NATIONAL TRANSPORTATION SAFETY BOARD
Investigative Hearing

Norfolk Southern Railway general merchandise freight train 32N derailment with subsequent hazardous material release and fires, in East Palestine, Ohio, on February 3, 2023

GROUP	B
EXHIBIT	
13	

Agency / Organization

NTSB

Title

Materials Laboratory Factual Report 23-040

National Transportation Safety Board
Office of Research and Engineering
Washington, DC 20594

RRD23MR005

MATERIALS LABORATORY

Factual Report 23-040

May 4, 2023

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A. ACCIDENT INFORMATION

Location: East Palestine, Ohio
Date: February 3, 2023
Vehicle: Norfolk Southern Railway freight train 32N
Investigator: Paul Stancil (RPH-20)

B. COMPONENTS EXAMINED

Disassembled PRD from tank car OCPX 80370.

C. EXAMINATION PARTICIPANTS

Specialist Adrienne Lamm
National Transportation Safety Board
Washington, D.C.

D. DETAILS OF THE EXAMINATION

On February 3, 2023, about 8:54 pm, local time, eastbound Norfolk Southern Railway, general merchandise freight train 32N of the 1st (Train 32N), derailed on main track 1 of the NS Fort Wayne Line of the Keystone Division in East Palestine, Ohio. As a result of the derailment, 38 rail cars derailed and a fire ensued which damaged an additional 12 cars.

During the post-derailment fire, the shell on tank car OCPX 80370 exhibited a temperature rise relative to the other four derailed tank cars that were carrying stabilized vinyl chloride. On February 5, 2023, the pressure relief device (PRD) on tank car OCPX 80370 stopped actuating for unknown reasons. Following the vent and burn operation conducted on February 6, 2023, on-scene investigators collected PRDs from several tank cars, including the PRD from tank car OCPX 80370, and shipped them to Trinity Rail Maintenance Services in Saginaw, Texas for bench testing, which subsequently occurred on March 15, 2023.

Under bench testing, the PRD from tank car OCPX 80370 was non-functional, with the PRD top guide seized to the valve stem and unmovable under pressure up to 275 psig, though the start to discharge pressure was supposed to be 247.5 psig. The hex nuts seized on the top body bolts were torch cut and then the bottom following nut on the valve stem was loosened to relieve the loading from the valve spring. Next, the spokes assembling the center portion of the top guide were torch cut and the top guide pieces were mechanically removed from the valve stem using a hammer. The valve stem exposed on the top of the PRD with the top guide removed was subsequently bead-blasted and examined for cracks via dye penetrant inspection; details of the dye penetrant examination are discussed in the report titled, “As Received Pressure Relief Device Inspection Report”.

The disassembled PRD was then shipped to the NTSB Materials Laboratory in Washington DC for further examination. The disassembled pieces of the PRD are shown in Figure 1.

The retainer was still assembled to the remainder of the PRD, as shown in Figure 2. Thick layers of soot and reddish-brown-colored burned deposits were visible on the inner surface of the body. Spots of wrinkled, silver-colored debris were fused on top of the deposits in several areas. Similar debris was collected from other PRDs and are documented in NTSB Materials Laboratory Factual Report 23-039.

Photos of the top guide pieces as viewed from the outboard side are shown in Figures 3 and 4, while photos of the top guide pieces as viewed from the inboard side are shown in Figures 5 and 6. Thick layers of soot and reddish-brown-colored burned deposits were visible on the inner diameter of the guide rim. Some areas where the deposits had flaked off were exposed and orange-colored rust was visible on the surface. Silver-colored splatter resulting from the torch cutting of the spokes was observed on top of the burned debris in some areas.

Figure 7 shows the inboard surface on the center portion of the top guide. Thick layers of soot and reddish-brown-colored burned deposits coated the entirety of the inboard surface. The inner diameter of the top guide insert also had evidence of burned deposits adhering to the surface.

Similar reddish-brown deposits were observed in a band on the outer diameter of the mating valve stem, indicated by the yellow bracket in Figure 8. Recall that the valve stem had been bead-blasted, and these deposits persisted even though the remainder of the valve stem was relatively clean and appeared silver. This band was thus the likely position of the mating top guide insert during the event and prior to disassembly, with the bottom of the band located approximately 0.75 inches from the valve stem end. Evidence of deposits also still adhered to the cleaned valve stem, while the removal of other deposits left divots in the valve stem surface.

Submitted by:

Adrienne V. Lamm
Materials Engineer

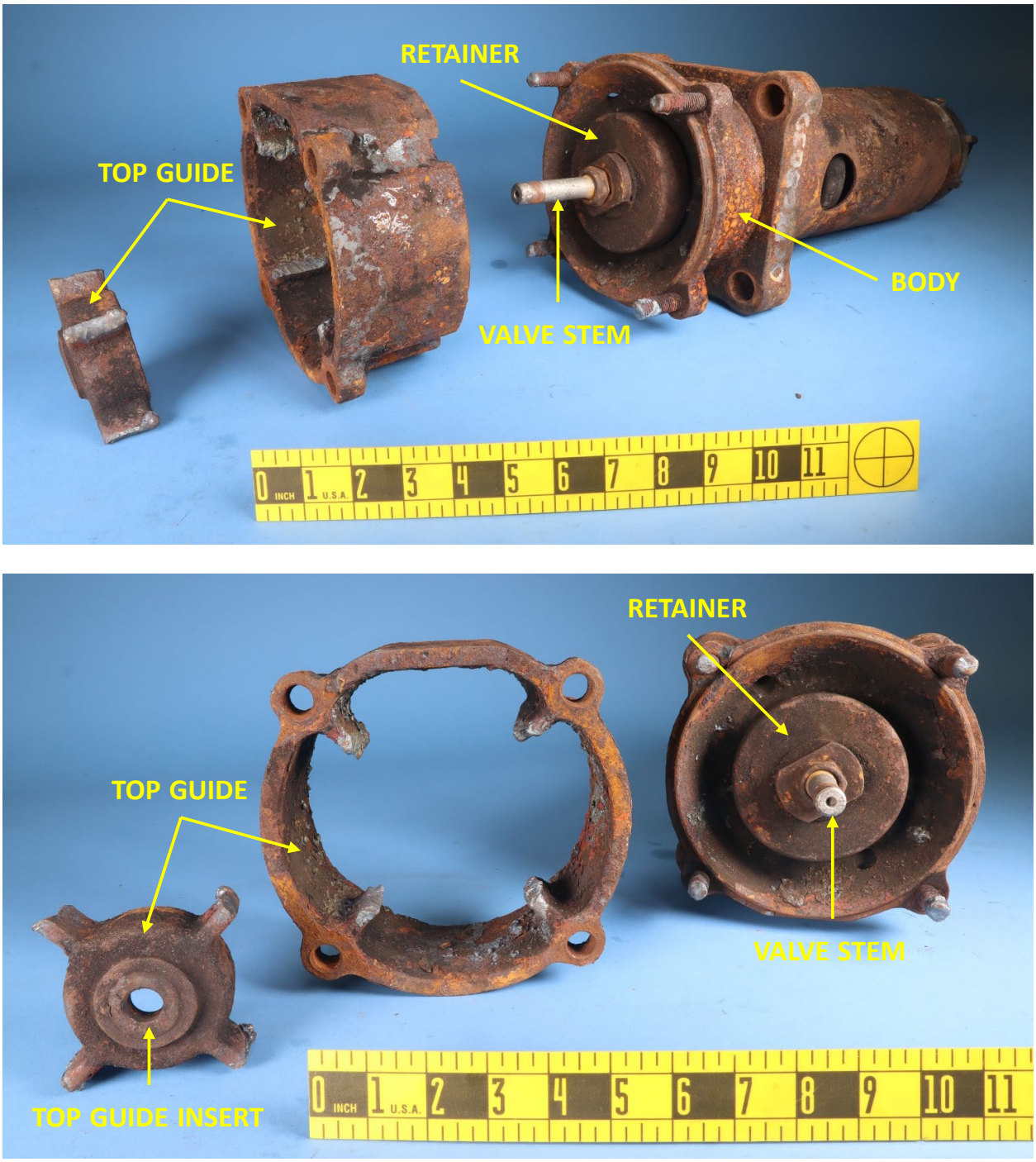

Figure 1. Macro photos showing the disassembled PRD from tank car OCPX 80370.

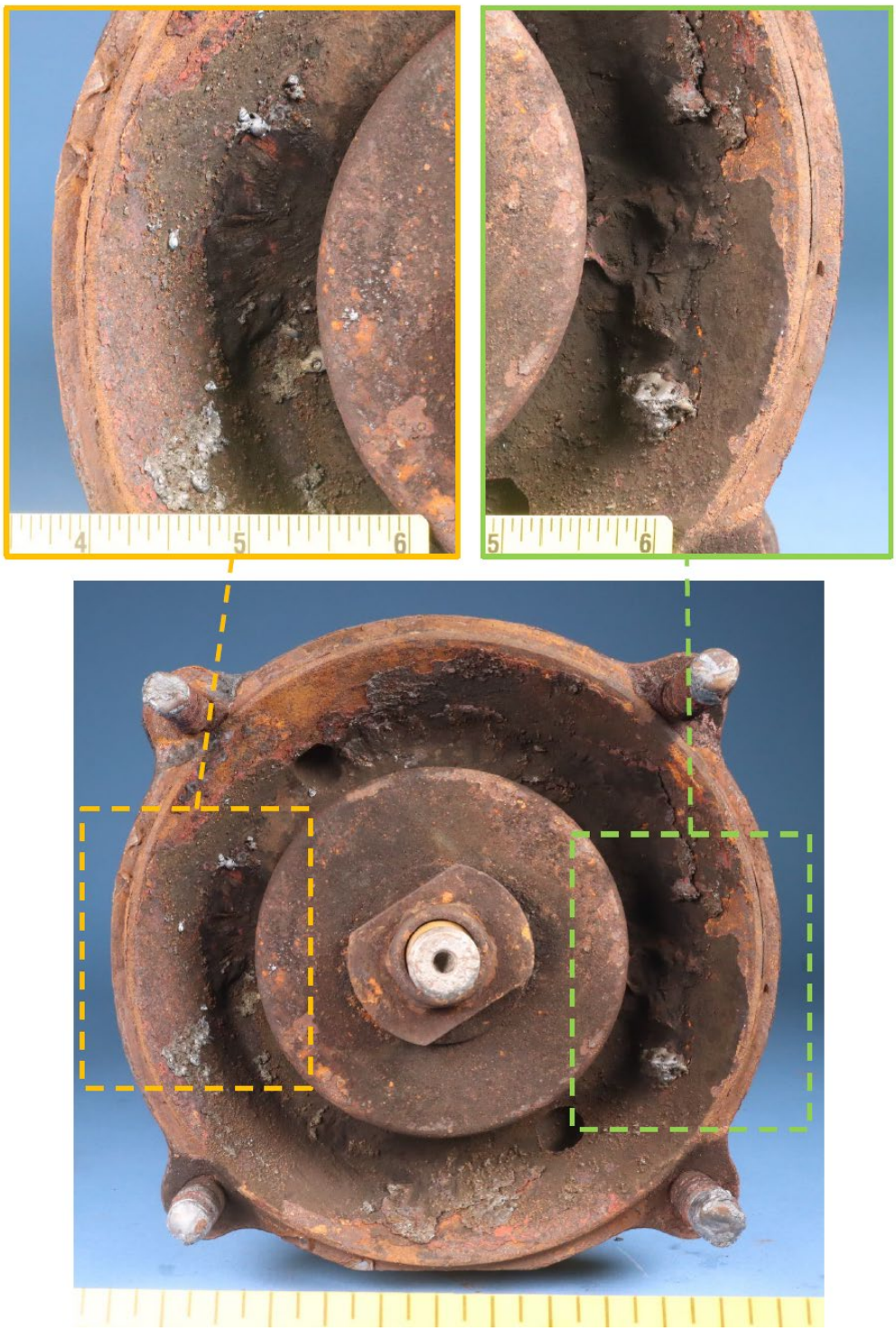

Figure 2. Overall (bottom) and close-up (top) photos of the inner surface on the body of the PRD.

Figure 3. Macro photos showing the top guide pieces of the PRD as viewed from the outboard side.

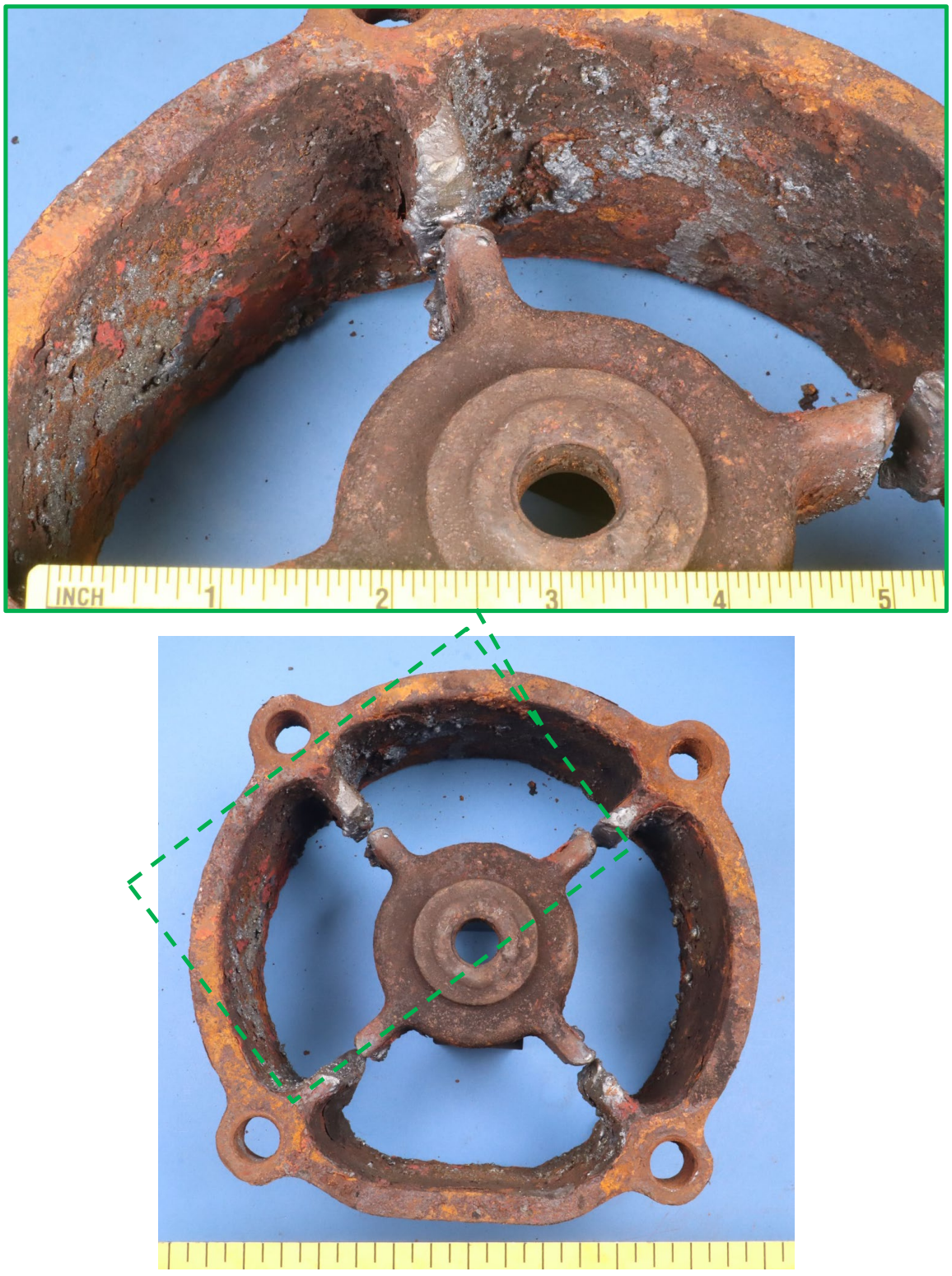

Figure 4. Macro (bottom) and close-up (top) photos showing the top guide pieces of the PRD as viewed from the outboard side.

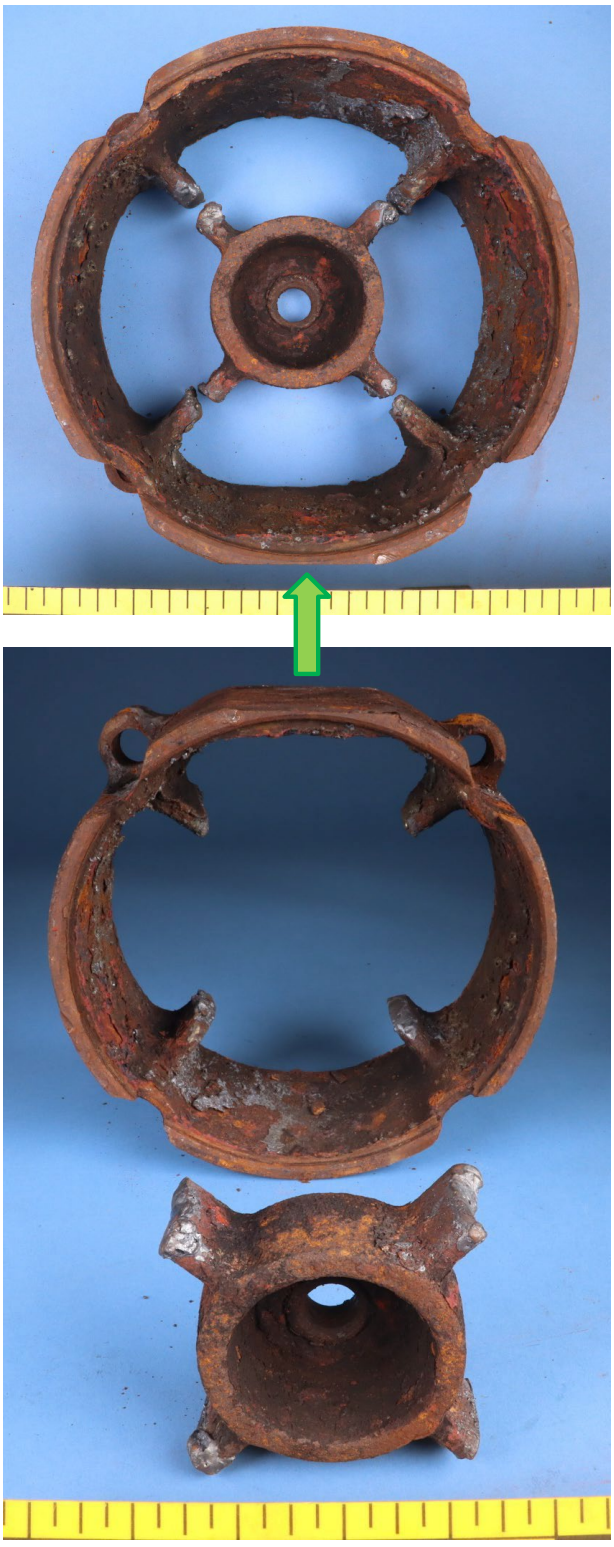

Figure 5. Macro photos showing the top guide pieces of the PRD as viewed from the inboard side.

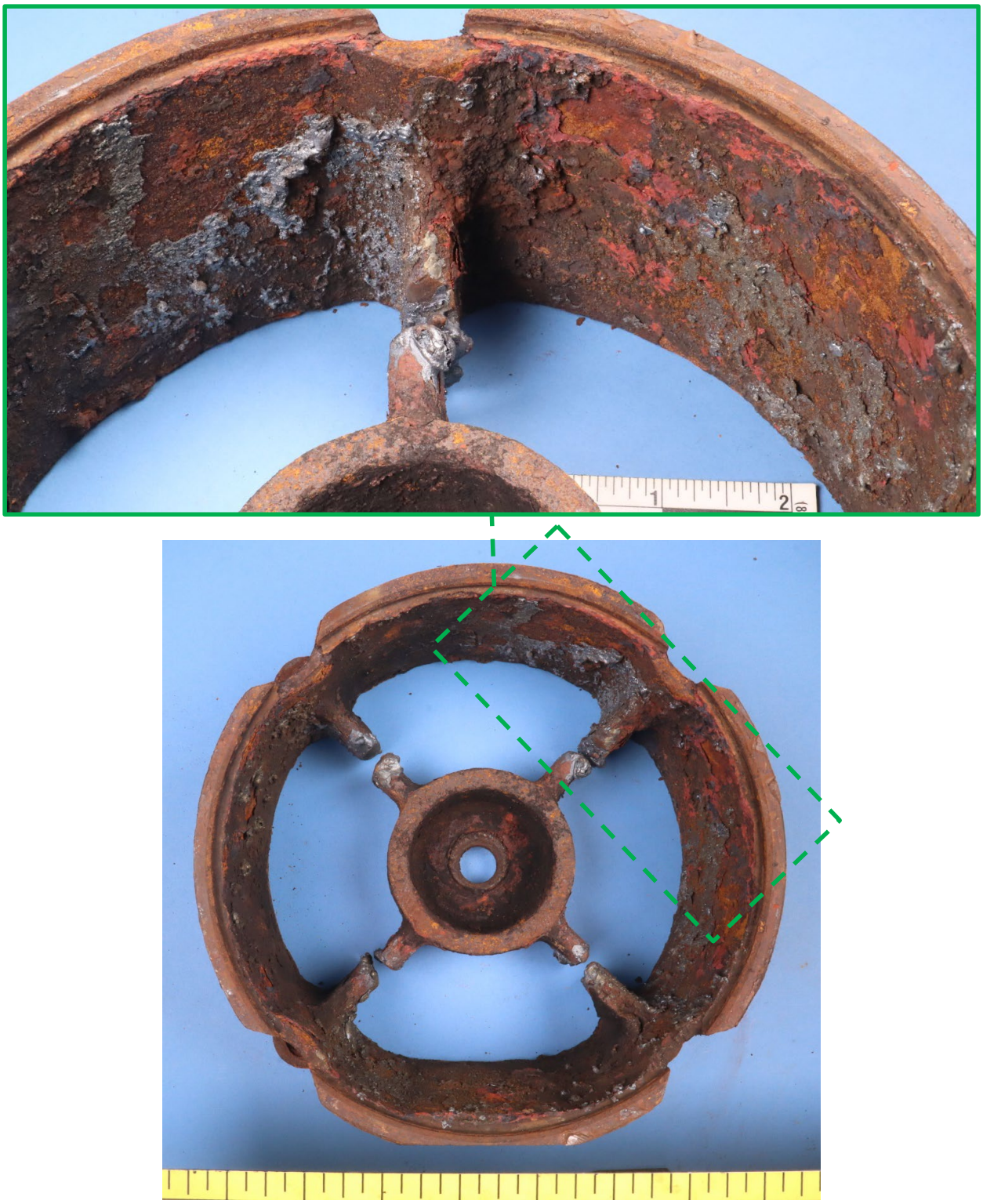

Figure 6. Macro (bottom) and close-up (top) photos showing the top guide pieces of the PRD as viewed from the inboard side.

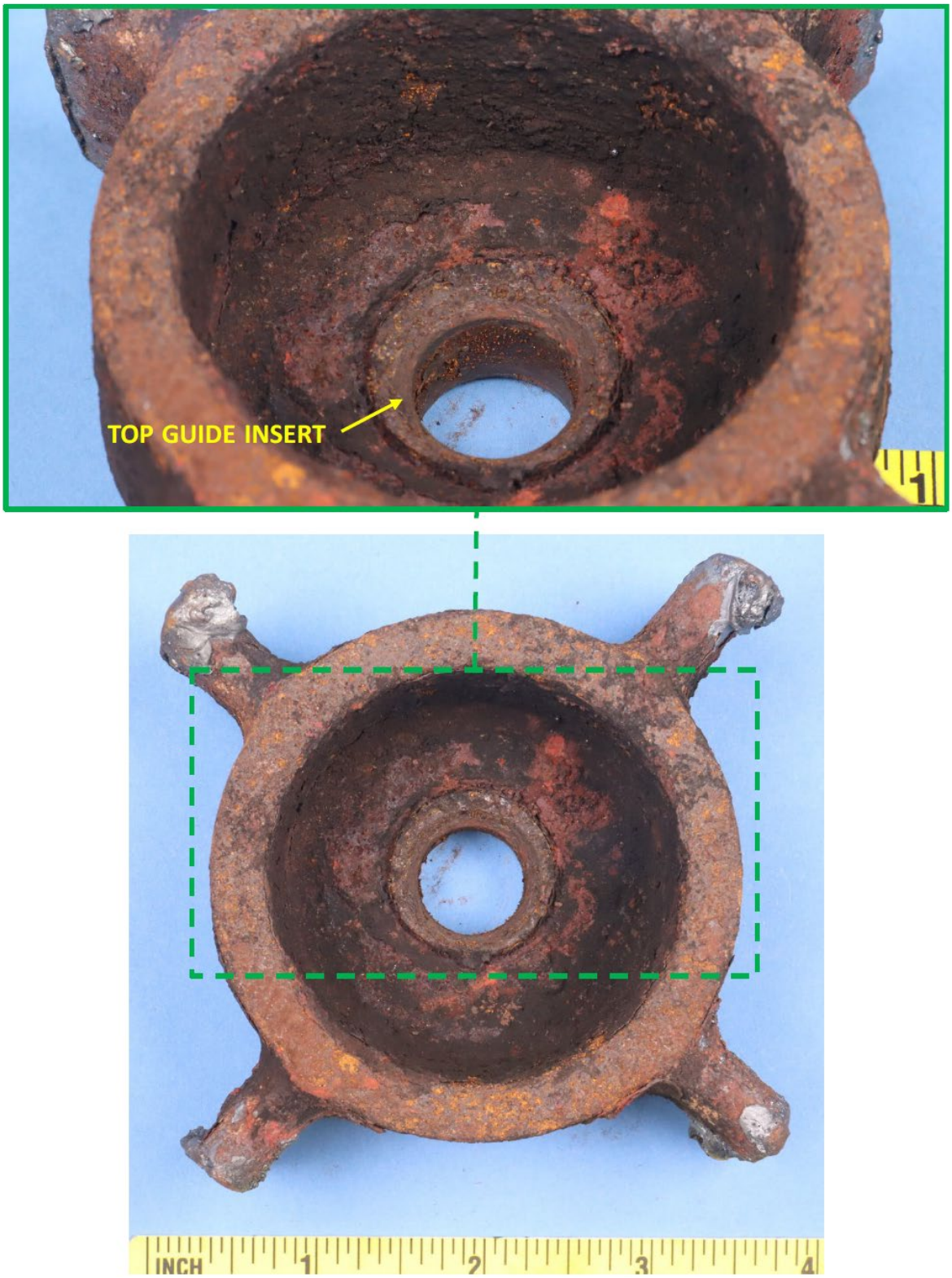

Figure 7. Macro (bottom) and close-up (top) photos showing the center portion of the PRD top guide as viewed from the inboard side.

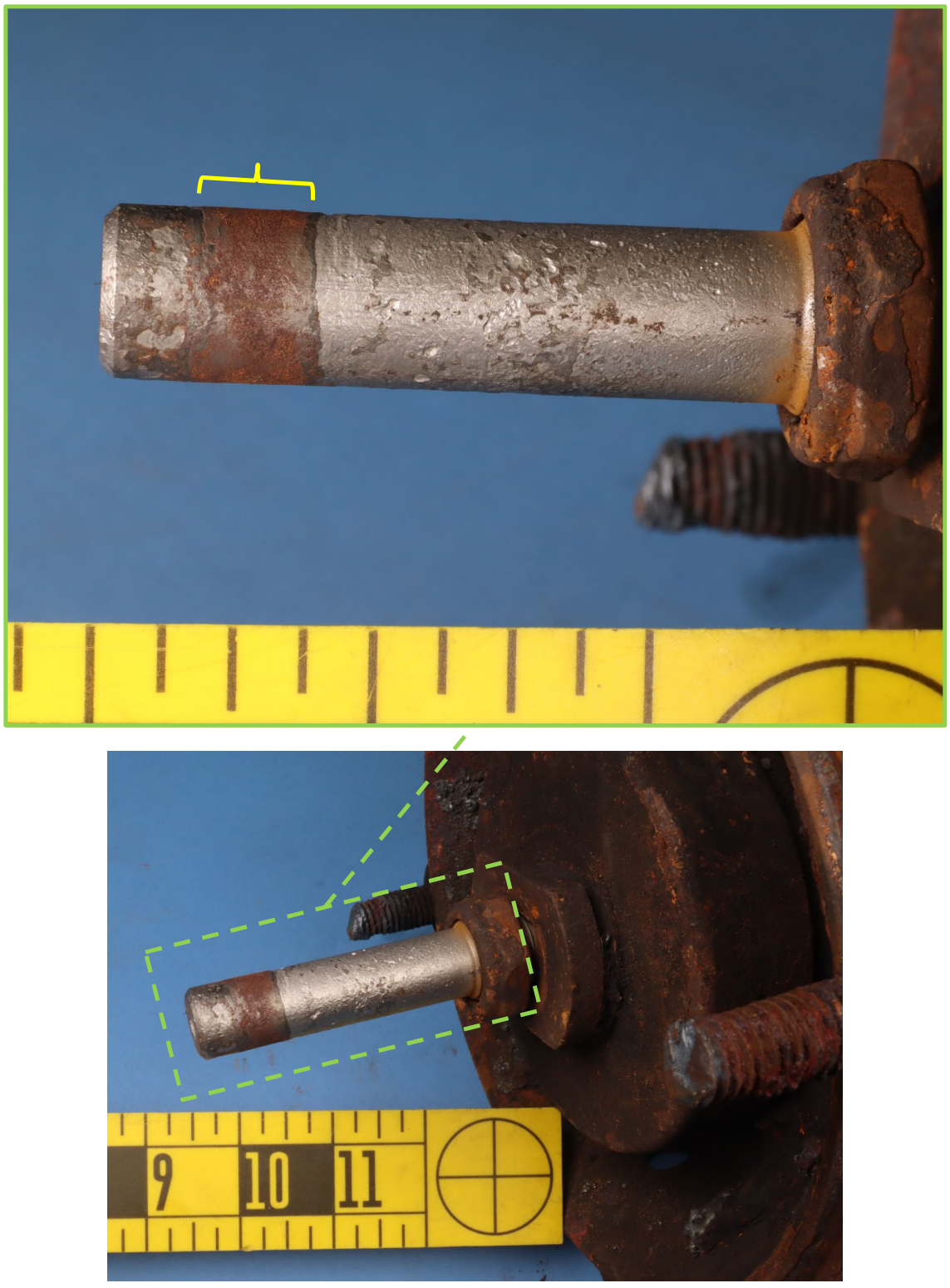

Figure 8. Close-up photos of the valve stem of the PRD with a band of reddish-brown deposits indicated by the yellow bracket.