interstation and at 03:50 a.m., FT No. 8632 was withdrawn from the interstation to Tchyrpan station.

At 04:04 a.m., the TWG from the Stara Zagora railway section entered in the dispatch order log at Tchyrpan station that the rail track at km 60+625 was aligned with the gauge and the movement of trains and vehicles was to be ensured at the speed according to the schedule.

Train traffic was suspended on the Svoboda - Tchyrpan interstation from 00:16 a.m. to 04:10 a.m. on 26.08.2024.

At 04:10 a.m., by order of the train dispatcher at the TOU Plovdiv, the Svoboda - Tchyrpan interstation was opened for the movement of all trains and vehicles at the scheduled speed.

At 04:20 a.m., the senior train dispatcher at the TOU Plovdiv assigned a work-service train (WST) No. 80392 to transport the train of FT No. 8632 with the burned-out locomotive No. 91520043309-1 to Plovdiv station. The train arrived at Plovdiv station at 07:40 a.m.

3.2.2.2. Rolling stock and technical facilities functioning.

During the servicing of FT No. 8632 from Varna station, the locomotive crew of locomotive No. 91520043309-1 did not detect any failures or damage that could have caused a fire in the locomotive. The locomotive is regularly registered in the European Vehicle Register (EVR).

Until the time of the accident, the rolling stock of FT No. 8632 (the locomotive and four coaches) was technically sound.

At Svoboda station, the traffic manager on duty, through the RRI, ordered a route to receive FT No. 8632 without stopping at the station. Due to repair work on the railway infrastructure, the movement of trains on the Svoboda - Tchyrpan interstation was provided by telephone.

3.2.2.3. Operational system functioning.

The operational system for train traffic control on main railway line No. 8 was operational and functioning normally before the accident. Train traffic in the Mihaylovo - Orizovo section is carried out on a single electrified railway line.

The operational system for train traffic control between Svoboda and Tchyrpan stations operates by telephone, which leads to risks in train traffic control.

3.2.3. Sequence of the events from the beginning of the occurrence until the end of the rescue services actions:

3.2.3.1. Undertaken measures for protecting and guarding the event location.

At 22:50 p.m., the authorities of the Tchyrpan Regional Police Division arrived at the scene of the accident and after clarifying the situation, the area was restricted to outsiders. The authorities of the EMS, the RS FSaCP and the interested officials of the two entities were allowed on site.

3.2.3.2. Actions of the emergency rescue services.

At around 22:50 p.m., specialized vehicles from the RS FSaCP Tchyrpan arrived at the scene of the accident to extinguish the fire in the locomotive and vehicles of EMA.

At 22:55 p.m., the energy dispatcher at the Plovdiv REU turned off the voltage in the overhead contact line, after which the extinguishing of the locomotive began.

At 00:40 a.m., two more fire vehicles arrived at the scene of the accident.

At 02:34 a.m., the employee of the RS FSaCP notified the power dispatcher from the Plovdiv REU that the fire in the locomotive had been extinguished and voltage could be applied to the overhead contact line.

3.2.3.3. Actions of the emergency rehabilitation services

At 02:47 a.m. after switching operations were carried out at the Belozem, Tchyrpan and Svoboda stations, voltage was applied to the Svoboda - Tchyrpan interstation.

At 04:04 a.m., the group leader from the Plovdiv Railway Section entered in the dispatch order log at Tchyrpan station the information about the straightened rail track at km 60+625 and the presence of a gauge for the movement of trains and vehicles according to the schedule.

At 04:30 a.m., auxiliary locomotive No. 91520044066-6 departed from the Tchyrpan station for the interstation to withdraw the train crew No. 8632 and the burned-out locomotive; at 04:50 a.m., the train was pulled into the Tchyrpan station.

3.2.3.4. Actions that SE NRIC and BDZ PP EOOD undertook for recovering the schedule and capacity along the railway line

On 26.08.2024 at 02:50 a.m., after the completion of the procedural and investigative actions by the Tchyrpan Regional Service of the Ministry of Interior, a written permit was given to carry out emergency and recovery activities.

At 04:10 a.m., the train dispatcher at the TOU Plovdiv opened the Svoboda – Tchyrpan interstation with an order for the movement of all trains and vehicles at the scheduled speed.

At 04:50 a.m., the train crew of FT No. 8632 and the burned locomotive were withdrawn from the interstation at Tchyrpan station.

On 26.08.2024 at 07:40 a.m., the burned locomotive No. 91520043309-1 arrived at Plovdiv station, towed by locomotive No. 91520044066-6 and handed over to the Plovdiv Locomotive Depot.

4. Analysis of the event

4.1.Participation and responsibilities of the entities, involved in the event

4.1.2. Railway undertaking.

Analysis of the movement of FT № 8632

The records from the recording device, registered on the speedometer tape of locomotive No91520043309-1, serving FT No. 8632 on 25.08.2024, have been downloaded.

An analysis of the data recorded on the speedometer tape of locomotive No. 91520043309-1, for the movement of FT No. 8632 on 25.08.2024, has been carried out.

The registration of the parameters for the movement of the locomotive, respectively the train, in speedometer installations of the "Hasler" system was carried out by recording on a speedometer control tape:

- Track speed (V-S);
- Astronomic time through the schedule and stamp on the tape, as well as the travelling and stopping time (diagram T);
- Passed track for the separate track sections (through perforations on the tape – 2,5 mm = 0,5 km);

On the speedometer tape for apparatus type RT9 (as are for locomotive № 91520043309-1) can be registered the following additional parameters:

- Pressure in the main air duct;
- Movement direction;
- Activation of the rheostat brake;
- Activation of the automatic brake (pneumatic registration);

The speedometer tape is checked within establishing:

- Whether the prescribed train movement maximum speed has been respected;
- Is the speed restricted to the prescribed one within the passing through the section which shall be passed with restricted speed;
- Is the continuation of movement with restricted speed respected, i.e. to be passed the distance equal to the length of the restriction plus the length of the whole train;
- Are there unpredicted stops in the interstation;
- Are there indicated locomotives slipping;
- Is there registered reduction of the pressure in the main air duct of the air brake within performance of the different tests;
- How is used the automatic air brake of the train and how the rheostat brake is used;
- Availability of additional registering as per the envisaged for each series of TRS (traction rolling stock);
- Availability of all records for the respective TRS.

The speedometer control tapes could be also used for other clarifications in the train movement, namely:

- Delays in departure and arrival;
- Stoppings before closed signals in the stations;
- Within calculation of the energy cost etc.

The speedometer control tapes are reviewed as a valuable objective document within the investigation of accidents on the transport safety and rail accidents.

Any falsification of the speedometer tape, intentional destruction or deliberate interference with the clock or recording mechanism is considered a violation of transport safety.

Locomotive № 91520043309-1 is equipped with speedometer installation type „Hasler“, which

Fig. 4.1. Tape tachograph

Fig. 4.2. Tachometer

consists of three-phase alternating current collector converter (Geber), driven by one of the locomotive's wheels. The resulting three-phase voltage with variable frequency, depending on the speed of movement, drives the mechanical speedometer synchronous electric motors mounted to it. One speedometer is installed in each of the locomotive's cabins: the recording device (tape tachograph) RT9 in cabin No. 1 (Fig. 4.1) and the non-recording device (tachometer) A16 in cabin No. 2 (Fig. 4.2). The two speedometers have a range of 0÷150 km/h.

The tape tachograph measures and displays on a clear dial the following data during the movement of the locomotive:

- Track speed in km/h;
- Time in hours and minutes;
- The entire distance travelled in km (odometer);

The tachometer measures and displays on a clear dial the same data that the strip tachograph shows, without the distance travelled and without recording the information. It is electrically connected to the tachograph and in the event of a power cable interruption, both devices stop recording the speed of movement.

The recording devices of the RT9 tachograph record the following main parameters:

- Track speed in km/h;
- Astronomic time, as well as travel and stop time;
- Distance travelled for individual track sections;
- Other parameters for the movement of the locomotive.

The recording (speedometer) tape is made of waxed paper. It has linear fields for recording the information transmitted by the tape tachograph (Fig. 4.3). The speedometer is a valuable objective source of data for the accurate determination of the beginning, course and end of processes related to movement.

On the speedometer tape are registered:

- Track speed in km/h;
- Astronomic time;
- Travelling time;

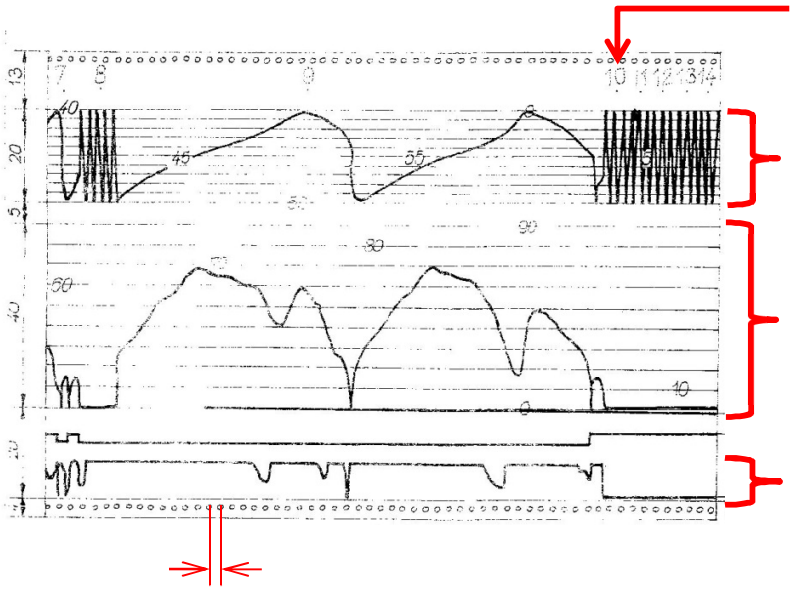


Fig. 4.3.

- Stopping time;
- Travelled track for separate track sections;
- Air pressure in the main air duct (MAD);
- Other data (optional).

An analysis of the train's movement was made on part of its movement in the section from Mihaylovo station to the accident site (Fig. 4.4).

It is necessary to note that the registrations on the tape during the movement of the train before the accident site are faint, which is due to the increase in temperature in the control cabin 1 after the ignition of the locomotive and the late removal of the speedometer tape from the recording speedometer. This significantly complicated the analysis of the train's movement.

FT No. 8632, led by locomotive No. 91520043309-1, arrived at Mihaylovo station at 22:00 p.m. (Fig. 4.4, pos. 1). It stayed for three minutes and departed at 22:03 p.m. (Fig. 4.4, pos. 2). It accelerated to 64 km/h, travelled about 1250 meters in 1 minute and 30 seconds (Fig. 4.4, pos. 3), after which the locomotive driver held it with the automatic train brake and the speed decreased to 15 km/h for about 500 meters (Fig. 4.4, pos. 4). Immediately after that, a new increase in speed began, initially steeper to 51 km/h (Fig. 4.4, pos. 5), and then more smoothly to 56 km/h, with the train traveling another about 1400 meters in 2 minutes (Fig. 4.4, pos. 6).

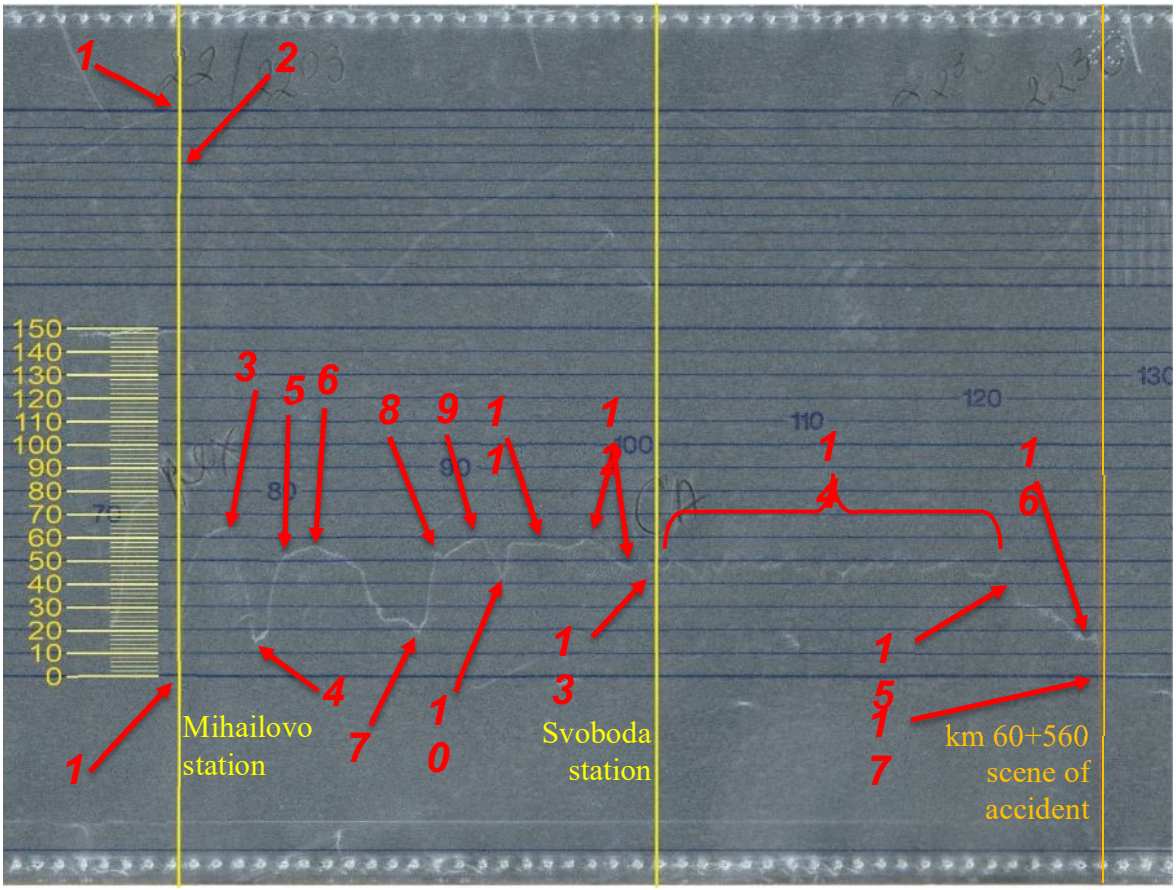


Fig. 4.4. Speedometer tape of locomotive № 91520043309-1 from Mihaylovo station at km 60+560

That was followed by a new speed reduction to 20 km/h (Fig. 4.4, pos. 7) and a new increase, initially steep with a peak at 54 km/h (Fig. 4.4, pos. 8), with a reduction to 50 km/h and a subsequent smoother increase to 60 km/h (Fig. 4.4, pos. 9). The speed reduction in that interval was carried out without using the automatic train brake – only by the natural resistance of the train movement.

After reaching a speed of 60 km/h, a new reduction in the speed to 44 km/h (Fig. 4.4, pos. 10), again without using the automatic train brake and a new steep acceleration to 58 km/h, after which the speed was maintained at that value for about 1500 meters (Fig. 4.4, pos. 11). That was followed by a new increase in speed to 60 km/h and a new decrease due to the natural resistance of the train to 48 km/h (Fig. 4.4, pos. 12).

FT No. 8632 passed Svoboda station without stopping at 22:19 p.m., with its speed fluctuating between 50 and 45 km/h (Fig. 4.4, pos. 13). After leaving Svoboda station, the train continues to move at a variable speed between 40 and 55 km/h, thus covering about 8000 meters in about 11 minutes (Fig. 4.4, pos. 14). At 22:30 p.m., the speed from 50 km/h began to decrease steeply, reaching 30 km/h in about 250 meters for about 15 seconds (Fig. 4.4, pos. 15). The speed remained at that value for about 500 meters for 1 minute, and then continued to decrease, reaching 15 km/h in about 1200 meters (Fig. 4.4, pos. 16). That was followed by a slight increase to 19 km/h and a sharp decrease to 0 km/h (Fig. 4.4, pos. 17). At 22:35:30 p.m., FT No. 8632 was located at km 60+560.

Analysis of the causes for the fire occurrence.

In the period from 02.09.2024 to 05.09.2024, the Investigation Commission at the NAMRTAIB carried out several inspections of locomotive No. 91520043309-1 at the Plovdiv Locomotive Depot (Fig. 4.5). The Commission questioned the locomotive driver. According to him, the train was moving with the first cabin in the direction of travel. After the neutral insert, he smelled a smell, looked through the window of the side door of the locomotive, and saw smoke. He took a wait for a more convenient place for the fire department and passengers to stop. We also listened to the train conductor. According to him,

after the neutral insert, he smelled something. During the movement of the train, he spoke with the locomotive crew on his personal phones due to the lack of official ones. The conductor took the passengers off the last carriage to wait for buses. Some of them moved by personal vehicles, the others by bus. During the inspection of the locomotive at the Plovdiv Locomotive Depot, the Investigation Commission found the following:

Fig. 4.5. View to the second rectifier block 022 and 221

When dismantling the second rectifier block 022, melted cooling elements of the diodes of the rectifier group were found, as well as destroyed auxiliary rectifiers 221 of the fans 232, 233 and the compressor 235 (Fig. 4.6 and 4.7).

Inspection of auxiliary rectifier 221, powering the compressor motor and fan motor – the coolers were burnt and melted. Most likely, the temperature was highest there. It was very likely that the fire started from rectifier 221 due to prolonged operation of the second compressor motor.

Dismantled first rectifier group 020. It can be seen that the burning and melting of the coolers was significantly less. That compressor motor may have been loaded less. It is assumed that it was not used during the train's movement (Fig. 4.7).

The location of the power auxiliary unit 221 is in the lower part of the rectifier power unit 022. It cools after the power unit 022 cools down. The R-C groups of the power and auxiliary units 022 and 221 are for protection against external and internal overvoltage. It was found that the capacitors in the R-C groups are made of liquid electrolyte (Fig. 4.8). Because of the increased temperature, it expanded and caused the capacitor to explode. The hot electrolyte falls on the heated surfaces of the rectifier diodes and on the power block of the auxiliary rectifier. That caused a fire in the rectifier. Initially, the fire occured with thick, impenetrable dense smoke due to the lack of oxygen.

Fig. 4.6. View of the burned rectifier 022 and 221

Fig. 4.7. View of the first rectifier 020

Fig. 4.8. View of blasted capacitor of R-C groups of 221

When the door to the passageway was opened, oxygen access was provided and a flame appeared. The damage was extensive to the rectifier groups, horizontal engine fans and traction motors (Fig. 4.9 and 4.10) due to the lack of adequate actions by the Fire and Rescue Service (the initial extinguishing began by pouring water on the locomotive body), as well as the failure of the locomotive's fire extinguishing system.

Fig. 4.9. View of second traction motor

Fig. 4.10. View of the horizontal fan after the fire

The commission inspected the two control cabins and found that they were smoky, with the temperature in the first control cabin being high, heating up the recording speedometer and to some extent damaging the recordings on the locomotive's speedometer tape (Fig. 4.11, 4.12).

Fig. 4.11. Condition of the control cabin № 1 after the fire

Fig. 4.12. Condition of the fuse panel in control cabin No. 1 after the fire

The commission inspected the engine compartment, as well as the elements located under the locomotive frame, and found burnt power cables of the traction motors, under-basket horizontal fans, part of the bogie frames, brake cylinders, the lever brake system and other elements, all of which were a result of the high temperature during the expansion of the fire (Fig. 4.13, 4.14, 4.15).

Fig. 4.13. Condition of the elements under the locomotive frame after the fire

Fig. 4.14.Condition of the bogie and the traction motor after the fire

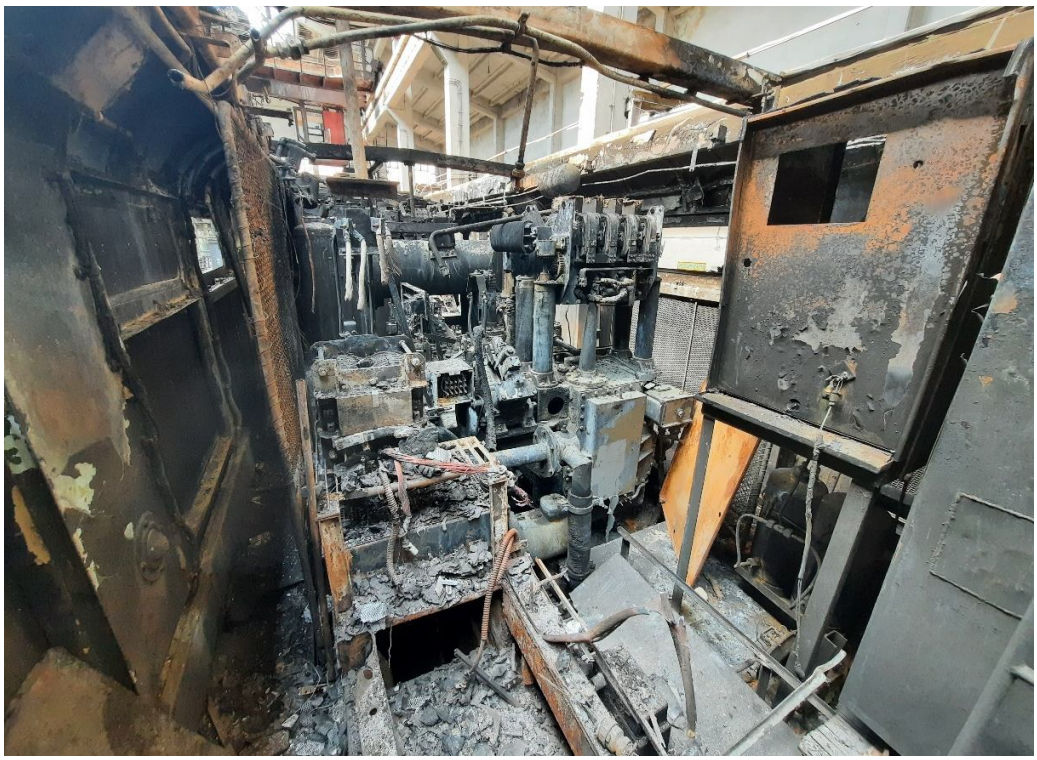


Fig. 4.15. Condition of the machine compartment after the ignition with removed rectifier blocks

The rectifier groups in the 44 series locomotives are cabinet type, with each cabinet being designed to work with a separate traction group. The interior of the cabinet can be conditionally divided into three parts: upper, lower and side. The upper part houses the valves of the traction bridge, which operate in traction mode together with the traction motors (Fig. 4.16, pos. 1). The lower part houses the elements of the four auxiliary bridges, which are included in the circuits of the auxiliary machines (Fig. 4.16, pos. 2), and the side part houses signal lamps, blinker relays and R-C groups, which consist of resistors and capacitors (Fig. 4.17).

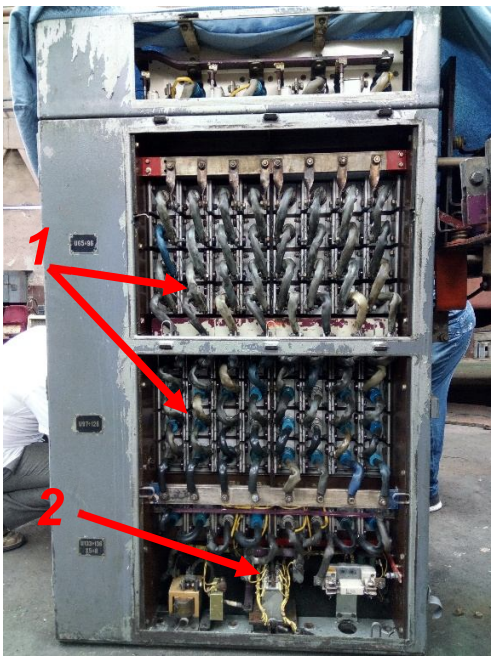


Fig. 4.16

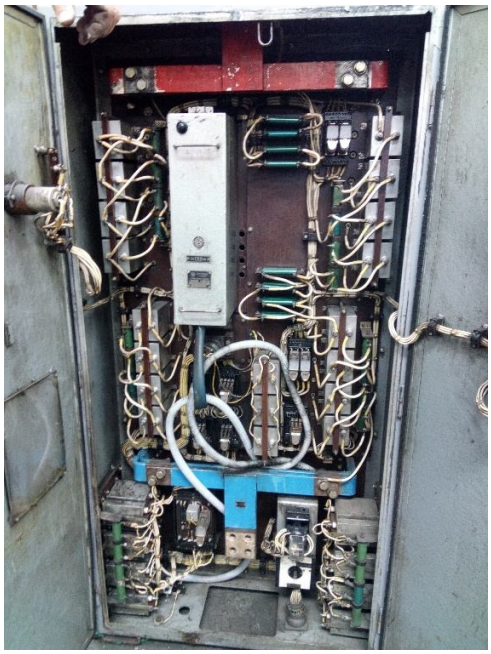


Fig. 4.17

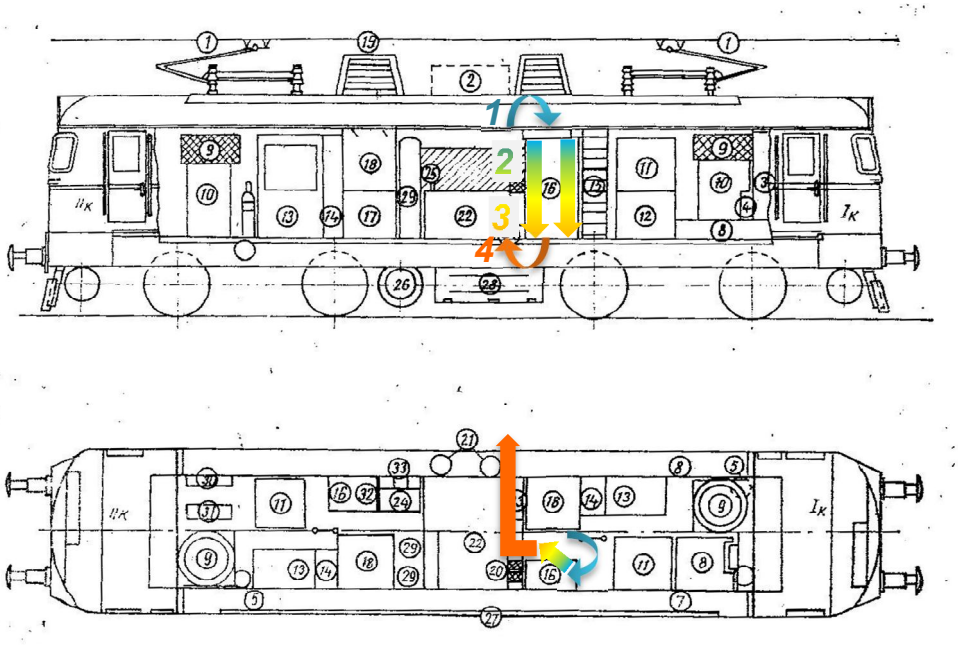


Fig. 4.18. Air flow diagram for cooling one of the rectifier units.
Arrows indicate the direction of airflow through the rectifier units.
The colours illustrate the temperature of the air flowing through them:
cold, heated, warm, hot air.
Layout of the main equipment in locomotive 43-309:

1. Current collectors;
2. MAD;
5. Portable fire extinguisher;
6. Impassable corridor;
7. Passable corridor;
9. Shunt resistors;
10. Vertical fans for cooling TDs and their shunts;
11. Engine-compressors;
12. Smoothing reactor;
13. Reverse cabinet;
16. Rectifier cabinet;
17. Motor-fans for the brake resistors;
18. Brake resistors;
19. Air outlet louvers for cooling the braking resistors;
20. Smoothing reactors for auxiliary machines;
21. Fire-fighting tanks of the FES;
22. Traction transformer;
23. ATS;
26. Horizontal under-body shell fans for cooling the rectifier cabinets;

The cooling of the units is forced with air that is sucked from the engine room (Fig. 4.18, pos. 1), enters through the upper opening of the cabinet, passes through it downwards, taking away part of the heat released by the valves of the traction axle (Fig. 4.18, pos. 2), already heated passes downwards to cool the valves of the auxiliary axles (Fig. 4.18, pos. 3) and exits through the suction under-basket horizontal fan (Fig. 4.18, pos. 4). The side part of the unit is not cooled. In the scheme described in this way, the way in which the operation is carried out is particularly important, because improper handling of the cooling system causes overheating of the rectifier unit, especially in its lower part, where the rectifier bridges for the auxiliary machines – fans and compressors – are located. When the locomotive is loaded in traction mode, the valves heat up and release a large amount of heat, which is transferred to

the passing cooling air. The same air, instead of cooling, additionally heats the rectifier bridges of the auxiliary machines, whose operation is not in accord with that of the traction rectifier bridges. In this situation, after switching off the traction mode and switching to coasting mode, the locomotive drivers usually turn off the ventilation with a button on the locomotive control panel and stop cooling the rectifier blocks. Heat release from the traction rectifier bridges, however, continues, but without cooling. At the same time, the rectifier bridges of the auxiliary machines (especially the compressors, which consume a sufficiently large amount of energy) continue to operate, because the auxiliary machines operate in a completely different mode from that of the traction motors. As a result, the insufficiently cooled auxiliary bridges continue to heat up due to the heat released by the traction bridges together with the heat that they themselves release during operation. All this affects the temperature in the side of the block and heats the capacitors located there. Their electrolyte ignites and becomes a catalyst for the ignition of the entire block. The observations that the Commission of Inquiry has made not only in this, but also in a number of previous investigations, and the analyses on them lead to the conclusion that this is the main reason for many of the fires of locomotives of this series in recent years.

4.1.3. Analysis of the railway infrastructure condition.

Non-applicable

4.1.4. Entities in charge of the technical maintenance.

Railway undertaking

"BDZ-Passenger Transport" EOOD holds a Certificate of a structure responsible for maintenance with EIN BG /31/0021/0001, valid from 19/04/2021 to 18/04/2026;

Infrastructure manager

SE NRIC has a Certificate of a structure responsible for maintenance with EIN BG /31/0020/ 0003, valid from 01.07.2020 to 30.06.2025.

SE NRIC has a Certificate of a structure responsible for vehicle maintenance with EIN BG/31/0023/0001, valid from 22.03.2023 to 21.03.2028.

4.1.5. Manufacturers or providers of rolling stock and railway products.

Non-applicable.

4.1.6. National Safety Authority.

Railway Administration Executive Agency is the National Safety Authority for railway transport in the Republic of Bulgaria.

4.1.7. Notified bodies or Risk assessment bodies.

Non-applicable.

4.1.8. Certifying bodies of the entities in charge of the technical maintenance.

The Railway Administration Executive Agency as the National Safety Authority for railway transport performs certification of the entities in charge of the vehicles maintenance (ECM) in accordance with Directive 2004/49/EC and Regulation (EU) 445/2011, as per Ordinance No 59 on the railway transport safety management and on the maintenance functions in accordance with Directive 2004/49/EC and Regulation (EU) 445/2011.

From June 16, 2020 the RAEA performs certification of the ECM as per the Commission Implementing Regulation (EU) 2019/779 of 16 May 2019 laying down detailed provisions on a system of certification of entities in charge of maintenance of vehicles pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 445/2011.

4.1.9. Persons or entities involved in the event, documented or not in the respective safety management systems or indicated in register.

- SE NRIC implements Safety Procedure SP 2.09 "Methodology for determining, assessing and managing of the risk" version 05 effective from 01.03.2019, part of the SMS.

• BDZ PP EOOD implements the Procedure of "Integrated Management System" - P-2-15, "Management of Safety of Passenger Transportation. Monitoring and information" from 25.03.2024, and Safety Risk Assessment Methodology in BDZ PP EOOD from 23.02.2012.

4.2. Rolling stock and technical facilities.

4.2.1. Factors, deriving from the design of the rolling stock, railway infrastructure or technical facilities.

Non-applicable.

4.2.2. Factors deriving from the installation and placing into service of the rolling stock, railway infrastructure and technical facilities.

Non-applicable.

4.2.3. Factors deriving from manufacturers or another provider of railway products.

Non-applicable.

4.2.4. Factors, deriving from the technical maintenance and/or modification of the rolling stock or the technical structures.

Non-applicable.

4.2.5. Factors, deriving from the technical maintenance and/or modification of the rolling stock or the technical structures.

Non-applicable.

4.2.6. Other factors or consequences considered as involved within the investigation objectives.

Non-applicable.

4.3. Human factor

4.3.1. Individual human characteristics:

4.3.1.1. Training and development, including skills and experience.

Railway undertaking

• Locomotive driver 1st person of locomotive № 91520043309-1:

Certificate of competence № 19774 acquired qualification for "Locomotive driver", training conducted in the period 15.02.÷10.07.2017, training institution PTC at BDZ, issued by RAEA;

Locomotive driving certificate BG 71 2019 0074, issued by RAEA;

Certificate № VII-706 for holding the position of "Locomotive driver" in BDZ PP EOOD from 01.07.2018;

Additional certificate No. 000004336706 from BDZ PP EOOD for rolling stock for which the driver is allowed to drive - series 43, 44, 45,000 and 80,000 from 16.08.2022 to 15.08.2025 on the national railway infrastructure of the Republic of Bulgaria.

• Locomotive driver 2nd person of locomotive No. 91520043309-1:

Certificate of competence No. 11193 acquired qualification for "Electric locomotive driver", training conducted in the period 01.06.÷08.08.2009, training institution PTC at BDZ, issued by RAEA;

Locomotive driving certificate BG 71 2017 0724, issued by RAEA;

Certificate No. VII-1225 for holding the position of "Locomotive Driver" at BDZ PP EOOD from 20.07.2022;

Additional certificate No. 000003511112 from BDZ PP EOOD for rolling stock for which the driver is allowed to drive - series 43, 44, 45,000 from 16.03.2022 to 15.03.2025 on the national railway infrastructure of the Republic of Bulgaria.

• Train manager, passenger traffic on FT No. 8632:

Certificate of competence No. 15873 acquired competence for "Train conductor", training conducted in the period 11.11.2013÷ 11.01.2014, training institution PTC at BDZ, issued by RAEA;

Certificate No. VI-601 for holding the position of "Train Chief, Passenger Traffic" at BDZ PP EOOD from 31.12.2021.

Railway infrastructure

• Traffic Manager at Svoboda Station:

Certificate of Competence No. 1710, acquired qualification for "Traffic Manager", training conducted in the period 23.02. ÷ 15.10.2004, training institution CPQ at SE NRIC;

Certificate No. 842 for holding the position of Traffic Manager at TOSAMD- Plovdiv from 30.10.2023;

• Traffic Manager at Tchyrpan Station:

Certificate of Competence No. 18183 acquired qualification for "Traffic Controller", training conducted in the period 01.10.2015÷15.03.2016, training institution CPC at SE NRIC;

Certificate No. 846 for holding the position of "Traffic Manager" in the TOSAMD- Plovdiv from 27.04.2021.

● Traffic Manager/Train Dispatcher in the TOU Plovdiv:

Certificate of professional qualification No. 001382, acquired legal capacity for "Traffic Manager", training conducted in the period 31.08.1997÷28.07.2000, training institution HTU "Todor Kableshkov" Sofia;

Certificate No. 4025 for holding the position of "Traffic Manager/Train Dispatcher" in the TOSAMD- Plovdiv from 01.01.2015.

4.3.1.2. Medical and personal circumstances, which influence the event, including the presence of physical and psychological stress.

Railway undertaking

• Locomotive driver 1st person of locomotive No. 91520043309-1:

Periodic medical examination card dated 26.10.2024, issued by the Gorna Oryahovitsa Multi-profile Transport Hospital;

Conclusion: fit for a locomotive driver.

Psychological certificate No. 1033/03.10.2022, issued by the Psychological Laboratory at the Gorna Oryahovitsa Multi-profile Transport Hospital for a locomotive driver.

Conclusion: admitted for a period of 3 years.

• Locomotive driver 2nd person of locomotive No. 91520043309-1:

Preliminary medical examination card dated 15.05.2024, issued by the Gorna Oryahovitsa Multi-profile Transport Hospital;

Conclusion: fit for Assistant Locomotive Driver.

Psychological certificate No. 583/26.06.2023, issued by the Psychological Laboratory at the Multidisciplinary Transport Hospital Gorna Oryahovitsa for an assistant locomotive driver.

Conclusion: admitted for a period of 5 years.

• Train Chief, Passenger Traffic of IFT No. 8632:

Periodic Medical Examination Card dated 06.10.2022, issued by the Multidisciplinary Transport Hospital Plovdiv.

Conclusion: fit for a train chief, passenger traffic.

Psychological certificate No. 532/11.04.2024, issued by the Psychological Laboratory at the Multidisciplinary Transport Hospital Plovdiv for a train chief.

Conclusion: admitted for a period of 5 years.

Railway infrastructure:

• Traffic Manager at Svoboda Station:

Single health information file dated 20.10.2023, issued by the Multi-profile Transport Hospital - Plovdiv.

Conclusion - fit for traffic manager.

Psychological certificate No. 1227/24.10.2023, issued by the Psychological Laboratory - Railway Transport Plovdiv at the Multi-profile Transport Hospital Plovdiv for traffic manager.

Conclusion: admitted for a period of 1 year.

• Traffic Manager at Tchyrpan Station:

Single health information file dated 18.07.2024, issued by the Occupational Health Service at the SE NRIC;.

Conclusion: fit for traffic manager.

Psychological certificate No. 705/08.06.2021, issued by the Psychological Laboratory - Railway Transport Plovdiv at the Multi-profile Transport Hospital Plovdiv for traffic manager.

Conclusion: admitted for a period of 5 years.

● Traffic Manager/Train Dispatcher in TOU Plovdiv:

Single Health Information File dated 26.07.2024, issued by the Occupational Health Service at the SE NRIC;

Conclusion: fit for Traffic Manager.

Psychological Certificate No. 42/12.01.2021, issued by the Psychological Laboratory - Railway Transport Plovdiv at the Multi-Profile Transport Hospital Plovdiv for Traffic Manager. Conclusion: admitted for a period of 5 years.

4.3.1.3. Fatigue.

Railway undertaking

• Locomotive driver 1st person of locomotive No. 91520043309-1:
Break: from 24.08.2024 one hour and 19.00 minutes to 25.08.2024 one hour and 16:00 minutes
Started work: 25.08.2024 one hour and 16:00 minutes– (21 hours and 00 min.)
• Locomotive driver 2nd person of locomotive No. 91520043309-1:
Break: from 28.11.2023 one hour and 22 minutes to 30.11.2023 one hour and 23 minutes 47
Started work: 30.11.2023 one hour 23 minutes and 47– (49 hours and 27 minutes)
• Train conductor, passenger traffic on FT No. 8632:
Break: from 24.08.2024 one hour 06 minutes 30 to 24.08.2024 one hour 23 minutes 30
Returned to work: 24.08.2024 one hour 23 minutes 30 – (17 hours and 00 min.)

Railway infrastructure

• Traffic Manager Svoboda Station:
Break: from 24.08.2024 one hour and 19:00 minutes to date 25.08.2024 one hour and 19:00 minutes
Started work: 25.08.2024 one hour and 19:00 minutes – (24 hours and 00 minutes)
• Traffic Manager Tchyrpan Station:
Break: from 24.08.2024 one hour and 19:00 minutes to date 25.08.2024 one hour and 19:00 minutes
Started work: 25.08.2024 one hour and 19:00 (24 hours and 00 minutes)
● Traffic Manager/Train Dispatcher at Plovdiv Railway Station:
Break: from 24.08.2024 one hour and 19 minutes 00 to date 25.08.2024 one hour and 19.00 minutes
Started work: 25.08.2024 one hour and 19 minutes 00 (24 hours and 00 minutes)

4.3.1.4.Motivation and attitudes

Non-applicable

4.3.2. Work related factors:

4.3.2.1.Tasks planning.

Railway infrastructure

● SE NRIC –manager carries out maintenance, repair and operation of the railway infrastructure. Prepares a year-round timetable for the movement of all categories of trains on the main and secondary railway lines. Prepares schedules and timetables for additionally requested trains and vehicles submitted by the railway undertakings for movement on the railway network.

Railway undertaking

● "BDZ-Passenger Transport" EOOD - a national railway carrier that transports passengers according to an approved Train Movement Schedule and Plan for composing the trains under a contract for the carriage of passengers with the state.

4.3.2.2.Constructive particularities of the facilities that influence the connection human-machine.
Non-applicable.

4.3.2.3.Communication means.
The communication links at Svoboda station and Tchyrpan station are implemented with UKSS-8.

In both cabins of the locomotive, TDRC devices are installed for radio communication between the locomotive driver and the traffic manager on duty at the respective station or with the train dispatcher. The operating personnel working on shifts at the SE NRIC and BDZ PP EOOD are provided with official mobile phones for quick communication.

4.3.2.4.Practices and processes.
Non-applicable.

4.3.2.5.Operation rules, local instructions, staff requirements, prescriptions for technical maintenance and applicable standards.

Railway infrastructure

● SE NRIC applies national and departmental regulations part of the SMS, relevant to the activities of the railway infrastructure manager:

- Working procedure RP 5.01-08 Rules for interaction between the operational services of SE NRIC and railway undertakings/carriers in the daily planning and management of trains on the railway infrastructure of SE NRIC;
- Working procedure RP 5.01-07 Instructions for work of switchman/posts at the operational points of SE NRIC;
- Working procedure RP 5.01-04 Instructions for work of the traffic manager on duty at the operational points of SE NRIC;
- Instruction VND – 1 for interruption and restoration of the operation of railway infrastructure sites managed by SE NRIC, when carrying out reconstructions, modernizations, renewals, rehabilitations and repairs;
- Instruction VND-130 for the movement of trains during reconstruction, modernization, renovation (renewal), rehabilitation and replacement (repair) within the framework of maintenance of railway infrastructure sites managed by SE NRIC.

Railway undertaking

● BDZ PP EOOD implements the national and departmental normative acts, which are part of the SMS in the Integrated Management System from 03.25.2024, which includes:

- Procedure P-2-8 – Repair and maintenance of traction rolling stock;
- Procedure P-2-6 – Management of transport activity;
- Procedure P-2-10 – Control and operation of the track transport system;
- Procedure P-2-11 – Repair control. Report and commissioning of TPRRS and passenger coaches;
- Instructions for the work of a locomotive driver and assistant locomotive driver in "BDZ-Passenger Transport" EOOD;
- Instruction on the order and method of performing the operational inspections of TPS MV;
- Prescriptions for the inter-repair runs and the cyclicality and planned inspections and repairs of ETPS and EMU - EOOD, PP_PLS 100/23.

4.3.2.6.Working time of the involved personnel.

• In accordance with the requirements for the implementation of Ordinance No. 50 of 28.12.2001 and the Labour Code:

The personnel involved in the accident at the SE NRIC works on a 12-hour work shift, for which a cumulative calculation of working time is applied (inter-shift breaks are respected).

The personnel involved in the accident of BDZ PP EOOD works on a 12-hour work shift, for which a cumulative calculation of working time is applied (inter-shift breaks are respected). Labour Code and Ordinance No. 50 of 28.12.2001.

4.3.2.7.Risk treatment practices.

Railway infrastructure

● SE NRIC applies safety procedure SP 2.09 „Methods of evaluation, assessment and management of the risk „version 05 effective from 01.03.2019, which is part of the SMS.

Railway undertaking

• "BDZ-Passenger Transport" EOOD applies "Procedure for integrated management system" PK-2-15. "Safety management of passenger transport. Monitoring and exchange of information" dated 25.03.2024 and Methodology for safety risk assessment in BDZ PP EOOD dated 23.02.2012. Register of hazards during operation, repair and maintenance of road transport in BDZ PP EOOD.

4.3.2.8.Context, machinery, equipment and indications for shaping the working practices

Non-applicable.

4.3.3. Organizational factors and tasks:

4.3.3.1.Planning of the working force and the working load.

The entities BDZ PP EOOD and SE NRIC in accordance with the requirements of the European and national normative acts, the entities have approved methodologies and models of good European practices and professional experience. The work is planned and related to the staff directly responsible for the safety and operation of railway transport in accordance with the norms prescribed in the SMS.

4.3.3.2.Communications, information and teamwork.

Non-applicable.

4.3.3.3.Recruitment, staffing requirements, resources

Railway undertaking

• In BDZ PP EOOD, the selection of personnel is carried out according to an established "Human Resources Management System", which includes:

o Recruitment and selection rules;

o Rules for appointment and changes in employment relations;

o Rules for staff training and development;

o Rules for ensuring HSWC, Ecology, and organization of the activity of STM.

The entity's personnel is selected and appointed with the relevant legal capacity, professional qualification and skills for working in the management and executive staff.

Railway infrastructure

• SE NRIC has an approved "Strategy for Human Resources Management 2021÷2025".

In the SE NRIC, the selection of personnel is carried out according to the established "Rules for recruitment, selection and appointment of personnel in the central administration of the SE NRIC" in force from 01.12.2020.

The recruitment, selection and appointment of personnel is carried out by the "Human Resources Management" department, which is responsible for:

- Recruitment;
- Maintaining a database of the personnel;
- Created system of selection techniques for recruitment;
- Carrying out the selection together with the head of the unit;
- Documenting the process and communicating with staff;
- Appointment.

4.3.3.4.Implementation management and supervision

Non-applicable

4.3.3.5.Compensation (remuneration).

Railway undertaking

● BDZ PP EOOD has approved "Internal rules for wages" effective from 03.12.2024, which regulate the general conditions for the organization of wages:

- Formation and distribution of funds for salary in the company;
- Determination and amendment of the basic salaries by position;
- Determination of the types and amounts of additional and other remunerations;
- Regulation of the order and manner of payment of staff salaries.

Railway infrastructure

• SE NRIC has approved "Internal rules for wages" in force from 01.09.2024, which regulate issues related to the wages of the company's personnel:

- General provisions for the organization of the salary in the entity;
- Determining and distributing the funds for wages - sources, order and way of forming the remuneration;
- Determination and amendment of wages and additional remuneration;
- Regulation, order and method of payment of wages.

4.3.3.6.Leadership, powers related issues.

Non-applicable.

4.3.3.7.Organizational culture.

Non-applicable.

4.3.3.8.Legal issues (including the respective European and national rules and provisions).

Non-applicable.

4.3.3.9.Regulatory framework conditions and application of safety management system.

Railway undertaking.

• Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety;
• Commission Delegated Regulation (EU) 2018/762 of 8 March 2018 establishing common safety methods on safety management system requirements pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulations (EU) No 1158/2010 and (EU) No 1169/2010;
• COMMISSION IMPLEMENTING REGULATION (EU) 2019/779 of 16 May 2019 laying down detailed provisions on a system of certification of entities in charge of maintenance of vehicles pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 445/2011;
• COMMISSION IMPLEMENTING REGULATION (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009;
• Railway Transport Act;
• ORDINANCE No 59 dated 5.12.2006 on the management of railway transport safety.

Railway infrastructure.

• Directive (EU) 2016/798 of the European Parliament and of the Council of 11 May 2016 on railway safety;
• Commission Delegated Regulation (EU) 2018/762 of 8 March 2018 establishing common safety methods on safety management system requirements pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulations (EU) No 1158/2010 and (EU) No 1169/2010;
• COMMISSION IMPLEMENTING REGULATION (EU) 2019/779 of 16 May 2019 laying down detailed provisions on a system of certification of entities in charge of maintenance of vehicles pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 445/2011;
• COMMISSION IMPLEMENTING REGULATION (EU) No 402/2013 of 30 April 2013 on the common safety method for risk evaluation and assessment and repealing Regulation (EC) No 352/2009;

- Railway Transport Act;
- ORDINANCE No 59 dated 5.12.2006 on the management of railway transport safety.

4.3.4. Environmental factors:

4.3.4.1.Labour conditions (noise, illumination, vibrations).
Non-applicable for SE NRIC and BDZ PP EOOD.

4.3.4.2.Meteorological and geographic conditions.
Described in detail in item 3.1.3.2.

4.3.4.3.Construction works, performed on the spot or in very proximity.
Described in detail in item 3.1.3.3.

4.3.4. Any other significant factor for the investigation objectives.
Non-applicable.

4.4. Feedback and control mechanisms, including risk and safety management, as well as monitoring processes.

4.4.1. Regulatory framework conditions.

Commission Delegated Regulation (EU) 2018/761 of 16 February 2018 establishing common safety methods for supervision by national safety authorities after the issue of a single safety certificate or a safety authorisation pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulation (EU) No 1077/2012

Commission Delegated Regulation (EU) 2018/762 of 8 March 2018 establishing common safety methods on safety management system requirements pursuant to Directive (EU) 2016/798 of the European Parliament and of the Council and repealing Commission Regulations (EU) No 1158/2010 and (EU) No 1169/2010

ORDINANCE No 59 dated 5.12.2006 on the management of railway transport safety.

4.4.2. Processes, methods and results from the activities on the risk assessment and monitoring that the involved entities performed:

Railway undertaking.

● "BDZ-Passenger Transport" EOOD applies “Procedure on Integrated Management System PK 2-15 "Safety Management of Passenger Transportation. Monitoring and exchange of information." dated 25.03.2024 and Methodology for safety risk analysis and assessment in force from 23.02.2012. "Periodic control of the implementation of the SMS is carried out through internal audits: monthly and complex. Comprehensive audits are conducted once a year of all safety-related structures.'

● In accordance with the requirements of the "Methodology for safety risk analysis and assessment in force from 23.02.2012", the railway enterprise BDZ PP EOOD prepares and presents monthly reports for the current year, as well as a complex (annual) audit report for the previous year regarding risk monitoring.

Railway Infrastructure Manager

- SE NRIC implements a safety procedure PB 2.09 "Methodology for determining, assessing and managing risk" version 05 effective from 01.03.2019, which is part of the SMS.

4.4.2.1.Entities in charge of the technical maintenance.

Railway undertaking

- "BDZ-Passenger Transport" EOOD has a Certificate of a structure in charge of maintenance with EIN BG /31/0021/ 0001, valid from 19.04.2021 to 18.04.2026.

Railway infrastructure

- SE NRIC has a Certificate of a structure in charge of maintenance with EIN BG /31/0020/ 0003, valid from 01.07.2020 to 30.06.2025.
- SE NRIC has a Certificate of a structure in charge of maintenance of vehicles with EIN BG/31/0023/ 0001, valid from 22.03.2023 to 21.03.2028.

4.4.2.2.Producers and all other participants.

Non-applicable.

4.4.2.3.Reports for independent risk assessment.

No assessment has been made by an Independent Assessor (AsBo) of any changes in operating conditions or factors relevant to the occurred accident.

4.4.3. Safety management system of the involved:

Railway undertaking.

"BDZ-Passenger Transport" EOOD implements the "Methodology for Analysis and Assessment of Safety Risk", which is part of the SMS.

Railway infrastructure.

SE NRIC implements a safety procedure SP 2.09 "Methodology for determining, assessing and managing the risk" version 05 effective from 01.03.2019, which is part of the SMS.

4.4.4. Safety Management System of the entities in charge of the technical maintenance.

Railway undertaking.

"BDZ-Passenger Transport" EOOD implements an approved "Safety Management System" effective from 27.09.2022, which regulates the technical maintenance of traction and non-traction rolling stock.

Railway infrastructure

SE NRIC implements Safety Procedure WP 7.01 "Regulations for maintaining the signalling system (Signalling equipment)", which is part of the SMS;

SE NRIC implements approved "Rules for current maintenance of a rail track" in force from 2021.

4.4.5. Results from the supervision, performed by the National Safety Authority.

The results of the performed audits and inspections regarding the functioning of the Safety Management System of SE NRIC and "BDZ-Passenger Transport" EOOD in accordance with the requirements of Regulation (EU) 2018/761, Regulation (EU) No. 1169/2010, Regulation No. 56 and Ordinance No. 59 to satisfy the specific requirements of European legislation and national rules for the design, maintenance and operation of the managed railway infrastructure, show that the companies maintain an SMS and can fulfil the requirements provided for in the relevant legal acts.

Railway infrastructure

In the period from 19.10.2020 to 30.10.2020, the National Safety Authority (RAEA) carried out a planned annual audit of the SMS of the railway infrastructure manager (SE NRIC).

In the period from 21.11.2022 to 25.11.2022, the National Safety Authority (RAEA) carried out a planned annual audit of the SOP, part of the SMS of SE NRIC.

In the period from 24.04.2023 to 05.05.2023, the National Safety Authority (RAEA) carried out an audit of the SMS of SE NRIC for the renewal of the Safety Authorization of the railway infrastructure manager (SE NRIC).

Railway undertaking

In the period from 08/02/2021 to 19/02/2021, the National Safety Authority (RAEA) carried out a scheduled annual audit of the SMS of "BDZ-Passenger Transport" EOOD.

In the period from 22.11.2022 to 09.12.2022, the National Safety Authority (RAEA) conducted an audit under the SMS for the issuance of a Single safety certificate of "BDZ-Passenger Transport" EOOD.

In the period from 23.10.2023 to 03.11.2023, the National Safety Authority (RAEA) carried out a planned annual audit of the SMS of "BDZ-Passenger Transport" EOOD.

4.4.6. Permits, certificates and assessment reports, provided by the National Safety Authority or other Conformity Assessment Bodies:

4.4.6.1. Safety Authorization of the involved infrastructure manager.

SE NRIC has a Safety Authorization IN EC BG 21/2023/0001, valid from 01/07/2023 to 30/06/2028.

4.4.6.2.Safety certificates of the involved railway undertaking.

„BDZ-Passenger Transport" EOOD has a Single Safety Certificate with IN EC BG 10 2022 0298, valid from 31/12/2022 to 30/12/2027;

4.4.6.3. Authorizations for placing in service of permanently fixed equipment and permits for placing on the market of vehicles.

Non-applicable.

4.4.7.Other system factors.

Non-applicable.

4.5. Previous similar cases.

In the period from 2009 ÷ 2023, NIB – BG has investigated 16 accidents of a similar nature; a fire occurred in electric locomotives series 43, 44 and 45. In accordance with the requirements of Art. 24, paragraph 2 of Directive (EU) 2016/798, all investigations have been concluded with final reports and in accordance with Art. 26, safety recommendations have been issued to the National Safety Authority (RAEA) and to the interested entities and other parties to the accident.

5. Conclusions

5.1. Summary of the analysis for the event causes.

The Investigation Commission conducted several inspections of the burned locomotive No91520043309-1 at the Plovdiv Locomotive Depot, reviewed the documentation provided on the technical condition (operation and repairs carried out) of the locomotive before the accident. It interviewed the personnel, the operation and repair managers at the Plovdiv Locomotive Depot and the statements given by them. It reviewed and analysed the documentation related to the operation and maintenance of the locomotive.

From the inspections and findings made, the Commission established that the most likely cause for the fire in locomotive No. 91520043309-1, serving FT No. 8632, was a prolonged temperature overheating of the power auxiliary unit 221, supplying the compressor motor 235. The auxiliary unit 221 was not cooled, since the locomotive driver had continuously turned off the operation of the locomotive fans during the movement of the train (visible in the locomotive driver's readings/witness).

Another probable cause for the fire was a prolonged overheating of the rectifier unit, due to a lack of cooling from the fans during the movement of the locomotive in traction mode.

The analyses and conclusions formulated by the Investigation Commission at the NAMRATIB are from the performed technical inspections and measurements, as well as from the downloaded data of the recording device, registered during the movement of the locomotive, respectively the train.

These two causes are closely related to create the possibility for a fire in the locomotive.

5.2. Undertaken measures after the event occurrence.

The railway infrastructure manager, SE NRIC, promptly organized and took action to restore the schedule and capacity of the railway infrastructure, through inspections and measurements of the railway track and the overhead contact line. Traffic was restored at 04:10 a.m. according to schedule.

After the accident, FT No. 8632 was cancelled by the TOS, and its passengers were taken by bus along the train route to Plovdiv station.

The burned-out locomotive No. 91520043309-1, which served FT No. 8632, was moved with auxiliary locomotive No. 91520044066-6 to the Plovdiv Locomotive Depot (place of residence).

The Investigation Commission at the NAMRATIB initiated an investigation into the accident regarding the ignition of the locomotive after its movement to the Plovdiv Locomotive Depot.

5.3. Additional findings of the Safety Investigation Commission.

The locomotives of series 43, 44 and 45 of BDZ PP EOOD in operation, which have not been overhauled, their technical condition often leads to a risk of fires during servicing passenger trains in motion.

There is a tendency among some locomotive drivers during operation of the locomotive to turn off the engine-compressor closer to the control cabin due to the noise it makes, when the locomotive is in traction mode, ventilation is not turned on.

Because of these accidents, there is a prolonged suspension of train traffic and limitation of the capacity of the railway infrastructure, which worsens the schedule for train movement in the affected section.

6. Safety recommendations

In order to improve the safety in the rail transport, the Chairperson of the Investigation Commission at NAMRATIB proposes to the Railway Administration Executive Agency (RAEA) the following safety recommendations adapted to SE NRIC and BDZ PP EOOD.

- Recommendation 1, proposes that SE NRIC and BDZ PP EOOD familiarize the interested personnel with the contents of this report;
- Recommendation 2 proposes that BDZ PP EOOD undertake the replacement of electrolytic capacitors of the R-C groups with dry-type capacitors of locomotives series 44 and 45;
- Recommendation 3 proposes that BDZ PP EOOD install technical means (thermostats) for temperature control of rectifier groups 020 and 022 of locomotives series 44 and 45;
- Recommendation 4 proposes that BDZ PP EOOD restore the power supply of the electronic control unit of the auxiliary machines Y_2 from its own transformer 222, in accordance with the design schemes of the manufacturing plant for series 44 and 45;
- Recommendation 5 proposes that BDZ PP EOOD organize and carry out major repairs of the locomotives of series 44 and 45, which have expired operational resources and are needed in operation;
- Recommendation 6 proposes that BDZ PP EOOD increase control and accountability for the implementation of planned and necessary repairs.

With reference to the requirements of art. 24, paragraph 2 of Directive (EU) 2016/798, and art. 91, paragraph 3 of Ordinance No 59 dated 5.12.2006, the member of the Management Board of NAMRATIB on 14.01.2025 provides a final report that contains information on the investigation of the accident with formulated and agreed safety recommendations in order to improve safety in railway transport.

In accordance with Art. 26, paragraph 3 of Directive (EU) 798/2016, the National Safety Authority (RAEA) and other bodies or structures to which the safety recommendations are addressed, to report regularly to the member of the management board of the NAMRATIB on the measures taken or planned as a result (sequence) from the recommendations.

Chairperson:

Dr Eng. Boycho Skrobanski

Deputy President of the NAMRTAIB AB