Title of Investigation:	Investigation Number:	Report Number:
716 E. 27th Street Explosion	784020-21-0014	56

DESCRIPTION OF ACTIVITY:

ATF National Response Team (NRT) Origin and Cause Determination.

SYNOPSIS:

From 7/2/21 – 7/6/21, Bureau of Alcohol, Tobacco, Firearms and Explosives (ATF) National Response Team (NRT) and Los Angeles Police Department (LAPD) personnel conducted a post blast scene examination of an explosion that occurred while LAPD bomb squad personnel were conducting a disposal operation in a Total Containment Vessel (TCV). The explosion occurred on East 27th Street just east of San Pedro Street in the city of Los Angeles, CA. The classification of the explosion was accidental.

NARRATIVE:

1. On 6/30/21, at approximately 8:00 AM, the LAPD received an anonymous tip there were fireworks being stored at a residence located at 716 East 27th Street in Los Angeles, CA. After initial investigation fireworks were found. The bomb squad responded to dispose of the large quantity of illegal fireworks being stored at the location.

2. During the collection of fireworks for disposal, numerous illegal pyrotechnic explosive devices (IPEDs; commonly referred to as M-Type devices) were located. Due to the improvised way IPEDs are assembled and the hazards these devices pose to bomb technicians; the decision was made to dispose of the IPEDs onsite.

3. The onsite disposal was prepared within a total containment vessel. Total containment vessels are designed to contain the heat, pressure, and shock from an explosion, within certain limits, and release those products in a controlled manner. When the prepared disposal shot was initiated, there was a failure of the total containment vessel, causing damage to surrounding businesses, residences, and vehicles. In addition to the damage, numerous injuries resulted from the blast.

4. On 6/30/21, the LAPD requested the ATF's assistance in determining the explosion's origin and cause and the National Response Team was activated on this same day.

Prepared by:	Title:	Signature:	Date:
[redacted]	Special Agent, Sacramento I Field Office	[redacted] Digitally signed by [redacted] Date: 2021.09.03 18:11:02 -07'00'	
Authorized by:	Title:	Signature:	Date:
[redacted]	Team Leader, National Response Team	[redacted] Digitally signed by [redacted] Date: 2021.09.03 20:41:15 -05'00'	
Second level reviewer (optional):	Title:	Signature:	Date:
[redacted]	Special Agent in Charge, Los Angeles Field Division		

INVESTIGATIVE PARTICIPANTS:

National Response Team

SACFI [redacted]	Team Supervisor
SACFI [redacted]	Scene/Mapping
SACES [redacted]	Scene/3D Vista
SABT [redacted]	Scene
SA [redacted]	Leads Coordinator
SACFI/CES [redacted]	Scene/ Lead CES
SACFI [redacted]	Leads
EEO [redacted]	Scene
EEO [redacted]	Scene
SABT [redacted]	Scene
SA [redacted]	Scene/Evidence
LETS [redacted]	Scene/Photographer
Chemist [redacted]	Scene
Chemist [redacted]	Scene
SACFI [redacted]	Scene/Medic

Los Angeles Field Division

SA [redacted]	ASAC/Team SAC
SA [redacted]	ASAC
SA [redacted]	Group Supervisor
SA [redacted]	Leads
SA [redacted]	Leads
SA [redacted]	Leads
SA [redacted]	Leads
SA [redacted]	Leads/Case Agent
SA [redacted]	Leads
SACFIC [redacted]	Leads
SA [redacted]	Leads
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SA [redacted]	Leads

Los Angeles Police Department

Deputy Chief [redacted]	Scene
Captain [redacted]	Scene
Lieutenant [redacted]	Scene

Los Angeles Fire Department

Firefighter [redacted]	Scene
Firefighter [redacted]	Scene
Firefighter [redacted]	Scene
Apparatus Operator [redacted]	Scene

LEGAL PRESENCE:

5. The explosion scene examination was conducted on a public street.

6. During the scene examination consent searches were conducted at the following addresses on East 27th Street: 708, 712, 716, 718, 720, 726, 713, 715, 717, 725 and 727

7. A consent search was conducted at 912 ½ East Adams Street on 7/2/21.

8. On 7/4/21 a federal search warrant was conducted at 716 East 27th Street.

OWNER / INSURANCE INFORMATION:

9. The affected bomb squad vehicle was owned by the City of Los Angeles, which is self-insured.

VEHICLE DESCRIPTION:

10. The affected vehicle was a 2009 Peterbilt Model 365 with VIN: 1NPSLU0XX9N777069 and bearing CA License Plate: 1242990. The truck was equipped with a NABCO, Model# 64 SCS, TCV attached to the frame of the vehicle and located above the twin rear axles. A folding metal ramp was located at the back of the vehicle to allow access to the door of the TCV. The door of the TCV faced the rear of the vehicle and was operated by a hydraulic system. See Figure 1.

Figure 1: LAPD TCV Vehicle

WITNESS STATEMENTS:

11. Investigators interviewed numerous witnesses in this investigation and reviewed numerous collections of photographs and video obtained through canvasses and interviews. The interviews have been detailed in separate ATF Reports of Investigation. The interviews deemed most relevant to the origin and cause explosion scene investigation have been summarized for this report.

Interview of [redacted], LAPD Bomb Technician (BT):

12. BT [redacted] stated while packaging the fireworks, they found some homemade devices which were isolated, covered and set aside to be dealt with after the commercial fireworks were separated. LAPD Major Crimes Division, Criminal Conspiracy Section was briefed about the items seized and obtained consent to search the property and the house.

13. BT [redacted] stated he went into the house and the resident directed him to other locations where he was storing fireworks and explosives. Those items that were commercial fireworks were transported and the non-commercial fireworks were sorted and placed in the shade. The Pyro Addict devices were from the suspect room. The Pyro Addict devices were the same diameter, length and weight of the brown wrap devices. BT [redacted] stated he put his hands on each one of soda can devices and felt the weight. They were all consistent weight of one another.

14. BT [redacted] stated he and the team briefed about evidence collection being done safely, using the new remote cutter on the small tube and one soda can size device. BT [redacted] directed two Bomb Techs to set up the cutter in the alley. They also pushed the alley evacuation area father out. BT [redacted] and [redacted] were directed to build a disposal box.

15. ATF Certified Explosives Specialist (CES) [redacted] was in the backyard to observe the cut but did not participate in the cutting. BT [redacted] has only used the cutter in a training scenario. The cutter is becoming more important for court to describe the energetic material and for the lab to determine what the product is inside. BT [redacted] stated he used the cutter, poured the powder into the box and reviewed the contents with SA [redacted]. The collection box consisted of the collection box with a paper bag taped down inside to collect the contents. BT [redacted] made the cut, the contents fell into the box and then BT [redacted] cut the fuse with SA [redacted].

16. BT [redacted] stated he looked at the silvery powder covering the items. BT [redacted] stated it was a silver powder consistent with flash powder and aluminum powder and maybe potassium chlorate.

17. BT [redacted] placed 20 triangle devices into the box. BT [redacted] stated the Thunder Crackers did not go into the box and he does not know what happened to those.

18. BT [redacted] stated BT [redacted] was tasked with constructing the countercharge. BT [redacted] constructed the charge box like a stove so the box of disposal product could be easily placed. BT [redacted] chose what to use for the countercharge. BT [redacted] presented her charge box, discussed how much net weight of C2 and Det Cord to use, and described the process of taping. BT [redacted] inspected the box and made changes so it opened differently to slide in like an oven. BT [redacted] used 6.3 pounds of C2 and 0.2 pounds of det cord gross weight; and the N.E.W. was 10 pounds or a little over.

19. BT [redacted] stated the box contained 280 small red M-type devices, 20 devices from a package of red ones and 45 soda can style devices. BT [redacted] stated for the weight measurement, he counted the pyro as a soda can even though they are smaller and thinner. He stated he errored on the side of going higher.

20. BT [redacted] stated BT [redacted] x-rayed one soda can device and one of the small devices. We observed the fill line and determined the fill to be powder, so we knew we could cut the devices. BT [redacted] and BT [redacted] agreed on the cut and initiated that process.

21. BT [redacted] said the weight (of disposal product) was based on the one device that was cut open. BT [redacted] stated he overestimated there was 0.5 ounces in the M-80s for safe math and 1.5 ounce for the soda can size. There was approximately 10 lbs N.E.W. going into the TCV. BT [redacted] stated no one weighed the material and no scale was used.

22. BT [redacted] stated he was satisfied with everything with the TCV and was good with the set up. During the final briefing, BT [redacted] asked if there were any other safety concerns, anything we could do differently, or anything that could be done safer. The only thing he noticed when he went to get the box, BT [redacted] was having the media backed up.

23. BT [redacted] brought the box out, loaded it into the TCV, taped it down, we were ready to close it. BT [redacted] stated he realized the generator wasn't turned on, so Logistics Officer [redacted] went down and turned on the generator. BT [redacted] primed in and closed the door.

24. BT [redacted] was the shooter at the front of the BAT vehicle and was standing on the passenger side. BT [redacted] could feel and hear people behind him but he didn't really look. There was one last safety verification with the Fire Department. BT [redacted] then wired in.

25. BT [redacted] stated that when they were ready to take the shot, no one expressed any concern over the construction of the charge, size of the countercharge or the size of the bad product going in. No one brought anything to his attention.

26. BT [redacted] stated the limitations of the TCV are for maintenance purposes. He stated there was a drop dead 40 pound weight for one shot that it can take and then that's it. There's a 25 lb C4 shot for a maintenance phase; a 25 pound or little over 33 pound N.E.W. it needs to go down for maintenance; manual standard for a 15 pound shot with a timed wait and 40 lbs N.E.W. is the maximum capacity. He has a NABCO specification sheet. He was not sure if the 40 pound maximum is on the specification sheet.

27. BT [redacted] did not know when the TCV was placed in service. BT [redacted] was aware the TCV had been used 3-4 times in the last 4-5 weeks. BT [redacted] used the TCV on June 2nd. He doesn't remember how many devices there were, but it was approximately 30 of coke can type devices. BT [redacted] stated they never put metal frag producing devices into the TCV.

28. BT [redacted] stated the aluminum foil lined device felt empty to him. BT [redacted] described it as having a fuse and the foil was applied with a spray glue. It had silver dust on it and the black plastic ball was offset. BT [redacted] stated he didn't want to rip the foil off. He could see inside a light dusting of aluminum powder and a fuse as if something had poured out of there. It was sketchy to him and he didn't want to touch that anymore and just make that go away. The ball was placed into the box by BT [redacted]. BT [redacted] placed the triangle devices and the red devices into the box.

29. BT [redacted] stated he does his calculations the way he has been trained and that is how all the other bomb techs in his unit do it too. All bomb technicians use the same formula taught at school. The mathematical equation is the same. Where they get their numbers may be different. BT [redacted] stated he used a math equation to figure out how much powder was in the devices as an estimation. BT [redacted] was asked how do you get the numbers to do your calculations if you didn't actually weigh it and he answered saying he assumed the soda can device was an ounce and a half. BT [redacted] stated he gets a weight based on how big something is. He could see the fill line on the x-ray and knew they were 1.5 ounce based on touching each item.

Interview of [redacted], LAPD Senior Logistics Officer:

30. SLO [redacted] stated the initial certification shot was conducted by NABCO in July 2008. The shot was 15 pounds of commercial dynamite. All shots in the TCV are logged. The current shot count is 36. There have been no issues with the TCV. The model number is 64-SCS. No modifications have been made to the TCV. A unique feature is the LAPD TCV platform is built on a Peterbilt 365 chassis.

31. SLO [redacted] stated the TCV is cleaned after every shot. Cleaning includes sweeping the inside and removing any residue, hosing down the inside of the vessel, with APR on, he uses simple green and scrub brush, uses a sump pump to remove the water as he rinses until the water is clean. SLO [redacted] then crawls inside to do an overview inspection to see if there was a piece of frag that would have left an indentation or something that was not normal. SLO [redacted] has never seen metal frag in the TCV before. SLO [redacted] stated he usually finds carbon dust and nothing over pea sized ash or very fine carbon debris thinking most would be consumed in the thermal blast.

32. SLO [redacted] stated after each use, he records an approximate gross weight, not including the cardboard box or whatever they build their countercharge in. The approximate gross weight of the countercharge and the product being destroyed is entered on the TCV log.

33. SLO [redacted] stated there are no issues with door malfunctions. On the day of the explosion there was no malfunction or issue. On the day of the explosion, there was a logistical issue with the generator being turned off so the hydraulic fluid wouldn't overheat. He got everything set up and the door opened so the bomb techs can do what they need to do. Once BTs [redacted] and [redacted] had placed the devices inside with the countercharge, SLO [redacted] had to go down range and start the generator, turn on the hydraulics for the ball.

34. SLO [redacted] stated the TCV maximum rating for a general use shot is 15 pounds military grade C4, repeatable within 15 minutes. The maximum rating for a one time emergency use shot is 25 pounds of military grade C4.

35. SLO [redacted] did not know the weight of the total charge that was detonated. In discussing the countercharge weight, SLO [redacted] stated the logistics officers have the keys to the explosive magazines. Their procedure is to pre-weigh anything taken out. The Bomb Techs then build their charge, the Logistics Officer weighs again and secures the charge in the magazine. SLO [redacted] stated on the day of the explosion, the C2 initial weight was 9.4 pounds, minus the cardboard tubes. All the C2 was used. The det cord weighed 0.7 lbs of 50 grain det cord. SLO [redacted] stated the shot was dual primed and he is unsure of the det cord name.

36. SLO [redacted] stated the explosives used for the counter charge are weighed using the scale on the bomb squad truck. The scale is calibrated by a 2-pound dive weight every time. Both the dive weight and scale are kept on the bomb squad response truck.

37. SLO [redacted] stated the requisition and maintenance records are kept in his daily log. The stress points or fiducial marks are checked annually and he monitors the TVC if they have done multiple shots. The last check was April 23 or 24, 2021.

38. SLO [redacted] stated he received chem bio training for the TCV at NABCO 2-3 years ago, which focused on sampling portions. In house cleaning training has been passed down through the unit by former BT [redacted] handing down his knowledge. There is no formal certification program.

Interview of [redacted], LAPD Bomb Technician (BT):

39. BT [redacted] stated that her original assignment, on June 30, 2021, started at 0500 hours at LAX Airport. At approximately 1330 hours, the LAX supervisor advised BT [redacted] that additional officers were needed to assist with a large fireworks seizure in LAPD's Newton Division. BT [redacted] travelled there and helped to load up pallets so that forklifts could load them onto trucks. Later, BT [redacted] supervisor [redacted] told BT [redacted] that a bag full of homemade fireworks had also been recovered. [redacted] showed BT [redacted] the bag of homemade fireworks and advised that at some point they would need to do a TCV shot. [redacted] asked BT [redacted] to prepare the counter charge and she agreed to do so. BT [redacted] retrieved a medium-sized Home Depot box from the TCV and formed rows of the homemade fireworks inside of the box. She also used the box to help determine the size of the counter charge. Based upon the number of rows, BT [redacted] calculated that approximately 282 devices had been removed from the bag and placed into the box. BT [redacted] noted that she only needed an approximate number of the devices and did not write the number down. BT [redacted] stated that

she placed approximately 40 to 42 "coke can size" devices in the box, on top of the 282 devices. BT [redacted] described the box as almost, but not full. BT [redacted] used another medium-sized box to build the counter charge.

40. BT [redacted] stated that their procedure is to place the counter charge into the TCV first, and then the hazardous material. BT [redacted] described how she taped the second medium-sized box closed. She also cut a slit in the box to create a flap for the counter charge. BT [redacted] did not take a picture of the finished counter charge box but did take a picture after the box had been placed into the TCV. BT [redacted] stated that she took the picture to show the other bomb techs how the box had been placed. BT [redacted] displayed the picture to investigators and detailed how she placed the C-2 counter charge around the box. [redacted] provided investigators with a copy of the picture, via AirDrop, during the interview. The picture was subsequently placed on the master hard drive.

41. BT [redacted] stated that she used C2 Deta Sheet and Det Cord as the counter charge. BT [redacted] stated that she used a C2 sheet that measured 12 inches in width and 10 feet in length or 120 inches by 12 inches. [redacted] stated that the before and after weight of the Det Cord was .8 ounces. BT [redacted] estimated the length of the Det Cord to be 30 feet but stated that she did not measure it. BT [redacted] also stated that the Det Cord was 50 grains and was cut into two pieces. BT [redacted] stated that the N.E.W. (Net Explosive Weight) for the C2 was 6.3 (pounds) and .2 (pounds) for the Det Cord. BT [redacted] stated she was not told the N.E.W. for the items that were being disposed.

42. BT [redacted] stated that she was not involved in measuring/weighing the homemade explosives. BT [redacted] stated that her partners x-rayed the devices and she believed that another bomb tech cut open one of the small and coke can size devices. BT [redacted] did not know if her partners weighed the powder afterwards. BT [redacted] stated that the powder that was retrieved from the two devices may have been given to [redacted] from ATF. BT [redacted] stated that [redacted] estimated the N.E.W for the homemade explosives that were to be destroyed.

43. BT [redacted] stated that the "shot" conducted on June 30th was the only one that was done at the scene. BT [redacted] confirmed that the TCV was commonly used to dispose of homemade fireworks. BT [redacted] stated that the TCV is used for items that are unstable or too dangerous to be stored. She noted the presence of powder residue on the outside of each of the devices and said that the plugs were not glued.

44. BT [redacted] stated that the shot is typically placed on top of a box inside of the TCV to elevate it (the shot). A medium or large size, empty Home Depot box is used to elevate the shot to the center of the TCV's ball.

45. BT [redacted] stated that the TCV has been used by the department since 2005. BT [redacted] stated that 3 shots, including this incident, were deployed inside of the TCV over the last three weeks. BT [redacted] was not present during the other shots. Logs are maintained by the Logistics Team whenever the TCV is used. BT [redacted] took a picture of the bag of homemade fireworks and videotaped the shot conducted on June 30, 2021. BT [redacted] provided investigators with the photograph and video recording via AirDrop. BT [redacted] stated that "nothing with frag" is shot inside of the TCV.

46. BT [redacted] stated that after the shot was set up, [redacted] pushed the button to close the TCV door. BT [redacted] stated that the TCV has an access port for the firing wire to pass through, so there is nothing to pinch the wire. BT [redacted] was unaware of any issues with the TCV's access door or any other issues with the TCV. BT [redacted] advised that a flashing red light activates after the TCV button to close the access door is pushed. A green light activates once the door closes. BT [redacted] stated that she observed the green light turn on after the door closed.

47. BT [redacted] stated that she was trained that the TCV's maximum explosive weight limit was 40 pounds N.E.W. The Logistics personnel clean and inspect the TCV after each shot, fix the robot, maintain TCV records, etc. The Logistics Officers are police officers, not bomb techs. The Logistics Officers are [redacted], [redacted] and [redacted] is currently out of the office on sick leave.

48. BT [redacted] stated that the TCV is used to dispose of materials that are unsafe to transport or store. BT [redacted] stated that the TCV has been used in residential areas in the past to detonate in place. The squad has a TCV S.O.P. (Standard Operating Procedure) and all the bomb techs are trained how to use the TCV.

49. BT [redacted] stated that the group believed the shot was well under what the TCV could handle and that they were in shock over what happened.

Interview of [redacted] LAPD Bomb Technician (BT):

50. BT [redacted] stated that he (BT [redacted] and Officer [redacted] were assigned to work at a fireworks buyback program in the LAPD's Mission District at Brand Park on the date of the incident. The buyback operation was scheduled to end at 1 p.m. While at Brand Park, the duo received a call from Bomb Squad Supervisor Detective [redacted] regarding a large fireworks seizure in the Newton Division. [redacted] requested their assistance in Newton Division, to load the fireworks onto pallets and trucks, after BT [redacted] and [redacted] were done at the buyback program. At approximately 3 p.m., the duo arrived at the residence in Newton Division and observed hundreds of boxes of commercially packaged fireworks inside. BT [redacted] stated that the boxes were stacked from floor to ceiling. BT [redacted] helped build pallets and loaded fireworks for several hours. Later, Primary BT [redacted] and secondary BT [redacted] found improvised devices inside of the residence. Those devices were separated from the commercial fireworks. BT [redacted] stated that BTs [redacted] and [redacted] were in charge; [redacted] and [redacted] were there to assist.

51. BT [redacted] stated that they decided to do a TCV shot to dispose of the improvised devices and the other suspect fireworks. BT [redacted] stated that he was not present when they prepared the shot. BT [redacted] understanding was that the shot was prepared for a net explosive weight (N.E.W.) of 10 or 11 pounds of flash powder or other material. BT [redacted] stated that [redacted], [redacted] and [redacted] mentioned the weight to BT [redacted] BT [redacted] was also present when [redacted] performed a remote cut and x-ray of two of the devices. [redacted] asked BT [redacted] opinion regarding the x-ray and he agreed that the fill line on the x-ray appeared to be half or less than half full of powder. The devices also had a fuse that went down into the fill line. BT [redacted] stated that somebody weighed those samples afterwards.

52. BT [redacted] stated that after the fireworks had been removed from the residence, they moved to the demo phase of the operation to set up for the TCV shot. BT [redacted] stated that [redacted], [redacted] and [redacted] set up the shot, and [redacted] may have helped to build the box used for the counter charge. BT [redacted] stated that he did not set up the shot. BT [redacted] was told that [redacted] did the calculations for the recovered devices. The

N.E.W. calculation was 10 or 11 pounds excluding the counter charge. BT [redacted] stated he believed [redacted] has a phone app for the calculations. BT [redacted] stated that the primary and secondary technicians make the decision regarding the shot and then present it to the supervisor [redacted]. BT [redacted] explained, however, that all the bomb techs have input regarding safety procedures, calculations, etc. The bomb techs' input is considered, but the supervisor makes the final call.

53. BT [redacted] and [redacted] looked at the large box of material to be disposed and agreed that it looked like a lot of stuff. BT [redacted] stated that [redacted] asked whether their concern was that the gross weight or N.E.W. was too much. BT [redacted] stated [redacted] responded both. [redacted] explained the calculations made for the N.E.W. versus the gross weight. BT [redacted] said okay because even though the gross amount of the product looked big, the N.E.W. was not big. BT [redacted] took their word regarding the N.E.W. calculations. BT [redacted] did not know the weight of the two devices that had been cut open. However, the amount did not look like a lot as he watched the contents being poured into bags. The bags were given to [redacted] from ATF.

54. BT [redacted] stated that he went to the TCV before the shot had been placed, but not afterwards. He stated that only the primary and/or secondary techs approach the TCV after the shot has been placed. BT [redacted] did see the box inside of the TCV, but that was before the explosive material was placed inside. BT [redacted] stated that Primary Technician [redacted] and Secondary Technician [redacted] carried the box to the TCV. Both techs were wearing protective wear when they placed the box inside of the TCV. BT [redacted] stated that only one tech typically carries the box of material, but this box was long and awkward.

55. BT [redacted] stated no further concerns were discussed regarding the shot after the conversation about the N.E.W. concluded. BT [redacted] stated that the N.E.W. discussed was well below the limits of the TCV. Based upon the training he received, BT [redacted] understood that the rating for the TCV was under 40 pounds of N.E.W.

56. BT [redacted] stated that he videotaped the TCV shot, per [redacted]'s request. The bomb squad typically videotaped the shots per BT [redacted] BT [redacted] texted a copy of the video to Explosives Enforcement Officer [redacted] during the interview.

57. BT [redacted] stated that excluding this incident, the TCV has been used three times during the last three weeks. BT [redacted] stated that he was not present for those calls. BT [redacted] did not believe that any frag producing shots were ever done in the TCV. BT [redacted] stated that the Logistics Technicians are responsible for the maintenance of the TCVs, robots and trucks.

58. BT [redacted] stated that the TCV door didn't work, on June 30, 2021, when [redacted] and [redacted] tried to close it. BT [redacted] stated Officer [redacted] (Logistics Division) did something and closed the door. They said it may have been something with the generator.

59. BT [redacted] stated that the TCV can only be used for one shot during a 24-hour period. BT [redacted] stated that a Hazmat TCV is available if a second shot is needed. The department can request mutual aid from other bomb squads and has done so in the past according to BT [redacted]. [redacted] stated that the TCV is typically used for disposal operations and fireworks.

60. BT[redacted] stated that he saw one box containing approximately 40 coke can size devices with fuses placed inside of the TCV. BT [redacted] was told that 200 additional smaller devices and other small homemade devices also went inside of the TCV. BT [redacted] stated he never observed those devices being placed inside of the TCV. He also never saw the other devices that were labeled Pyro Addict.

61. BT [redacted] was standing near the rear of the bomb squad response truck videotaping the TCV shot. [redacted] had the firing box and was off to [redacted]'s right. [redacted], [redacted] and [redacted] were also nearby. Media personnel were assembled near the laundromat until [redacted] alerted the supervisor that the press was too close. The media was subsequently moved to another location.

VIDEO ANALYSIS / TIMELINE:

62. Throughout the investigation, investigators reviewed numerous videos and still photographs related to the explosion of the TCV. Investigators found two videos that provided valuable data as it relates to the origin and cause investigation.

63. Investigators reviewed video footage from a security camera on the front of the residence located at 712 East 27th Street. The video footage reviewed begins at approximately 7:27pm on 6/30/21 and ends at approximately 7:39pm on 6/30/21. The offset time, which is the time difference between the time/date shown on the camera system and the actual time/date the video was captured, for this video is approximately 7 hours and 9 minutes.

- On 6/30/21, at approximately 7:27 pm (offset time), the total containment vessel (TCV) appears in front of the residence at 712 East 27th Street and a light affixed to the top left portion of the vessel can be seen flashing. See Figure 2.

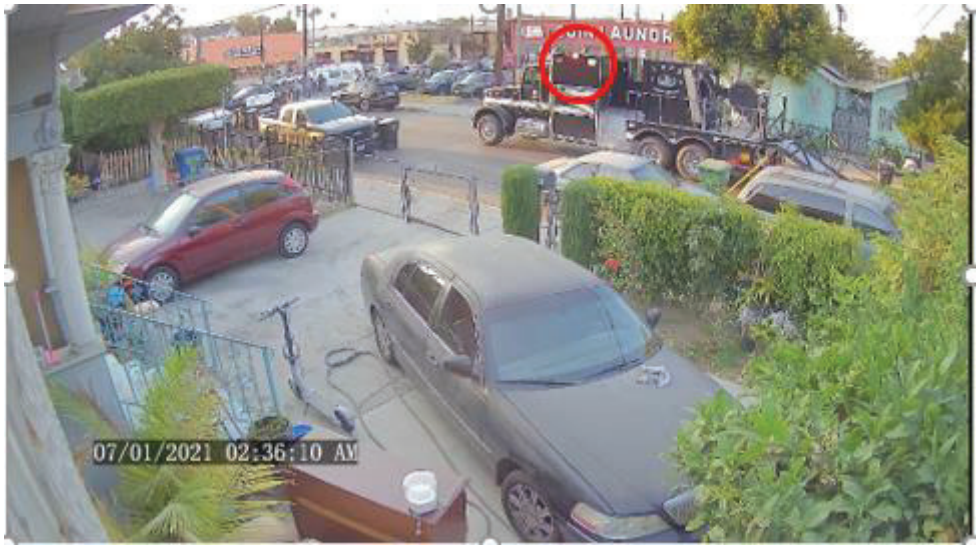


Figure 2: Picture showing TCV open and warning light illuminated

- Continuing the same date approximately one minute later, the door to the TCV can be seen closing. See Figure 3.

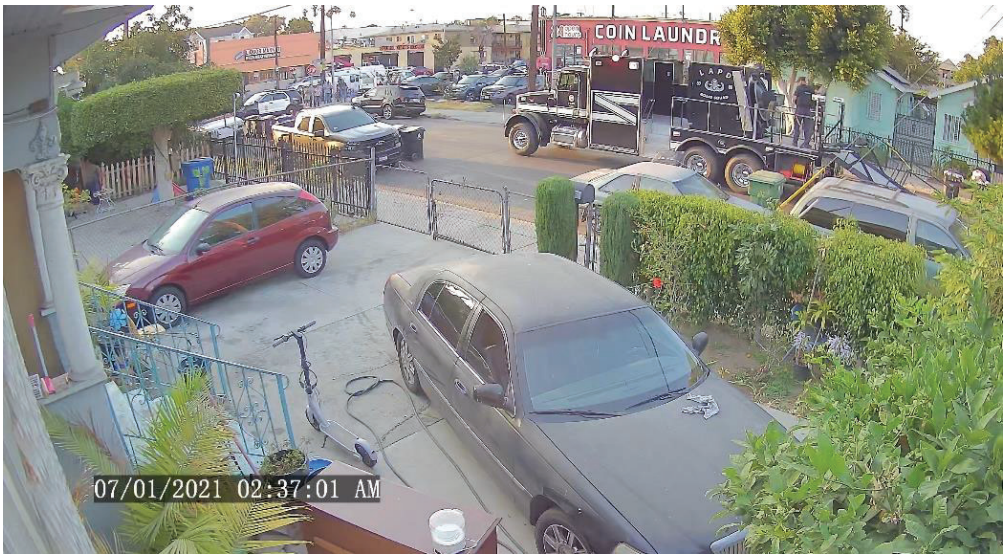


Figure 3: Picture showing TCV closing, and warning light illuminated.

- Continuing the same date, approximately one minute later, the door to the TCV can be seen closed with the light turned off. See Figure 4.

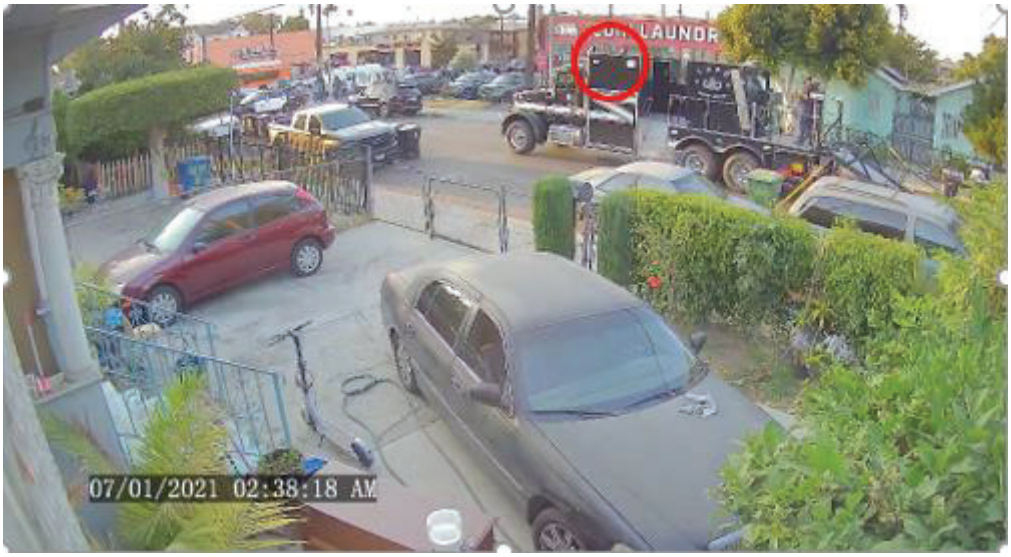


Figure 4: Picture showing TCV closed and warning light off

- On 6/30/21, at approximately 7:35pm *(*offset time*)*, the total containment vessel (TCV) appears in front of the residence at 712 East 27th Street in working order. See Figure 5.

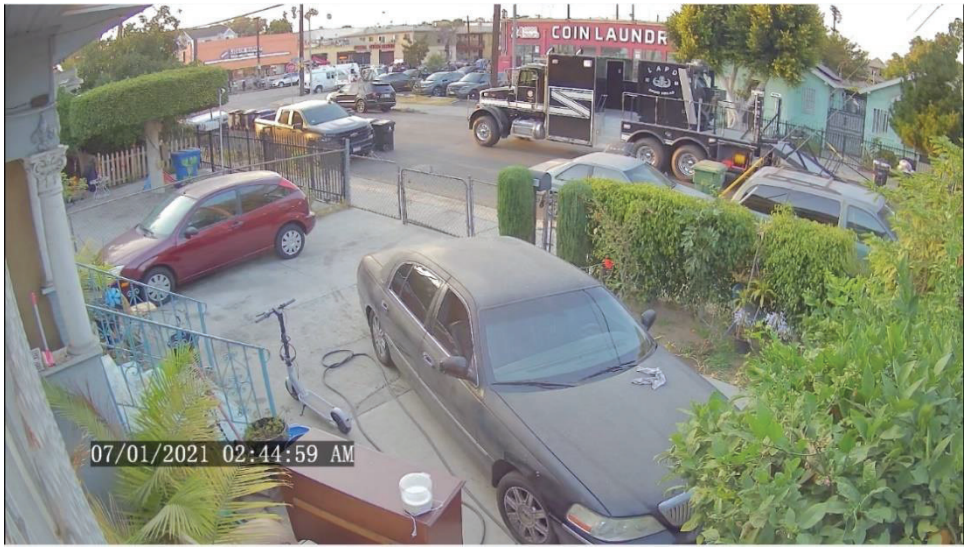


Figure 5: Picture showing TCV vehicle just prior to explosion.

- Continuing the same date seconds later, a fire ball is observed towards the back end of the TCV, followed by smoke and debris can be seen in front of the residence. See Figure 6 and 7.

Figure 6: Picture showing fireball coming from rear of TCV vehicle.

Figure 7: Picture showing dust and debris after explosion.

64. Investigators reviewed video captured by [redacted] one of the LAPD bomb technicians on scene the day of the explosion. The short video shows the initiation sequence of the explosion. The video also contains audio. The video begins with the TCV in view and off camera a loud voice can be heard shouting, "Fire in the hole, fire in the hole, fire in the hole." This is a common warning given prior to the initiation of an explosion. See Figure 8.

Figure 8: Picture showing TCV just prior to explosion

65. Immediately after the three "fire in the holes" are heard, a countdown of 3-2-1 can be heard. This countdown is usually performed by the person initiating the explosion so other participants in the explosives operation have a precise time when the explosion will occur. Immediately after 1 is heard in the countdown, the explosion occurs. See Figure 9.

Figure 9: Picture showing fireball at rear of TCV vehicle immediately after countdown.

66. The two videos show the TCV door close and the warning lights go off. This is evidence the TCV was closed and properly operating just prior to the explosion. The videos also show the explosion occurred when initiated by the bomb squad and the explosion occurred at the back of the TCV vehicle.

WEATHER:

67. Local weather was considered as a possible causal factor for this incident. Based on the video evidence, weather can be eliminated as a cause of this explosion. Weather data for Los Angeles was also reviewed. No evidence of lightning in the area was found. See Figure 10.

Time	Temperature	Humidity	Wind	Wind Speed	Wind Gust	Pressure	Condition
5:53 PM	68 °F	78 %	WSW	12 mph	0 mph	29.75 in	Fair
6:53 PM	66 °F	81 %	WSW	12 mph	0 mph	29.76 in	Fair
7:22 PM	66 °F	81 %	WSW	12 mph	0 mph	29.76 in	Mostly Cloudy
7:53 PM	64 °F	90 %	SW	9 mph	0 mph	29.76 in	Cloudy
8:53 PM	64 °F	90 %	W	7 mph	0 mph	29.78 in	Cloudy

Figure 10: Weather data from Los Angeles on 6/30/21.

SCENE EXAMINATION:

68. After the explosion, a request for an ATF National Response Team callout was made by LAPD to the ATF Los Angeles Field Division. The callout was subsequently initiated. LAPD set up a perimeter, evacuated the neighborhood and maintained security around the explosion site as soon as possible after the explosion and throughout the duration of the scene exam.

69. The scene examination was conducted in a systematic method with emphasis on recognition, identification, and analysis of damage and debris patterns. The steps of the scientific method, as described in National Fire Protection Association (NFPA) 921, *Guide to Fire and Explosions Investigations*, 2021 edition, were utilized.

70. Throughout the investigation, in a cyclical manner, data was collected and analyzed, reasonable hypotheses were developed, and these hypotheses were then tested. This process was applied during and after the scene investigation to both the origin and the cause determinations.

71. The NRT scene examination commenced on 7/2/21 and ended on 7/6/21. Briefings were held daily, and scene investigator consultations were held frequently throughout the duration of the investigation.

72. The investigation proceeded in a logical fashion with some tasks occurring simultaneously. The scene was documented prior to processing and on a continuous basis each day. See Figure 11.

Figure 11: Picture showing the scene prior to processing.

73. In the scene exam sections, the item numbers listed are the numbers used and documented during scene processing. If an ATF Evidence Item number was assigned to a particular piece of evidence, it will appear in parentheses at the end of the description.

74. Throughout the scene examination, items of interest were identified and collected. Items determined to be part of the TCV were reconstructed in the parking lot of Best Laundry after the parking lot was cleared of both vehicles and items of interest. Investigators utilized an exemplar TCV at LAPD to identify parts of the TCV and assist in the reconstruction of the TCV.

75. Items of interest determined not to be part of the TCV (such as vehicle parts) were placed into clean, new trash receptacles that corresponded with the area where the item was found. See the section labeled Scene Exam on 7/3/21 for information on how areas where items were found were identified.

Scene Exam on 7/2/21

76. The scene documentation on 7/2/21 consisted of photographing the scene, mapping the scene with a Total Station, and scanning the scene with a laser scanner. Vehicles (those parked on the street as well as first responder vehicles) were removed from the west end of East 27th Street after being photographically documented.

77. The parking lot of Best Laundry, located at 2616 S San Pedro, was searched. Four items (protective rail tubing, a hydraulic motor, a small metal fragment and the support for the bottom yoke arm) were found. They were photographed by SA [redacted], collected, and associated with the TCV parts in the parking lot of Best Laundry or the trash receptacle where items from section 2 were collected.

78. Initial scene processing began in areas more distant from the explosion. Searches for items of interest were performed in these areas by members of the ATF NRT and the Los Angeles Field Division.

79. During the search the following areas were searched using a line search method: South San Pedro Street from 29th street to the south to 2614 S San Pedro to the north. East 27th Street ½ block west of S San Pedro. The alley that runs east from S San Pedro to Stanford St. South of E 27th Street. The Alley that runs from Stanford Street to S San Pedro on the west side of E 27th St.

80. During the search several items were located that were marked by initial investigators at the scene on 6/30/21. These items were reviewed by NRT subject matter experts. After review, the pertinent items remained marked as items of interest.

81. The following items were located, documented, and photographed as items of interest:

001: Piece of railing handle from the TCV. Located at 2720 S San Pedro St, edge of sidewalk, east side of the St.

002: TCV Door actuator. Located in front of 2623 S San Pedro on the west side of the street just north of the intersection with E 27th St. (ATF Item 28)

003: TCV gear. Located in front of 2623 S San Pedro on the sidewalk against the building. (ATF Item 29)

82. Prior to the arrival of the NRT, LAPD had located the door of the TCV. The TCV door was propelled from its original location, travelled more than 1000 feet, and came to rest in the backyard of 912 ½ Adams Street.

83. On the afternoon of 7/2/21, SABT [redacted] spoke with [redacted], the resident of 912 ½ Adams Street. [redacted] agreed to meet investigators and accompany them into her gated yard and to the residence located at 912 ½ Adams Street. Mrs. [redacted] provided SA [redacted] with a key to unlock a back gate so the TCV door could be removed.

84. At the request of ATF the TCV door was removed by LAFD heavy rescue under the supervision of SABT [redacted]. The LAFD heavy rescue personnel that assisted with the move were [redacted], Apparatus Operator, HR3, LAFD and [redacted] Fire Fighter, HR3, LAFD. The TCV door was then transported, accompanied by SA [redacted], to the lot of Best Laundry located on E 27th at S San Pedro that was being used as a collection point for the TCV parts.

004: TCV Door. Located in the backyard of the residence located at 912 ½ Adams St. (ATF Item 30)

Scene Exam on 7/3/21

85. On 7/3/21 members of the NRT conducted a systematic search of the inner perimeter. The inner perimeter was E 27th Street from S San Pedro to Stanford Ave. The area was divided into 5 sections with the TCV truck being section 1, the area NW of the truck being section 2, the area NE of the truck being section 3, the area SE of the truck being section 4 and the area SW of the truck being section 5.

86. Smaller items of interest were collected from the 5 sections. These items were placed into clean, new trash receptacles numbered to correspond with the five sections or associated with the TCV parts being collected in the parking lot of Best Laundry as appropriate. See Figure 12.

Figure 12: Picture showing section locations and TCV part collection area.

87. The larger items (items requiring equipment to be moved) of interest were identified, numbered, photographed, and collected individually by section. These items were weighed, and the locations measured using the Total Station to show distance from the TCV. These items were moved by LAFD heavy rescue with a skid steer and placed in the parking lot of Best Laundry at 27th St and S San Pedro.

88. The larger items were weighed with department of transportation scales. The skid steer was weighed with the scales to obtain a tare weight. The skid steer and the large item were then weighed. The tare weight was subtracted from the combined weight to determine the approximate weight of each item.

89. The large items of interest from the TCV that were collected are described as follows and depicted in the photo at the end of the list (See Figure 13):

Item 005: Hydraulic arm from TCV Door. Located in section 2, in the street just west of 713 E 27th St, weighed approximately 51 lbs. (ATF Item 31)

Item 006: ½ of TCV door locking yoke with screws (right half if facing TCV from rear). Located in section 3 at the edge of the sidewalk and street in front of 713 E 27th St, weighed approximately 550 Lbs. (ATF Item 32)

Item 007: TCV door hinge. Located in section 3 in front of 713 E 27th Street, weighed approximately 500 pounds. (ATF Item 33)

Item 008: TCV yoke screw handle. Located in section 3 in front of 715 E 27th St, weighed approximately 5 pounds. (ATF Item 34)

Item 009: S 5000 electric motor for the winch from the top of TCV. Located in section 3 in front of 717 E 27th St, weighed 11.7 pounds. (ATF Item 35)

Item 010: TCV door hinge arm. Located in section 3 in front of 725 E 27th St, weighed approximately 77 lbs. (ATF Item 36)

Item 011: TCV door hinge arm bracket. This item originally attached the TCV door (item 004) to the TCV door hinge (item 007). Located in section 3 in front of 729 E 27th St, weighed approximately 38 pounds. (ATF Item 27)

Item 012: TCV yoke half (left half if facing TCV from rear). Located in section 4. This item was imbedded in a car parked on E 27th in front of 712 E 27th St, weighed approximately 270 pounds. (ATF Item 37)

Item 013: TCV door hinge structure and frame. Located in section 3 in the backyard of 713/715 E 27th St, weighed approximately 200 pounds. (ATF Item 38)

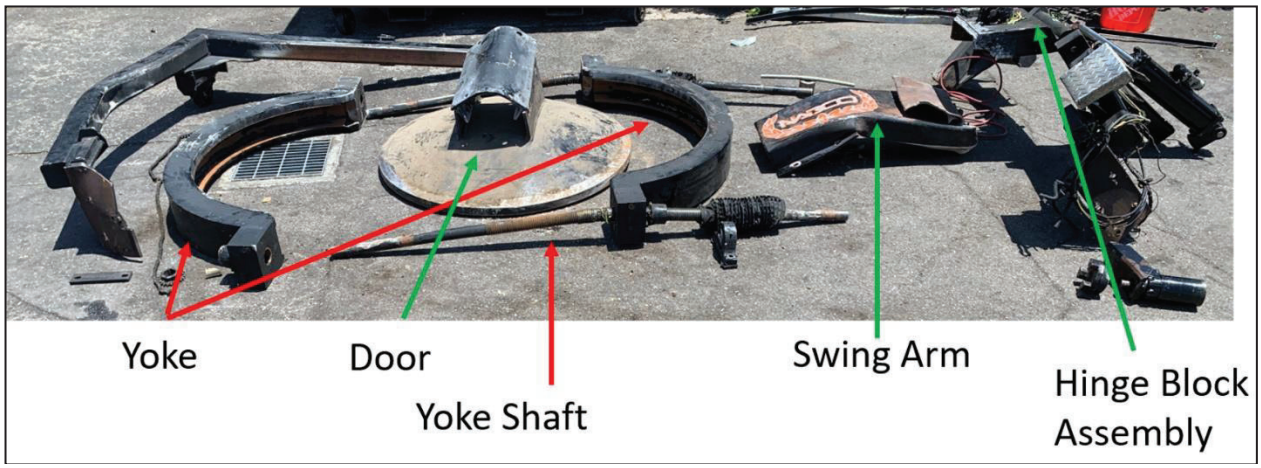


Figure 13: Picture showing reconstruction of TCV parts.

Scene Exam on 7/4/21

90. On 7/4/21 members of the NRT and the LAPD conducted a consent search at 706/708 E 27th St. Consumer fireworks were found in the basement of one of the residences on the property. LAPD seized the fireworks as evidence. The resident was subsequently charged in state court by LAPD.

91. In addition to the fireworks, several items from the TCV were found in the front yard of the search location. They were photographed, collected, and associated with the TCV parts in the parking lot of Best Laundry or the trash receptacle where items from section 5 were collected.

92. One of the items found in the front yard was documented as Item# 014: Door yoke drive chain. Item 14 was located in the carport on the east side of 706/708 (ATF Item 39).

93. The vessel of the TCV (See Figure 14) was removed from the vehicle. Two samples of the debris inside the vessel were removed and placed into gallon paint cans (ATF Items 5 and 6). The items were subsequently submitted to the ATF lab for analysis.

Figure 14: Picture showing vessel of the TCV.

94. The fiducial marks on the vessel were measured using the procedure prescribed by the manufacturer. The measurements were consistent with the measurements of the fiducial marks taken prior to the explosion occurring on 6/30/21. This indicates there were no significant deformations of the vessel that resulted from the explosion event on 6/30/21.

95. A federal search warrant was conducted at 716 E 27th St. This is the location where more than 30,000 pounds of consumer fireworks were removed by LAPD on 6/30/21. Nothing significant to the explosion event that occurred in the TCV was located during the search of the residence.

96. The vessel and the components of the TCV that had been collected in the parking lot of Best Laundry were loaded onto a LAPD bomb squad trailer and taken to LAPD bomb squad HQ garage for storage.

Scene Exam on 7/5/21

97. On 7/5/21 the remains of the Peterbilt chassis were removed and a final search of the area around the truck was conducted. Investigators continued to get consent to search addresses at the west end of E 27th St and do searches of those addresses for which consent was obtained. No significant items were located during the consent searches nor during the final search of the area around the truck. See Figure 15.

Figure 15: Picture showing scene after removal of TCV vehicle.

98. The TCV parts of interest, to include the LAPD trailer the parts were stored on, were taken into ATF evidence. The trailer and the parts were stored in the LAPD Bomb Squad HQ garage located at 2029 N Main Street. This is a secure police facility. The parts and trailer were secured in this garage on the afternoon of 7/4/21 and moved by ATF/LAPD in the afternoon of 7/5/21 to a secure ATF facility.

99. The items on the trailer were assigned ATF evidence item numbers. The item number on the left of the list below is the number assigned on ATF Form 3400.23. This form is a receipt for property and other items taken into ATF custody. This form was used to memorialize the list of items ATF obtained from the LAPD Bomb Squad HQ garage. The ATF evidence item number (the item number which is assigned by the ATF evidence system and appears on the ATF evidence tag) is in parentheses at the end of the descriptions:

Item 15, LAPD trailer holding the TCV and the various parts. (ATF Item 19)

Item 16, Top horizontal TCV brackets. (ATF Item 20)

Item 17, Hydraulic drive motor for TCV door. (ATF Item 21)

Item 18, TCV and remaining frame. (ATF Item 22)

Item 19, TCV drive gear Pillow block(ATF Item 23)

Item 20, TCV yoke shaft collar removed from Item 12. (ATF Item 24)

Item 21, Three pieces of yoke drive chain and sprocket. (ATF Item 25)

Item 22, Yoke shaft support bracket. (ATF Item 26)

Item 23, Miscellaneous suspected TCV parts. (ATF Item 40)

Investigative Activities on 7/6/21

100. Investigators continued to obtain consent to search the addresses at the west end of E 27th St and perform searches of those addresses for which consent was obtained. No significant items were located during the consent searches.

HYPOTHESIS AND DATA ANALYSIS:

101. Numerous hypotheses were considered throughout the origin and cause investigation. The five hypotheses deemed most reasonable as to the cause of the failure of the TCV were: a collapse of the disposal charge and product within the vessel, pressure and/or friction imparted on spilled disposal material, the TCV door malfunctioning or not closing properly, metal fatigue and overloading the TCV.

Charge Collapse

102. When explosives are placed within a TCV, the charge should be centered within the sphere that makes up the vessel of the TCV. Had the disposal charge and product collapsed during the disposal operation the charge would have no longer been centered in the sphere and would have been resting on the bottom of the sphere. Had the charge been laying at the bottom of the TCV at the time of the disposal, this positioning of explosives could have caused the TCV to operate less than optimally.

a. There was no scarring or denting seen on the interior of the vessel. Had the explosives been in direct contact with the interior surface of the vessel, scarring or denting would have been expected.

b. There was no bulging present on the exterior of the vessel. Additionally, the fiducial measurements (measurement used to determine the suitability of the vessel for use) taken after the explosion were within specifications. Had the explosives been displaced bulging and/or measurements being outside specifications would have been expected.

103. Therefore, the hypothesis of the explosive charge collapsing after being placed in the vessel was disproven.

Pressure and/or Friction

104. The IPEDs placed in the TCV for disposal contained flash powder. Flash powder is a fine free-flowing energetic powder that can spill from its containers and can be ignited by shock or friction. Had this powder spilled on and collected around the door of the TCV, the pressure and the friction of the TCV door closing could have ignited the spilled powder.

a. Pressure and friction are most likely to occur when the door to the TCV closed. Based on video evidence the door to the TCV is closed for approximately 6 minutes before the explosion occurs. Additional video evidence shows the explosion was initiated by the bomb technicians after announcing “fire in the hole” three times and counting down 3-2-1.

105. Therefore, the hypothesis of pressure or friction causing the explosion was disproven.

TCV Door Malfunctioning or Not Closing Properly

106. If the TCV door does not close and seal all the way or the door closing mechanism were to not work properly, this could lead to the door and the vessel not functioning properly and lead to an unintended event.

a. There is a very specific sequence the TCV goes through when the door to the TCV opens and closes. When the door begins to open a warning light starts to flash to indicate the door is not closed properly. The light continues to flash until the door is closed properly again. The hydraulic system then pulses several times to ensure the yokes are closed. As an additional safety check, the T-Bar handle used to manually open and close the yokes is in a vertical position. Lastly the gap between the yokes is visually checked to make sure the gap is even.

b. Video evidence shows the TCV door went through the proper closing procedure. The door closed, the yokes moved into place, the warning light stopped flashing and the T-Bar handle was observed in the vertical position. In an interview with LAPD Officer [redacted], he confirms the gap between the yokes was correct, the hydraulic system pulsed and the closing procedure went as designed.

c. Several parts of the TCV were examined by [redacted]. Mr. [redacted] is a metallurgist hired by ATF to examine parts of the TCV and determine if any conclusions could be made about the failure of the TCV based on his metallurgical examination. In his report dated 8/23/21, Mr. [redacted] wrote the following, "The location of the sheared flanged collar threads on the threaded rods was consistent with the yokes having been fully closed at the time of the incident failure."

107. Therefore, the hypothesis of the door malfunctioning or not closing properly was disproven.

Metal Fatigue

108. The TCV was used more than 50 times prior to the event that occurred on 6/30/21. The repeated used may have fatigued the components of the TCV. This fatigue may have caused the TCV to not function properly.

a. In the metallurgist report dated 8/23/21, Mr. [redacted] wrote the following, "The failure of the flanged collars on the threaded rod which held the yokes in place on the door of the subject TCV was a onetime overload event. The flange collars showed no evidence of prior cracking or any significant wear. This unit had reportedly been used successfully on numerous prior occasions with no damage to the components suggesting that the loading on the flanged collar threads was significantly higher at the time of this incident."

109. Therefore, the hypothesis of metal fatigue was disproven.

Overloading the TCV

Rated Capacity

110. Investigators obtained two documents to determine the allowed capacity of the TCV used by LAPD on 6/30/21. One was a test report from NABCO, Inc. and the other was a memorandum for the Air Force Safety Center from the Department of Defense Explosives Safety Board (DDESB) approving four NABCO systems for use.

111. The NABCO test report is titled "15-pound C-4 (6.8kg C-4) Testing for the NABCO 64 Self Closing System (64-SCS) and Gas Tight System (64-SCS-GT)". The report was published May 2010 and contains data for both the Self Closing System and the Self Closing Gas Tight System (used for Chemical and Biological devices). There is no difference between the systems regarding load capacities.

112. The 64-SCS is designed for repeated detonations of 15-pounds C-4 equivalent explosive material. C-4 is a high quality, military plastic explosive and in their test methodology NABCO utilizes a relative effectiveness factor (Re Factor) of 1.28 for C-4 for their calculation to TNT equivalency. The RE factor for TNT is 1. See Figure 16.

> The 64-SCS (GT) testing verified that the unit can successfully contain multiple detonations up to and including the design repeated charge weight of 15-lb_{C-4} (6.8-kg_{C-4}). The blast and thermal atmosphere was contained sufficiently to establish a reasonable safe standoff distance. All secondary fragments were contained within the vessel.
>
> The 64-SCS (GT) vessel experienced no permanent deformations or large strains. The door opening and closing was completely operable following each detonation. The vessel performed normally and experienced no failures or complications during the testing.

Figure 16: Conclusions from the NABCO test report appearing on page 37 of that document.

113. The DDESB imposed an allowable rated capacity for the 64-SCS of 15 pounds of C-4 explosives (19.20 Lbs. TNT equivalent). This rated capacity can be found in the conclusion from the DDESB memo on the subject, "Approval of Four NABCO Incorporated Total Containment Systems: Models 64-SCS, 64-SCS-GT, 42-SCS, and 42-SCS-GT. This rated capacity appears on page 4 of the document. The Figure 17:

> weight (NEW) of C-4 explosives (or TNT equivalent material of 12.8 pounds), and the allowable rated capacity for the NABCO 64-SCS and 64-SCS-GT is 15 lbs NEW of C-4 explosives (or TNT equivalent material of 19.20 lbs). Based on the results of testing, the associated exclusion distance is 5 feet (ft) for all variants of the NABCO 42 and 64, when the doors are secured.

Figure 17: Screen capture showing the rated capacity found in the DDESB memo.

114. During the investigation a performance matrix from the NABCO Model 64-GT-SCS was reviewed. This matrix provides, "Performance guidelines to consider for a Total Containment Vessel". The matrix notes the NABCO TCV has been designed for a one-time containment rating of 26 pounds of C-4 explosives (33.28 Lbs. TNT equivalent). The non-linear, dynamic analysis referenced as the validation for the 26-pound rating in the matrix is a computer simulation. No physical testing was performed to confirm the unit's ability to contain a 26 pound C-4 charge. Additionally, the matrix notes the TCV unit was tested to failure at 40 pounds C-4 (51.2 Lbs. TNT equivalent). The matrix indicates this failure test was, "above the rated containment capacity to validate safety factors". See Figure 18.

MODEL 64-GT-SCS SPECIFICATIONS

The matrix below provides performance guidelines to consider for a Total Containment Vessel. These standards are rated as the most important by our end users. The far left column lists some fundamental standards that every TCV should have. The middle column provides some tips for determining the validity of a company's claims to meet those standards. The far right column explains how NABCO meets or exceeds those standards and testing requirements.

Performance Standard	Validation Certification	NABCO TCV Performance/Capability
Repeatable Blast Containment Capacity	▪ Repeat capacity to withstand at least 5 full rated [15-pounds (6.8-kg) C-4], consecutive, repeat detonations	▪ **15 pounds (6.8 kg) C-4 Repeatable 15X Blast Containment Capacity** In addition to the single full capacity detonation that every TCV unit is subjected to by NABCO before shipment, a single NABCO 64-GT-SCS unit has been independently tested for structural performance 15 consecutive times to the maximum repeatable design charge weight of 15-pounds (6.8-kg) C-4.
Gas-Tight Blast Containment Capacity & Testing Protocol	▪ Gas tight at maximum repeat charge capacity [15-pounds (6.8-kg) C-4]and remain sealed indefinitely following a detonation Testing using (i) thermal and pressure resistant tracer gas (i.e., helium), parts per million detection equipment and a secondary enclosure to increase detection fidelity, and (ii) measurement of the tracer gas before and after detonation	▪ **15 pounds (6.8 kg) C-4 Gas-Tight Containment Capacity** ▪ **Independently tested using a thermal and pressure resistant tracer gas** Testing performed using helium with parts per million detection equipment and a secondary enclosure to increase detection fidelity ▪ **Testing included measurement of tracer gas before and after detonation** ▪ **Tested for extended periods of time following a detonation to verify system can remain sealed indefinitely** A single NABCO TCV unit has been independently tested 8 times to qualitatively establish the gas-tight performance and ability to remain sealed; this testing also included verification of structural performance. A third party test report to validate sealed design capacity is available.
One-Time Blast Containment Capacity	▪ 26-pound (11.8-kg) maximum capacity rating for a one time detonation validated by non-linear, dynamic analysis	▪ **26 pounds (11.8 kg) C-4 One-Time Blast Capacity** NABCO TCV has been designed for a one-time containment rating of 26-pounds (11.8-kg) of C-4 explosives (may require maintenance post detonation). Non-linear, dynamic analysis report is available.
Maximum Blast Testing	▪ R&D testing above the rated containment capacity to validate safety factors	▪ **TCV unit tested to failure at 40 pounds (18.1 kg) C-4** NAVEODTECH, after conducting a 20-pound (9.1-kg) C-4 explosive detonation test and a 30-pound (13.6-kg) C-4 detonation test on the original NABCO TCV design, tested the same unit to rupture at 40-pounds (18.1-kg) C-4 explosives. ▪ **This is the only unit that has been tested to failure (as noted in DDESB's approval of the NABCO 42 and 64-GT-SCS).**
	▪ Testing with a wide variety of devices and charge	

Figure 18: Screen capture of the top section of the NABCO performance matrix.

115. The NABCO test report titled "15-pound C-4(6.8kg C-4) Testing for the NABCO 64 Self Closing System (64-SCS) and Gas Tight System (64-SCS-GT)" also states the single detonation rating for the 64-SCS is greater than 25 pounds of C-4 (32 Lbs. TNT equivalent). See Figure 19.

2.2.1 Explosive Charges

During the testing, C-4 explosive material was used for the internal detonations. C-4 is a high quality, military plastic explosive. For the purpose of this work, the TNT equivalence of C-4 is assumed to be 1.28 based on the average of pressure and impulse equivalencies[1].

Vessels designed for a single detonation such as the NABCO Storage Vessel (SV) units include a 125 percent safety factor as required. Because the 64-SCS is designed for repeated detonations, no safety factor is used for the explosive rating. This vessel is designed for a repeated detonation of 15-lb_{C-4} (6.8-kg_{C-4}). Thus, it can easily sustain 125 percent of the repeated design charge weight. In fact the single detonation rating for the 64-SCS unit is greater than 25-lbs_{C-4} (11.3 - kg_{C-4}).

Figure 19: Screen capture from page 9 of NABCO test report

116. Based on the DDESB and NABCO documents the 64-SCS has an allowable rated capacity of 15 pounds of C-4 (19.2 Lbs. TNT equivalent) for repeated detonations. The 64-SCS is designed/rated for a single detonation of no more than 26 pounds of C-4 (33.28 Lbs. TNT equivalent)

NEW Calculations for Explosives in the TCV on 6/30/21

117. Calculating Net Explosives Weight (N.E.W.) is a methodology utilized by explosives experts, explosives breachers and bomb technicians. To calculate N.E.W. the explosives community utilizes a comparison to TNT which is the standard for all explosives (Relevant Equivalency factor of 1). The first step is to identify the energetic material you are wanting to dispose of then relate the known product to TNT. This is called the Relevant Equivalency factor (RE). The RE factors are industry standard numbers that can be obtained from a variety of sources. One of the common sources, and the source utilized during this investigation, is the ATF EDA application. Once a product is identified the RE factor for that product is then used to determine the products N.E.W.

118. During the investigation by LAPD on 6/30/21, bomb technicians collected, X-rayed, and disassembled two devices. The energetic material was removed from the devices and packaged. The disassembled devices were also packaged. This is done for the preservation of evidence as well as allowing the bomb technicians on scene to determine the type and weight of energetic material inside of each device. The technicians with this data can then apply that known type and weight of the energetic material to the number of like devices. This allows the technicians to have an accurate calculation of the material to be disposed of and allows for an accurate N.E.W. calculation on that material.

119. On 7/2/21 SABT [redacted], EEO [redacted] and TFO [redacted] went to the LAPD Bomb Squad HQ, 2029 West Main Street, LA, to examine and weigh the two devices LAPD collected and disassembled at the scene of the explosion that occurred on 6/30/21 at 716 E 27th Street. The items are described as follows:

- Item 001, M style device, measured 5” long X 2 ½” across, cardboard tube with fuse, weighed 4 oz., suspected explosive filler weighed 4.94 ounces.

- Item 002, M style device, measured 4” long X 1” across, cardboard tube with fuse, weighed 1 ounce, suspected explosive filler weighed 1.3 ounces.

120. Through interviews and reviewing photographs, at least 40 of the large devices, identified above as Item 001, were placed into the disposal shot. The number of large devices ranged from 40 to 45 in the interviews conducted with bomb squad personnel. Photographs show 41 large devices. One device was disassembled and used for lab testing, leaving 40 large devices. Therefore, 40 was the number used to estimate the N.E.W. below.

121. In an interview with Arturo CEJA, he stated he paid $2 for the large devices and $0.50 for the small devices. There were $250 worth of devices according to CEJA. Based on the statements of the bomb squad personnel and the photos described above, this indicates there were approximately 50 large devices and approximately 300 small devices.

122. Through interviews approximately 280 of the small devices, identified above as Item 002, were placed into the disposal shot. The number of small devices ranged from 200 to 280 to 282 in the interviews conducted with bomb squad personnel. CEJA’s statement indicates approximately 300 small devices were purchased. Therefore, 280 was the number used to estimate the N.E.W. below.

123. There were also triangle shaped tri fold flash powder crackers, red colored flash powder devices, large M style devices labeled “Pyro Addicts”, and what appeared to be a 3” aerial shell wrapped in foil with a visible fuse in the disposal shot. These items were not included in the N.E.W. calculations because the amount of explosive filler contained in each type of item was unknown.

124. The information below is an estimate of the total N.E.W. (weight of the product to be disposed plus the weight of the counter charge) for the disposal shot from the operation on 6/30/21. Investigators used the data from the devices that were cut open and weighed and the counter charge to estimate the total N.E.W. of the disposal shot in the TCV identified as NABCO, Model# 64 SCS, SN# 6414-06. The ATF EDA application was used to gain RE factors.

Counter Charge

125. On 7/2/21 SABT [redacted] and EEO [redacted] spoke with LAPD bomb squad logistics Officer [redacted] and reviewed the explosives control log from the LAPD Bomb Squad Truck with Officer [redacted]. During this meeting Officer [redacted] explained that on the night of the incident the bomb technicians pulled 9.4 Lbs. gross weight of C2 sheet explosive on the roll and 0.7 Lbs. gross weight of 50 grain det cord for the counter charge. This gross weight of det cord is not a good measurement to use for N.E.W calculations. The Gross weight of the C2 included the cardboard tube the sheet explosive is rolled around for storage and transportation. The roll was recovered at the scene and weighed .35 Lbs. The net weight of C2 used was 9.05 Lbs.

- 9.05 Lbs. of C2 sheet, using an RE factor of 1.27 gives a N.E.W. of 11.494 Lbs. TNT equivalent.
- During an interview with LAPD Bomb Technician [redacted] on 7/2/21 she told investigators that she estimated that she used approximately 30’ of 50 grain det cord.
- 30’ of 50 grain det cord, contains approximately 1500 grains = 97 grams = .214 Lbs. of PETN, using a RE factor of 1.27 gives a N.E.W. of 0.272 Lbs. TNT equivalent.
- Total estimated N.E.W for the counter charge used on 6/30/21 is 11.77 Lbs. TNT equivalent.

Disposal Product

- 40 devices described as Item 001 contained 197.6 ounces of flash powder each = 12.35 Lbs. of flash powder, using an RE factor of .8 (the lowest RE for flash powder) gives a N.E.W. of 9.88 Lbs. TNT equivalent.
- 280 devices described as Item 002 contained 364 ounces of flash powder each = 22.75 Lbs. of flash powder, using an RE factor of .8 gives a N.E.W. of 18.2 Lbs. TNT equivalent.
- The estimated N.E.W for the disposal product is 28.08 Lbs. TNT equivalent.

126. Total estimated N.E.W. for the disposal shot, which includes the disposal product and counter charge, is 39.85 Lbs. TNT equivalent.

Conclusion Related to the N.E.W. Calculations

127. Therefore, the hypothesis of overloading the TCV could not be disproven. This is based on:
   a. The N.E.W. calculations for the disposal shot exceeded both the repeated and the single detonation rated capacity of the TCV.
   b. The results of the metallurgical exam showed the failure of the flanged collars on the threaded rod which held the yokes in place on the door of the subject TCV was a onetime overload event.

EVIDENCE:

128. The scene was documented via photographs, videos, measurements using a Total Station, and laser scanning. All files were included in evidence on the master hard drive.

129. The following items of evidence were taken into custody by ATF:

Items 1-4 and 7-18 are explosives related samples.
Items 5 and 6 are samples of debris from inside the TCV after the explosion.
Items 19-40 are TCV components
Items 41-51 are items related to the federal search warrant conducted tat 716 E. 27th Street.

LABORATORY RESULTS:

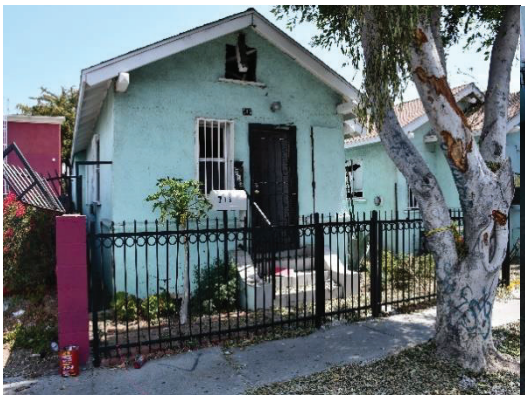
130. Laboratory results showed the powder removed from Item 001 and Item 002, as described in the N.E.W. calculations section, was identified as a perchlorate explosive mixture, commonly known as flash powder. Flash powder is an explosive as defined by ATF.

EXPOSURES:

131. On June 30, 2021 and continuing through July 5, 2021, SA/CFIC [redacted] surveyed an approximate 5,000-foot perimeter surrounding the epicenter for exposures from the blast and observed the following structures and vehicles that sustained damage.

Twenty-six (26) residential structures

Structure Type:	Residence
Address:	713 East 27th Street, Los Angeles, CA
Description:	1,328 square-foot residence
Damage:	Red tagged by Los Angeles Department of Building and Safety. Displaced and fractured walls, broken windows and framing, cracked stucco, and a damaged gas meter





Structure Type: Residence

Address: 715 East 27th Street, Los Angeles, CA

Description: 1,120 square-foot residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Displaced and fractured walls, broken windows and framing, cracked stucco, and a damaged gas meter


Structure Type: Residence

Address: 717 East 27th Street, Los Angeles, CA

Description: 1,215 square-foot residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows, cracked stucco, and a damaged front door

Structure Type: Residence

Address: 725 East 27th Street, Los Angeles, CA

Description: 6,334 square-foot multi-family residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Damaged walls and garage, broken windows, and cracked stucco

Structure Type: Residence

Address: 727 East 27th Street, Los Angeles, CA

Description: 3,750 square-foot multi-family residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows and stucco

Structure Type: Residence

Address: 733 East 27th Street, Los Angeles, CA

Description: 738 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 753 East 27th Street, Los Angeles, CA

Description: 1,824 square-foot residence

Damage: Broken windows, cracked siding and displaced columns

Structure Type: Residence

Address: 752 East 27th Street, Los Angeles, CA

Description: 2,232 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 748 East 27th Street, Los Angeles, CA

Description: 1,534 square-foot residence

Damage: Broken window

Structure Type: Residence

Address: 742 East 27th Street, Los Angeles, CA

Description: 930 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 736 East 27th Street, Los Angeles, CA

Description: 2,192 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 732 East 27th Street, Los Angeles, CA

Description: 1,737 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 726 East 27th Street, Los Angeles, CA

Description: 1,911 square-foot residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows

Structure Type: Residence

Address: 720 East 27th Street, Los Angeles, CA

Description: 1,387 square-foot residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows

Structure Type: Residence

Address: 718 East 27th Street, Los Angeles, CA

Description: 1,270 square-foot residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows, dislodged siding, and damage to the roof. Vehicle: Ford Expedition (CA 6RNX980) in driveway with broken windows

Structure Type: Residence

Address: 716 East 27th Street, Los Angeles, CA

Description: 1,270 square-foot residence

Damage: Broken windows and stucco, and damage to the roof.

Structure Type: Residence

Address: 712 East 27th Street, Los Angeles, CA

Description: 1,262 square-foot residence

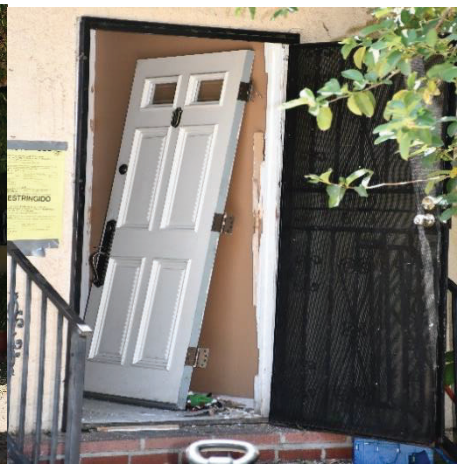
Damage: Red tagged by Los Angeles Department of Building and Safety. Broken windows, damage to wood framing and roof. Vehicles: Ford Focus (CA 6XEP119) and Lincoln Sedan (CA 63780Z1) in driveway with broken windows, large dents and roof damage.


Structure Type: Residence

Address: 706 East 27th Street, Los Angeles, CA

Description: 2,114 square-foot multi-family residence

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows, dislodged door, and damage to the roof. Vehicle: Chevrolet Suburban (CA 4DQE643) in driveway with broken windows

Structure Type: Residence

Address: 912 1/2 East Adams Boulevard, Los Angeles, CA

Description: 1,882 square-foot residence

Damage: Damage to wall, roof, and trees

Structure Type: Residence

Address: 801 East 27th Street, Los Angeles, CA

Description: 1,344 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 2612 Stanford Avenue, Los Angeles, CA

Description: 600 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 750 East Adams Boulevard, Los Angeles, CA

Description: 2,874 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 747 East Adams Boulevard, Los Angeles, CA

Description: 2,853 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 665 East Adams Boulevard, Los Angeles, CA

Description: 1,972 square-foot residence

Damage: Broken windows

Structure Type: Residence

Address: 2615 South San Pedro Street, Los Angeles, CA

Description: Multiple unit apartment residence

Damage: Broken windows

Structure Type: Residence

Address: 2617 South San Pedro Street, Los Angeles, CA

Description: Multiple unit apartment residence

Damage: Broken windows

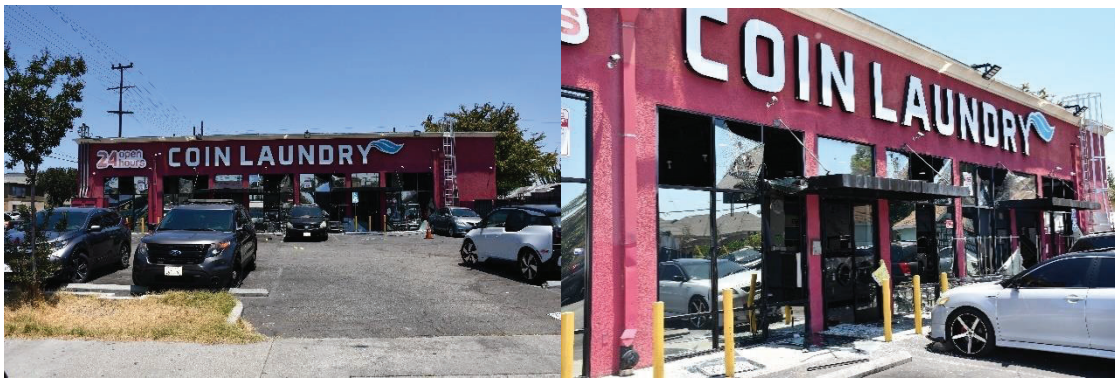
Nine (9) commercial businesses

Structure Type: Commercial business

Address: 2616 South San Pedro Street, Los Angeles, CA

Description: Coin Laundry

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Broken windows and damaged door



Structure Type: Commercial business

Address: 2700 South San Pedro Street, Los Angeles

Description: Lilly's Beauty Salon & Supplies

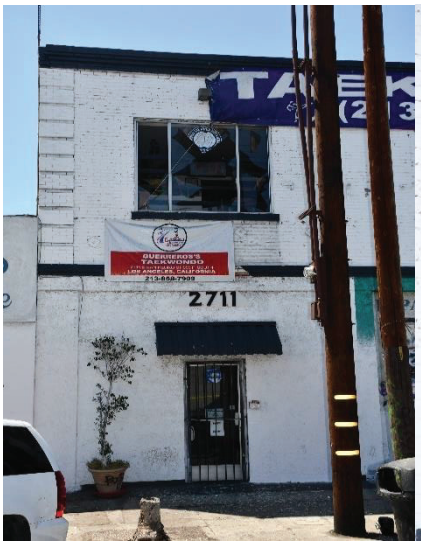
Damage: Damage to rolling gate and windows

Structure Type: Commercial business

Address: 2711 South San Pedro Street, Los Angeles

Description: Guerrero's Taekwondo

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Damage to windows



Structure Type: Commercial business

Address: 2709 South San Pedro Street, Los Angeles

Description: Garcia's Appliances

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Damage to windows

Structure Type: Commercial business

Address: 2703 South San Pedro Street, Los Angeles

Description: Maquinsa Sewing Machines

Damage: Yellow tagged by Los Angeles Department of Building and Safety. Damage to windows

Structure Type: Commercial business

Address: 2701 South San Pedro Street, Los Angeles

Description: New California Sewing Machine

Damage: Damage to windows

Structure Type: Commercial business

Address: 2623 South San Pedro Street, Los Angeles

Description: Mexicali Liquor Market

Damage: Damage to windows

Structure Type: Commercial business

Address: 2601 South San Pedro Street, Los Angeles

Description: Panaderia y Pasteleria (Bakery)

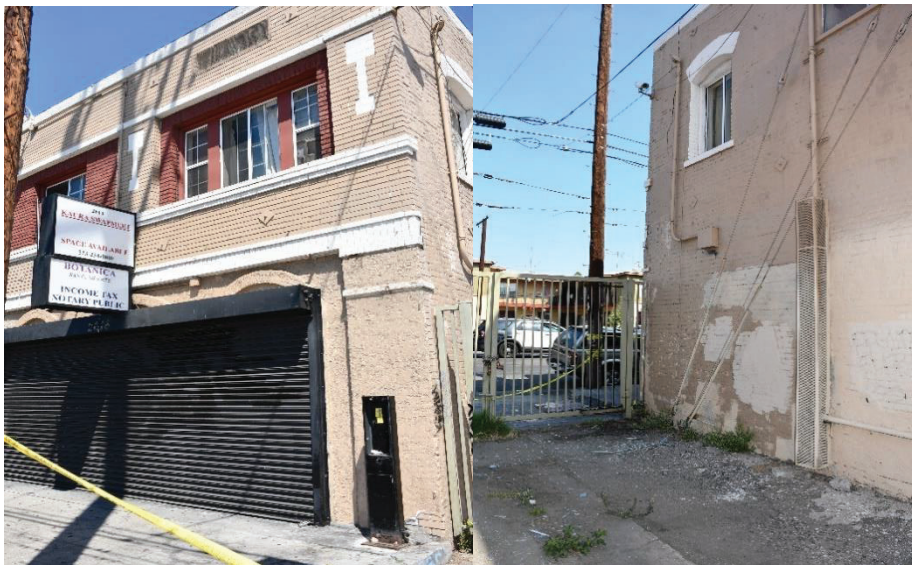
Damage: Damage to windows

Structure Type: Commercial business

Address: 2614 South San Pedro Street, Los Angeles

Description: Kaura Swapmeet

Damage: Damage to windows



Thirty-two (32) vehicles

Vehicle Description	Color	CA License Plate	Location	Damages
Nissan Titan Pickup Truck	Red	7Z04394	736 E. 27th Street (southside curb)	Driver's side body damage
Mitsubishi Lancer 4-door Sedan	Red	7BUP303	732 E. 27th Street (southside curb)	Body damage rear bumper, shattered rear window, scratches on driver's side
Toyota 4-Runner SUV	Dark green	4USK906	726 E. 27th Street (southside curb)	Superficial scratches
GMC Yukon SUV	White	4SYN814	720 E. 27th Street (southside curb)	Scratches near rear bumper
Toyota Tacoma Pickup Truck	Gray	18610W2	718 E. 27th Street (southside curb)	Body damage to driver's side
Honda Civic	Dark blue	8SXJ177	716 E. 27th Street (southside curb)	Extensive damage – shattered windows and body damage

Ford Windstar Mini Van	Green	7PAZ779	712 E. 27th Street (southside curb)	Extensive damage – shattered windows and body damage
Honda Accord	Blue	2MQC181	712 E. 27th Street (southside curb)	Extensive damage – rolled on side, frame deformed
Chevrolet Pickup Truck	Gray	32252B3	706 E. 27th Street (southside curb)	Passenger side body damage and shattered front windshield
Ford Pickup Truck	White	7A15372	706 E. 27th Street (southside curb)	Body damage on both sides
Ford Explorer SUV	Black	7XQD607	713 E. 27th Street (northside curb)	Scratches to rear bumper
Toyota Highlander SUV	Gray	8HGX507	717 E. 27th Street (northside curb)	Shattered front windshield, body damage on all sides
LAPD Ford Explorer	Black/white	1439240	717 E. 27th Street (northside curb)	Shattered back windows, body damage, airbags deployed
Ford F350 Pickup	White	1348378	725 E. 27th Street (northside curb)	Covered with debris and body damage to roof
Nissan NV3500 Passenger Van	Blue	90797M1	725 E. 27th Street (northside curb)	Covered in debris, body damage to both sides
Dodge Grand Caravan	Red	S490H0	733 E. 27th Street (northside curb)	Body damage to front bumper and hood area
Honda 4-door Sedan	Black	7PDM346	2622 San Pedro Street (northside of lot)	Body damage to rear bumper
Toyota Camry	Gray	5VFV216	2622 San Pedro Street (northside of lot)	Rear and passenger side body damage
Nissan Mini Van	Black	7UXN546	2622 San Pedro Street (northside of lot)	Shattered front windshield, body damage to driver's
LAPD BMW i3	Black/white	1602924	2622 San Pedro Street (southside of lot)	Shattered windows
Ford Explorer SUV	Gray	1461351	2622 San Pedro Street (southside of lot)	Scratches and body damage on passenger side
Honda CRV	Gray	8ABV102	2622 San Pedro Street (southside of lot)	Scratches to front end
Chevrolet 2500 HD Truck	White	8L73161	2622 San Pedro Street (southside of lot)	Scratches to rear
Scion XB	Gray	5XAD256	2709 San Pedro Street (westside curb)	Front bumper dislodged/rear bumper cracked
Toyota Camry	Black	6JOE169	2707 San Pedro Street (westside curb)	Scratches left rear quarter panel
Honda Accord	Gray	7LEX870	2615 San Pedro Street (westside curb)	Scratches on hood

Dodge Grand Caravan	Gray	7NEW399	2615 San Pedro Street (westside curb)	Scratches and dislodged right rear quarter panel and scratches on bumper
Kia Forte	Blue	8TKC948	2607 San Pedro Street (westside curb)	Right taillight dislodged and scratched
Nissan Frontier	Gray	6F38061	2614 San Pedro Street (east side curb)	Scratches on left rear; front bumper damage
Toyota Previa	Blue	3BAV130	2614 San Pedro Street (east side curb)	Dents on front left corner
Kia Forte	White	7VCD499	2616 San Pedro Street (east side curb)	Scratches to right side mirror cap
Toyota T100	White	8F78134	660 E. 27th Street (North side curb)	Scratches on all sides; flat left rear tire

NUMBER OF FATALITIES AND / OR INJURIES:

132. A total of 27 people were injured because of the explosion. There were 18 civilians, 8 LAPD officers and 1 ATF Agent injured.

Civilians Injured

[redacted] – 712 E. 27th St, LA CA 90011

[redacted] – 720 E. 27th St, LA CA 90011 (323) 215-8344

[redacted] – 23130 Hatteras Ave, Woodland Hills, CA 91367

[redacted] -716 E. 27th St, LA CA 90011

[redacted] - 912 ½ Adams Bl, LA, CA 90011

[redacted] – 712 E. 27th St, LA CA 90011

[redacted] - 712 E. 27th St, LA CA 90011

[redacted] - 712 E. 27th St, LA CA 90011

[redacted] - 725 E. 27th St, LA CA 90011

[redacted] – 715 E. 27th St, LA CA 90011

[redacted] - 715 E. 27th St, LA CA 90011

[redacted] -715 E. 27th St, LA CA 90011

[redacted] – 2700 S. San Pedro St. LA CA 90011

[redacted] - 715 E. 27th St, LA CA 90011

[redacted] – 2703 S. San Pedro St. LA CA 90011

[redacted] - 712 E. 27th St, LA CA 90011

[redacted] - 712 E. 27th St, LA CA 90011

[redacted] - 715 E. 27th St, LA CA 90011

LAPD Injured

[redacted]

ATF Injured

[redacted]

ESTIMATED VALUE OF LOSS:

133. Based on the damage to the affected vehicle as well as the surrounding residences and vehicles, the estimated damages are more than one million dollars.

CONCLUSION:

134. Based on the systematic explosion scene examination and analysis of witness statements and electronic data, it was the combined opinion of the investigators that the explosion occurred within the LAPD TCV.

135. During the disposal operation conducted on 6/30/21, more than 39.85 Lbs. TNT equivalent of explosive material were placed in the TCV. NABCO, the manufacturer of the TCV, states the TCV is designed/rated for a single detonation of no more than 26 pounds of C-4 (33.28 Lbs. TNT equivalent).

136. This inadvertent overloading of the TCV with more explosives than the TCV was designed to hold was the cause of the failure of the TCV that occurred on 6/30/21.

137. The failure of the TCV allowed pressure inside to the vessel to be released rapidly instead of in a controlled manner as designed. This rapid release of gas pressure caused significant damage to the TCV and the surrounding area.

138. Investigators have classified the explosion as ACCIDENTAL.

139. This report was authored by an ATF SA/CFI/CES in conjunction with other members of the ATF National Response Team.

DISPOSITION:

140. The investigation will remain open. The National Center for Explosives Training and Research (NCETR) will issue a technical review of the incident.

ATTACHMENTS:

1) ATF Lab Report 2021-A-000158
2) Metallurgical report authored by [redacted], dated 8/23/21
3) Forensic map and table of distances for evidence items

U. S. Department of Justice

BUREAU OF ALCOHOL, TOBACCO, FIREARMS AND EXPLOSIVES
Forensic Science Laboratory – Atlanta
2600 Century Parkway
Atlanta, GA 30345
Phone: (404) 315-4600

Laboratory Report

ANAB ISO/IEC 17025:2017 Accredited
Forensic Testing Laboratory

Special Agent [redacted]
Bureau of Alcohol, Tobacco, Firearms and Explosives
550 N. Brand Boulevard
Suite 800
Glendale, CA 91203

Date of Report: 8/3/2021
Case Number: 2021-A-000158
Submission(s): 1,2
Reference: 784020-21-0014
Title: 716 E 27th Street Explosion
Type of Exam: Explosives

Exhibits 1 through 6 were received by the laboratory on July 7, 2021.
Exhibit 7 was received by the laboratory on July 9, 2021.

EXHIBITS

Lab # – Agency #
1 - (S1) Powder
2 - (S2) Fuse
3 - (S3) Powder
4 - (S4) Fuse
5 - (5) Debris
6 - (6) Debris
7 - (13) Cardboard tube

EXAMINATION/ANALYSIS AND INTERPRETATION OF RESULTS

This report refers to exhibits by Lab Number. The following results only apply to the items tested.

Exhibits 1 and 3 contained gray powder that was identified as a perchlorate explosive mixture, commonly known as flash powder.

Exhibit 2 contained a functional brown (with white and red fibers) pyrotechnic fuse that measured approximately ¼ inch in diameter.

Exhibit 4 contained a functional green pyrotechnic fuse that measured approximately ⅛ inches in diameter.

Exhibit 7 contained a cardboard tube that measured approximately 4 inches in length and 1¼ inches in diameter. A functional green pyrotechnic fuse, measuring approximately 3 inches in length and ⅛ inch in diameter, protruded from a solid material plug in one end of the tube. The other end of the tube had a red plastic plug (that had been removed from the tube). The tube contained a sample of gray powder that was identified as a perchlorate explosive mixture, commonly known as flash powder.

Exhibits 5 and 6 have not been analyzed. These analyses will occur at a later date, and a supplemental report will be generated.

DISPOSITION OF EVIDENCE

The excess powder in Exhibits 1, 3, and 7 will be destroyed in the laboratory. Exhibits 5 and 6 will remain in the laboratory pending testing. The remaining evidence and evidence packaging will be returned to Special Agent [redacted].

[redacted]
Forensic Chemist

REVIEWED BY
[redacted]

[redacted]
Section Chief

TESTS PERFORMED

Exhibit ID	Analysis
1	Ignition susceptibility test, Scanning electron microscopy-energy dispersive spectroscopy, Visual examination, X-ray diffraction
2	Ignition susceptibility test, Scanning electron microscopy-energy dispersive spectroscopy, Visual examination, X-ray diffraction
3	Ignition susceptibility test, Scanning electron microscopy-energy dispersive spectroscopy, Visual examination, X-ray diffraction
4	Ignition susceptibility test, Scanning electron microscopy-energy dispersive spectroscopy, Visual examination, X-ray diffraction
5	No analysis
6	No analysis
7	Ignition susceptibility test, Scanning electron microscopy-energy dispersive spectroscopy, Visual examination, X-ray diffraction

CRAIG CLAUSER ENGINEERING CONSULTING, INC.

August 23, 2021

Mr. [redacted]
Special Agent/ CFI
ATF - National Response Team
Fire Investigation and Arson Enforcement

RE: NRT 21-11 Los Angeles, CA - TCV Failure Analysis
File C21062

Dear Mr. [redacted]:

At your request I made an investigation to determine if the flanged collars on the threaded rods of the subject total containment vessel (TCV) failed suddenly as a onetime overload event or if they failed slowly over time and repeated use.

You shipped the two threaded rod and four flanged collars to me, and I examined them at Micron Inc. in Wilmington, De and had chemical analysis of the rod metal and flanged collar metal performed at Laboratory Testing Inc. in Hatfield, PA.

During my investigation you informed me that damage to the threads on the rods of a second TCV in service with the Los Angeles Police Department (LAPD) had been observed. I travelled to Los Angeles to inspect this damage to determine the nature of the damage and if it provided any insight into the cause of the subject failure. During this visit I was also able to examine the remains of the incident unit.

The components as received are shown in Figure 1.

The upper threaded rod is shown in Figure 2. Figure 3 shows that the bronze threads of the left (driver's) side flanged collar have been shear off and remain in the threads of the steel rod. Figure 4 shows that the right (passenger's) side flanged collar has broken. The flange is broken away from the rest of the collar. The threads that had been inboard of the flange have been sheared off and remain in the mating threads of the steel rod. The threads of the remainder of the collar are still intact and that portion of the collar turns freely on the steel threaded rod. The flanged collar that had been attached to the top of left side yoke (based on site photographs) is shown in Figures 5 and 6. All the threads have been sheared from this collar, the collar has a crack on a radial-axial plane through one of the bolt holes, and a piece of the collar is broken away.

The lower threaded rod is shown in Figure 7. Figure 8 shows that the bronze threads of the left-side flanged collar have been sheared off and remain in the threads of the steel rod. Figure 9 shows that the right-side flanged collar has broken. The flange is broken away from the rest of the collar. The threads that had been inboard of the flange have been shear off and remain in the mating threads of the steel rod. The threads of the remainder of the collar are still intact and that portion of the collar turns freely on the steel threaded rod. The flanged collar that had been attached to the bottom of left side yoke (based on site photographs) is shown in Figures 10 and 11. All the threads have been sheared from this collar and the collar has a crack on a radial-axial plane through one of the bolt holes.

A scene photograph reproduced as Figure 12 shows that the threaded rods remained with the right-side yoke. The scene photographs reproduced as Figures 13 and 14 show that the left-side yoke has separated from the threaded rod and struck an automobile.

As shown in the image of the harden steel insert in the yoke of Figure 15, the clamping surface between the vessel and door flanges and the yoke surface is sloped at approximately 20 degrees from the plane of the door. This results in part of the outward explosion force on the door being directed radially outward against the yokes and part of that load is carried by the flanged collars on the threaded rods.

The threads were sheared from the left side flanged collar by a force pushing the flanged collars on the yoke to the left. This is consistent with an outward force on the yoke from the explosion having caused the failure at this location. However, the failure of the flanged collars on the right-side were caused by outward force (to the right) attempting to pull the collars from the yoke.

Examination of evidence at the ATF Los Angeles facility showed that the vertical columns of the vessel support structure had been bent severely outward by impact from the yokes as they travelled laterally away from the door. This is indicated by the red arrows on Figure 16. The corresponding impact witness marks on the yokes are shown in Figures 17 and 18.

When the flanged collars on the left side yoke failed, the left-side yoke began traveling to the left off the threaded rods and the right-side yoke began traveling to the right with the threaded rods attached. When the right-side yoke struck the support structure column on the right, the yoke was slowed down while the momentum of the threaded rod acted to keep the rods moving to the right. This created the load on the flanged collars that broke collars away from the flanges and sheared the threads under the flanges.

The point of this is that the fracture and failure of the right-side flanged collars was secondary and a consequence of the primary failure of the left-side flanged collars. The failure of the flanged collars on the left-side was what allowed the door to separate from the vessel.

For this reason, the microscopic laboratory exam was focused of the left side failures. Since the failures of the top and bottom left-side flanged collars were virtually identical (the threads were entirely sheared off and the collars fractured longitudinally through a bolt hole) only one flanged collar was subjected to destructive examination.

The top left-side flanged collar is shown in Figure 19. It was sectioned to facilitate direct examination of the longitudinal fracture and to obtain a section through the sheared threads for metallographic examination as shown in Figure 20.

The fracture surfaces indicated by the yellow arrows on Figure 20 are shown in the stereo microscope images of Figure 21. The fracture appears to be a onetime overload fracture starting at the bolt hole in the flange. The black arrows show the fracture propagation direction.

The fracture was examined with the scanning electron microscope (SEM). SEM images obtained at Location 2, 5, and 4 (on Figure 21) are shown in Figures 22 through 33. These images show a mostly brittle, onetime overload fracture morphology. This confirms that the fracture occurred as a onetime, rapid event and that there was no prior slow crack growth.

It was noted that the collars of the broken flanged collars on the right-side still rotated smoothly on the threaded rods. To remove one of these collars and to facilitate cleaning of the threaded rod, a section was cut from the bottom threaded rod as shown in Figure 34.

The removed section of the bottom threaded rod after degreasing is shown in Figure 35. The sheared off collar threads are visible. The distance between where the threads were sheared off is consistent with the yokes having been in the fully closed position when this occurred. The threads which sheared off the left-side flanged collar are shown in Figures 36 and 37. The threads which had sheared off from the flange on the right-side are shown in Figures 38 and 39. This type of shear failure of entire threads does not occur slowly over time; it occurs as a rapid onetime event. The longitudinal break in the threads visible in Figure 37 shows that the longitudinal cracking of the collar occurred slightly before the threads were completely sheared off.

The threads of the collars were highly loaded at the time of this incident. The first threads to fail were on the left-side. As the threads of the collar began to shear over the stronger rod threads a hoop stress was created in the collar which fractured the collar longitudinally starting at a bolt hole.

The portion of the right-side collar that had remained intact is shown in Figures 40 and 41after removal from the threaded rod. The threads are in good condition and undamaged. This shows that the threads of the bronze collars had not worn down in service prior to the subject incident.

A section on a radial-axial plane was cut at the location indicated by the dashed red line on Figure 40 for metallographic examination. This section after mounting, polishing, and etching is shown in Figure 42. The thread profile shows no indication of significant wear. Higher magnification images in Figures 43 and 44 show typical microstructure for C954 cast aluminum bronze.

A section on the radial-axial plane indicated by the red X on Figure 20 was cut for metallographic examination of the sheared threads. This section after mounting, polishing, and etching is shown in Figure 45. Higher magnification images in Figures 46 and 47 show the tearing and shearing of the threads. The general microstructure of this collar is shown in Figures 48 and 49 and is also typical microstructure for C954 cast aluminum bronze.

A radial-axial section through the steel threaded rod after mounting, polishing, and etching is shown in Figure 50. The higher magnification images in Figures 51 and 52 show typical microstructure for quenched and tempered alloy steel.

Samples of a collar and a threaded rod were submitted for chemical analysis. The certified laboratory test report with the results is included as Appendix I. The analysis shows that the collar is type C954 aluminum bronze and that the rod is 4140 alloy steel.

Microhardness testing showed the collars to be an average of Knoop 187 and the steel rod to be an average of Knoop 336. The steel strength is approximately 160 ksi which is about double the strength of the bronze.

These chemistries and strengths are typical of bronze and steel used for this type of threaded drive in which sliding friction is a major concern.

As mentioned above, I traveled to Los Angeles to examine damage to the threaded rods on another LAPD TCV. Photographs of this vessel by others are reproduced as Figures 53 and 54 with the door closed and opened, respectively. The yokes and rods had been removed as shown in Figure 55. After significant effort, a rod was removed as shown in Figure 56 to allow examination of the internal threads of a collar to determine the amount of wear.

The damage to the threads of the steel rod is shown in Figures 57 and 58 (red arrows). This is galling type of damage caused by lubrication failure. It occurs when surfaces of metals that have a high coefficient of friction slide across each other under high load.

When the collar (see Figure 59) was removed it was determined that the collar was steel, not bronze as was the incident collar. Steel on steel is not a good combination for a rod and collar of a threaded drive. The coefficient of friction if lubrication breaks down is very high and galling can occur.

The exemplar vessel was older than the incident vessel. It appears that the manufacturer changed to bronze collars to address this problem.

CONCLUSION

The failure of the flanged collars on the threaded rod which held the yokes in place on the door of the subject TCV was a onetime overload event. The flange collars showed no evidence of prior cracking or any significant wear.

The location of the sheared flanged collar threads on the threaded rods was consistent with the yokes having been fully closed at the time of the incident failure.

This unit had reportedly been used successfully on numerous prior occasions with no damage to the components suggesting that the loading on the flanged collar threads was significantly higher at the time of this incident.

Sincerely,

[redacted]

[redacted], P.E., FASM

FIGURE 1

FIGURE 2

FIGURE 3

FIGURE 4

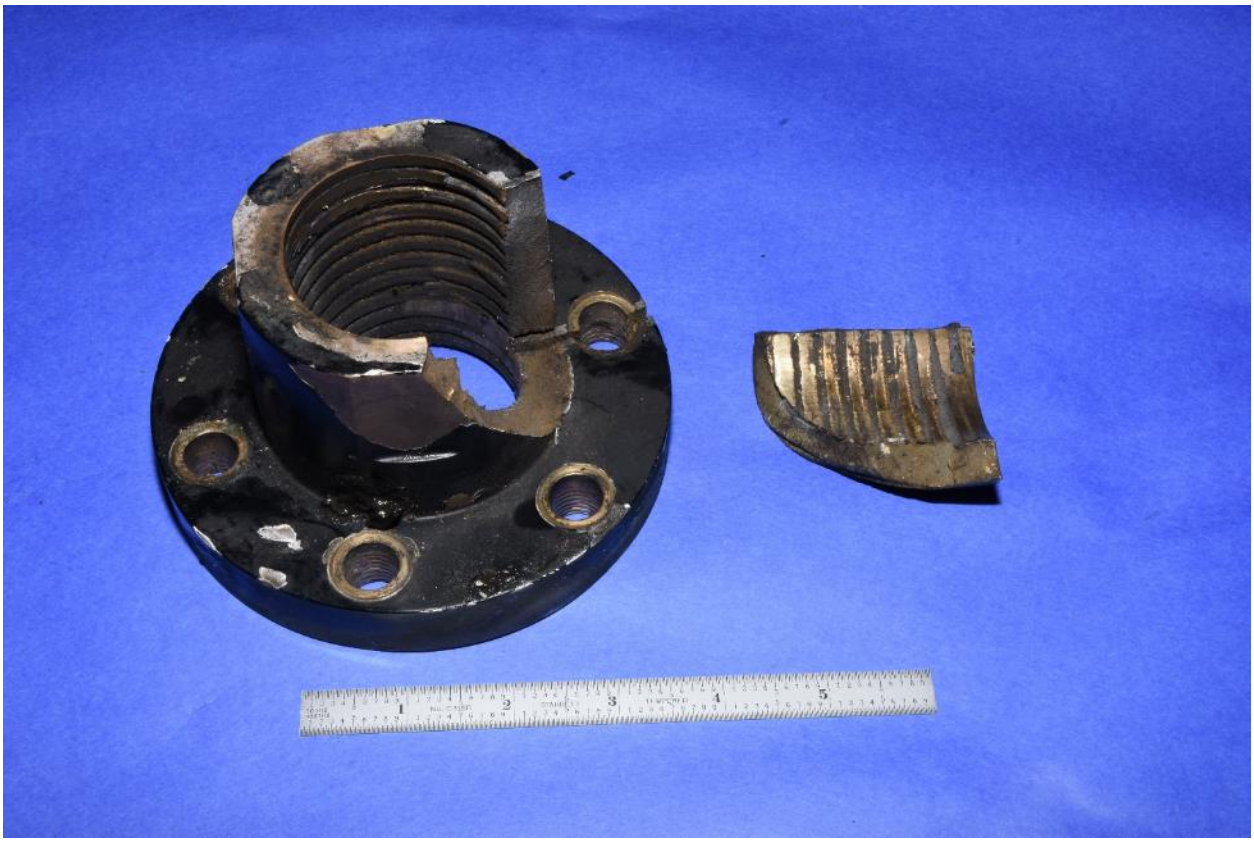


FIGURE 5

FIGURE 6

FIGURE 7

FIGURE 8

FIGURE 9

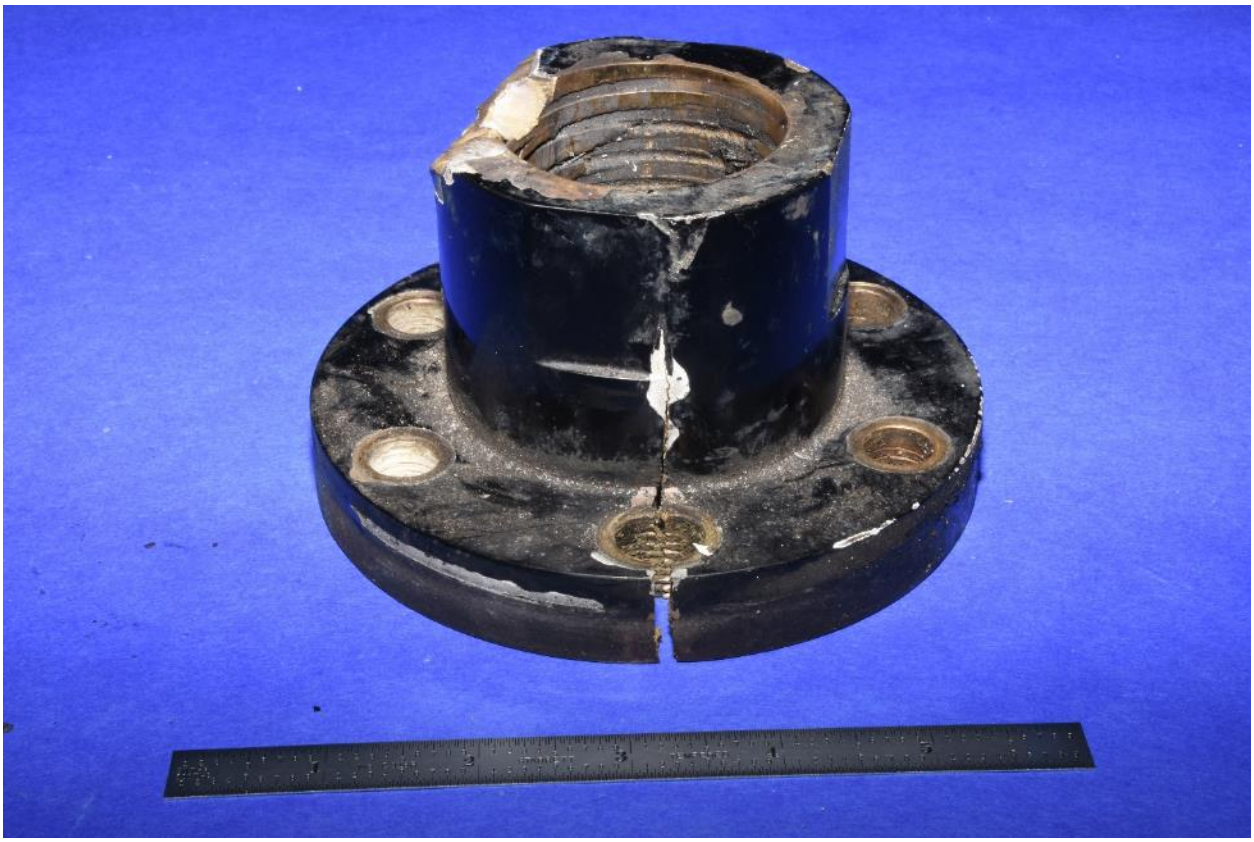


FIGURE 10

FIGURE 11

FIGURE 12

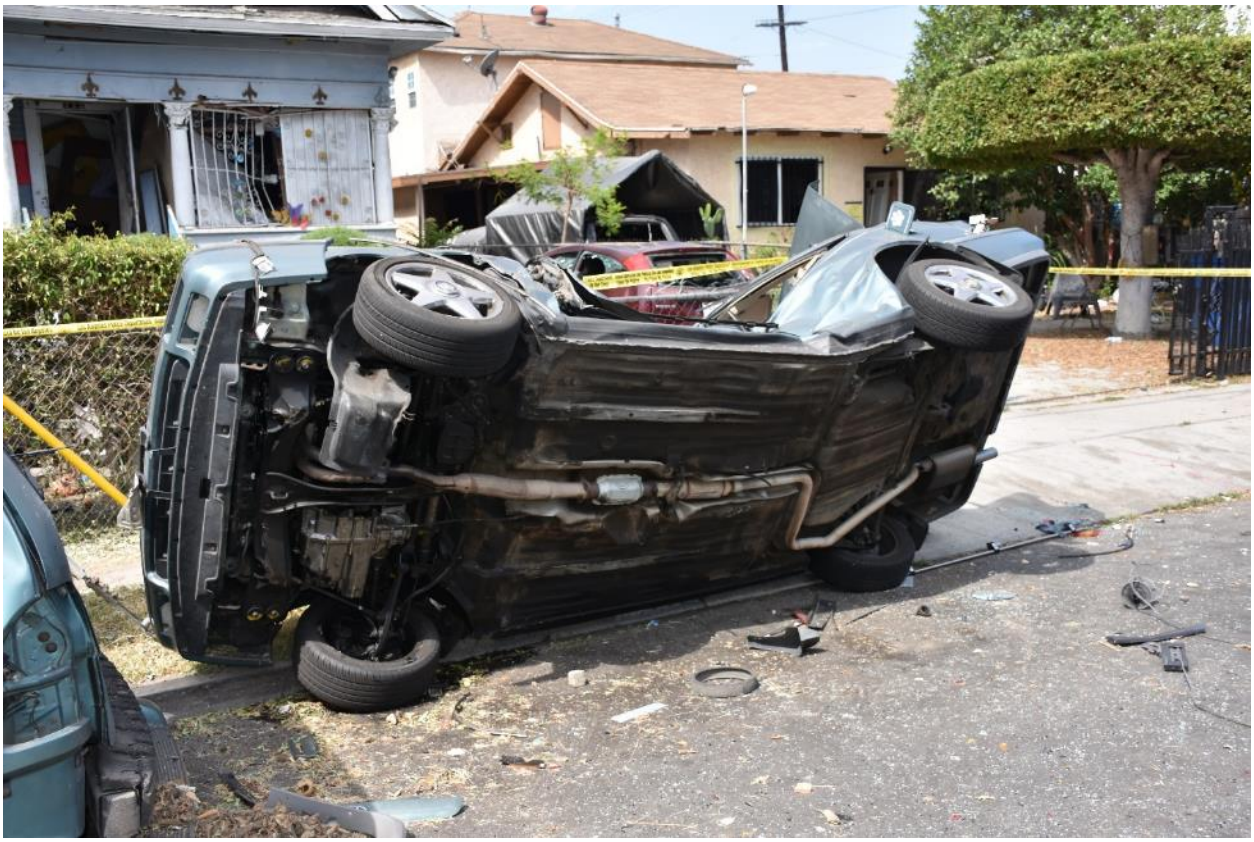


FIGURE 13

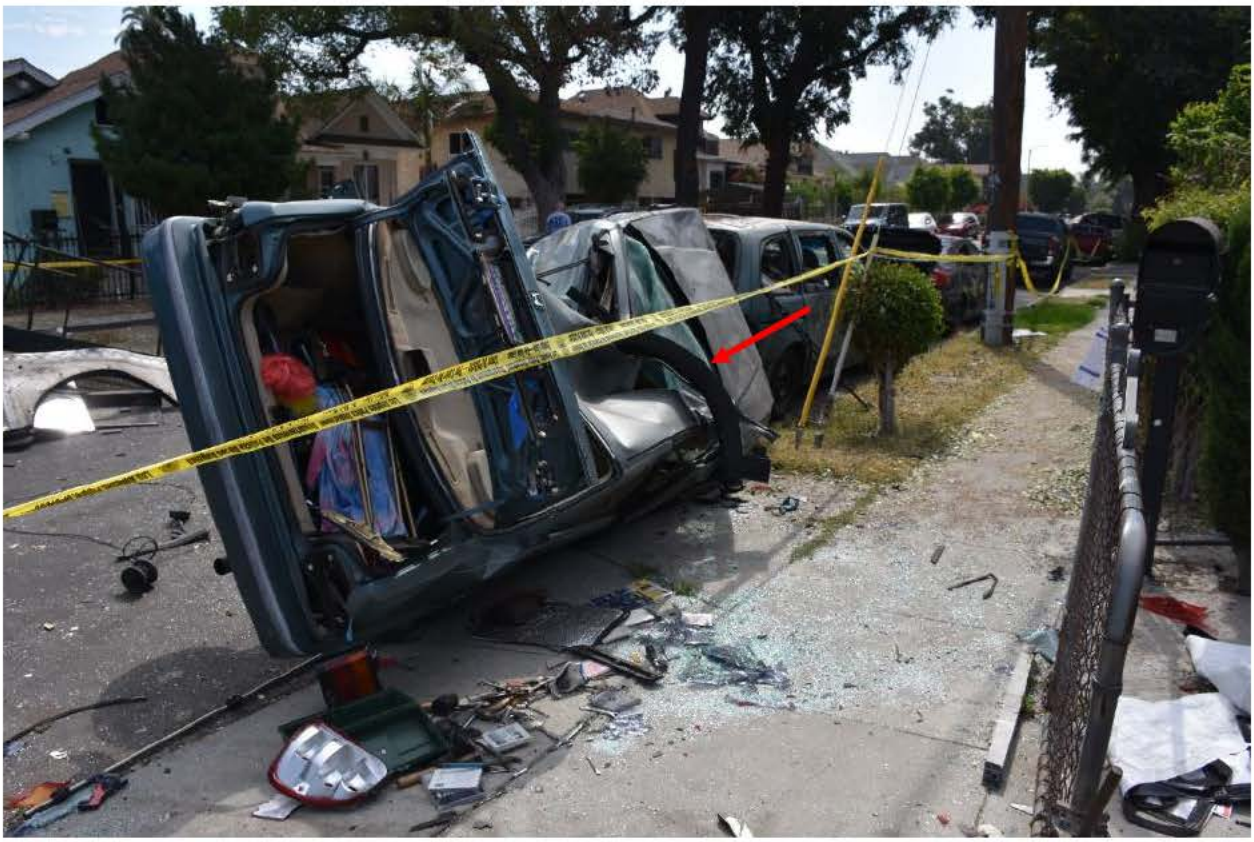


FIGURE 14

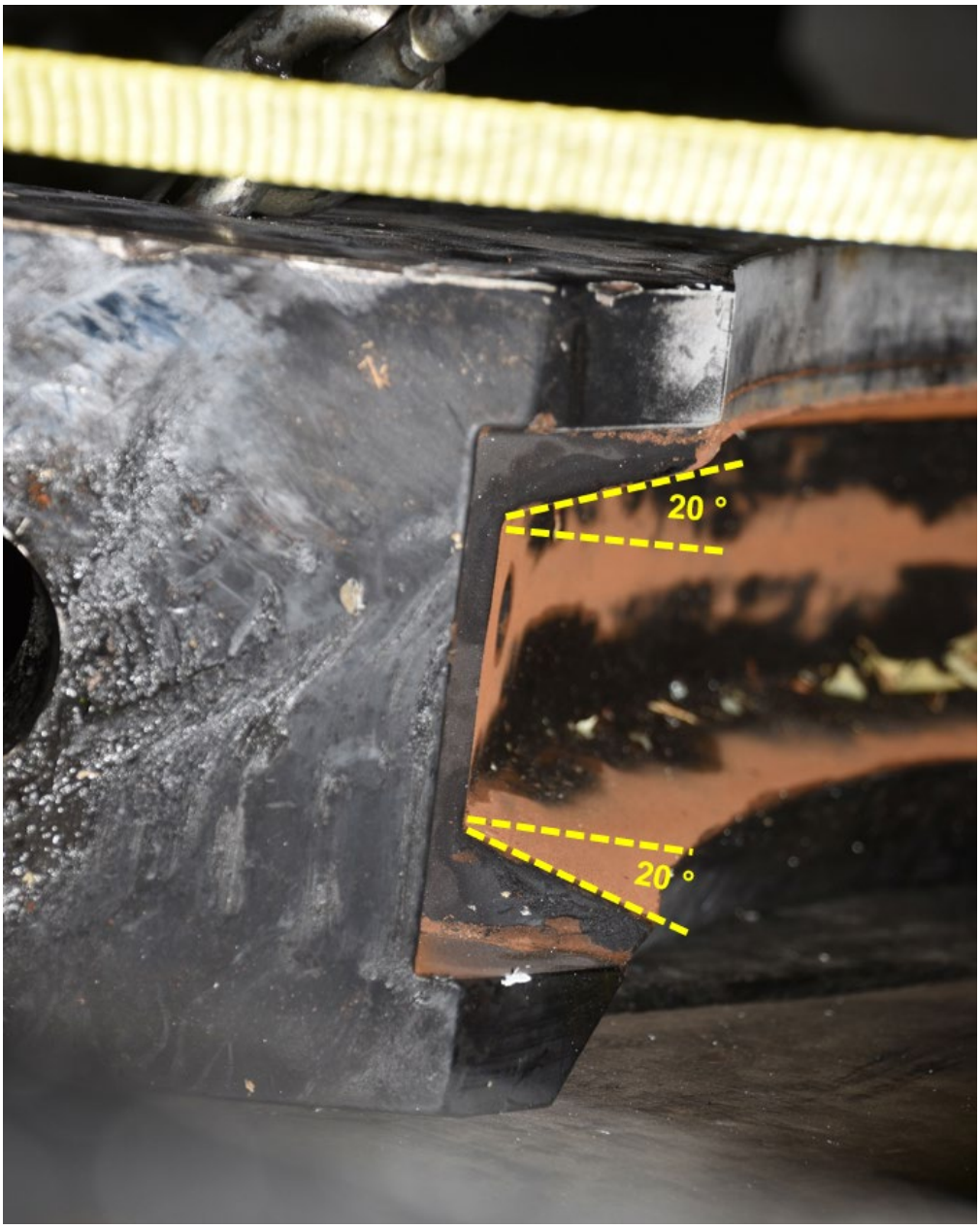


FIGURE 15

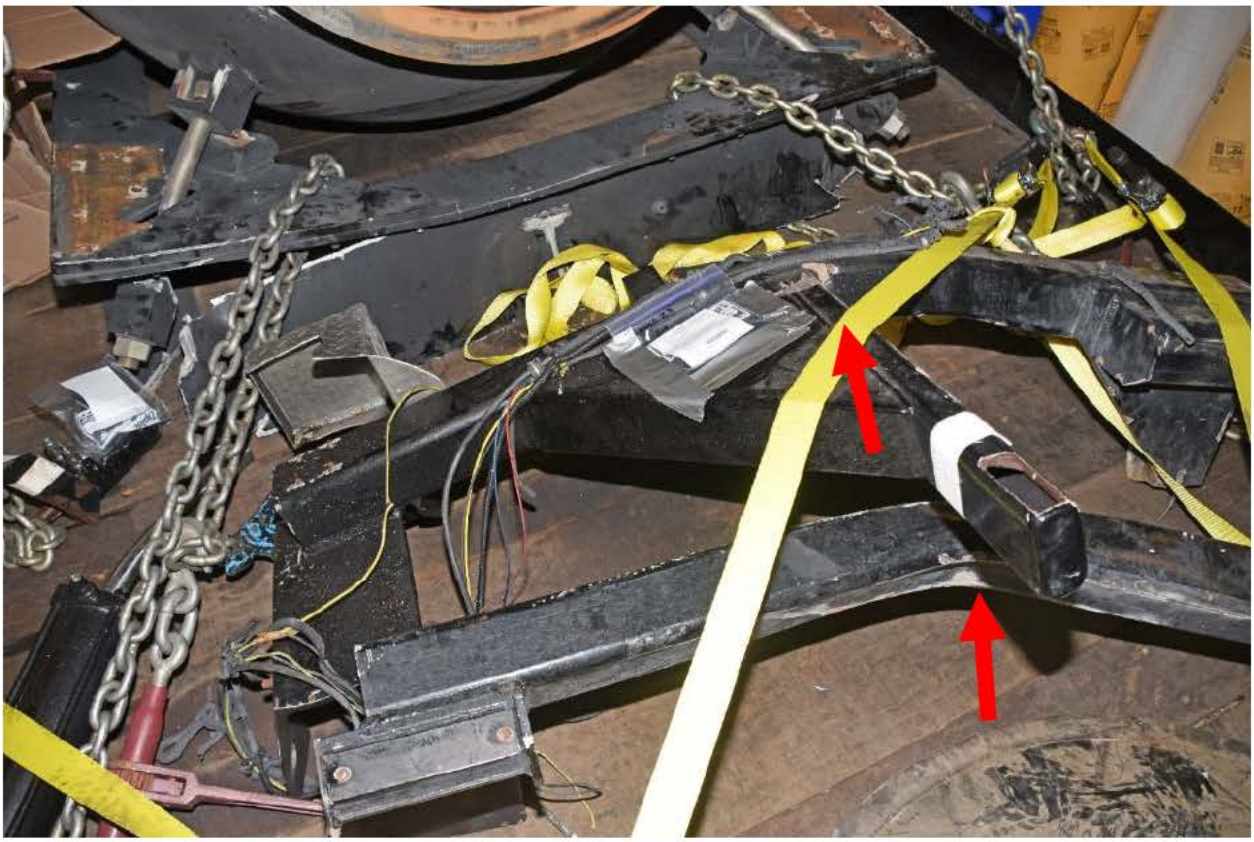


FIGURE 16

FIGURE 17

FIGURE 18

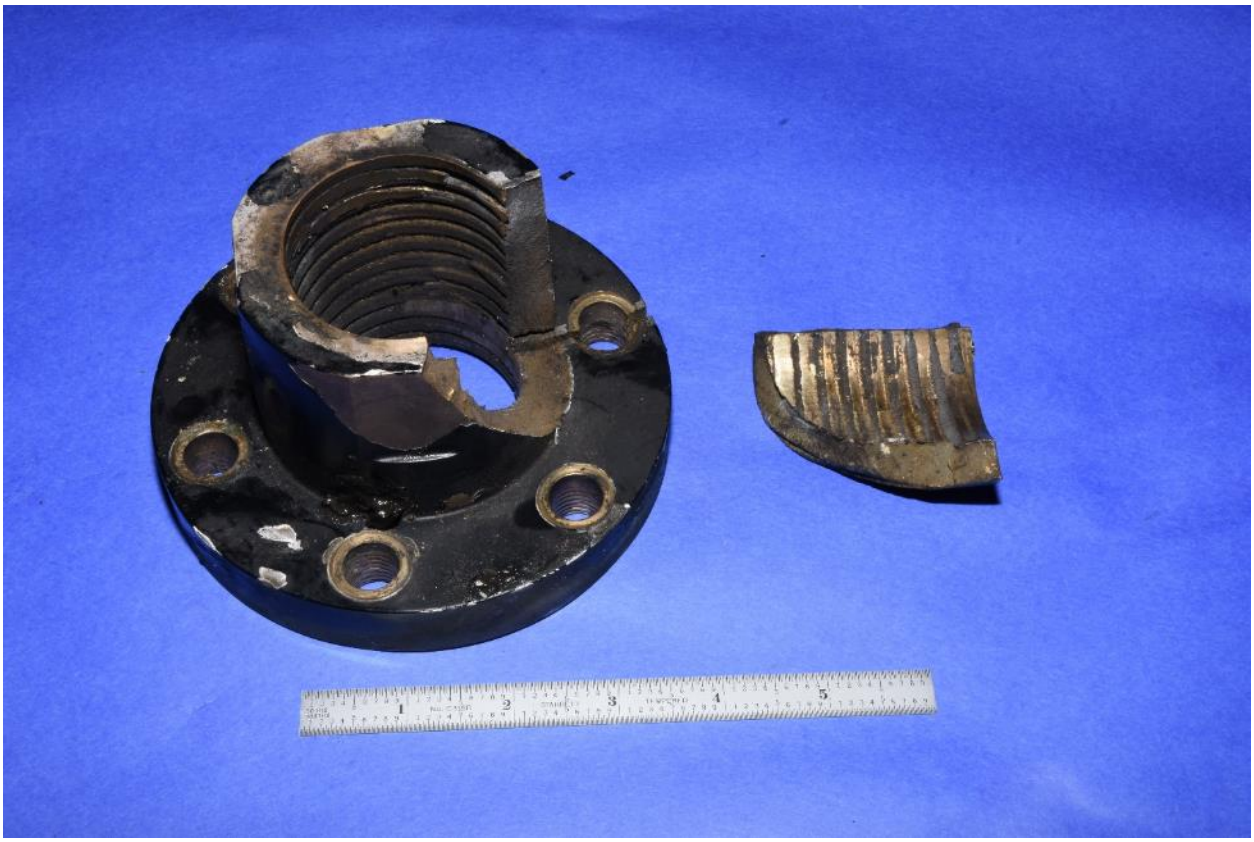
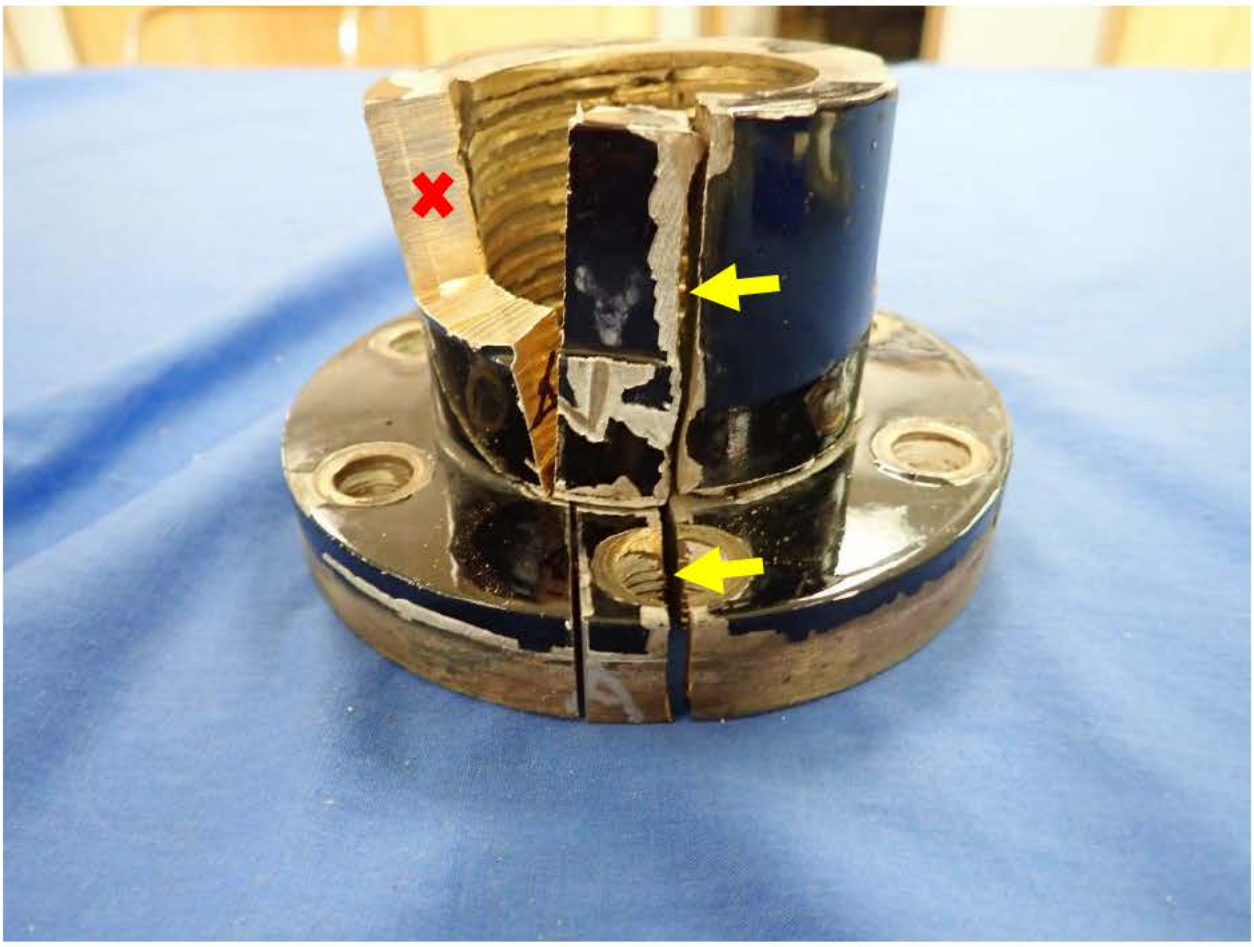


FIGURE 19



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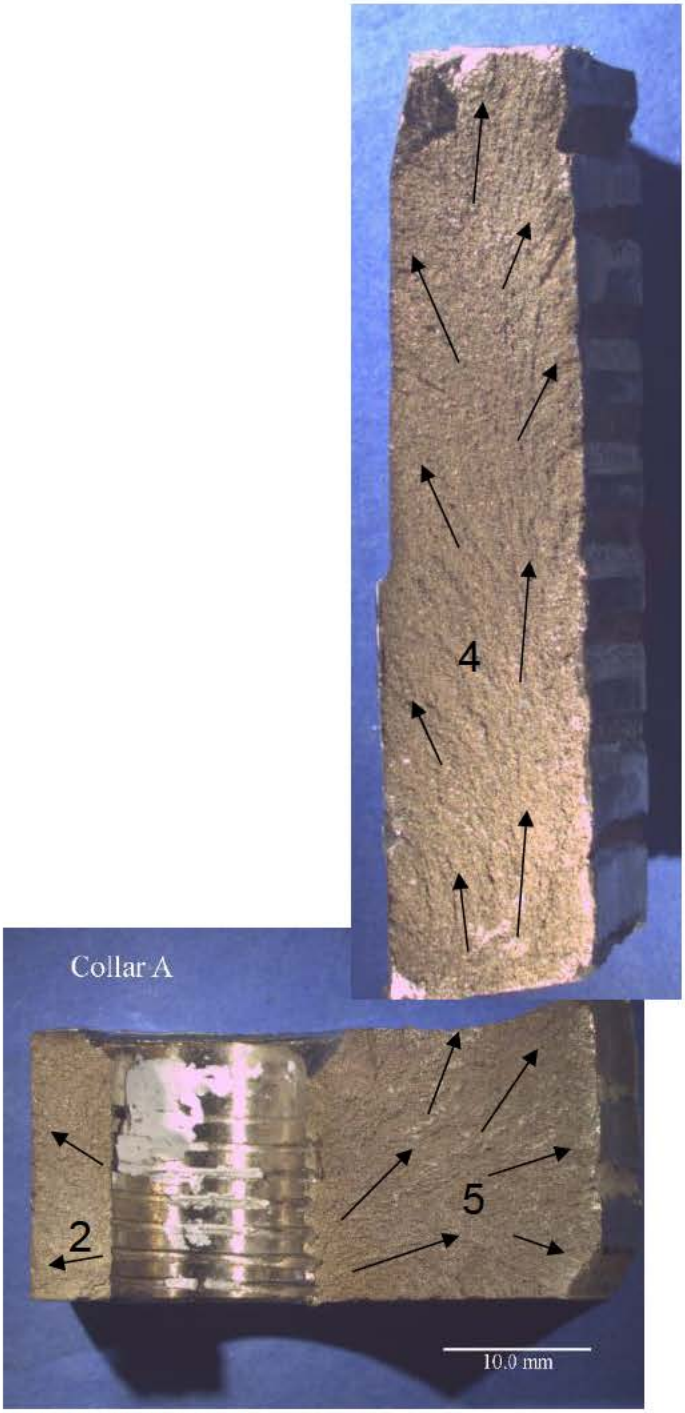

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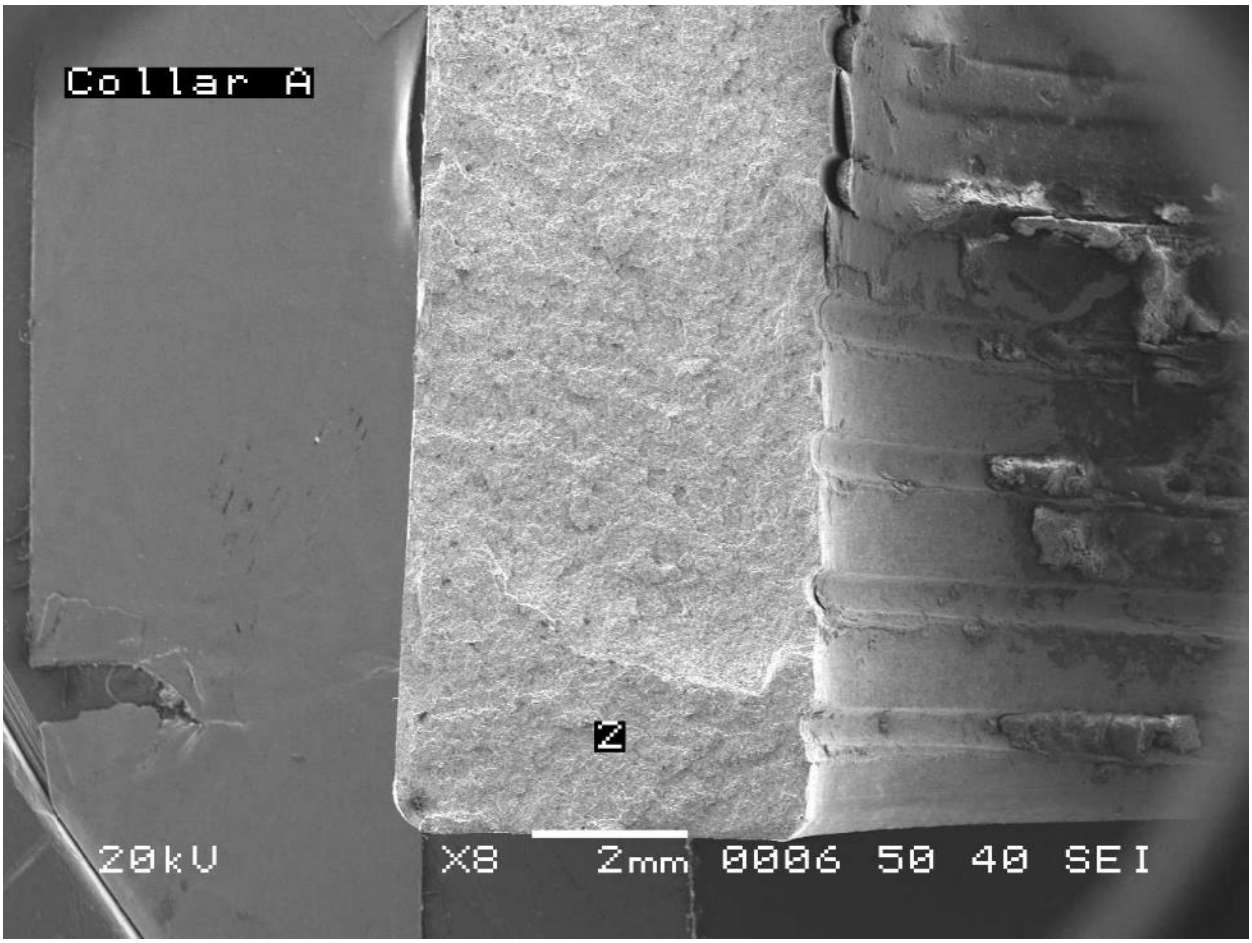

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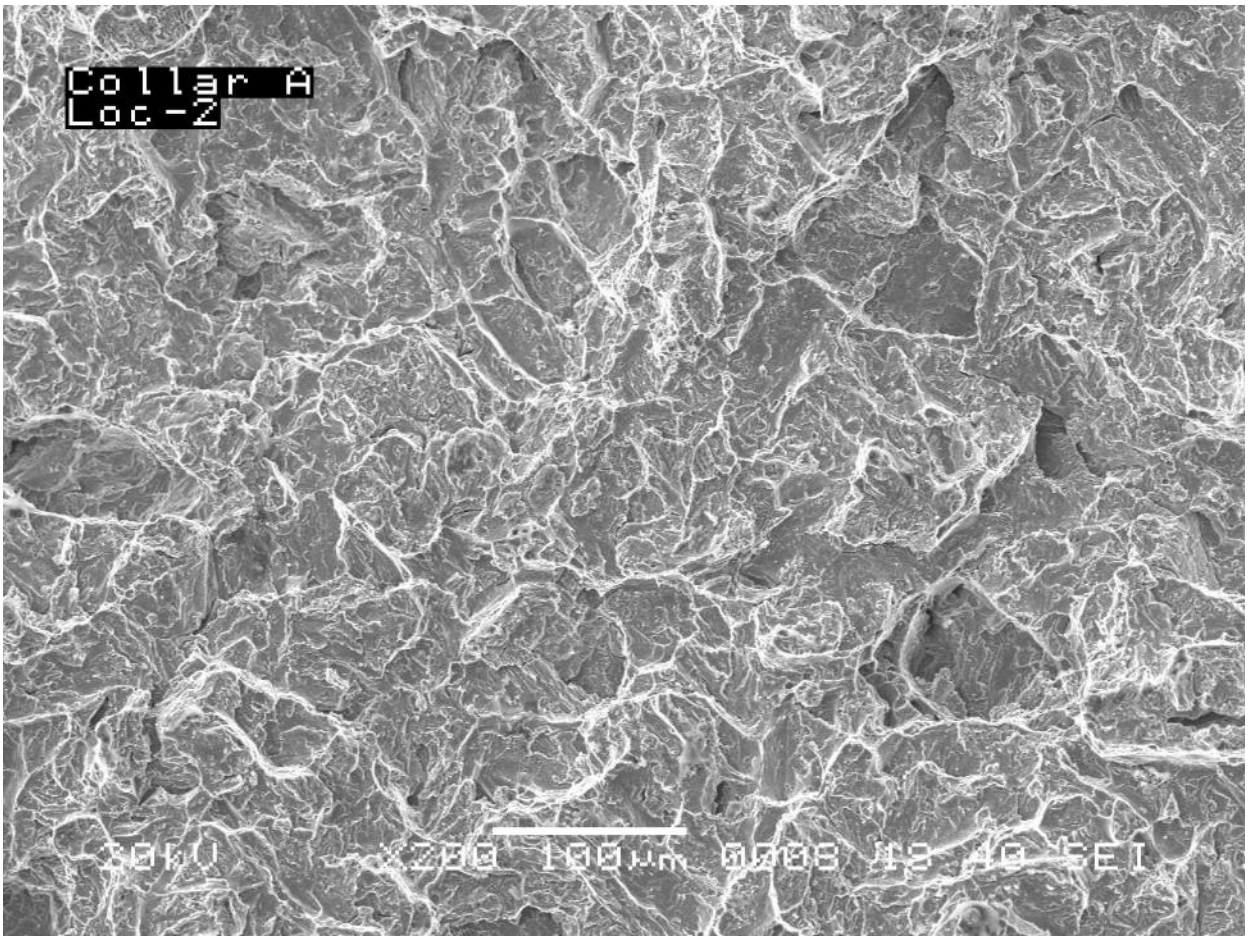

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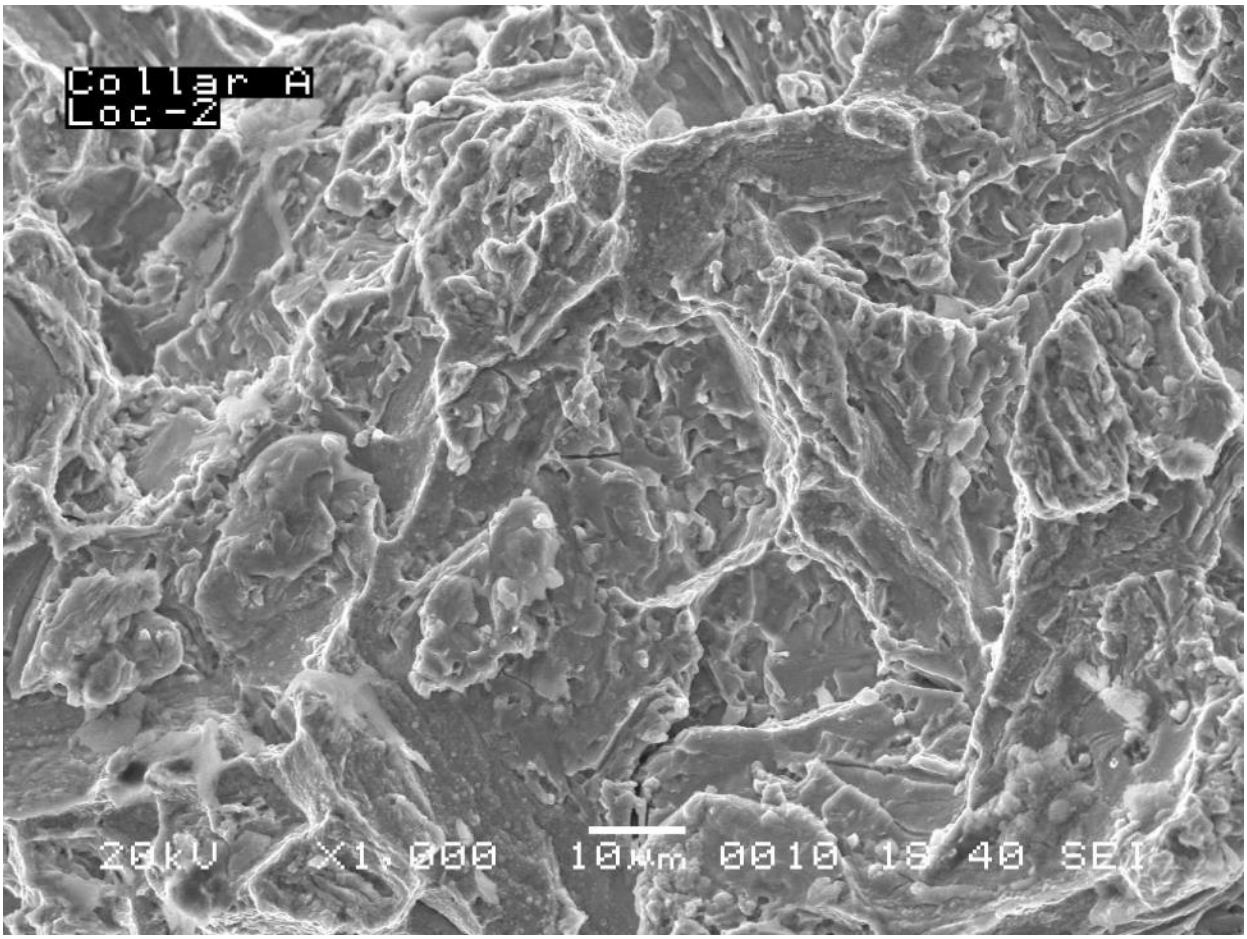

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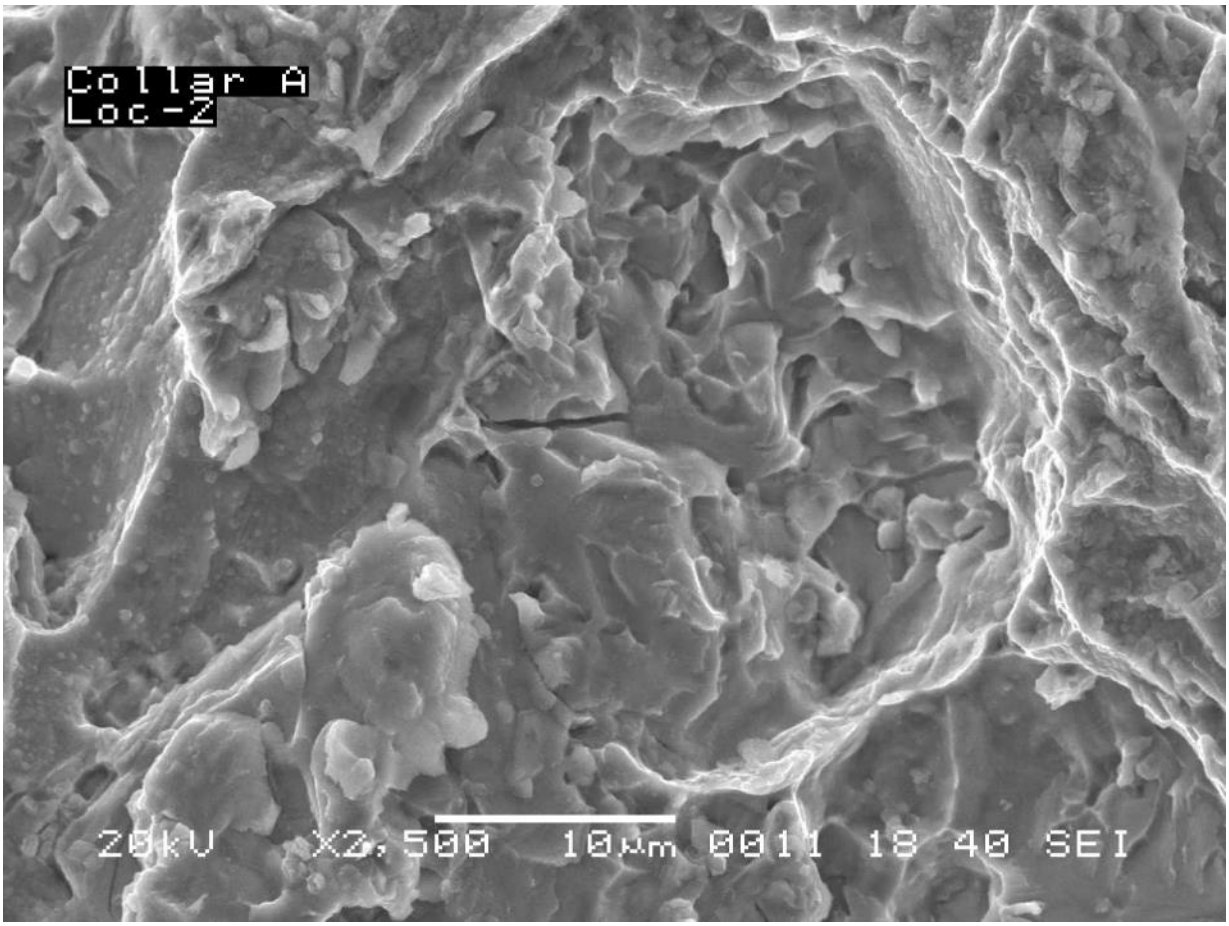
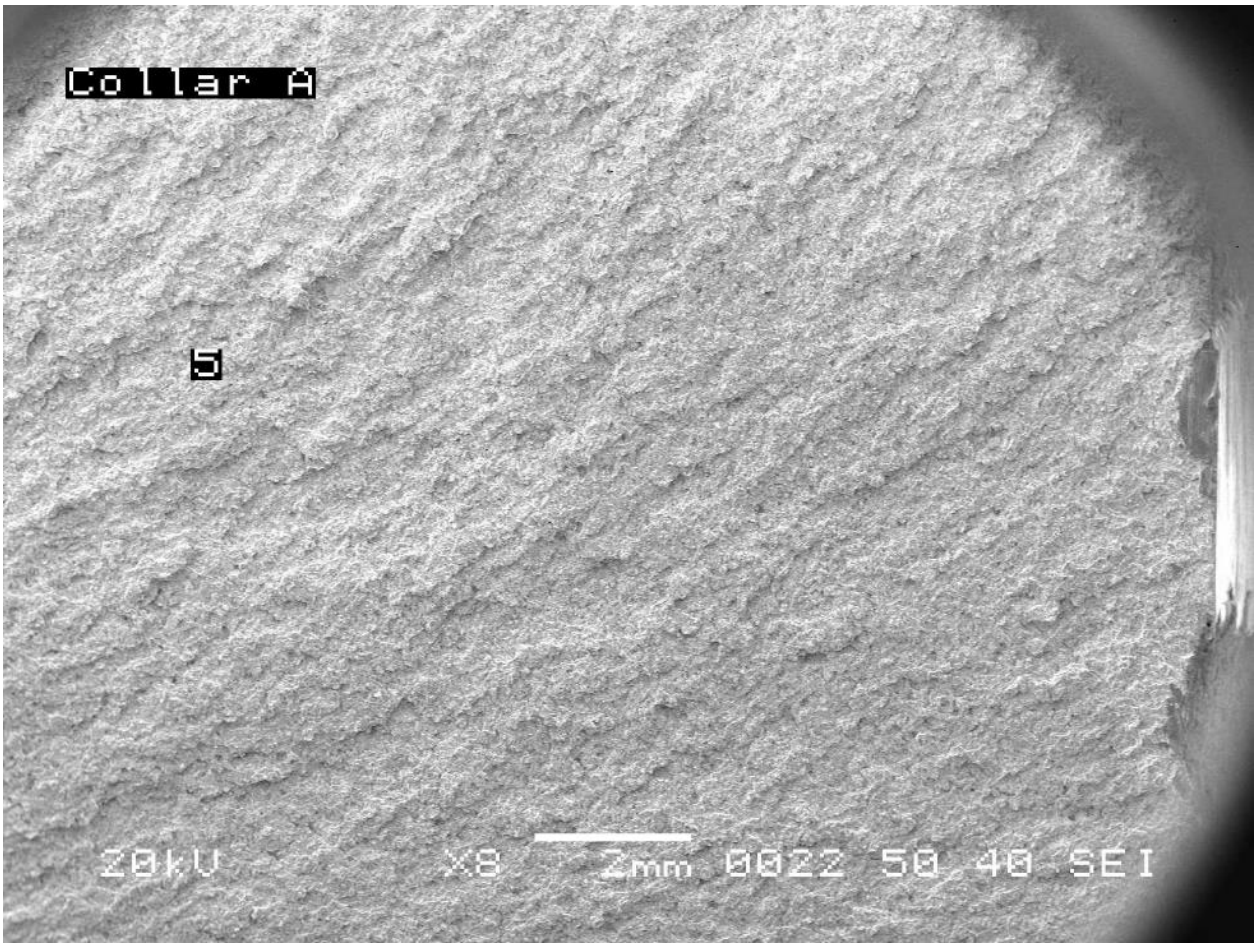


FIGURE 25



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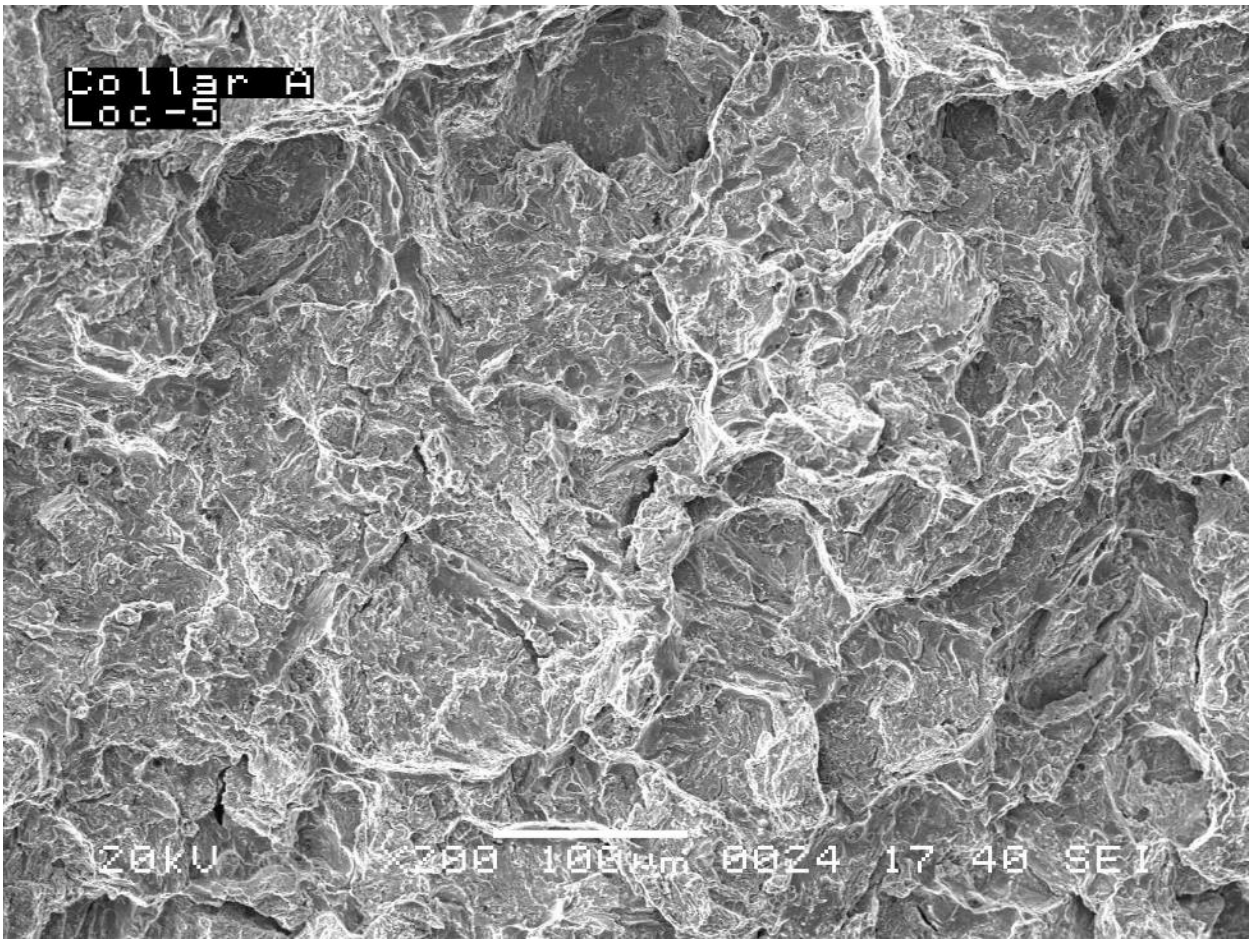

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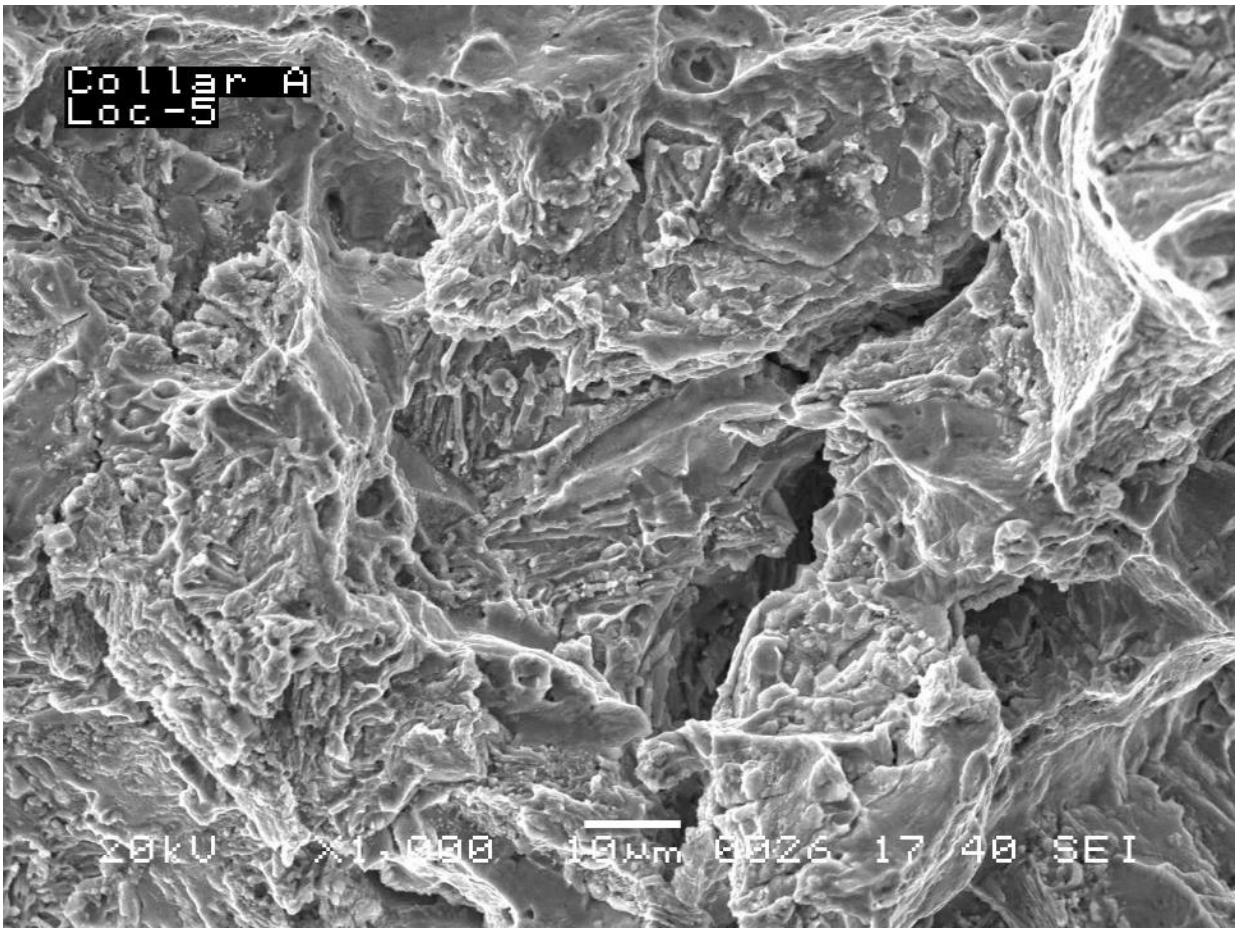

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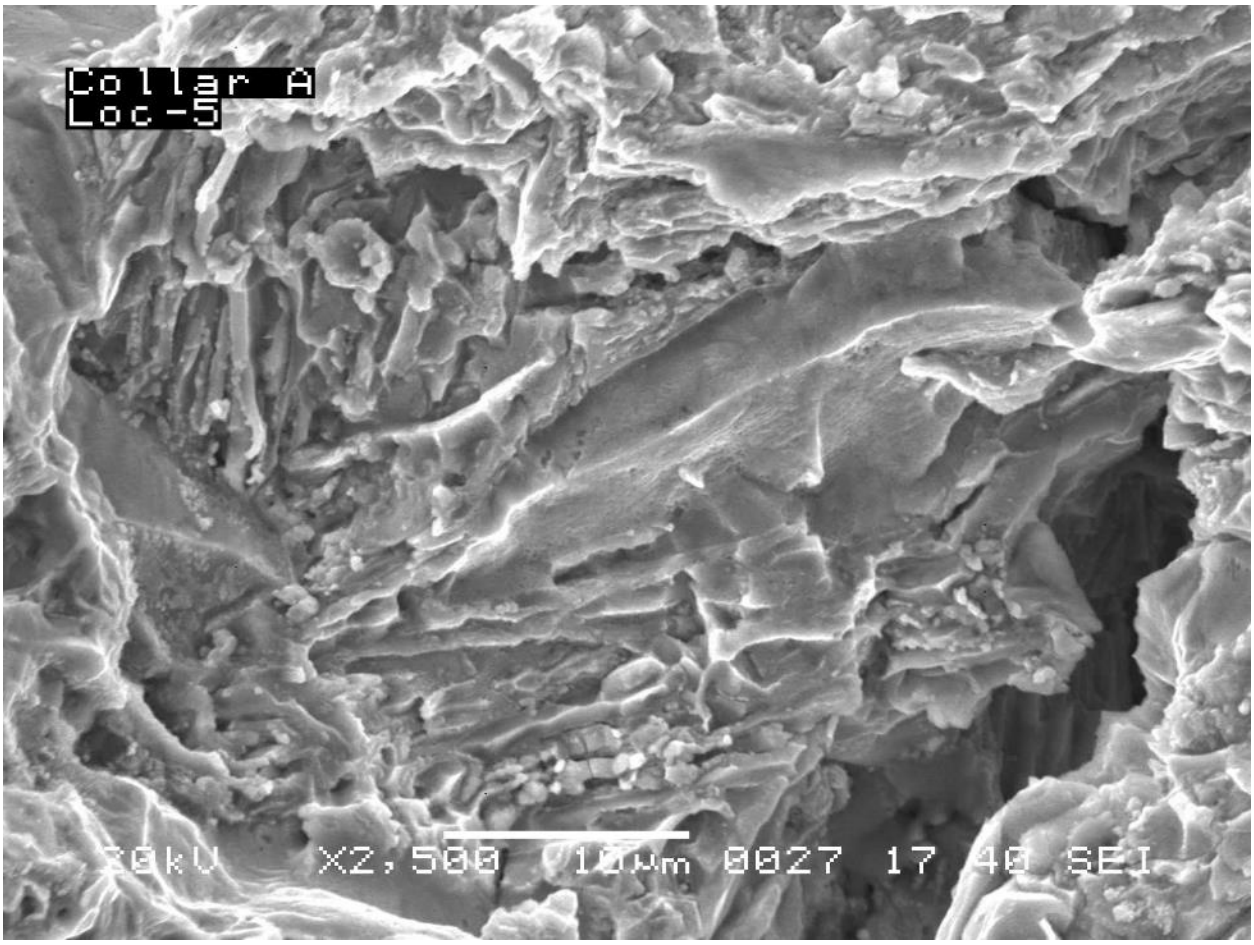

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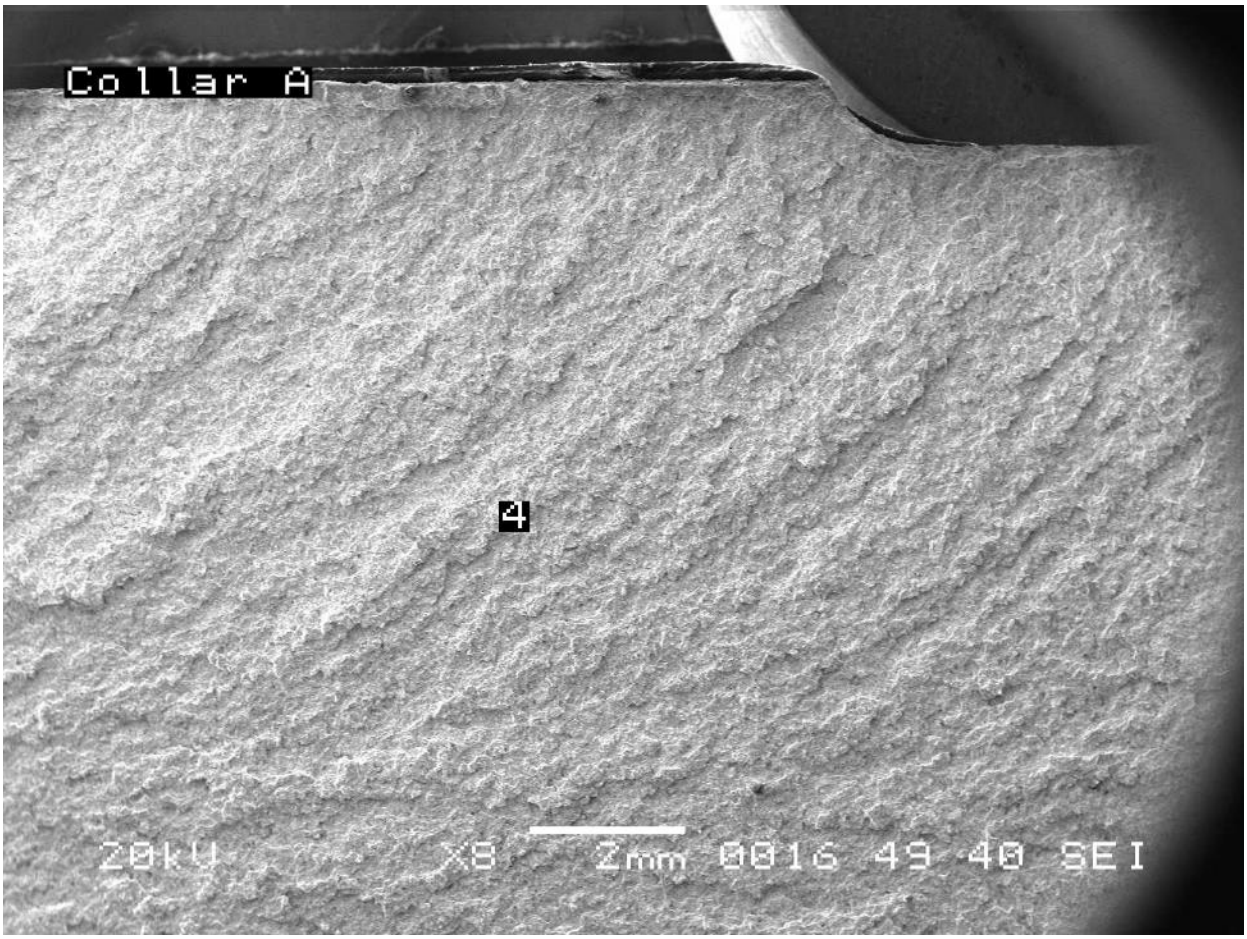

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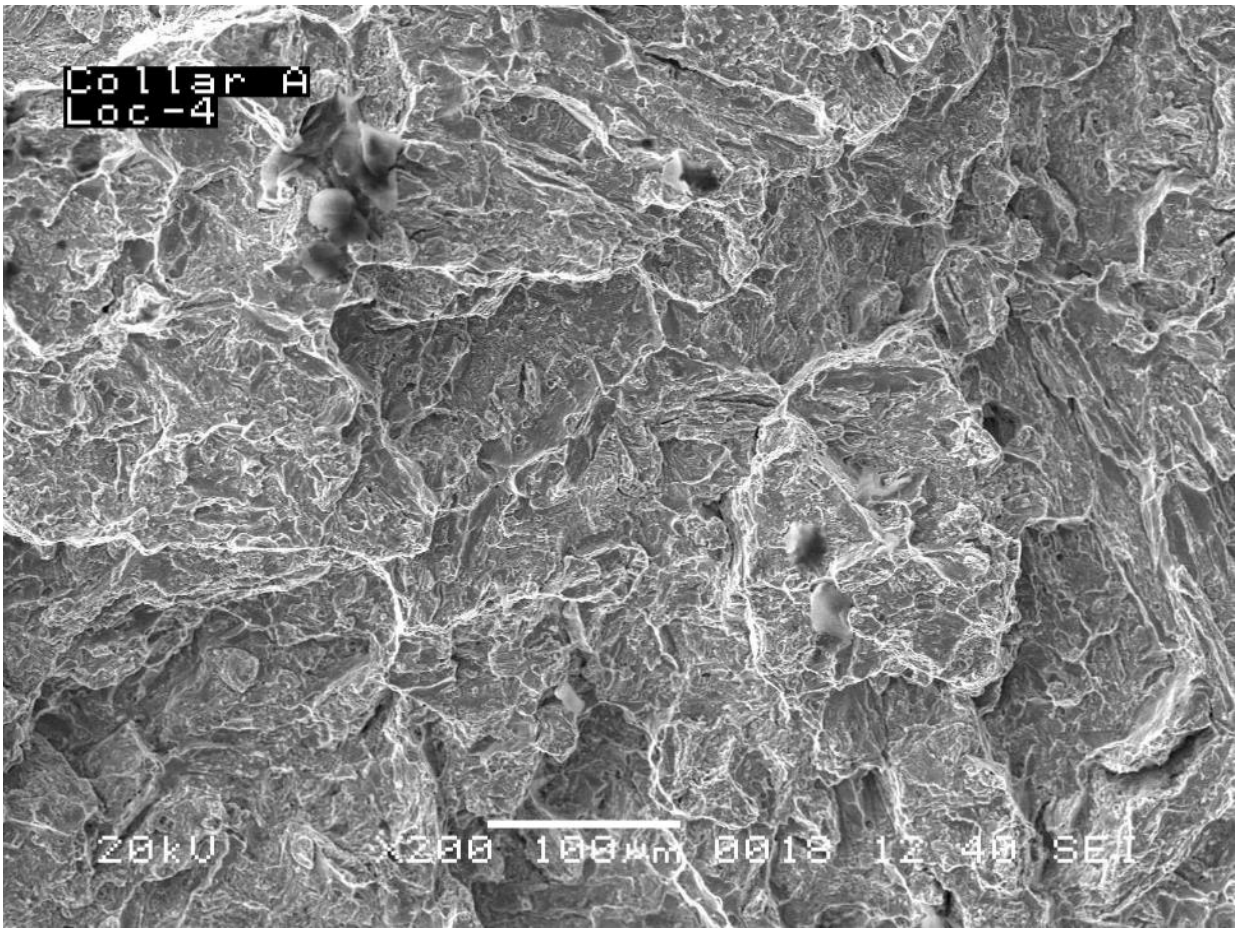

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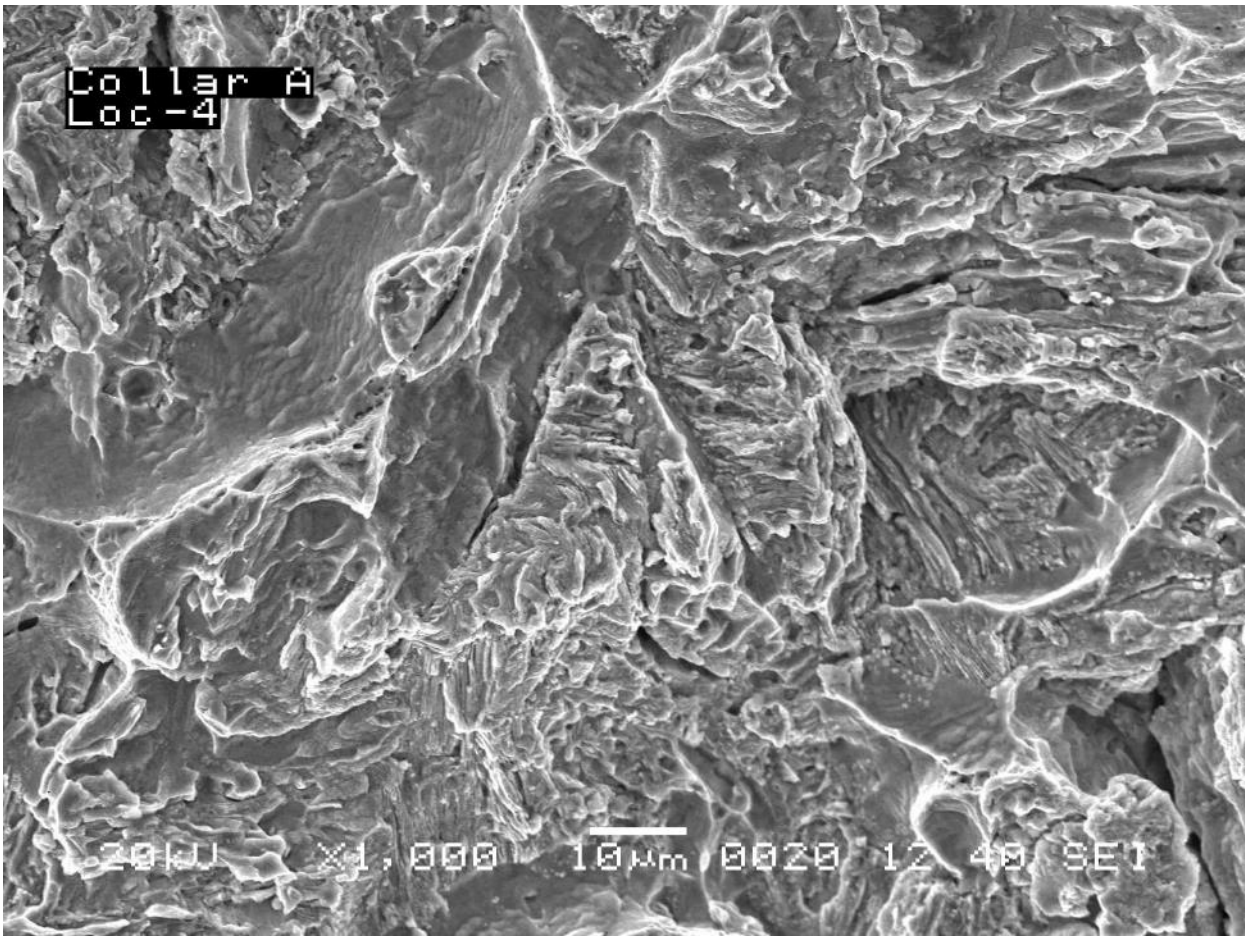

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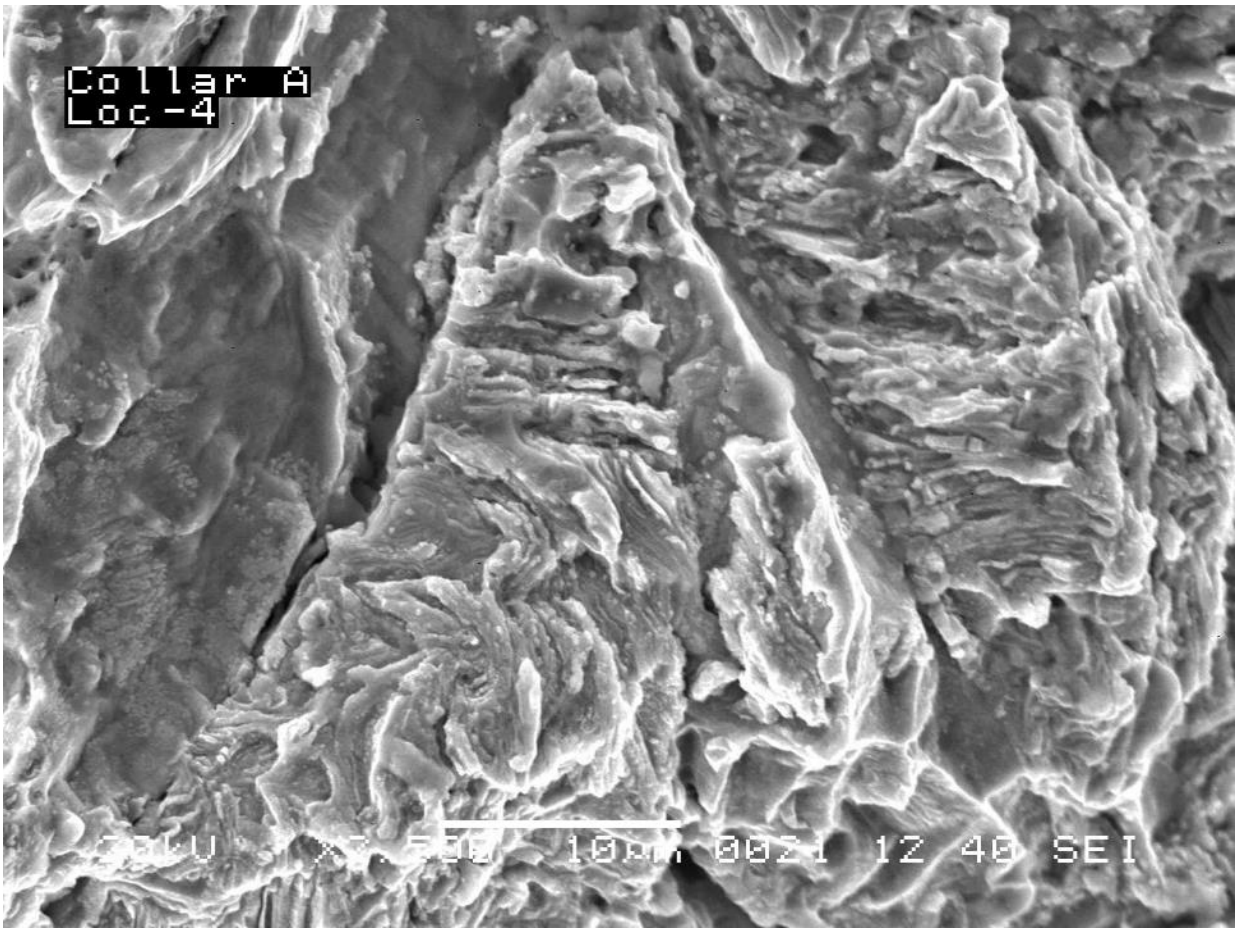


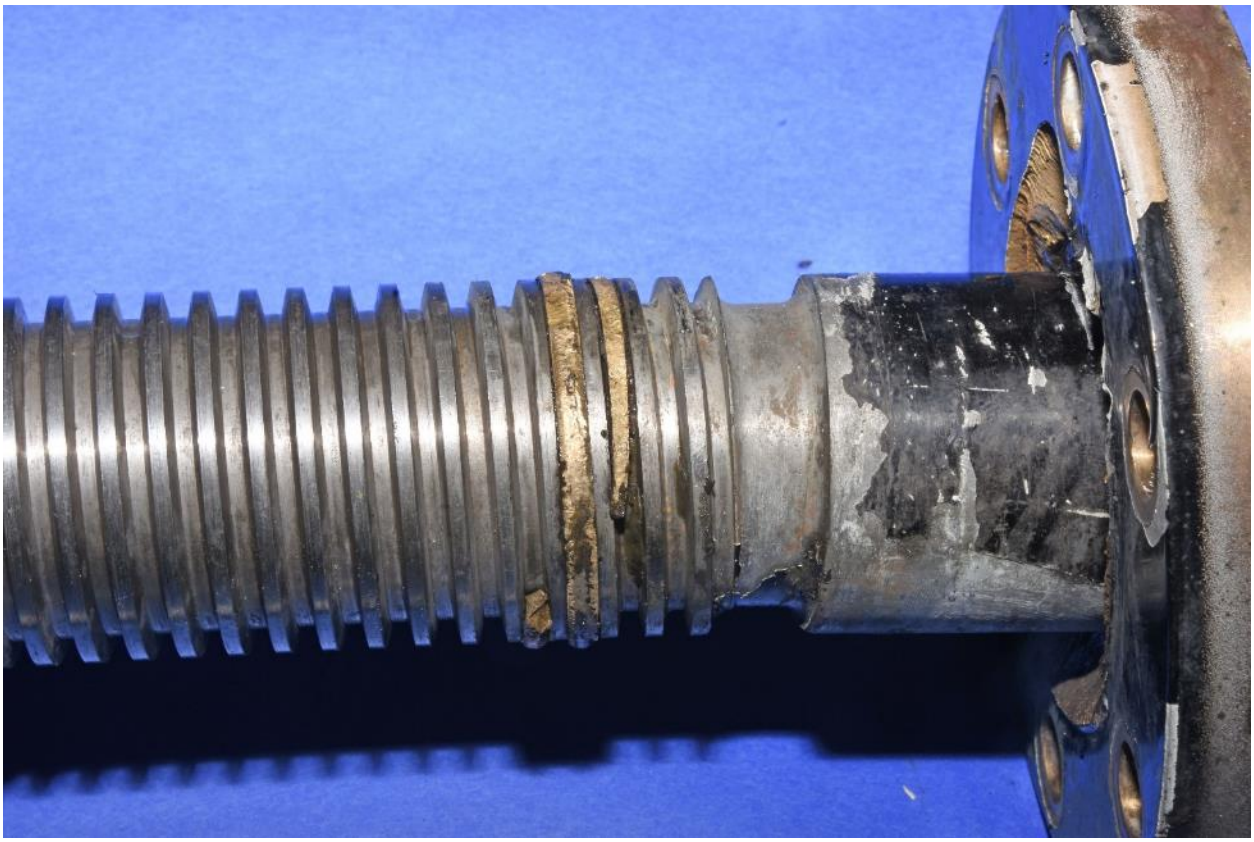
FIGURE 33

FIGURE 34

FIGURE 35

FIGURE 36

FIGURE 37



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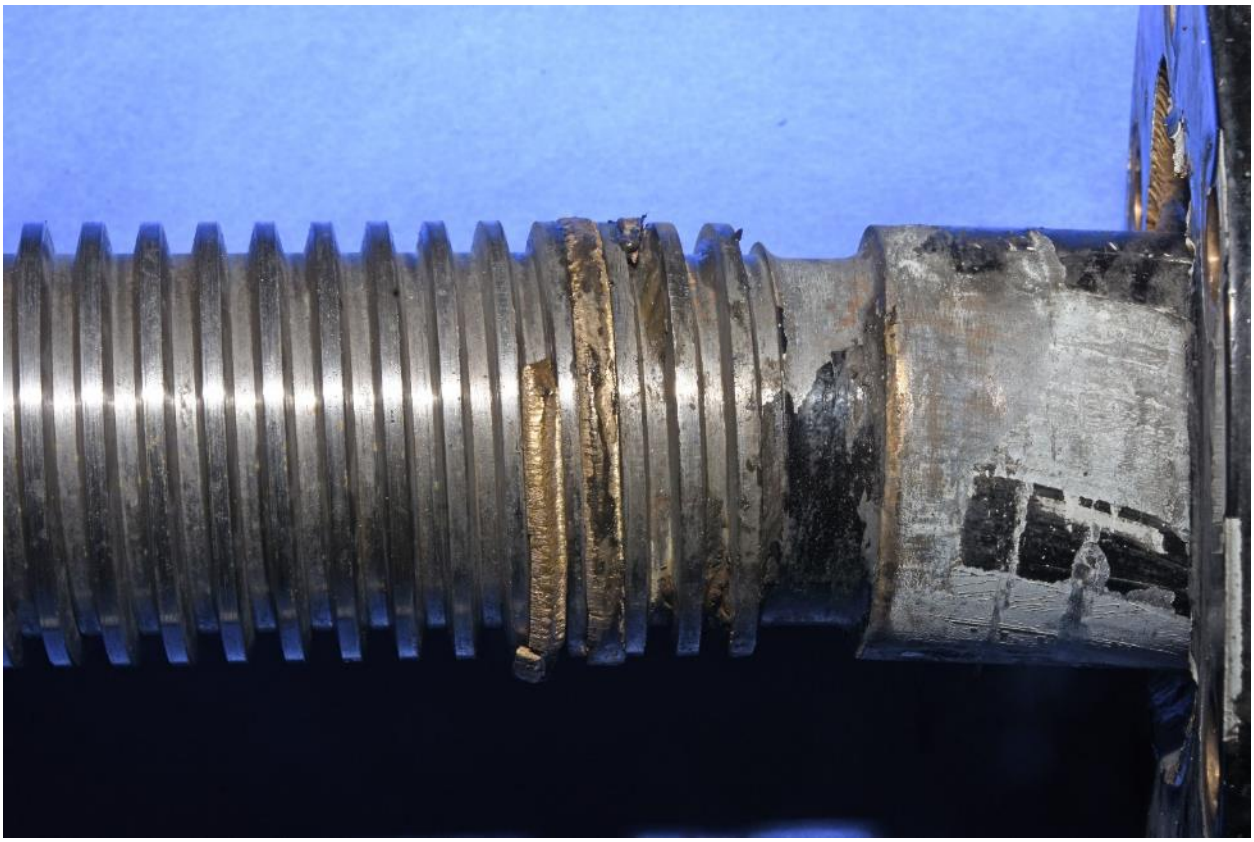

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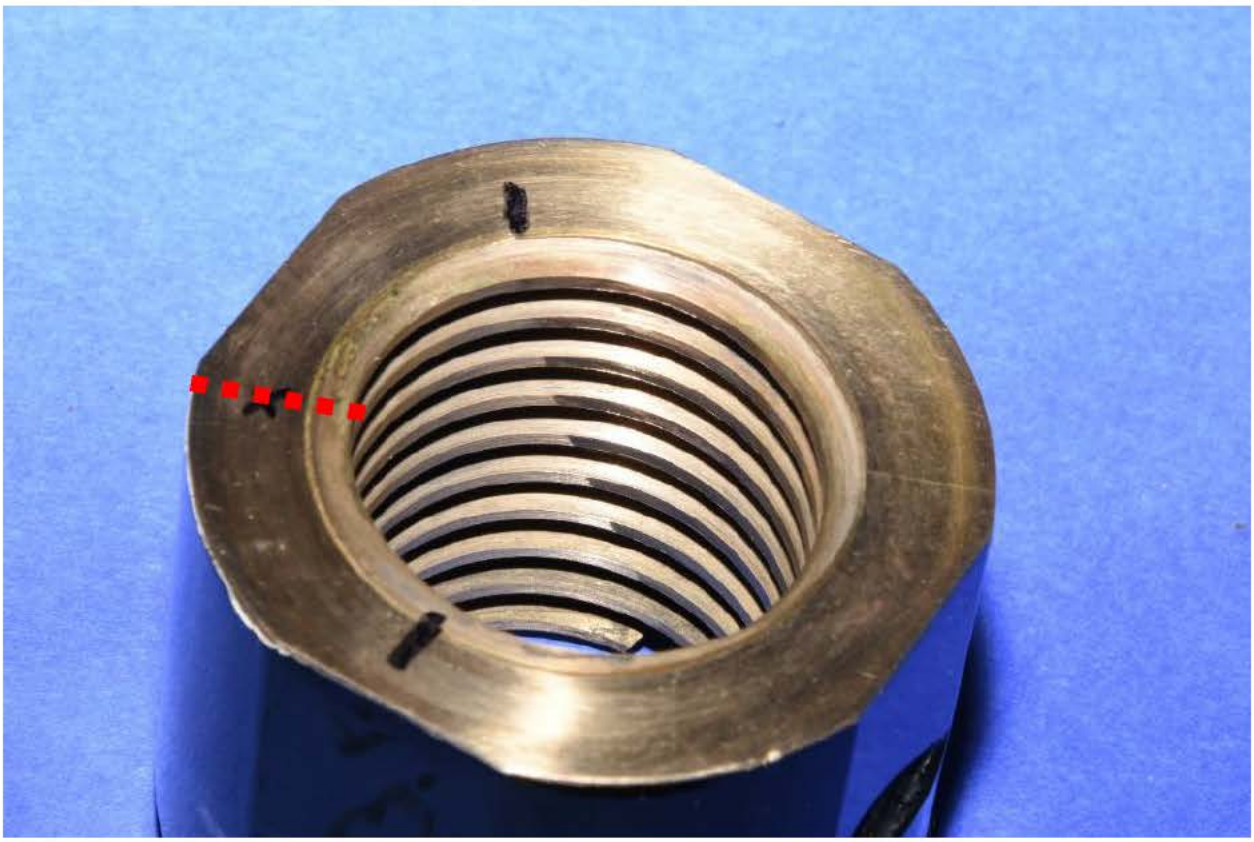
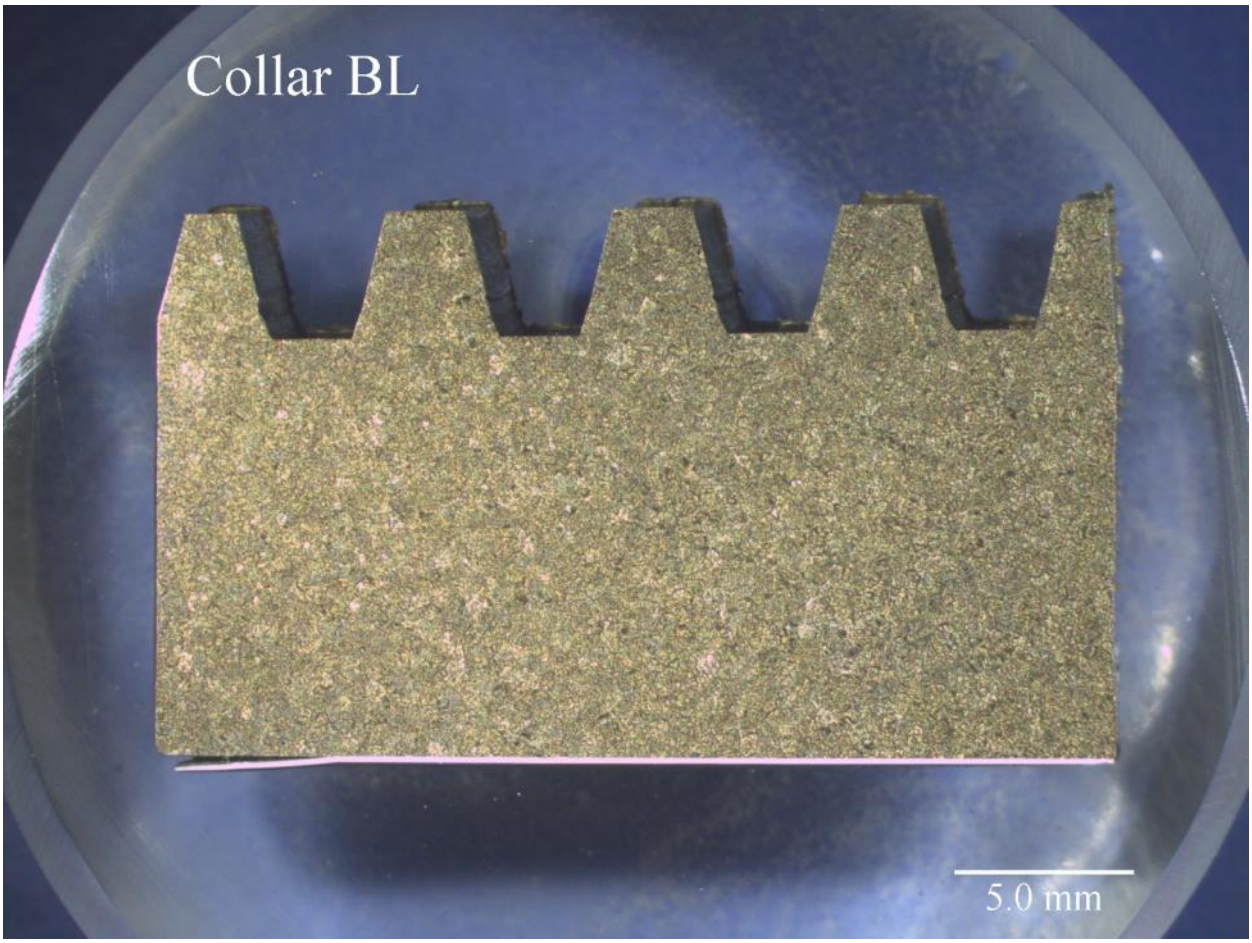


FIGURE 40

FIGURE 41



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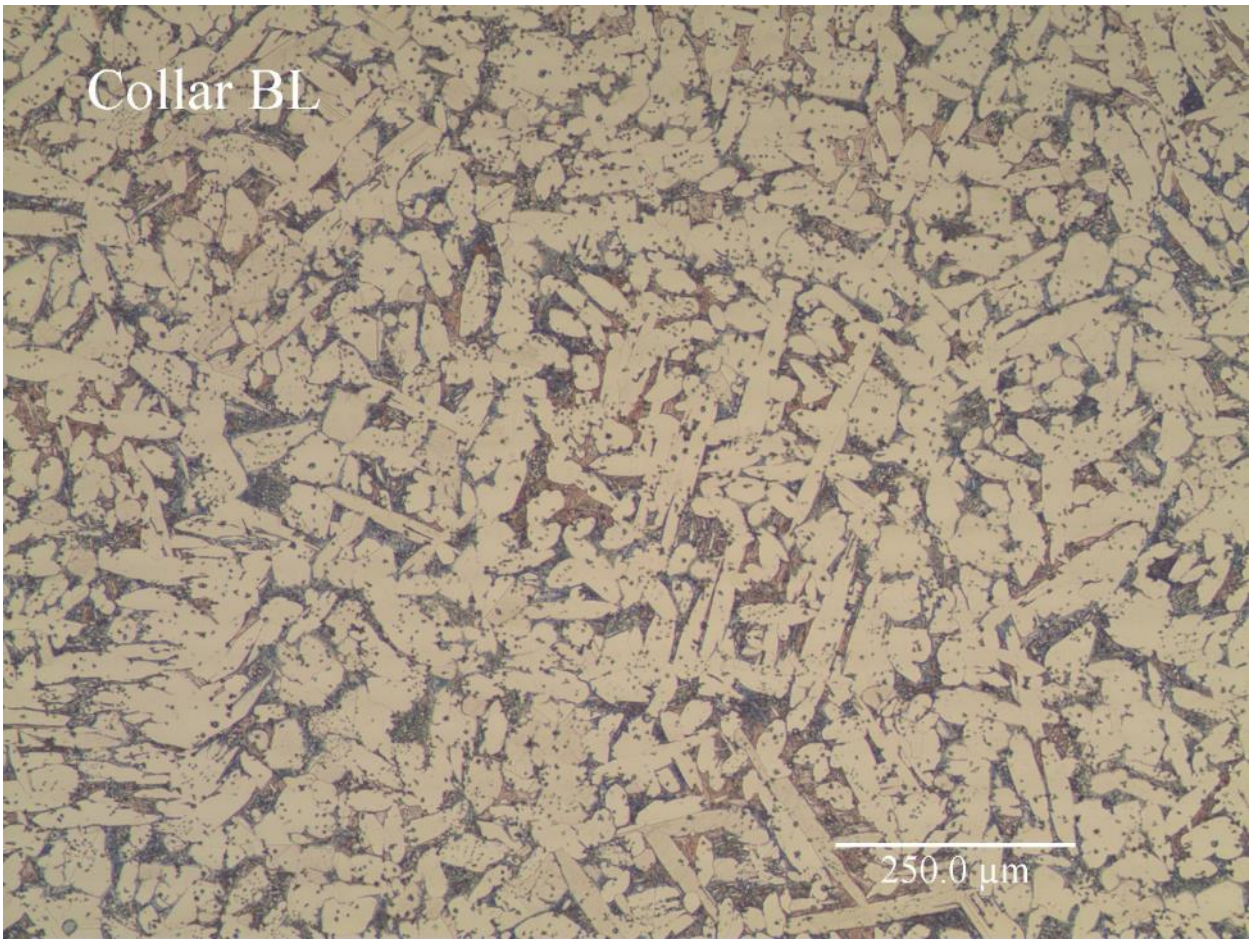

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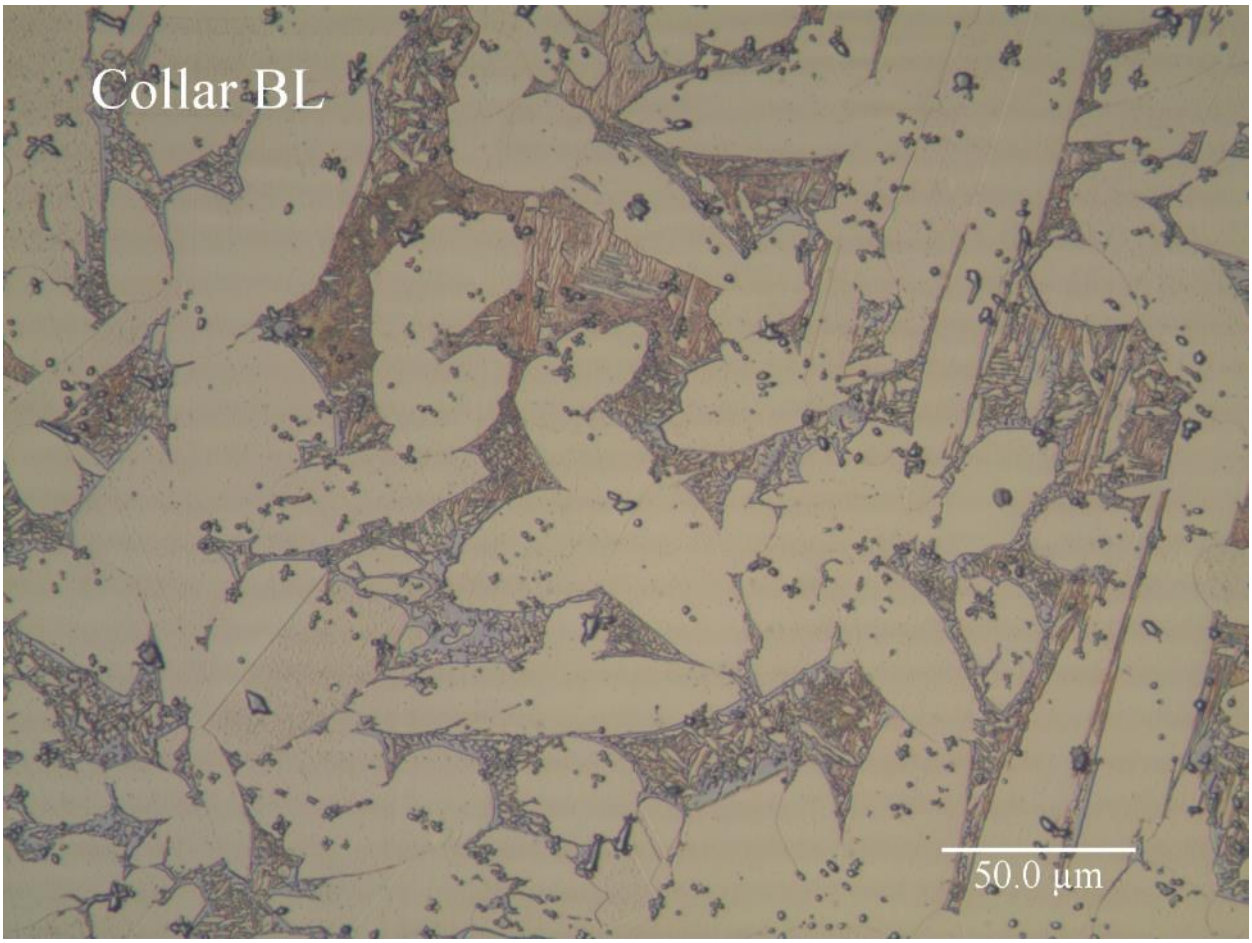

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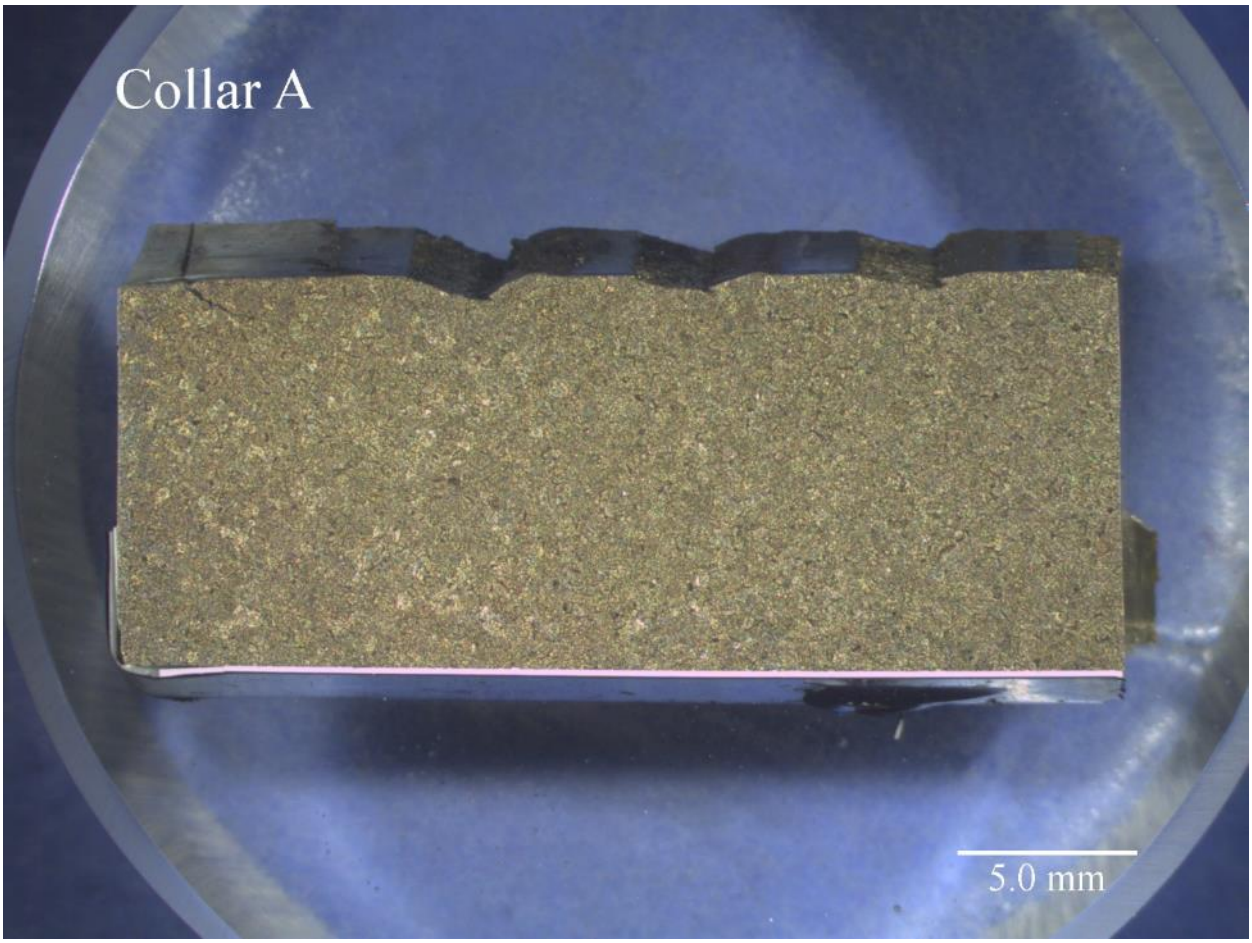

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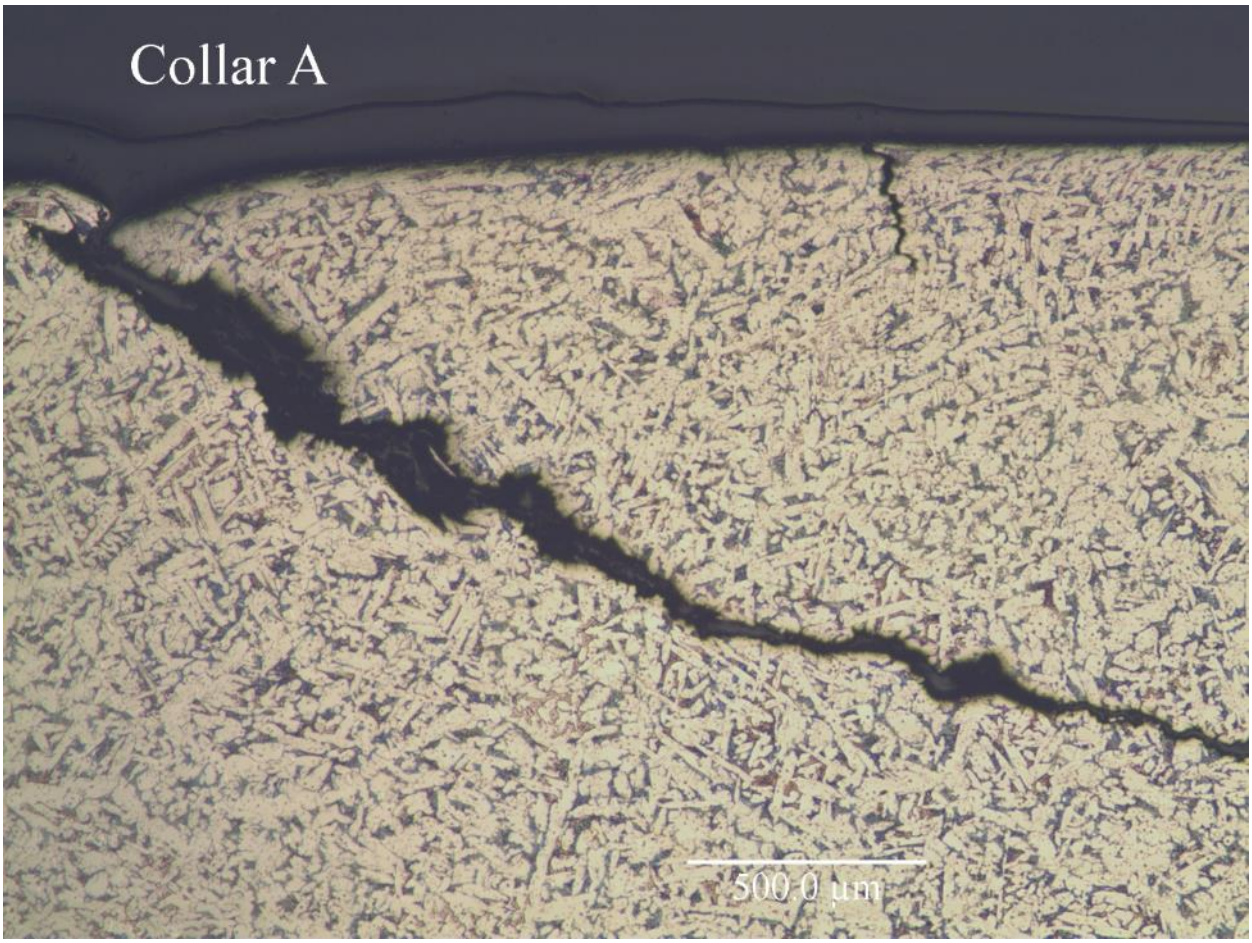

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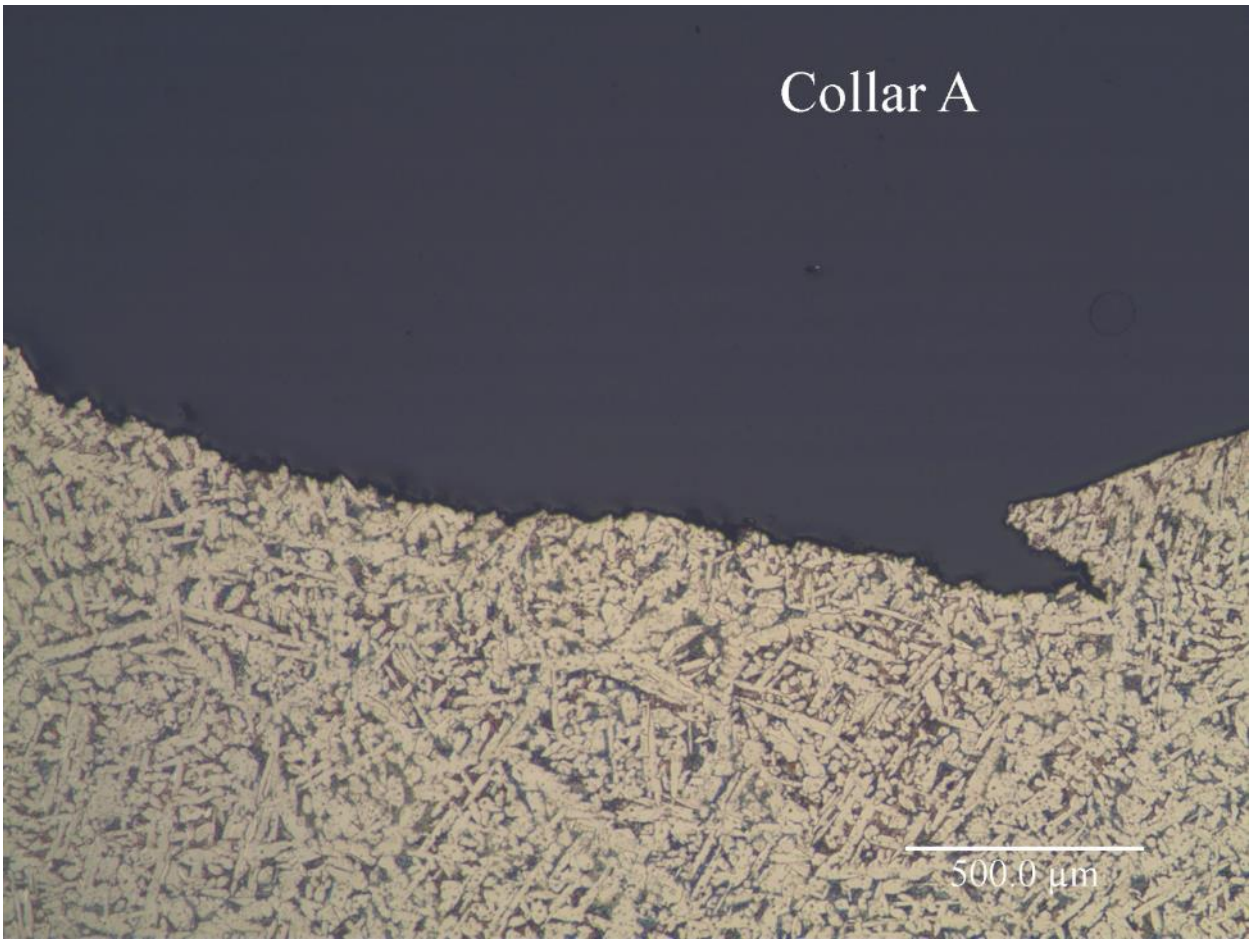
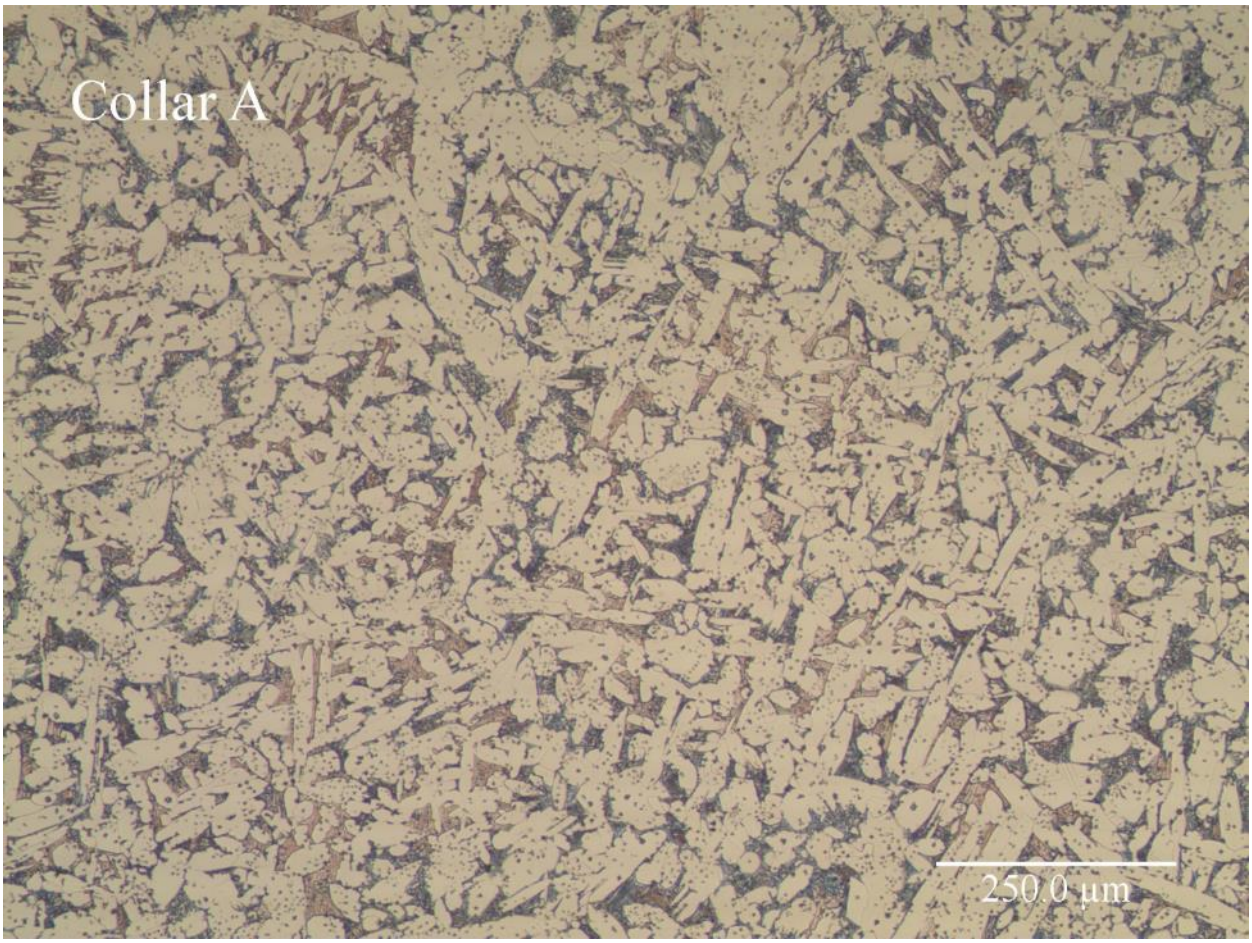


FIGURE 47



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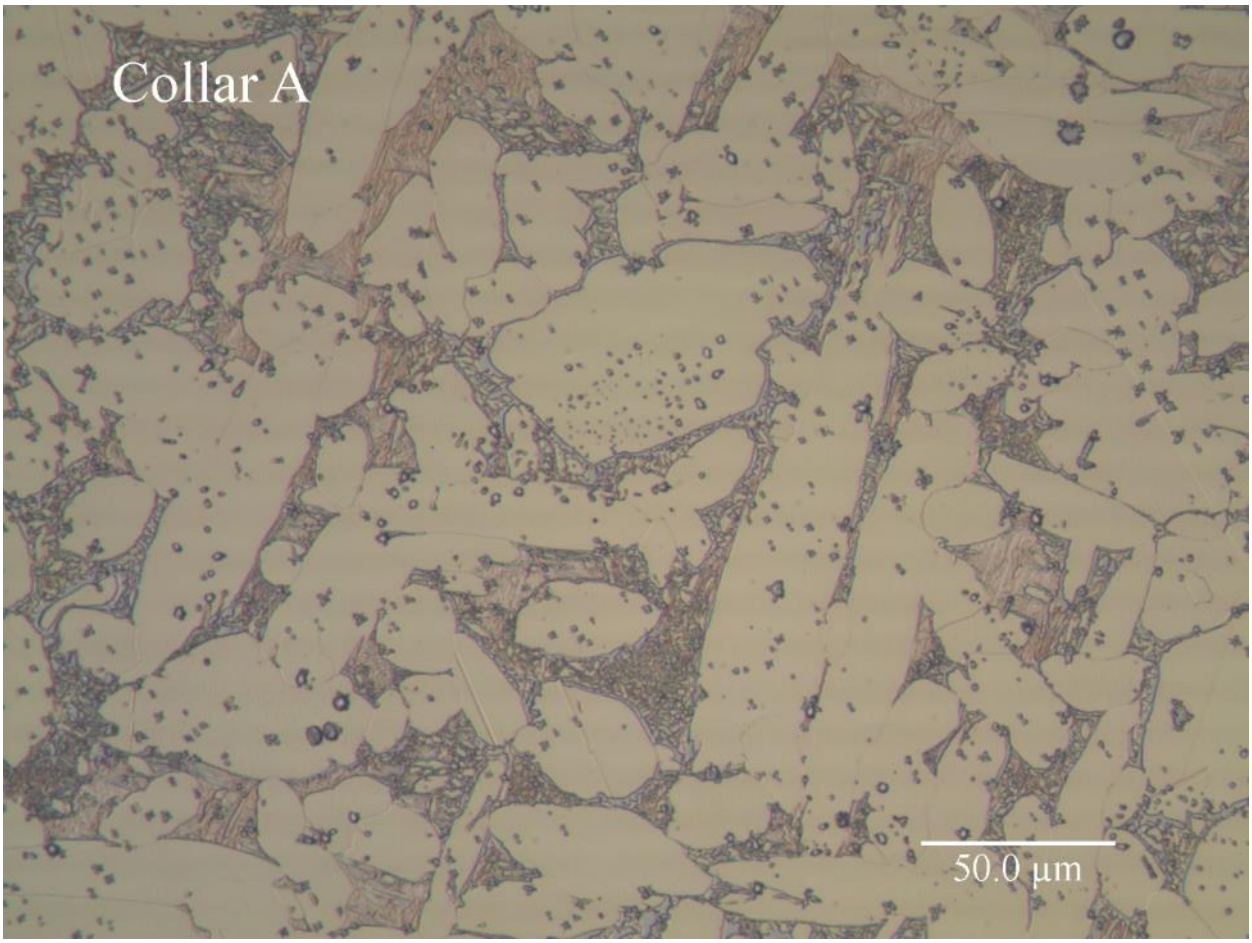

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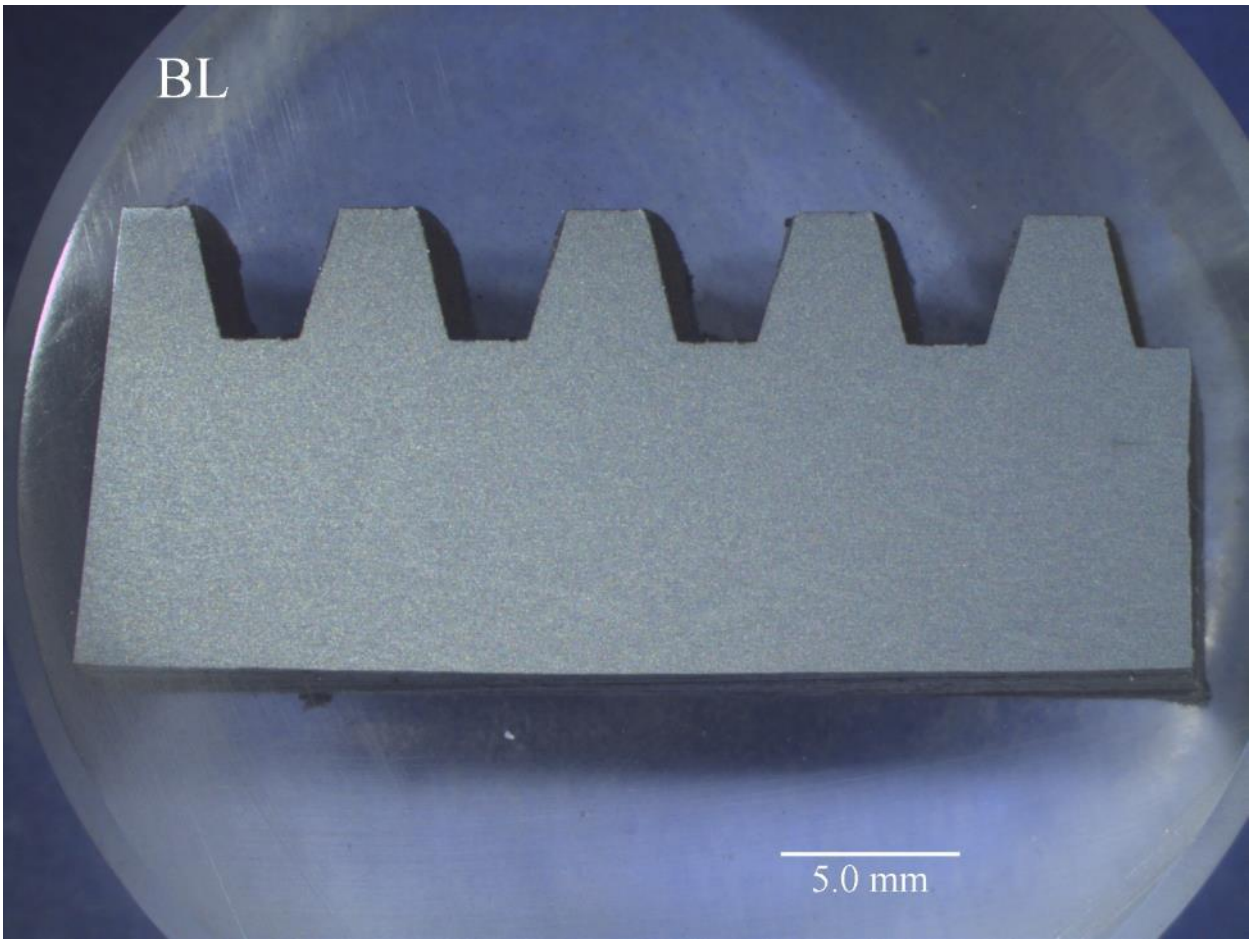

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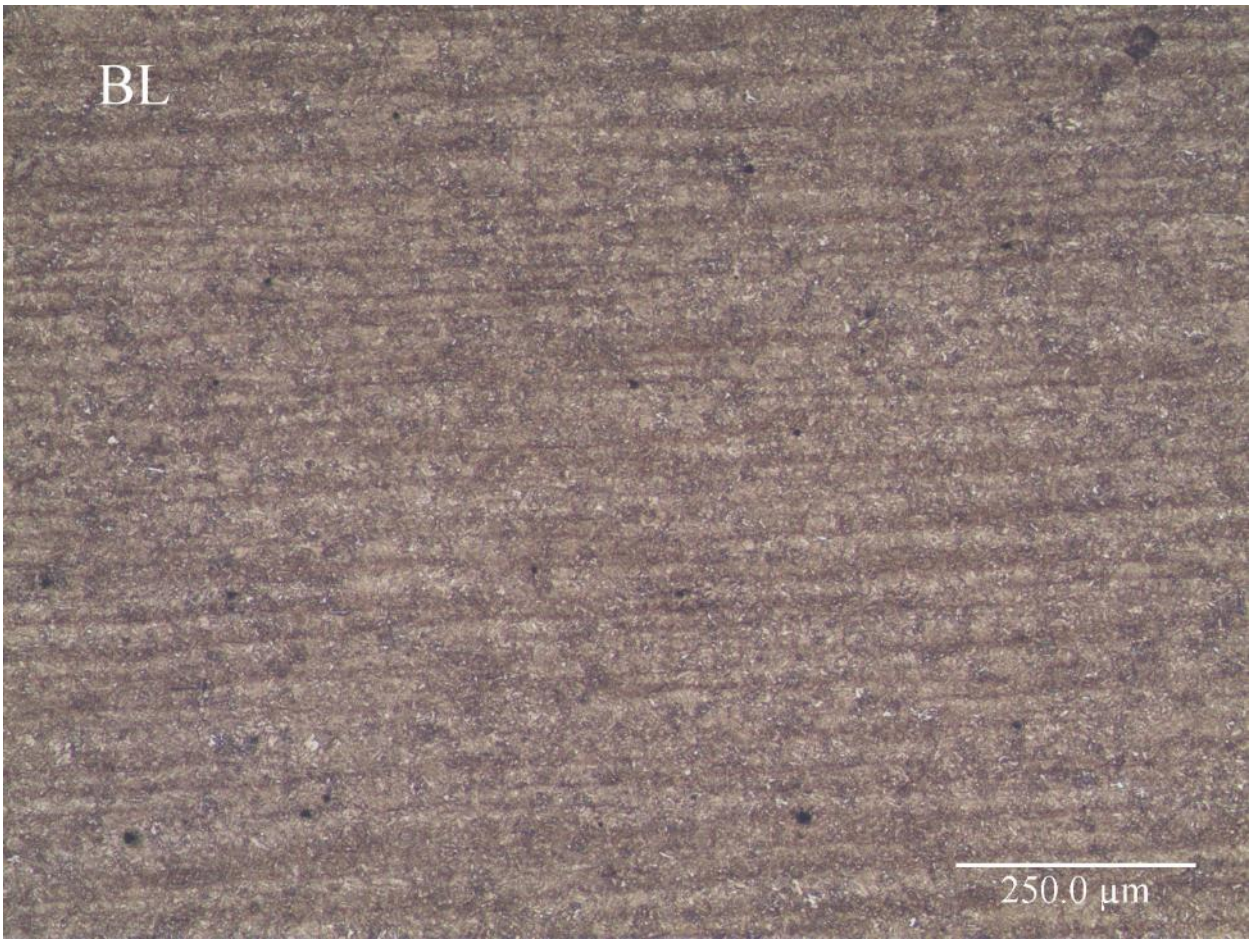

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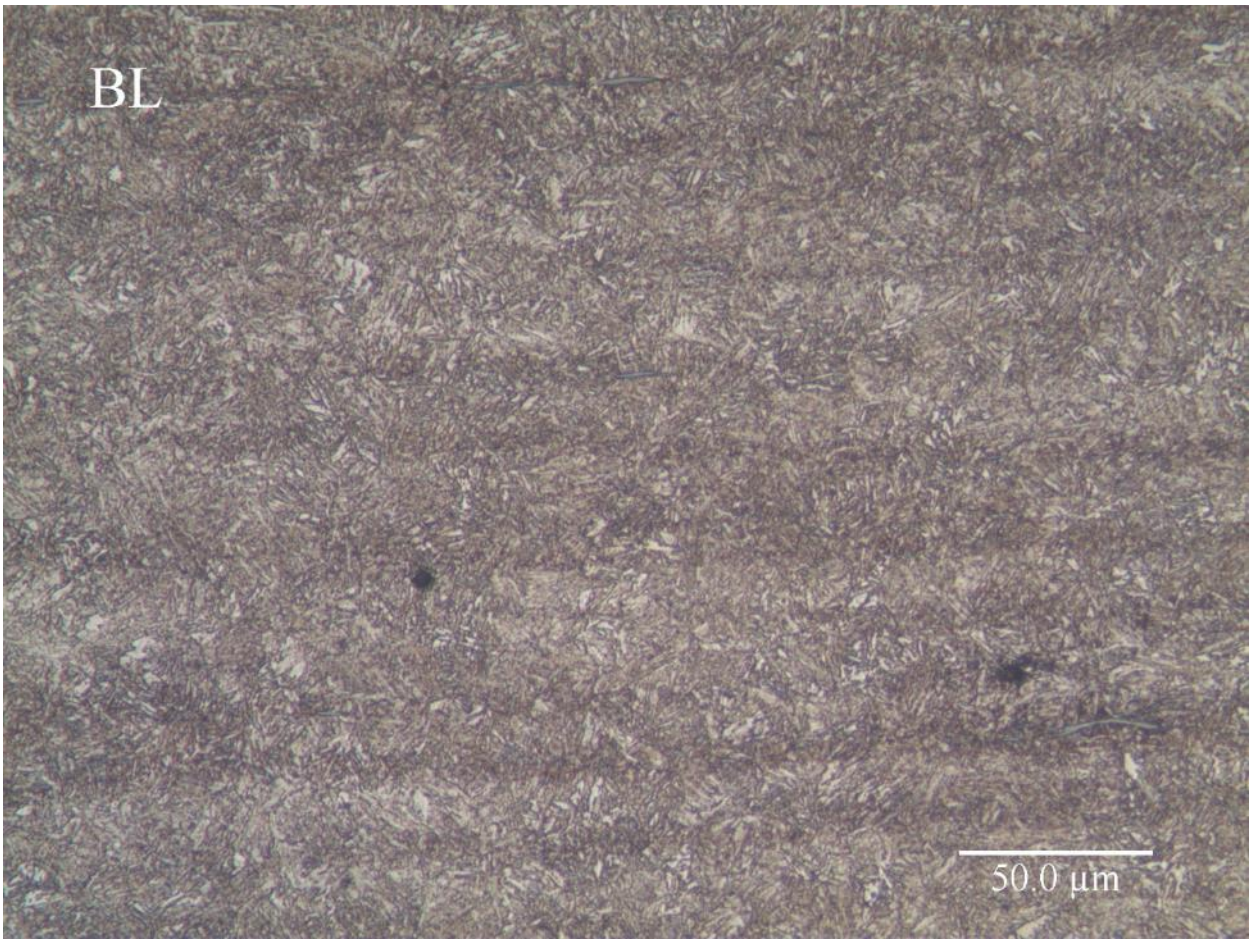
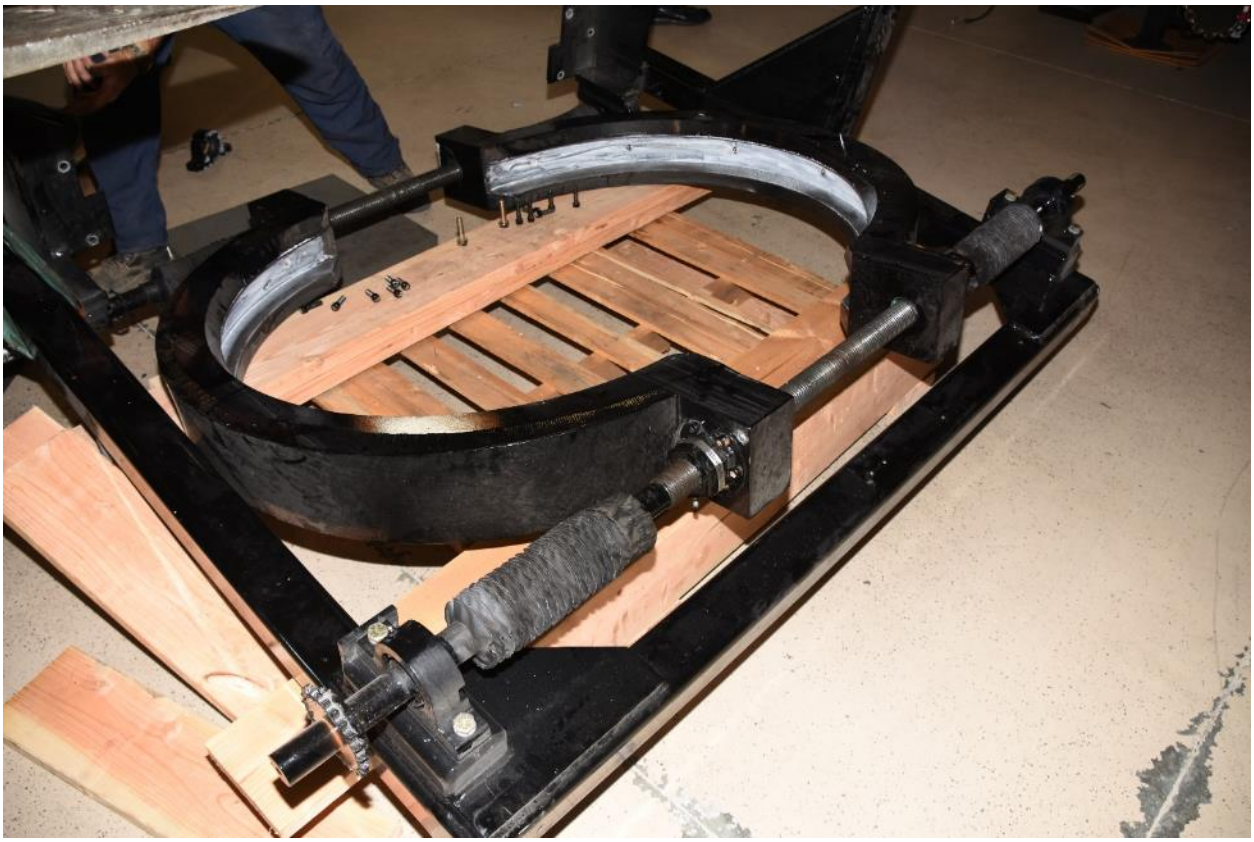


FIGURE 52

FIGURE 53

FIGURE 54



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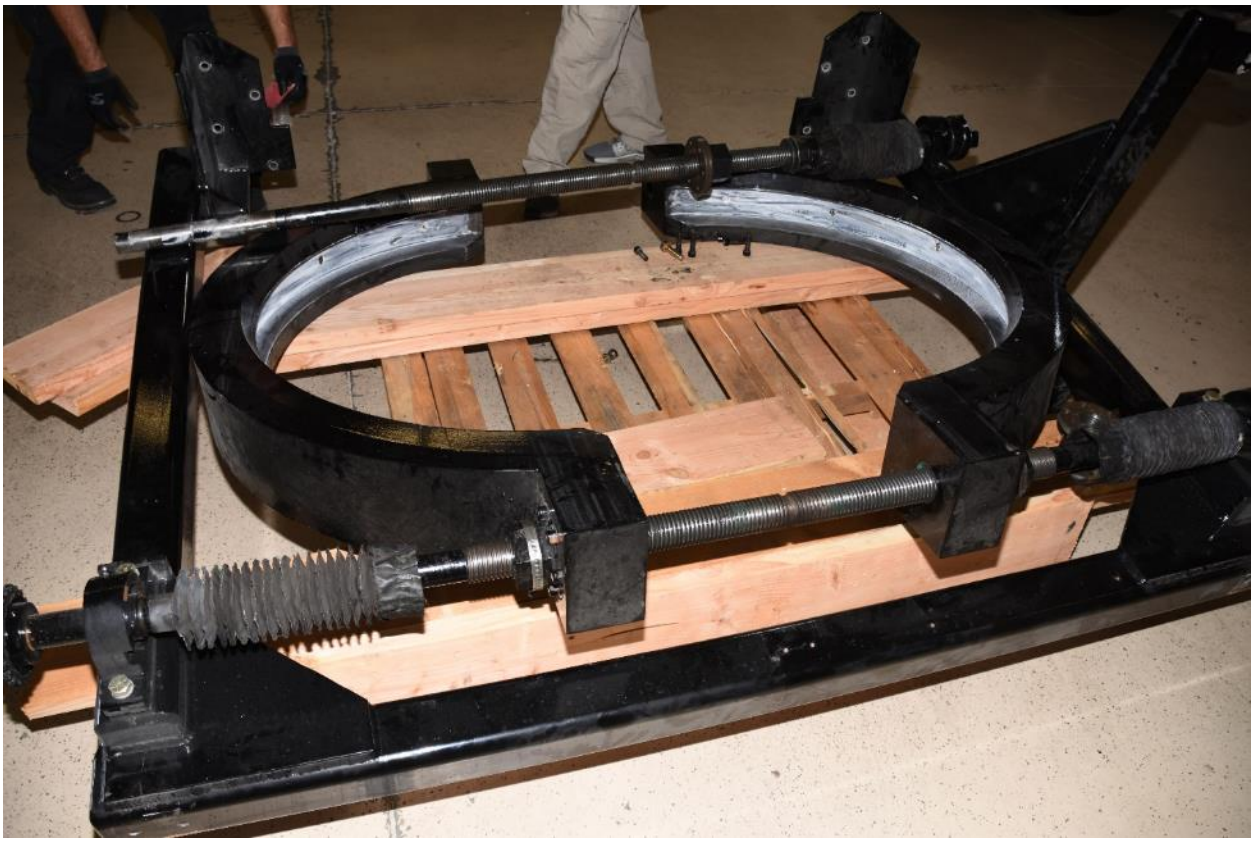

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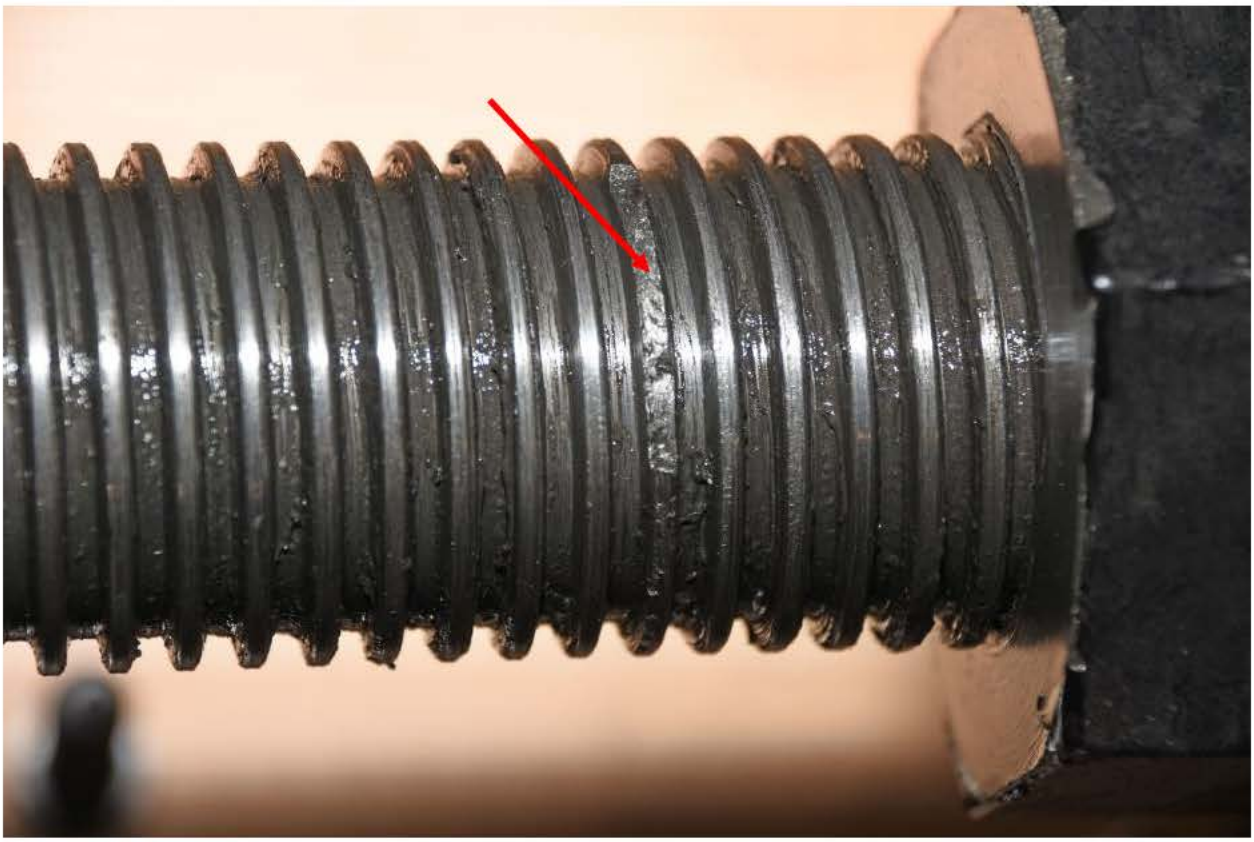


FIGURE 57

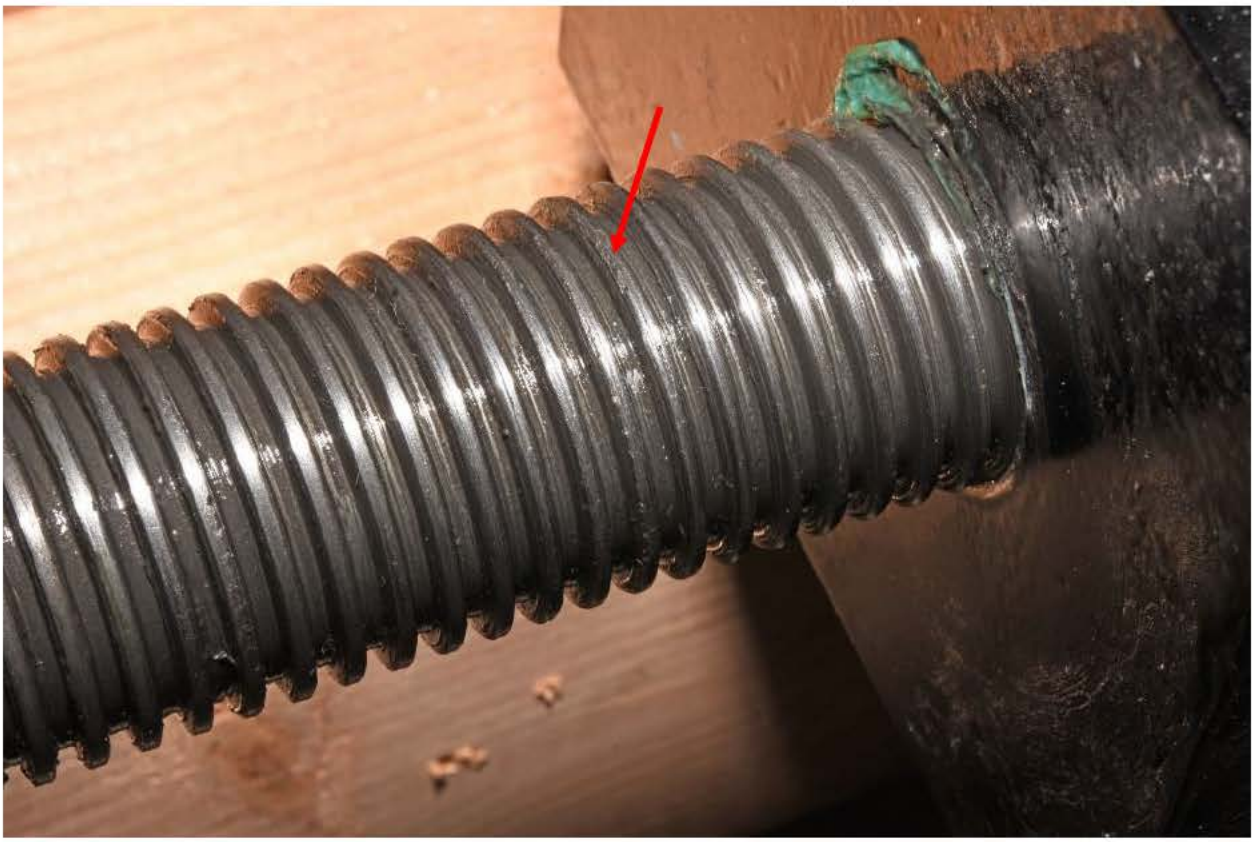


FIGURE 58

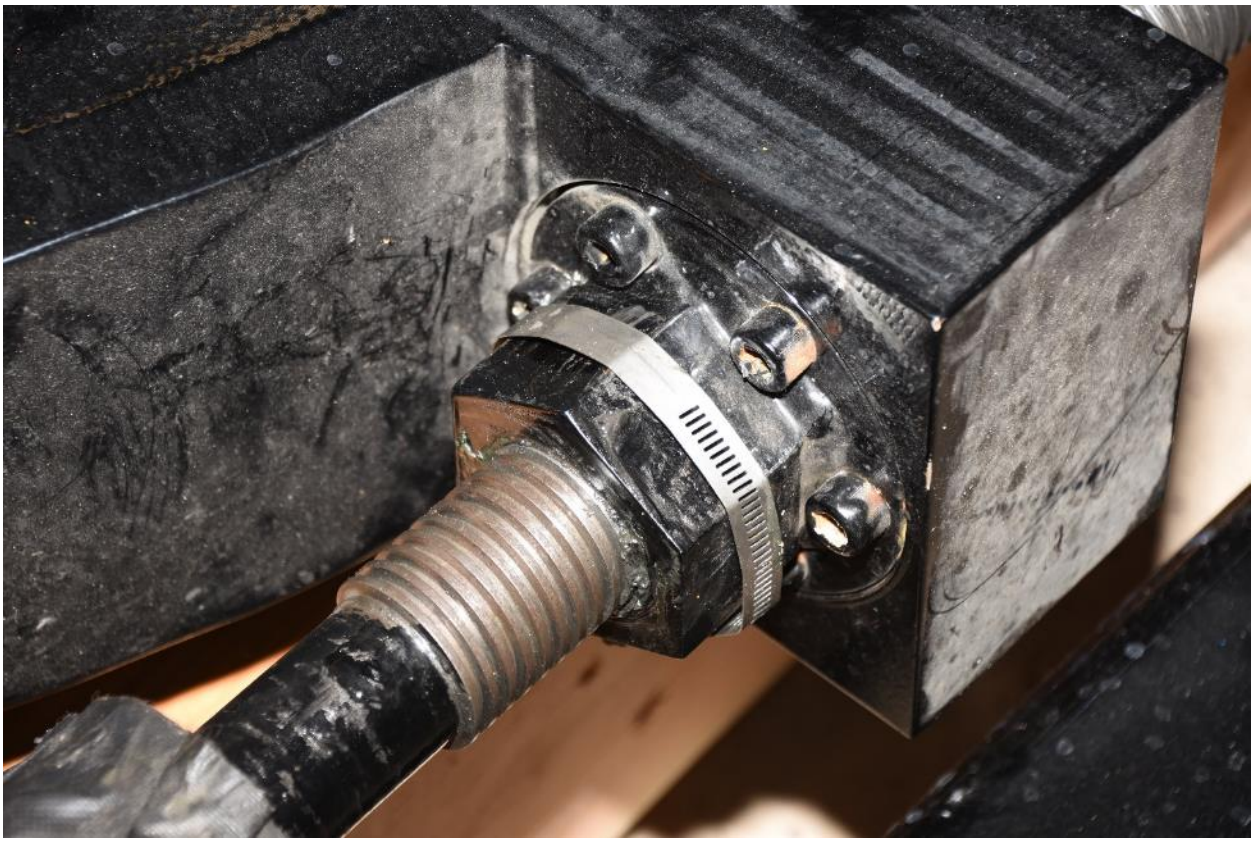


FIGURE 59

APPENDIX I

LABORATORY TESTING INC.
2331 Topaz Drive, Hatfield, PA 19440
TEL: 800-219-9095 • FAX: 800-219-9096

Certified Test Report

CCE001-21-08-24566-1

Nadcap Administered by PRI
ACCREDITED
Materials Testing Laboratories
NonDestructive Testing

SOLD TO
Craig Clauser Eng. Consulting
1610 Hunter Circle
West Chester, PA 19380

SHIP TO
Craig Clauser Eng. Consulting
1610 Hunter Circle
West Chester, PA 19380
ATTN: [redacted]

CUSTOMER P.O.	CERTIFICATION DATE	SHIP VIA
C21062	8/19/2021	EMAIL

DESCRIPTION

Quantity:	1	**Quantity:**	1
Material:	Bronze	**Material:**	Steel
Identified as:	A	**Identified as:**	BL
Job No.:	C21062	**Job No.:**	C21062

***REVISED CERTIFICATION**

***CHEMICAL ANALYSIS:**
APPLICABLE SPECIFICATIONS: Customer's Information
KEY: C - Conforms NC - Non-Conformance R-Report for Information

ELEMENT	A
Al	10.20%
C	0.006%
Co	0.006%
Cr	0.003%
Fe	3.63%
Mn	0.013%
Ni	0.36%
P	0.008%
Pb	0.013%
S	0.001%
Sb	0.001%
Si	0.038%
Sn	0.010%
Zn	0.079%
KEY (C/NC/R):	R

---CHEMICAL ANALYSIS RESULTS CONTINUED ON NEXT PAGE---

LABORATORY TESTING INC.
2331 Topaz Drive, Hatfield, PA 19440
TEL: 800-219-9095 • FAX: 800-219-9096

Certified Test Report
CCE001-21-08-24566-1

Nadcap Administered by PRI
ACCREDITED
Materials Testing Laboratories
NonDestructive Testing

***REVISED CERTIFICATION**

***CHEMICAL ANALYSIS (Continued...)**
APPLICABLE SPECIFICATIONS: Customer's Information
KEY: C - Conforms NC - Non-Conformance R-Report for Information

ELEMENT	BL
Al	0.026%
B	0.0002%
C	0.39%
Co	0.009%
Cr	0.95%
Cu	0.29%
Mn	0.82%
Mo	0.17%
Nb	<0.001%
Ni	0.096%
P	0.011%
S	0.016%
Si	0.24%
Ti	0.001%
V	0.003%
W	0.004%
KEY (C/NC/R):	R

Date Completed: 8/19/2021 (C and S) / 8/20/2021 (Balance of elelments)*
Procedures/Methods: MAS-CS, Rev. 7, Carbon and Sulfur Analysis; 86-SCA-0, Rev. 22, Direct Reading Atomic Emissions Spectroscopy*

CERTIFICATION REVISION HISTORY:

*REVISION DATE:	SUMMARY OF CHANGE:
8/20/2021	Amended with additional elements

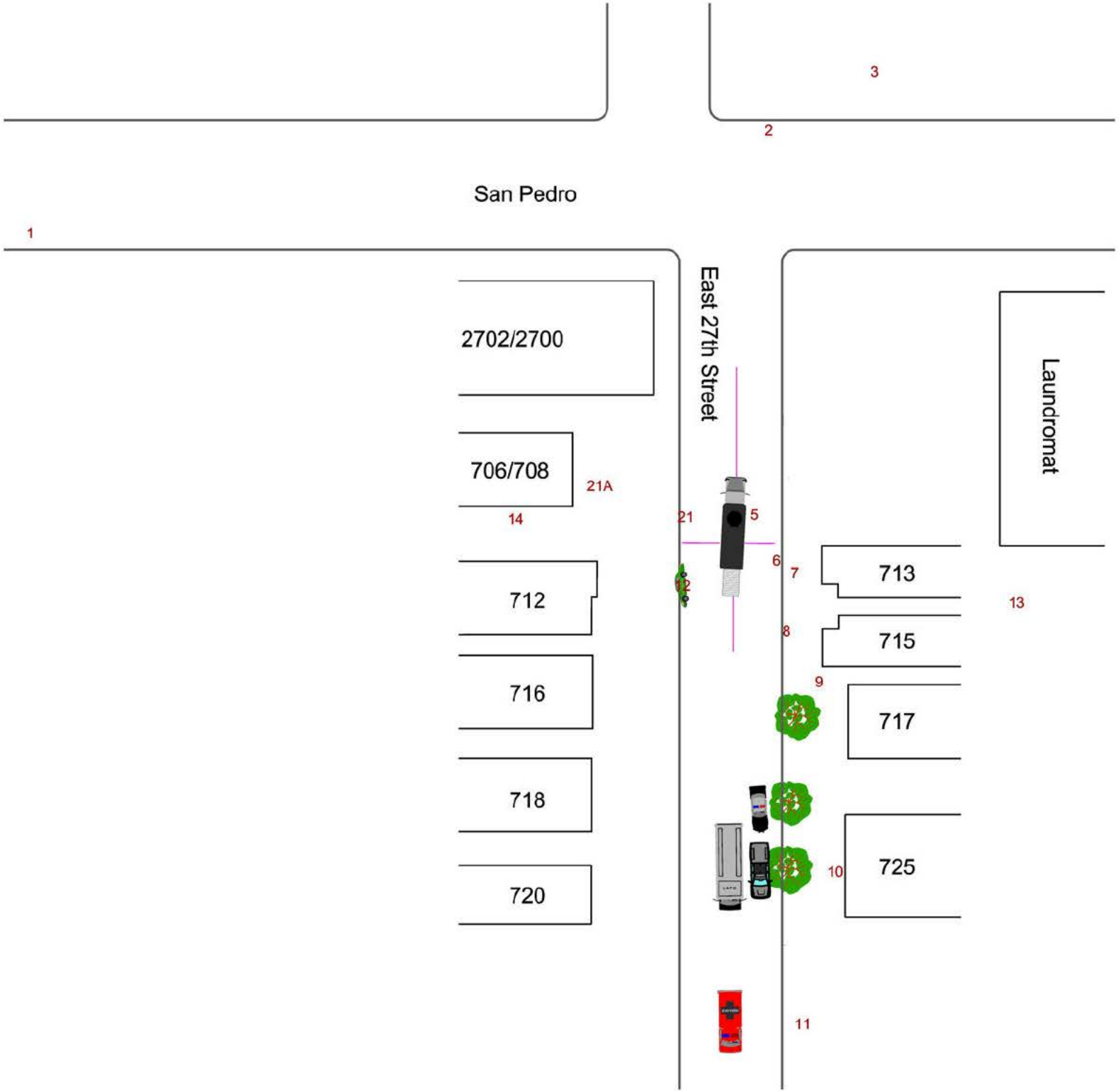
The services performed above were done in accordance with LTI's Quality System Program Manual Revision 21 dated 5/1/2019 and ISO/IEC 17025:2017. These results relate only to the items tested and this report shall not be reproduced, except in full, without the written approval of Laboratory Testing, Inc. The services provided on this certificate have been performed in conformance with the customer's purchase order requirements. L.T.I. is accredited by Nadcap for NDT and Materials Testing for the test methods and specific services as listed in the Scopes of Accreditation available at www.labtesting.com and www.eAuditNet.com. The results reported on this test report represent the actual attributes of the material tested and indicate full compliance with all applicable specification and contract requirements. This is a shared risk decision rule which the customer also has responsibility for determining acceptance of the results.

MERCURY CONTAMINATION: During the testing and inspection, the product did not come in direct contact with mercury or any of its compounds nor with any mercury containing devices employing a single boundary of containment.

NOTE: The recording of false, fictitious or fraudulent statements or entries on this document may be punishable as a felony under Federal Statutes.

[redacted]
QA Specialist

[redacted]
Authorized Signature



716 E. 27th Explosion

716 E. 27th
Los Angeles, CA

ATF #:
784020 21 0014

Los Angeles FD
1295

Los Angeles PD
211312016

Date Recorded On:
July 2-5, 2021

Date Recorded by:
SA [redacted]
SA [redacted]

Drawn By:
SA [redacted]

Notes

Red numbers designate significant items recovered from TCV. See associated Report of Investigation for complete description.

Plan View
Overall
7/6/2021

Drawing Status
VER. 1

Recovered TCV components

Item	Distance	Description
1	292'	Piece of railing handle from TCV
2	151'	TCV door actuator
3	181'	TCV gear
4	1362'	Door of TCV --- 525lbs
5	7'	Hydraulic arm from TCV door --- 51 lbs
6	19'	TCV door locking yoke, passenger side --- 550 lbs
7	28'	TCV door hinge --- 500 lbs
8	42'	TCV yoke screw handle --- 5 lbs
9	65'	S 5000 electric motor, top of TCV --- 11.7 lbs
10	135'	TCV door hinge arm --- 77 lbs
11	190'	TCV door hinge arm bracket, designed to connect item 4 to item 7 --- 38 lbs
12	26'	TCV door locking yoke, driver side (embedded in vehicle) --- 270 lbs
13	109'	TCV door hinge structure and frame --- 200 lbs
14	81'	TCV door yoke drive chain