

NATIONAL TRANSPORTATION SAFETY BOARD

Vehicle Recorder Division

Washington, D.C. 20594

June 20, 2019

Engine Data Monitor (EDM)

Specialist's Factual Report

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1. EVENT SUMMARY

Location: Moose Lake, Minnesota
Date: May 08, 2019
Aircraft: Mooney M20J
Registration: N111JP
Operator: Private
NTSB Number: CEN19FA139

On May 8, 2019, about 1630 central daylight time, a Mooney M20J airplane, N111JP, crashed into Moose Horn River northwest of the Moose Lake Carlton County Airport (KMZH), Moose Lake, Minnesota. The pilot was fatally injured. The airplane sustained substantial damage. The airplane was owned by Club Cherokee, Inc., and operated by a private individual under the provisions of Title 14 *Code of Federal Regulations* Part 91. The business flight was originating at the time of the accident and was en route to Crystal Airport (KMIC), Minneapolis, Minnesota.

2. GROUP

A group was not convened.

3. DETAILS OF INVESTIGATION

The National Transportation Safety Board (NTSB) Vehicle Recorder Division received the following device:

Device Manufacturer/Model:	JPI EDM-900
Serial Number:	N/A

3.1. Device Description

The JPI EDM-900 is a panel-mounted gauge with color display that allows the operator to monitor and record up to 24 parameters related to engine operations. Depending on the installation, engine parameters monitored can include: Exhaust Gas Temperature (EGT), Cylinder Head Temperature (CHT), Oil Pressure and Temperature, Manifold Pressure, Outside Air Temperature, Turbine Inlet Temperature, Engine Revolutions Per

Minute (RPM), Compressor Discharge Temperature, Fuel Flow, Carburetor Temperature, and Battery Voltage etc..

The unit can also calculate in real time, percent of maximum horsepower, fuel used, shock cooling rate, engine hours (Hobbs time) and EGT differentials between highest and lowest cylinder temperatures. The calculations are also based on the aircraft installation.

The unit includes a GPS interface to any GPS device.

The unit contains non-volatile memory¹ for data storage of the parameters recorded and calculated. The rate at which the data is stored is selectable by the operator from 1 to 500 seconds per sample. The memory can store up to 30 hours of data at a 6 second-per-sample rate. The data can then be downloaded by the operator using the J.P. Instruments software.

3.2. Data Recovery

Upon arrival at the Vehicle Recorder Division, an exterior examination revealed the unit had lost its display but remained its essential components, as shown in Figure 1.

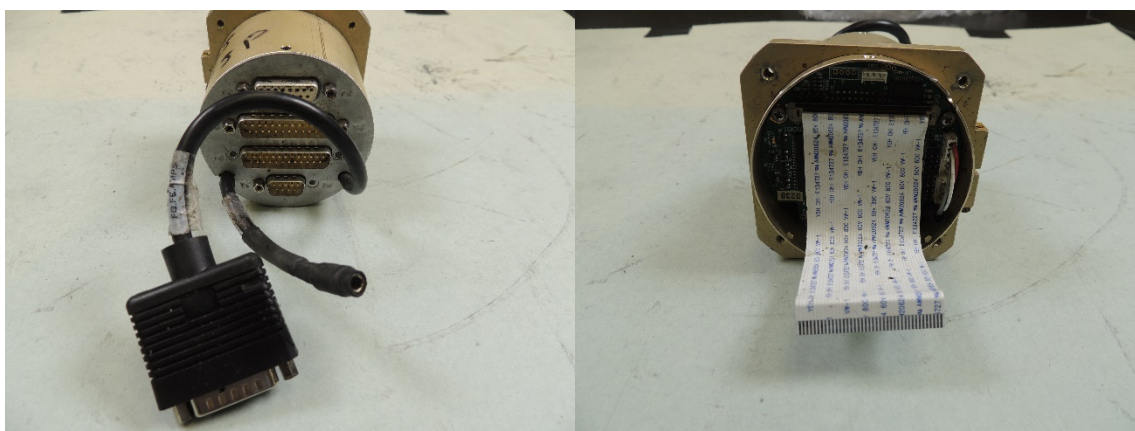


Figure 1: JPI EDM-900 as received (back and front)

During further examination, the device was found to be severely damaged internally. The circuit boards were heavily covered by mud and corrosion was found on several components on, as shown in Figure 2 and Figure 3. To avoid losing any data, the normal process of powering on the device and extracting data with manufacturer's software was abandoned. Instead, a chip-level recovery process was executed. The non-volatile memory chips were removed, and a binary image was created using laboratory tools.

¹ Non-volatile memory (NVM) is semiconductor memory that does not require external power for data retention.

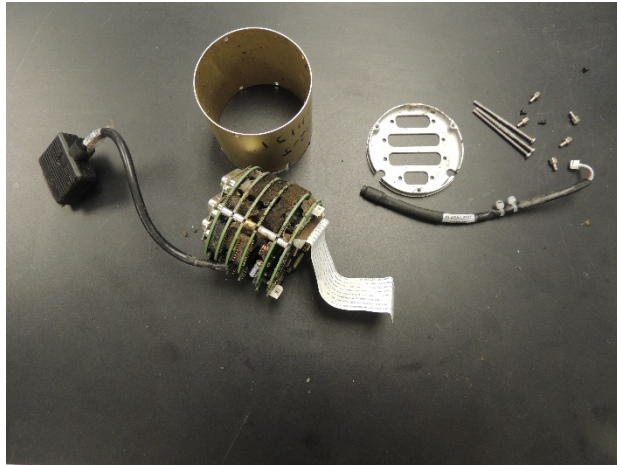


Figure 2: Interior of JPI EDM-900 as received

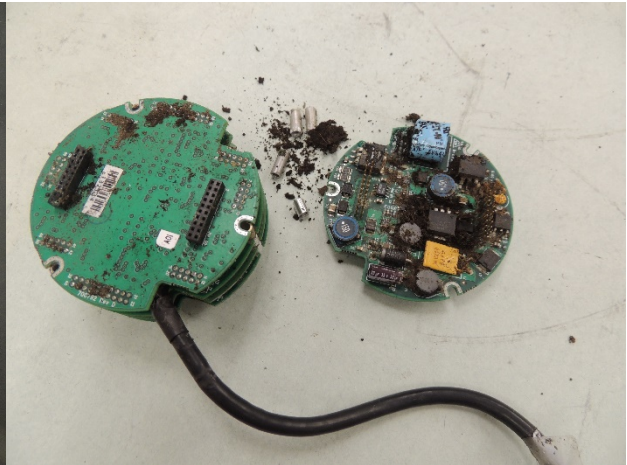


Figure 3: Damaged Circuit Boards

3.3. Data Description

The data extracted included 73 sessions from March 7, 2019 through May 8, 2019. The recorded time was UTC time, which was synchronized by the GPS device to which the device was connected. The last recorded session was determined to be related to the accident and is included in this report. The data was recorded at a 6 second-per-sample rate.

3.4. Parameters Provided

Table 1 describes data parameters recorded by the device.

Parameter Name	Parameter Description
Time	Time (UTC) for recorded data point (HH:MM:SS)
EGT 1-4 (degF)	Exhaust Gas Temperature Cylinder # (degrees Fahrenheit)
CHT 1-4 (degF)	Cylinder Head Temperature Cylinder # (degrees Fahrenheit)
CLD (degF/min)	Shock Cooling Rate (degrees Fahrenheit per minute)
OAT (degF)	Outside Air Temperature (degrees Fahrenheit)
MAP (hg)	Manifold Pressure (mercury)
FF (GPH)	Fuel Flow (gallons per hour)
FP (psi)	Fuel Pressure (Pascals per inch)
RPM	Engine RPM (revolutions per minute)
OIL (degF)	Oil Temperature (degrees Fahrenheit)
OILP (psi)	Oil Pressure (Pascals per inch)
HOBS (h)	Engine run time (hours)

Table 1: JPI EDM-700 Data Parameters

3.5. OVERLAYS AND TABULAR DATA

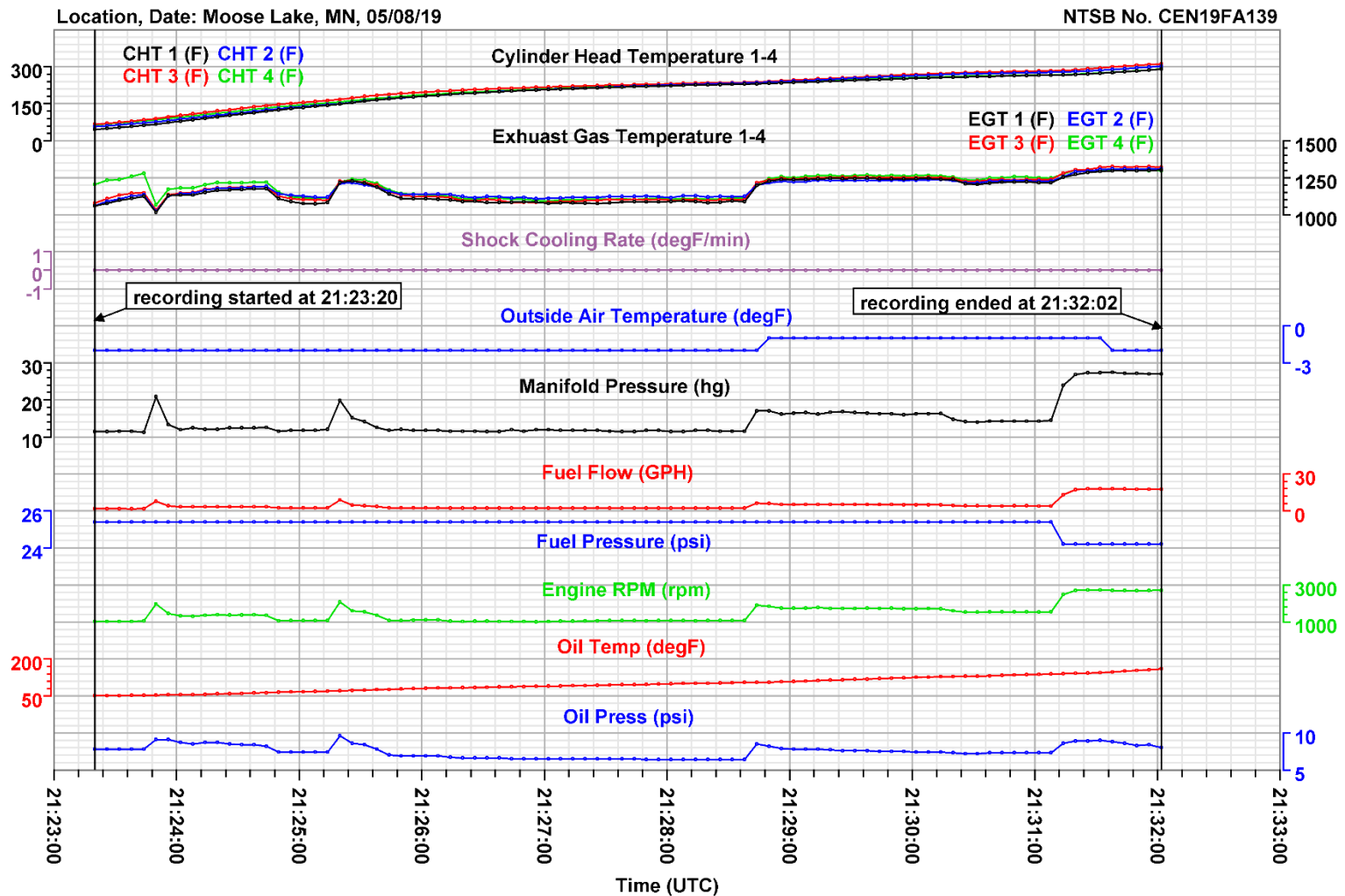
Figure 4 is a plot of parameters from the JPI device for the accident flight (flight session 73). The time interval is 21:23:20 to 21:32:02 UTC on May 8, 2019.

Figure 5 is a plot of engine run time (Hobbs time) from the JPI device for the flight session 72 (the flight before the accident flight). The time interval is 12:01:46 to 12:47:28 UTC on May 8, 2019.

Figure 6 is a plot of engine run time (Hobbs time) from the aircraft recorded on the JPI device for the accident flight (flight session 73). The time interval is 21:23:20 to 21:32:02 UTC on May 8, 2019.

The tabular data from the accident flight recorded by the JPI EDM-900 device is included as Attachment 1 and Attachment 2. These attachments are provided in electronic comma-delimited (.csv) format.

Mooney M20J, N111JP, Session 73

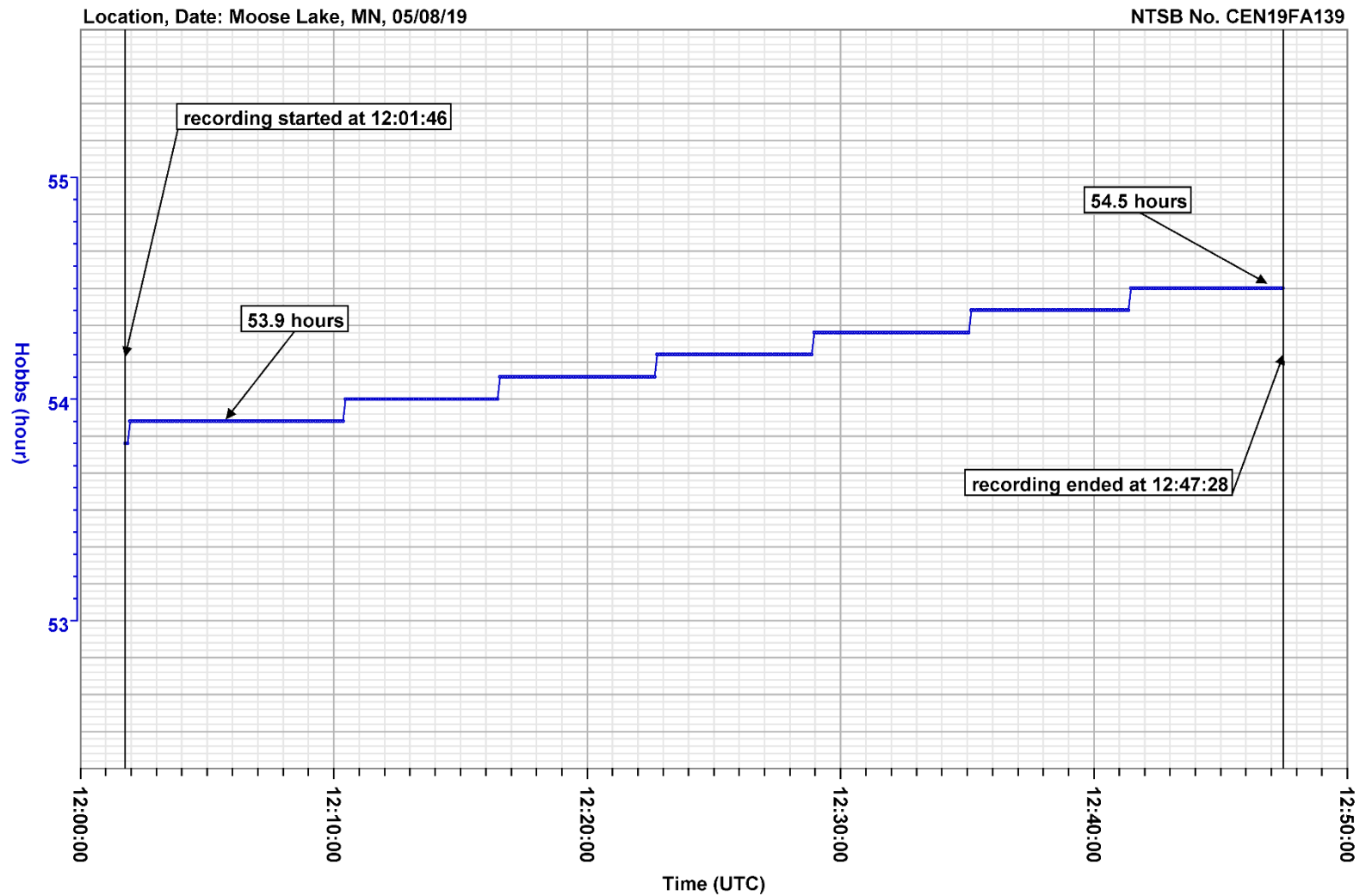


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Figure 4: Plot of data from the JPI EDM-900 of the accident flight

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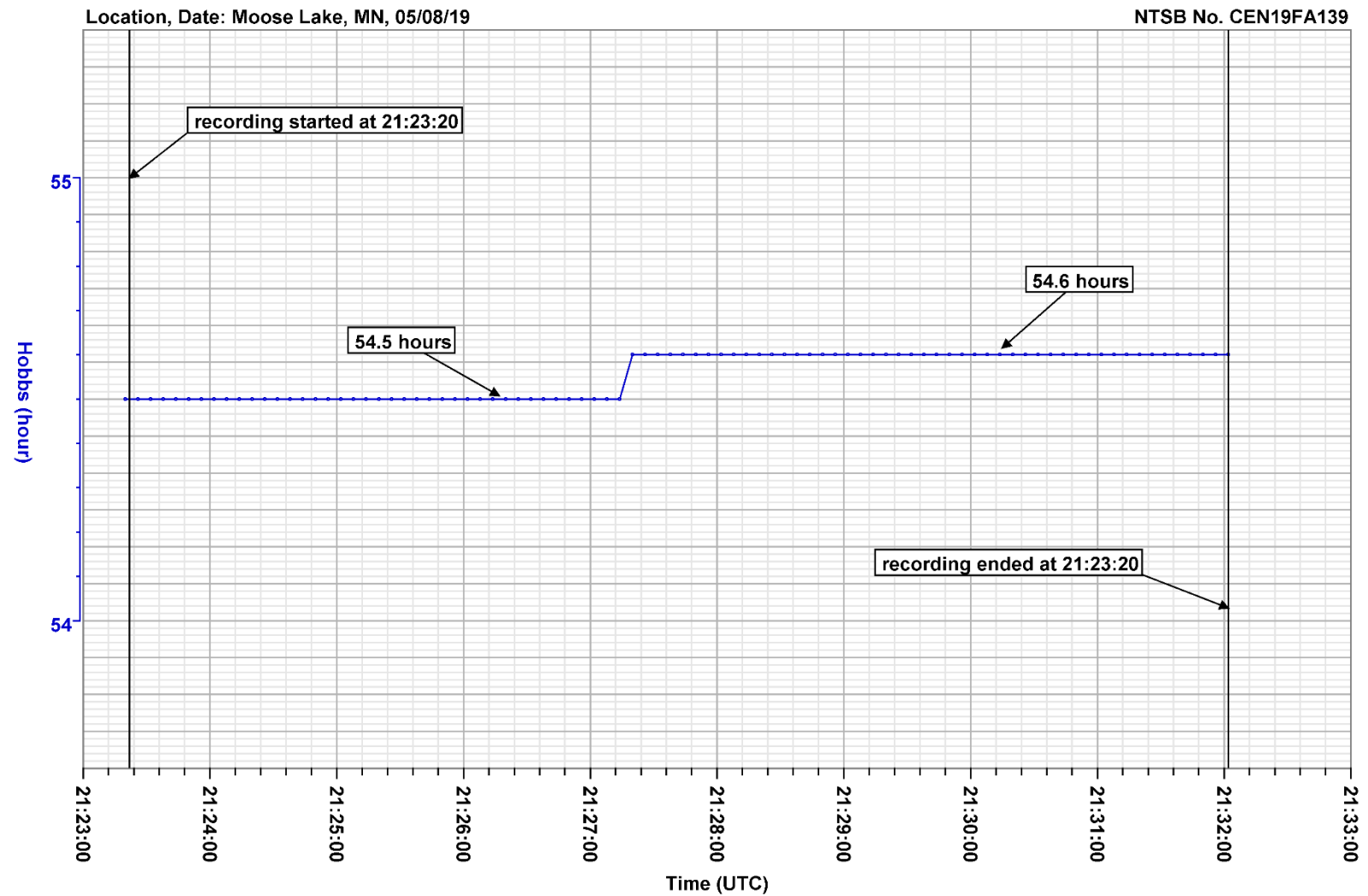


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Figure 5: Hobbs time of flight session 72

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Figure 6: Hobbs time of flight session 73

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