Incident Summary #II-1303191-2021 (#25432) (FINAL)

SUPPORTING INFORMATION	Incident Date		December 13, 2021
	Location		Whistler, British Columbia
	Regulated industry sector		Electrical - Low voltage electrical system (30V to 750V)
	Impact – Injury	Qty injuries	0
		Injury description	N/A
		Injury rating	None
	Impact – Damage	Damage description	Mechanical damage to the main electrical panelboard and the associated circuit breaker installed within the panelboard due to nail punctures. Mechanical damage to a feeder cable due to nail puncture.
		Damage rating	Minor
	Incident rating		Minor
	Incident overview		The main distribution panelboard, which was located within an exterior wall, had been struck and punctured by multiple nails used to fasten wood siding to the exterior of the house. A circuit breaker within the panelboard was damaged by one of those nails. A feeder cable extending from the main distribution panelboard was also discovered to have been damaged by a nail, however this nail had been driven from the interior of the house. The damaged panelboard and feeder cable were both discovered at the same time during unrelated electrical work being carried-out within the house.
INVESTIGATION CONCLUSIONS	Site, system and components		This incident took place at a detached single-family dwelling of wood-frame construction. The damaged panelboard and feeder cable were both located near each other in a bedroom exterior wall on the first floor. **Panelboard:** The main distribution panelboard is the primary source of electricity for the various branch and feeder circuits throughout the house. Each of those branch and feeder circuits is protected by a circuit breaker located within the panelboard. The exterior siding associated with the nail damage to the panelboard consisted of solid wood board-and-batten style siding. **Cable:** The feeder cable, which consisted of a #6 AWG 3 conductor (copper) NMD90 cable, originated from the main distribution panelboard, and was providing power to a sub-distribution panelboard located elsewhere in the house. The nail that damaged the feeder cable was driven from inside the house.

Incident Summary #II-1303191-2021 (#25432) (FINAL)

Failure scenario(s)	**Panelboard:** The main distribution panelboard was installed within a 2x4 wood-frame exterior wall. The panelboard enclosure was 3.5” deep, which resulted in an air gap approximately ¼” wide between the exterior sheathing and the back of the panelboard enclosure. At some point exterior siding was installed, which consisted of solid wood board-and-batten style siding. The nails used by the siding installers to secure the siding to the plywood exterior sheathing appeared to be driven through the sheathing at various locations dictated by the layout of the siding on the exterior of the building, including the spaces between 2x4 studs. The use of a pneumatic nailer would likely generate enough force to drive the nails through the siding, sheathing, and into the panelboard without the operator noticing the panelboard had been struck. The siding nails were long enough, and driven with enough force, to penetrate the metal panelboard enclosure, as well as the metal backplate upon which the circuit breakers are secured. **Cable:** The damaged feeder cable was located in the same section of exterior wall as the damaged panelboard, approximately two feet away. The cable was routed horizontally through the wall away from the main distribution panelboard and had been routed through holes drilled horizontally through the 2x4 studs. The nail that struck the cable was approximately 2” long, and driven its full length into the stud, which allowed it to reach and damage the cable located in the centre of the 2x4 stud.
Facts and evidence	**Panelboard:** An electrical contractor was hired by a restoration company to replace the main distribution panelboard which had sustained water damage due to a ruptured hot water tank located on the floor above. The electrical contractor discovered the nail damage to the panelboard and feeder cable in the process of carrying out their work. As stated by the on-site electrician: when they removed the mounting screws which secured the panelboard to the studs, they realized that the panelboard was not coming loose. Upon further investigation they noticed that there were several siding nails that had been driven through the exterior sheathing and into the panelboard enclosure, which were now holding the panelboard in place. The electrician was able to pull the panelboard away from the nails and out of the wall. The electrician estimates that the nails were approximately 2” long. Examination of the panelboard yielded the following observations: The panelboard enclosure shows evidence of having been struck by 6 separate siding nails. (See photo #1) One nail penetrated the rear of the panelboard enclosure, as well as the internal metal backplate upon which the circuit breakers are mounted, which then struck and damaged a circuit breaker. (See photo #2 and #3)

Incident Summary #II-1303191-2021 (#25432) (FINAL)

	One nail punctured the rear of the panelboard enclosure and struck the backplate, but failed to penetrate the backplate. (See photo #1) One nail penetrated the rear of the panelboard enclosure and entered the service compartment section but did not appear to strike any components located within the compartment. (See photo #2 and #4) One nail struck an un-used knock-out located at the back of the service compartment, which partially dislodged the knock-out. (See photo #1 and #4) Two nails appear to have struck the rear of the panelboard but did not penetrate into the enclosure. (See photo #1) The nail that struck the circuit breaker damaged the outer molded frame of the breaker, which resulted in a penetration exposing the internal breaker components. No internal circuit breaker components appear to have been damaged by the nail, and the damage did not appear to affect the functionality of the circuit breaker. (See photo #5) **Cable:** The on-site electrician stated that the damaged feeder cable had been struck by a nail driven from inside the house and into one of the studs through which the cable had been routed. The nail was observed to be projecting into the hole through which the feeder cable had been ran. (See photo #8) The nail penetrated the cable's outer jacket as well as the insulation of the B phase conductor. The nail appears to have made contact with the B phase copper conductor. (See photo #6 and #7) The circuit breaker protecting the damaged feeder cable was not known to have been tripped by this damage.
Causes and contributing factors	**Panelboard:** The location of the panelboard in a 2x4 exterior wall, which is not prohibited by the Canadian Electrical Code, resulted in exposure to mechanical damage by the siding nails which were likely driven by a pneumatic nailer. **Cable:** Due to the length of the nail driven from inside the house, it reached far enough into the stud to strike and damage the feeder cable, which was run through the middle of the stud.

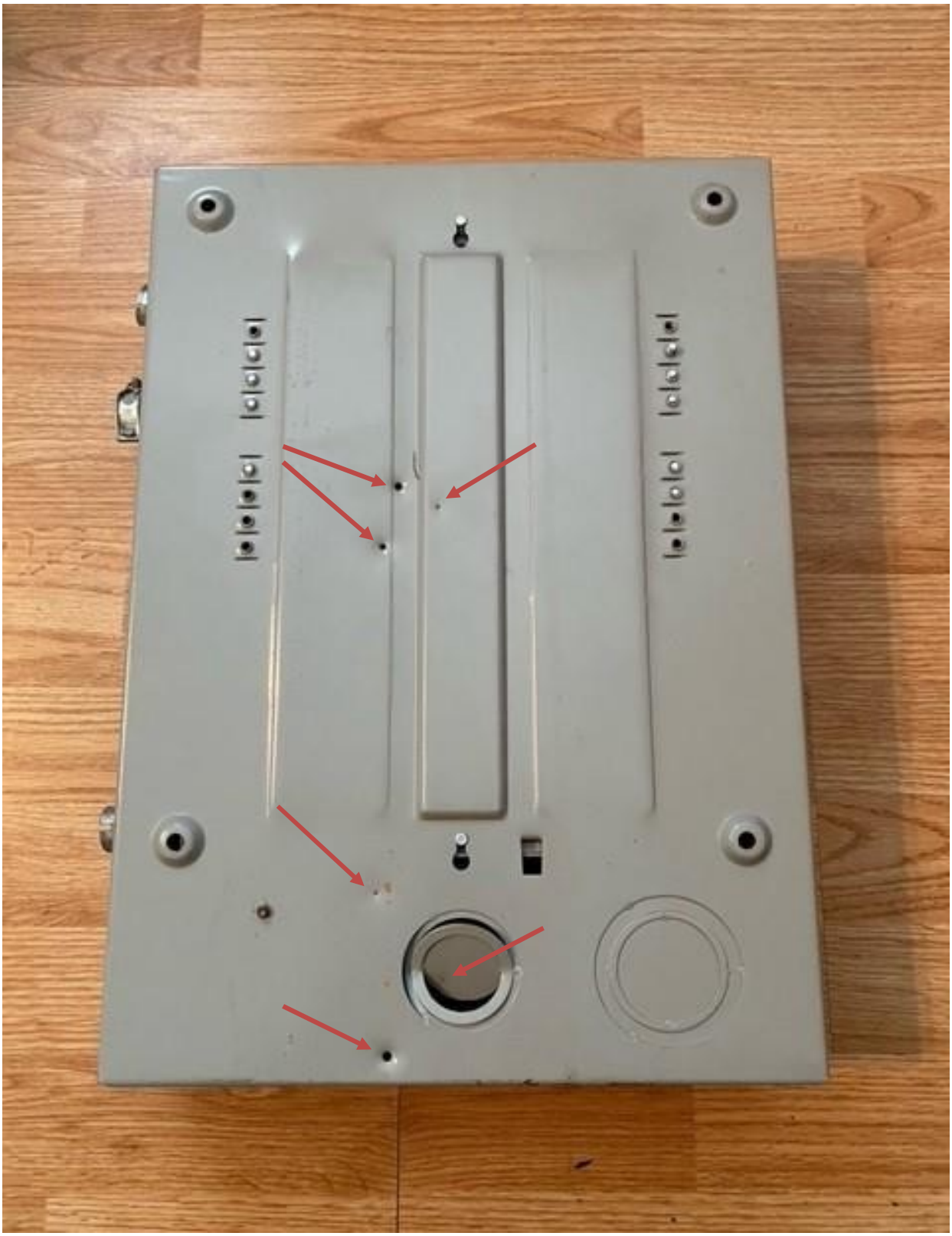

Photo #1 – Back side of main distribution panelboard enclosure

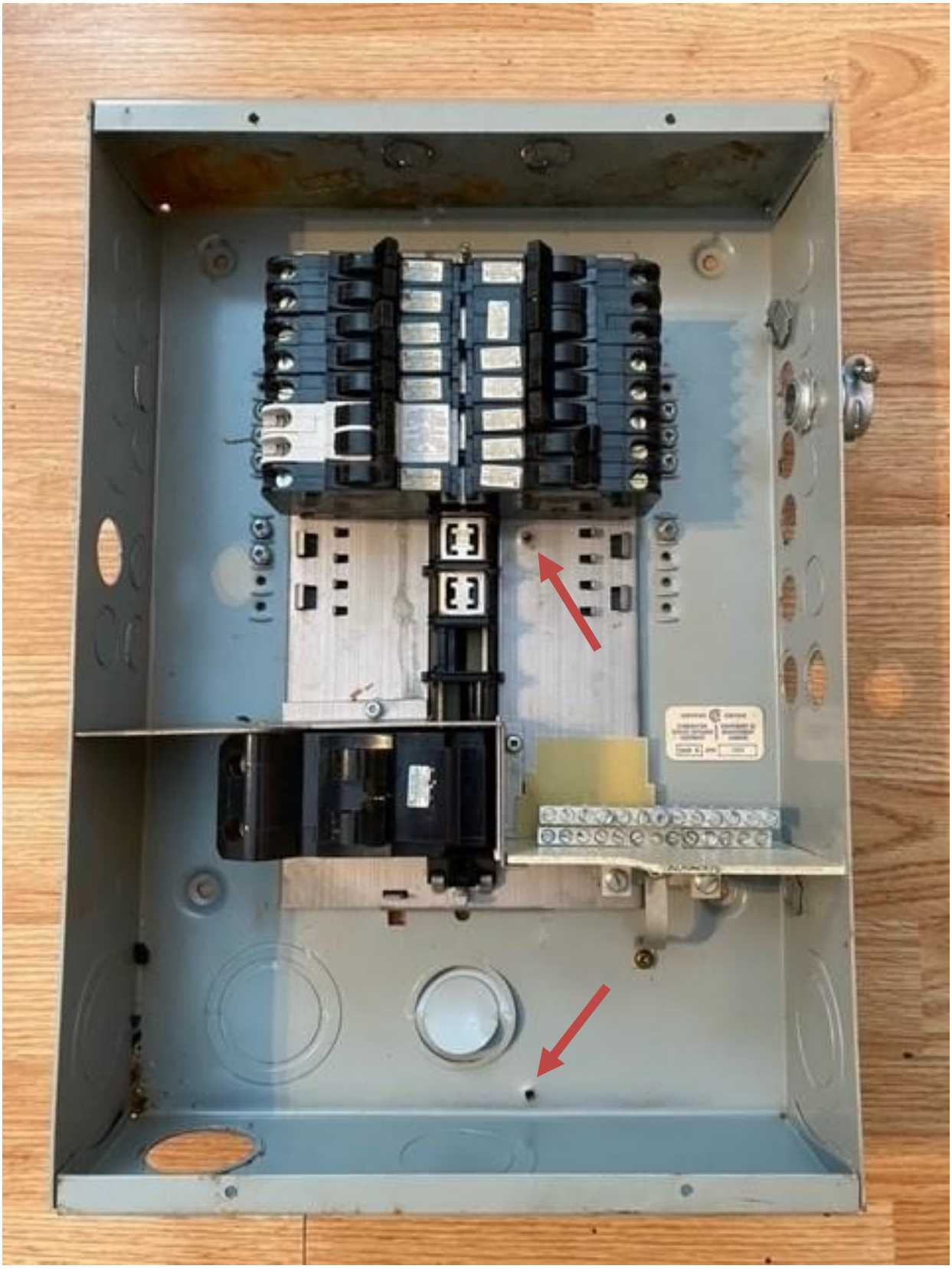

Photo #2 – Interior compartment of main distribution panelboard

Photo #3 – Close-up of nail hole associated with damaged circuit breaker

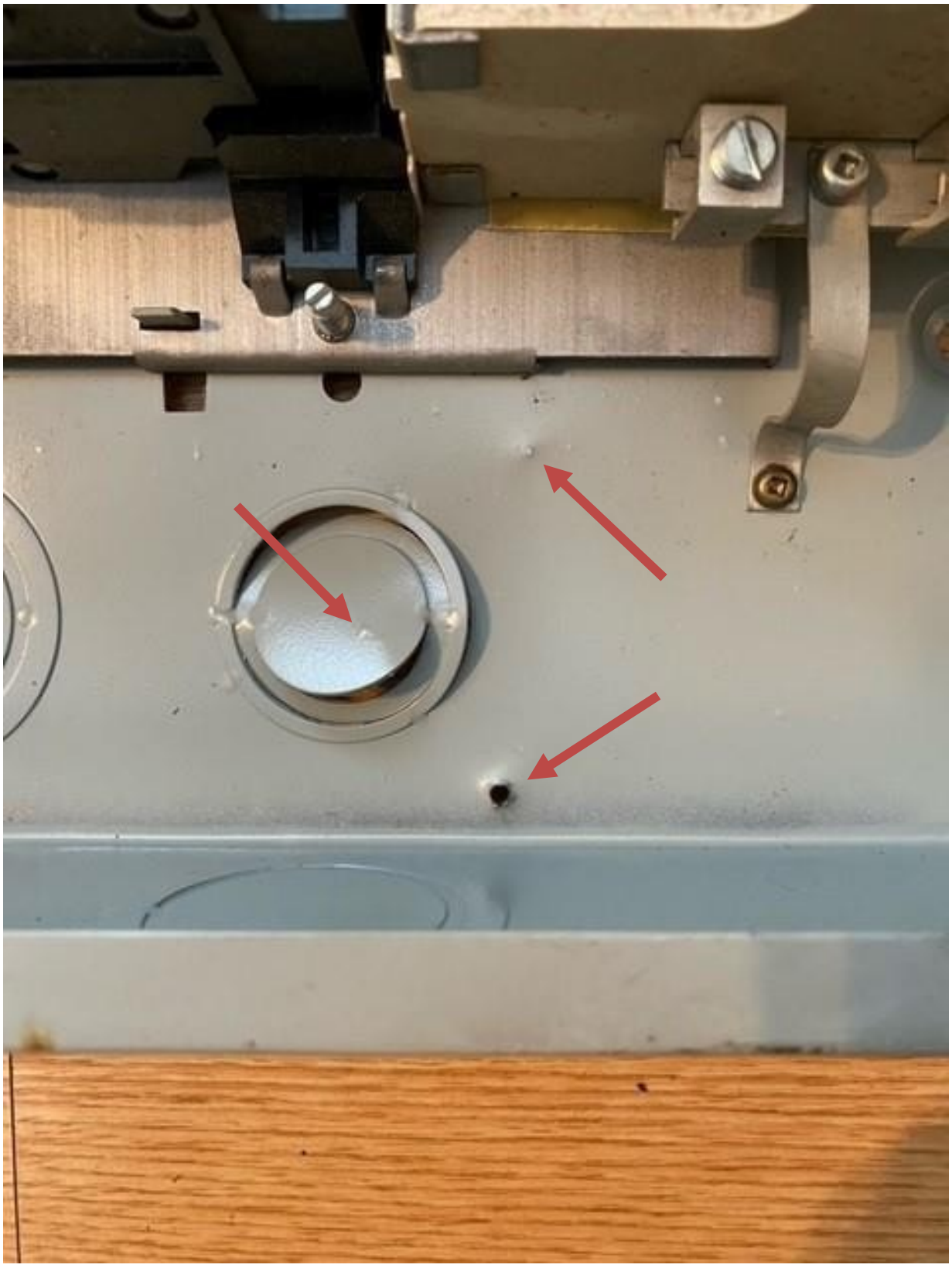

Photo #4 – Close-up of nail hole in the service compartment of the panelboard, indentation cause by second nail strike that did not penetrate the enclosure, and the partially dislodged knock-out caused by the nail strike.

Photo #5 – Underside of damaged circuit breaker

Photo #6 – Damage to outer jacket of feeder cable

Photo #7 – Damage to conductor insulation of feeder cable.

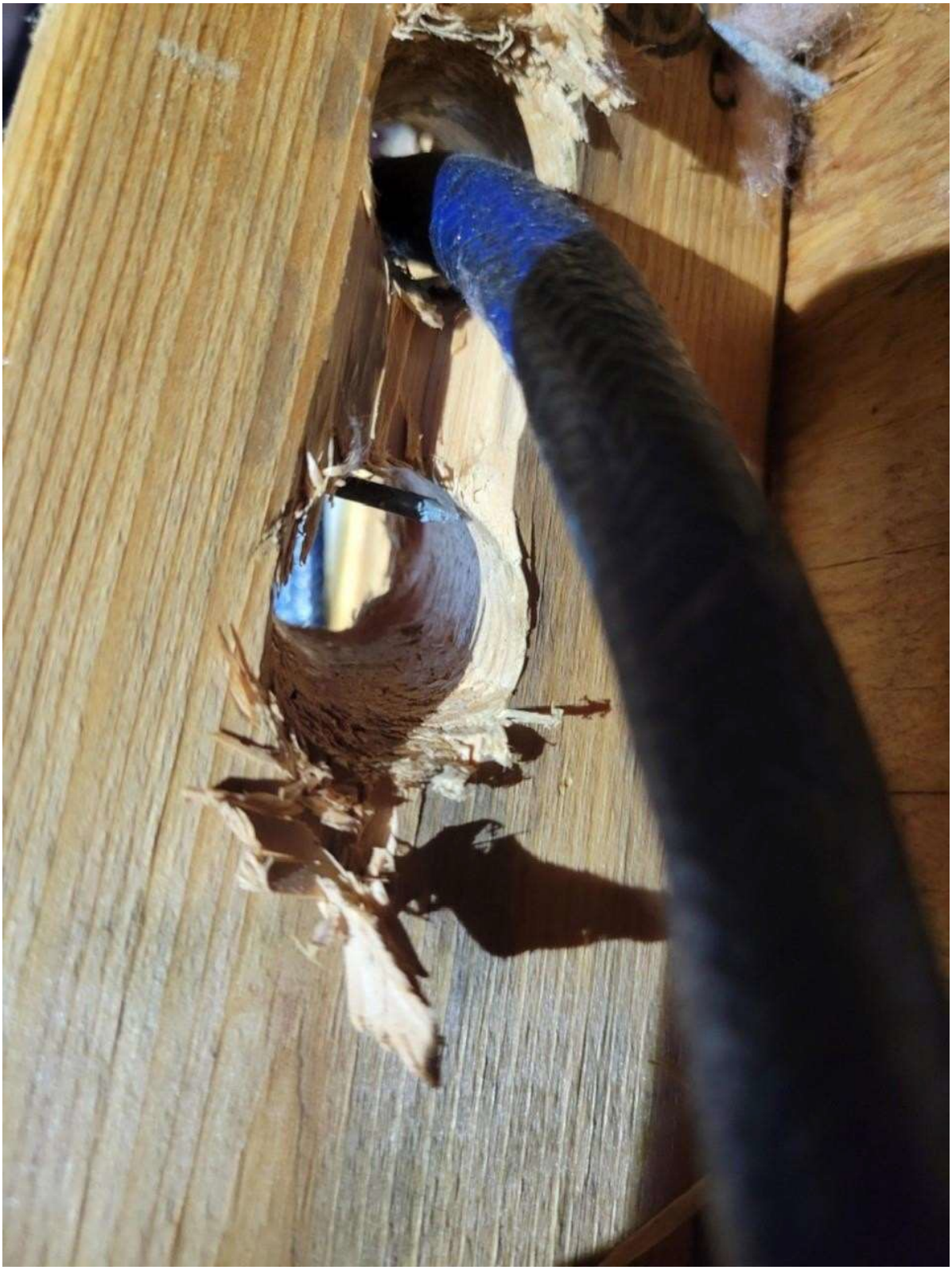

Photo #8 – Hole in 2x4 stud showing the nail that caused the damage to the feeder cable.