DOT US Department of Transportation
PHMSA Pipeline and Hazardous Materials Safety Administration
OPS Office of Pipeline Safety
Eastern Region

Principal Investigator	Michael Yazemboski
Senior Accident Investigator	Michael Yazemboski
Region Director	Byron E. Coy
Date of Report	10/29/2012
Subject	Failure Investigation Report – Texas Eastern Transmission (SPECTRA) Marietta Station Incident

Operator, Location, & Consequences

Date of Failure	04/13/2012
Commodity Released	Air
City/County & State	Marietta, Lancaster County, PA
OpID & Operator Name	19235 – Texas Eastern Transmission L.P. (Spectra)
Unit # & Unit Name	15091 – Eagle/Marietta/Chester-PA
SMART Activity #	139285
Milepost / Location	Latitude: 40.0641275; Longitude: -76.5773285
Type of Failure	Rupture of the starting air piping system due to check valve malfunctions on Compressor Engine #1.
Fatalities	0
Injuries	1
Description of area impacted	Rural, Class 1 Area, Non-High Consequence Area
Total Costs	Property Damage: $250,000 ; Intentional Gas Lost (blowdown): $1,170

Failure Investigation Report
Texas Eastern Transmission (SPECTRA) - Marietta Station Incident
[Failure Date 04/13/2012]

Executive Summary

On April 13, 2012, at approximately 1:20 p.m. Eastern Standard Time (EST), an explosion occurred at Texas Eastern Transmission L.P.'s (Texas Eastern) Marietta Compressor Station located in Marietta, Pennsylvania. The explosion occurred on the starting air system during the startup of a reciprocating engine located in the main compressor building. Texas Eastern made a notification to the National Response Center reporting the incident.

The station operator was in the process of starting Engine Unit #1 when the air piping system exploded. The station operator suffered injuries during the explosion and was taken to a local hospital for treatment and overnight observation. He was released from the hospital on April 14, 2012. Damage to the station was confined to the air piping within the main compressor building. There was no release of gas and no fire resulting from this incident.

On April 16, 2012, an inspector from the Eastern Region was dispatched to the incident site to conduct an investigation.

The incident was caused by a malfunction of the "Air Start Check Valve" and the "Air Start Valve" on engine #1. The Air Start Valves are designed to regulate starting air into the engine cylinders during startup, and the Air Start Check Valves are designed to prevent hot combustion gases and combustible fuel/air mixtures from back flowing into the air supply piping during startup operations. The malfunction of the valves allowed hot engine exhaust gases, during startup, to come in contact with an explosive mixture of lubricating oils from the air compressor that had accumulated in the air piping system.

System Details

The Marietta Compressor Station is comprised of one turbine unit and seven natural gas-fired reciprocating compressor units that are used to maintain pressure and move natural gas through the Texas Eastern System.

The air system was installed during the construction of the station in 1952 and consists of 2-inch-diameter, 0.188-wall, Grade B steel pipe. The air system in the main reciprocating compressor building consists of a 250 psig system that is used for starting the compressor engines, and a 150 psig system that is used for service air only (crane, air tools). Each system is pressure-regulated and equipped with an overpressure relief valve. The 250 psig system relief is set at 300 psig, and the 150 psig system is set at 200 psig. The turbine building is only equipped with instrument/service air. The air compressor servicing the station is an Ingersoll, 50 horsepower, 2-stage unit that was installed in 1990. Based on a review of inspection/maintenance records and interviews with station personnel, there have been no problems reported regarding the air system prior to this event.

Events Leading up to the Failure

Prior to the incident, the station was utilizing the unit 7 turbine compressor to move natural gas on the main transmission lines. The station received a request from the control center to bring the unit 7 turbine offline and to start the reciprocating units. The station operator was in the process of starting engine unit #1, in accordance with the startup procedures (Appendix F), when the incident occurred. The recycle valve to the compressor unit was open, and the unit was not loaded at the time of the failure. The recycle valve allows the natural gas to circulate through the compressor during engine startup, thus reducing the amount of load on the engine. The station operator indicated that he was in the process of closing the starting air valve, after the engine start, when the air system exploded. He also indicated that he did not notice anything out of the ordinary prior to the incident and that the engine had run the day before without any problems (Appendix H Photos).

Emergency Response

On Friday April 13, 2012, at approximately 1:20 p.m. EST, an individual driving along River Road (SR 141) near the Marietta Compressor Station heard an explosion and called 911. Two employees in the station office approximately 300 feet from the main compressor building also contacted 911 when they heard the explosion. The station operator was the only individual inside the main compressor building during the incident. The emergency shutdown system was tripped manually by the mechanic who was one of the individuals in the station office. The local police and fire department arrived on scene within 10 minutes. The station operator was taken by ambulance to a local hospital where he was treated for facial and head injuries and kept overnight for observation.

Summary of Return-to-Service

As a result of the incident investigation, Texas Eastern took immediate action across its U.S. operations at compressor stations with reciprocating engines and reciprocating air compressors. On April 20, 2012, Texas Eastern distributed a system-wide safety alert requiring that specific action be taken at reciprocating compressor stations that utilize starting air systems. The safety alert required station personnel to inspect and overhaul the starting air check valves on all reciprocating units with starting air systems. At locations where the units were not running, the alert stated that the units should not be run until these maintenance activities were completed. If units in-service were shutdown, they were not to be restarted until the requirements of the alert were met.

As part of the safety alert, locations were required to document all starting air check valve issues identified during the inspection and overhaul activities. Each location was also required to identify any units that had a history of sluggish/malfunctioning starting air check valves found during scheduled maintenance activities or during start-up. Reciprocating compressor stations were required to review and/or revise their unit start-up and shut-down procedures to ensure that the procedures included a temperature check of the starting air piping at each cylinder head. Elevated temperatures indicate a malfunctioning starting air check valve and require that the unit be shut down and the check valve replaced or repaired.

The safety alert also required that stations with reciprocating air compressors revise their routine operating duties to require that all low-point drains on air systems be blown out once per shift when the station is manned to prevent the accumulation of compressor lubricants in the air piping. Stations were also required to identify and document the daily oil consumption rate of each reciprocating air compressor, identify and document the manufacturer, type, and specification of the lube oil currently used, and identify and document the historical data on previous lube oils used.

The Marietta Station will remain offline until remediation activities have been completed. Texas Eastern will install a new air piping system at the Marietta Station that will include the addition of chillers, air driers, and additional drains at low points throughout the air piping system to prevent fluids from accumulating in the piping. In addition, an oil separator will be installed on the air compressor to aid in removing oil and fluids from the air stream.

Investigation Details

On April 13, 2012, at approximately 1:20 p.m. EST, Texas Eastern reported an incident at their Marietta Compressor Station in Marietta, Pennsylvania, (Appendix A) to the National Response Center (Appendix B). The damage resulting from the incident was confined to the air piping system within the main compressor building. Although this event did not involve an unintentional release of gas from the facility, Texas Eastern reported this event as a reportable incident under 191.5 of the code because of the significant nature of the event and the resulting injury to the station operator. The Marietta Station is located in a rural, Class 1, non-High Consequence Area. The Marietta Station has no history of reportable incidents or safety-related conditions.

An investigator from PHMSA's Eastern Region was dispatched to the site and began the investigation on April 16, 2012. Upon arriving at the station, a briefing meeting was held with Texas Eastern personnel. Site drawings, procedures, pipe specifications, system schematics, and information related to the incident were discussed.

The failure of the air system originated at Engine Unit #1 (unit ID 30501) (Appendix H, page 4). The engine was a naturally aspirated reciprocating Clark Model HBA8, with a total output of 1760 HP. This unit was installed in 1952. Prior to starting Engine #1 on April 13, the day of the incident, Engine #1 was operated on April 12 with no reported problems. According to a Unit Maintenance and Operations Log, Engine Unit #1 (unit ID 30501) logged a total of 720 hours for the 13 days in April 2012 prior to the incident (Appendix E). The total accumulated hours of runtime for this unit was 169,662. There were no reported maintenance or operational issues associated with this unit (Unit Maintenance/Operations Log). Maintenance records for Engine Unit #1 showed that the Air Start Valves were inspected and reconditioned every 2 years per the Preventative Maintenance Checklist outlined in Section 1, Volume 1, of the Spectra Energy Transmission Maintenance Manual (Appendix D). Scheduled maintenance on the Air Start Valves was completed on June 26, 2008, and July 27, 2010.

The Air Start Valves are designed to regulate the starting air into the engine cylinders during startup, and the Air Start Check Valves are designed to prevent hot combustion gases and combustible fuel/air mixtures from back-flowing into the air supply piping during startup operations. Upon examining the Air Start Valves on compressor engine No. 1, it was observed that the valve was slow to respond when opened manually. Upon disassembly of the valve, coking deposits (a residue similar to creosote), were found around the valve stem, preventing the valve from operating freely as designed (Appendix H, page 12). This indicates that hot exhaust gases had made it past the Air Start Check Valve and were in direct contact with the Air Start Valve. It is believed that the residual lubricating oil from the air compressors (500 °F flashpoint) that had accumulated in the air piping was ignited by the hot exhaust gases that were impinging on the Air Start Valve, thus causing the incident.

The starting air systems for all six reciprocating engines located at the Marietta Station were inspected by Texas Eastern immediately following the incident. As a result of the inspection, Engine #3, Cylinder #4, was found to have a similar coking condition as was found on Engine #1.

The investigation also focused on the air collectors and the fluid collection system for the air system. The collectors were located outside of the main compressor building (Appendix H, page 18). The collectors store the compressed air for use throughout the station. Lubricating oils and fluids from the air compressors that accumulate in these vessels are drained into a holding tank at the beginning of each 12-hour shift. There were no additional drains at low points on the air piping located downstream of the air collectors. It is believed that the accumulation of lubricating oil at these low points downstream of the air collectors resulted in a combustible mixture that was a contributing factor in this incident (Appendix H, page 1).

As part of the investigation, Operator Qualification records and Station Operating and Maintenance procedures were reviewed. The station operator has been working at Texas Eastern for a total of 4 years, during all of which he has worked as a station operator. The station operator was successfully qualified on September 13, 2011, for the following tasks related to this incident:

1. Covered Task 6030P-Compressor Units/Stations: Start-up, Operations, Shutdown, and Purging Before Returning to Service (Qualification Expiration Date: 9/13/2014)
2. Covered Task 6020P- Monitoring Pipeline Pressure (Qualification Expiration Date: 9/13/2014)
3. Covered Task 0070P- Operate Valves (Qualification Expiration Date: 9/13/2014)

Findings and Contributing Factors

Based on the results of the incident investigation conducted by PHMSA's Eastern Region, the cause of the incident was due to the malfunction of the "Air Start Check Valve" and the "Air Start Valve" on Compressor Engine No. 1. In addition, oil from the air compressors had accumulated in the air lines, creating a combustible mixture that was ignited by the hot combustion gases.

Appendices

Appendix	Description
A	139285 Appendix A Aerial photo map
B	139285 Appendix B NRC report 1008605
C	139285 Appendix C Marietta Incident 2012 final
D	139285 Appendix D Maintenance Checklist
E	139285 Appendix E Maintenance Operations Log
F	139285 Appendix F Unit Startup Procedures
G	139285 Appendix G Station Operating Pressure
H	139285 Appendix H Photos

Appendix A

Map Removed

File Available at PHMSA

139285 Appendix B NRC report 1008605

NATIONAL RESPONSE CENTER 1-800-424-8802
*** For Public Use ***
Information released to a third party shall comply with any
applicable federal and/or state Freedom of Information and Privacy Laws

Incident Report # 1008605

INCIDENT DESCRIPTION

*Report taken at 15:11 on 13-APR-12
Incident Type: FIXED
Incident Cause: EQUIPMENT FAILURE
Affected Area:
The incident occurred on 13-APR-12 at 13:20 local time.
Affected Medium: AIR ATMOSPHERE

SUSPECTED RESPONSIBLE PARTY

Organization: SPECTRA ENERGY
HOUSTON, TX 77056

Type of Organization: PUBLIC UTILITY

INCIDENT LOCATION

HIGHWAY 30 County: LANCASTER
City: MARIETTA State: PA

RELEASED MATERIAL(S)

CHRIS Code: ONG Official Material Name: NATURAL GAS
Also Known As:
Qty Released: 0 UNKNOWN AMOUNT

DESCRIPTION OF INCIDENT

CALLER REPORTED A RELEASE OF NATURAL GAS DUE TO A BACKFIRE IN A COMPRESSOR UNIT.

INCIDENT DETAILS

Package: N/A
Building ID:
Type of Fixed Object: OTHER
Power Generating Facility: UNKNOWN
Generating Capacity:
Type of Fuel:
NPDES:
NPDES Compliance: UNKNOWN

DAMAGES

Fire Involved:	NO	Fire Extinguished:	UNKNOWN		
INJURIES:	YES	Hospitalized:	1	Empl/Crew:	Passenger:
FATALITIES:	NO	Empl/Crew:		Passenger:	Occupant:
EVACUATIONS:	NO	Who Evacuated:		Radius/Area:	
Damages:	NO				

Closure Type		Description of Closure	Length of Closure	Direction of Closure
Air:	N			
Road:	N			
Waterway:	N			
Track:	N			

Major Artery: N

Passengers Transferred: NO

139285 Appendix B NRC report 1008605

Environmental Impact: UNKNOWN

Media Interest: NONE Community Impact due to Material:

REMEDIAL ACTIONS

SHUTDOWN SYSTEM

Release Secured: YES
Release Rate:
Estimated Release Duration:

WEATHER

Weather: UNKNOWN, °F

ADDITIONAL AGENCIES NOTIFIED

Federal: NONE
State/Local: PHMSA, DOT
State/Local On Scene: NONE
State Agency Number: NONE

NOTIFICATIONS BY NRC

ATLANTIC STRIKE TEAM (MAIN OFFICE)
13-APR-12 15:19
CHEM SAFETY AND HAZARD INVEST BOARD (CSB AUTOMATIC NOTIFICATIONS)
13-APR-12 15:19
DOT CRISIS MANAGEMENT CENTER (MAIN OFFICE)
13-APR-12 15:19
U.S. EPA III (MAIN OFFICE)
13-APR-12 15:19
FLD INTEL SUPPORT TEAM PHILADELPHIA (MAIN OFFICE)
13-APR-12 15:19
USCG NATIONAL COMMAND CENTER (MAIN OFFICE)
13-APR-12 15:20
NATIONAL INFRASTRUCTURE COORD CTR (MAIN OFFICE)
13-APR-12 15:19
NJ STATE POLICE (MARINE SERVICES BUREAU)
13-APR-12 15:19
NOAA RPTS FOR PA (MAIN OFFICE)
13-APR-12 15:19
PA STATE POLICE (BUREAU OF CRIMINAL INVESTIGATION)
13-APR-12 15:19
MD DEPT OF ENV (MAIN OFFICE)
13-APR-12 15:19
PA EMERG MGMT AGCY (MAIN OFFICE)
13-APR-12 15:19

ADDITIONAL INFORMATION

NONE

*** END INCIDENT REPORT # 1008605 ***

The National Response Center is strictly an initial report taking agency and does not participate in the investigation or incident response. The NRC receives initial reporting information only and notifies Federal and State On-Scene Coordinators for response. The NRC does not verify nor does it take follow-on incident information. Verification of data and incident response is the sole responsibility of Federal/State On-Scene Coordinators. Data contained within the FOIA Web Database is initial information only. All reports provided via this server are for informational purposes only. Data to be used in legal proceedings must be obtained via written correspondence from the NRC.

NOTICE: This report is required by 49 CFR Part 191. Failure to report can result in a civil penalty not to exceed 100,000 for each violation for each day that such violation persists except that the maximum civil penalty shall not exceed $1,000,000 as provided in 49 USC 60122.		OMB NO: 2137-0522 EXPIRATION DATE: 01/31/2014
U.S Department of Transportation Pipeline and Hazardous Materials Safety Administration	**Report Date:**	05/11/2012
	No.	20120048 - 15529 (DOT Use Only)

INCIDENT REPORT - GAS TRANSMISSION AND GATHERING PIPELINE SYSTEMS

INSTRUCTIONS

Important: *Please read the separate instructions for completing this form before you begin. They clarify the information requested and provide specific examples. If you do not have a copy of the instructions, you can obtain one from the PHMSA Pipeline Safety Community Web Page at http://www.phmsa.dot.gov/pipeline.*

PART A - KEY REPORT INFORMATION

Report Type: *(select all that apply)*	**Original:**	**Supplemental:**	**Final:**
		Yes	

Last Revision Date:	05/29/2012
1. Operator's OPS-issued Operator Identification Number (OPID):	19235
2. Name of Operator	TEXAS EASTERN TRANSMISSION LP (SPECTRA ENERGY CORP)
3. Address of Operator:	
3a. Street Address	5400 WESTHEIMER COURT 77056
3b. City	HOUSTON
3c. State	Texas
3d. Zip Code:	77056
4. Local time *(24-hr clock)* and date of the Incident:	04/13/2012 13:20
5. Location of Incident:	
Latitude:	40.0641275
Longitude:	-76.5773285
6. National Response Center Report Number (if applicable):	1008605
7. Local time *(24-hr clock)* and date of initial telephonic report to the National Response Center (if applicable):	04/13/2012 15:20
8. Incident resulted from:	Reasons other than release of gas
9. Gas released: (select only one, based on predominant volume released)	
- Other Gas Released Name:	
10. Estimated volume of commodity released unintentionally - Thousand Cubic Feet (MCF):	
11. Estimated volume of intentional and controlled release/blowdown - Thousand Cubic Feet (MCF)	585.00
12. Estimated volume of accompanying liquid release (Barrels):	
13. Were there fatalities?	No
- If Yes, specify the number in each category:	
13a. Operator employees	
13b. Contractor employees working for the Operator	
13c. Non-Operator emergency responders	
13d. Workers working on the right-of-way, but NOT associated with this Operator	
13e. General public	
13f. Total fatalities (sum of above)	
14. Were there injuries requiring inpatient hospitalization?	Yes
- If Yes, specify the number in each category:	
14a. Operator employees	1
14b. Contractor employees working for the Operator	0
14c. Non-Operator emergency responders	0
14d. Workers working on the right-of-way, but NOT associated with this Operator	0
14e. General public	0
14f. Total injuries (sum of above)	1

15. Was the pipeline/facility shut down due to the incident?	Yes
- If No, Explain:	
- If Yes, complete Questions 15a and 15b: *(use local time, 24-hr clock)*	
15a. Local time and date of shutdown	04/13/2012 13:20
15b. Local time pipeline/facility restarted	
- Still shut down? (* Supplemental Report Required)	Yes
16. Did the gas ignite?	No
17. Did the gas explode?	No
18. Number of general public evacuated:	0
19. Time sequence *(use local time, 24-hour clock)*:	
19a. Local time operator identified Incident	04/13/2012 13:20
19b. Local time operator resources arrived on site	04/13/2012 13:20

PART B - ADDITIONAL LOCATION INFORMATION

1. Was the origin of the Incident onshore?	Yes
- Yes (Complete Questions 2-12)	
- No (Complete Questions 13-15)	
If Onshore:	
2. State:	Pennsylvania
3. Zip Code:	17547
4. City	Marietta
5. County or Parish	York
6. Operator designated location	Milepost/Valve Station
Specify:	1203.64
7. Pipeline/Facility name:	Marietta Compressor Station
8. Segment name/ID:	Marietta Compressor Station
9. Was Incident on Federal land, other than the Outer Continental Shelf (OCS)?	No
10. Location of Incident :	Operator-controlled property
11. Area of Incident (as found) :	Aboveground
Specify:	Inside a building
Other – Describe:	
Depth-of-Cover (in):	
12. Did Incident occur in a crossing?	No
- If Yes, specify type below:	
- If Bridge crossing –	
Cased/ Uncased:	
- If Railroad crossing –	
Cased/ Uncased/ Bored/drilled	
- If Road crossing –	
Cased/ Uncased/ Bored/drilled	
- If Water crossing –	
Cased/ Uncased	
Name of body of water (If commonly known):	
Approx. water depth (ft) at the point of the Incident:	
Select:	
If Offshore:	
13. Approx. water depth (ft) at the point of the Incident:	
14. Origin of Incident:	
- If "In State waters":	
- State:	
- Area:	
- Block/Tract #:	
- Nearest County/Parish:	
- If "On the Outer Continental Shelf (OCS)":	
- Area:	
- Block #:	
15. Area of Incident:	

PART C - ADDITIONAL FACILITY INFORMATION

1. Is the pipeline or facility: - Interstate - Intrastate	Interstate
2. Part of system involved in Incident:	Onshore Compressor Station Equipment and Piping
3. Item involved in Incident:	Auxiliary Piping (e.g. drain lines)
- If Pipe – Specify:	
3a. Nominal diameter of pipe (in):	
3b. Wall thickness (in):	

3c. SMYS (Specified Minimum Yield Strength) of pipe (psi):	
3d. Pipe specification:	
3e. Pipe Seam – Specify:	
- If Other, Describe:	
3f. Pipe manufacturer:	
3g. Year of manufacture:	
3h. Pipeline coating type at point of Incident – Specify:	
- If Other, Describe:	
- If Weld, including heat-affected zone – Specify:	
- If Other, Describe:	
- If Valve – Specify:	
- If Mainline – Specify:	
- If Other, Describe:	
3i. Mainline valve manufacturer:	
3j. Year of manufacture:	
- If Other, Describe:	
4. Year item involved in Incident was installed:	1952
5. Material involved in Incident:	Carbon Steel
- If Material other than Steel or Plastic – Specify:	
6. Type of Incident involved:	Other
- If Mechanical Puncture – Specify Approx. size:	
Approx. size: in. (in axial) by	
in. (circumferential)	
- If Leak - Select Type:	
- If Other – Describe:	
- If Rupture - Select Orientation:	
- If Other – Describe:	
Approx. size: in. (widest opening):	
by in. (length circumferentially or axially):	
- If Other – Describe:	
	Starting air system failure

PART D - ADDITIONAL CONSEQUENCE INFORMATION

1. Class Location of Incident:	Class 1 Location
2. Did this Incident occur in a High Consequence Area (HCA)?	No
- If Yes:	
2a. Specify the Method used to identify the HCA:	
3. What is the PIR (Potential Impact Radius) for the location of this Incident? Feet:	1
4. Were any structures outside the PIR impacted or otherwise damaged due to heat/fire resulting from the Incident?	No
5. Were any structures outside the PIR impacted or otherwise damaged NOT by heat/fire resulting from the Incident?	No
6. Were any of the fatalities or injuries reported for persons located outside the PIR?	No
7. Estimated Property Damage :	
7a. Estimated cost of public and non-Operator private property damage	$ 0
7b. Estimated cost of Operator's property damage & repairs	$ 250,000
7c. Estimated cost of Operator's emergency response	$ 0
7d. Estimated other costs	$ 0
Describe:	
7e. Total estimated property damage (sum of above)	$ 250,000
Cost of Gas Released	
7f. Estimated cost of gas released unintentionally	$ 0
7g. Estimated cost of gas released during intentional and controlled blowdown	$ 1,170
7h. Total estimated cost of gas released (sum of 7.f & 7.g above)	$ 1,170

PART E - ADDITIONAL OPERATING INFORMATION

1. Estimated pressure at the point and time of the Incident (psig):_	250.00
2. Maximum Allowable Operating Pressure (MAOP) at the point and time of the Incident (psig):	250.00
3. Describe the pressure on the system or facility relating to the	Pressure did not exceed MAOP

Incident:	
4. Not including pressure reductions required by PHMSA regulations (such as for repairs and pipe movement), was the system or facility relating to the Incident operating under an established pressure restriction with pressure limits below those normally allowed by the MAOP?	No
- If Yes - (*Complete 4a and 4b below)*	
4a. Did the pressure exceed this established pressure restriction?	
4b. Was this pressure restriction mandated by PHMSA or the State?	
5. Was "Onshore Pipeline, Including Valve Sites" OR "Offshore Pipeline, Including Riser and Riser Bend" selected in PART C, Question 2?	No
- If Yes - (*Complete 5a. - 5f. below):*	
5a. Type of upstream valve used to initially isolate release source:	
5b. Type of downstream valve used to initially isolate release source:	
5c. Length of segment isolated between valves (ft):	
5d. Is the pipeline configured to accommodate internal inspection tools?	
- If No – Which physical features limit tool accommodation? *(select all that apply)*	
- Changes in line pipe diameter	
- Presence of unsuitable mainline valves	
- Tight or mitered pipe bends	
- Other passage restrictions (i.e. unbarred tee's, projecting instrumentation, etc.)	
- Extra thick pipe wall (applicable only for magnetic flux leakage internal inspection tools)	
- Other	
- If Other, Describe:	
5e. For this pipeline, are there operational factors which significantly complicate the execution of an internal inspection tool run?	
- If Yes, which operational factors complicate execution? *(select all that apply)*	
- Excessive debris or scale, wax, or other wall build-up	
- Low operating pressure(s)	
- Low flow or absence of flow	
- Incompatible commodity	
- Other	
- If Other, Describe:	
5f. Function of pipeline system:	
6. Was a Supervisory Control and Data Acquisition (SCADA)-based system in place on the pipeline or facility involved in the Incident?	No
- If Yes:	
6a. Was it operating at the time of the Incident?	
6b. Was it fully functional at the time of the Incident?	
6c. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume or pack calculations) assist with the detection of the Incident?	
6d. Did SCADA-based information (such as alarm(s), alert(s), event(s), and/or volume calculations) assist with the confirmation of the Incident?	
7. How was the Incident initially identified for the Operator?	Local Operating Personnel, including contractors
- If Other – Describe:	
7a. If "Controller", "Local Operating Personnel, including contractors", "Air Patrol", or "Ground Patrol by Operator or its contractor" is selected in Question 7, specify the following:	Operator employee
8. Was an investigation initiated into whether or not the controller(s) or control room issues were the cause of or a contributing factor to the Incident?	No, the facility was not monitored by a controller(s) at the time of the Incident
- If No, the operator did not find that an investigation of the controller(s) actions or control room issues was necessary due to: *(provide an explanation for why the operator did not investigate)*	
- If Yes, Describe investigation result(s) *(select all that apply)*:	
- Investigation reviewed work schedule rotations, continuous hours of service (while working for the operator), and other factors associated with fatigue	
- Investigation did NOT review work schedule rotations, continuous hours of service (while working for the Operator) and other factors associated with fatigue	

- Provide an explanation for why not:	
- Investigation identified no control room issues	
- Investigation identified no controller issues	
- Investigation identified incorrect controller action or controller error	
- Investigation identified that fatigue may have affected the controller(s) involved or impacted the involved controller(s) response	
- Investigation identified incorrect procedures	
- Investigation identified incorrect control room equipment operation	
- Investigation identified maintenance activities that affected control room operations, procedures, and/or controller response	
- Investigation identified areas other than those above –	
Describe:	

PART F - DRUG & ALCOHOL TESTING INFORMATION

1. As a result of this Incident, were any Operator employees tested under the post-accident drug and alcohol testing requirements of DOT's Drug & Alcohol Testing regulations?	Yes
- If Yes:	
1a. Describe how many were tested:	1
1b. Describe how many failed:	0
2. As a result of this Incident, were any Operator contractor employees tested under the post-accident drug and alcohol testing requirements of DOT's Drug & Alcohol Testing regulations?	No
- If Yes:	
2a. Describe how many were tested:	
2b. Describe how many failed:	

PART G - APPARENT CAUSE

Select only one box from PART G in the shaded column on the left representing the APPARENT Cause of the Incident, and answer the questions on the right. Describe secondary, contributing, or root causes of the Incident in the narrative (PART H).

Apparent Cause:	G6 - Equipment Failure

G1 - Corrosion Failure - *only one **sub-cause** can be picked from shaded left-hand column*

Corrosion Failure – Sub-cause:	
- If External Corrosion:	
1. Results of visual examination:	
- If Other, Describe:	
2. Type of corrosion: *(select all that apply)*	
- Galvanic	
- Atmospheric	
- Stray Current	
- Microbiological	
- Selective Seam	
- Other	
- If Other – Describe:	
3. The type(s) of corrosion selected in Question 2 is based on the following: *(select all that apply)*	
- Field examination	
- Determined by metallurgical analysis	
- Other	
- If Other – Describe:	
4. Was the failed item buried under the ground?	
- If Yes:	
4a. Was failed item considered to be under cathodic protection at the time of the incident?	
- If Yes, Year protection started:	
4b. Was shielding, tenting, or disbonding of coating evident at the point of the incident?	
4c. Has one or more Cathodic Protection Survey been conducted at the point of the incident?	
If "Yes, CP Annual Survey" – Most recent year conducted:	
If "Yes, Close Interval Survey" – Most recent year conducted:	

If "Yes, Other CP Survey" – Most recent year conducted:	
- If No:	
4d. Was the failed item externally coated or painted?	
5. Was there observable damage to the coating or paint in the vicinity of the corrosion?	
- If Internal Corrosion:	
6. Results of visual examination:	
- If Other, Describe:	
7. Cause of corrosion *(select all that apply)*:	
- Corrosive Commodity	
- Water drop-out/Acid	
- Microbiological	
- Erosion	
- Other	
- If Other, Describe:	
8. The cause(s) of corrosion selected in Question 7 is based on the following *(select all that apply)*:	
- Field examination	
- Determined by metallurgical analysis	
- Other	
- If Other, Describe:	
9. Location of corrosion *(select all that apply)*:	
- Low point in pipe	
- Elbow	
- Drop-out	
- Other	
- If Other, Describe:	
10. Was the gas/fluid treated with corrosion inhibitors or biocides?	
11. Was the interior coated or lined with protective coating?	
12. Were cleaning/dewatering pigs (or other operations) routinely utilized?	
13. Were corrosion coupons routinely utilized?	
Complete the following if any Corrosion Failure sub-cause is selected AND the "Item Involved in Incident" (from PART C, Question 3) is Pipe or Weld.	
14. Has one or more internal inspection tool collected data at the point of the Incident?	
14a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage Tool	
Most recent year run:	
- Ultrasonic	
Most recent year run:	
- Geometry	
Most recent year run:	
- Caliper	
Most recent year run:	
- Crack	
Most recent year run:	
- Hard Spot	
Most recent year run:	
- Combination Tool	
Most recent year run:	
- Transverse Field/Triaxial	
Most recent year run:	
- Other	
Most recent year run:	
If Other, Describe:	
15. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Incident?	
- If Yes,	
Most recent year tested:	
Test pressure (psig):	
16. Has one or more Direct Assessment been conducted on this segment?	
- If Yes, and an investigative dig was conducted at the point of the Incident:	
Most recent year conducted:	
- If Yes, but the point of the Incident was not identified as a dig site:	
Most recent year conducted:	
17. Has one or more non-destructive examination been conducted at the point of the Incident since January 1, 2002?	

17a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Most recent year examined:	
- Guided Wave Ultrasonic	
Most recent year examined:	
- Handheld Ultrasonic Tool	
Most recent year examined:	
- Wet Magnetic Particle Test	
Most recent year examined:	
- Dry Magnetic Particle Test	
Most recent year examined:	
- Other	
Most recent year examined:	
If Other, Describe:	
G2 - Natural Force Damage - *only one **sub-cause** can be picked from shaded left-handed column*	
Natural Force Damage – Sub-Cause:	
- If Earth Movement, NOT due to Heavy Rains/Floods:	
1. Specify:	
- If Other, Describe:	
- If Heavy Rains/Floods:	
2. Specify:	
- If Other, Describe:	
- If Lightning:	
3. Specify:	
- If Temperature:	
4. Specify:	
- If Other, Describe:	
- If High Winds:	
- If Other Natural Force Damage:	
5. Describe:	
Complete the following if any Natural Force Damage sub-cause is selected.	
6. Were the natural forces causing the Incident generated in conjunction with an extreme weather event?	
6a. If yes, specify: *(select all that apply)*:	
- Hurricane	
- Tropical Storm	
- Tornado	
- Other	
- If Other, Describe:	
G3 - Excavation Damage *only one **sub-cause** can be picked from shaded left-hand column*	
Excavation Damage – Sub-Cause:	
- If Excavation Damage by Operator (First Party):	
- If Excavation Damage by Operator's Contractor (Second Party):	
- If Excavation Damage by Third Party:	
- If Previous Damage Due to Excavation Activity:	
Complete Questions 1-5 ONLY IF the "Item Involved in Incident" (From Part C, Question 3) is Pipe or Weld.	
1. Has one or more internal inspection tool collected data at the point of the Incident?	
1a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	
Year:	
- Ultrasonic	
Year:	
- Geometry	
Year:	
- Caliper	
Year:	
- Crack	

Year:	
- Hard Spot	
Year:	
- Combination Tool	
Year:	
- Transverse Field/Triaxial	
Year:	
- Other:	
Year:	
Describe:	
2. Do you have reason to believe that the internal inspection was completed BEFORE the damage was sustained?	
3. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Incident?	
- If Yes:	
Most recent year tested:	
Test pressure (psig):	
4. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Incident:	
Most recent year conducted:	
- If Yes, but the point of the Incident was not identified as a dig site:	
Most recent year conducted:	
5. Has one or more non-destructive examination been conducted at the point of the Incident since January 1, 2002?	
5a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Year:	
- Guided Wave Ultrasonic	
Year:	
- Handheld Ultrasonic Tool	
Year:	
- Wet Magnetic Particle Test	
Year:	
- Dry Magnetic Particle Test	
Year:	
- Other	
Year:	
Describe:	
Complete the following if Excavation Damage by Third Party is selected as the sub-cause.	
6. Did the operator get prior notification of the excavation activity?	
6a. If Yes, Notification received from *(select all that apply)*:	
- One-Call System	
- Excavator	
- Contractor	
- Landowner	
Complete the following mandatory CGA-DIRT Program questions if any Excavation Damage sub-cause is selected.	
7. Do you want PHMSA to upload the following information to CGA-DIRT (www.cga-dirt.com)?	
8. Right-of-Way where event occurred *(select all that apply)*:	
- Public	
- If Public, Specify:	
- Private	
- If Private, Specify:	
- Pipeline Property/Easement	
- Power/Transmission Line	
- Railroad	
- Dedicated Public Utility Easement	
- Federal Land	
- Data not collected	
- Unknown/Other	
9. Type of excavator :	
10. Type of excavation equipment :	
11. Type of work performed :	
12. Was the One-Call Center notified? - Yes - No	
12a. If Yes, specify ticket number:	
12b. If this is a State where more than a single One-Call Center	

exists, list the name of the One-Call Center notified:	
13. Type of Locator:	
14. Were facility locate marks visible in the area of excavation?	
15. Were facilities marked correctly?	
16. Did the damage cause an interruption in service?	
16a. If Yes, specify duration of the interruption: (hours)	
17. Description of the **CGA-DIRT Root Cause** (*select only the one predominant first level CGA-DIRT Root Cause and then, where available as a choice, then one predominant second level CGA-DIRT Root Cause as well*):	
- Predominant first level CGA-DIRT Root Cause:	
- If One-Call Notification Practices Not Sufficient, Specify:	
- If Locating Practices Not Sufficient, Specify:	
- If Excavation Practices Not Sufficient, Specify:	
- If Other/None of the Above, Explain:	
G4 - Other Outside Force Damage - only one **sub-cause** can be selected from the shaded left-hand column	
Other Outside Force Damage – Sub-Cause:	
- If Nearby Industrial, Man-made, or Other Fire/Explosion as Primary Cause of Incident:	
- If Damage by Car, Truck, or Other Motorized Vehicle/Equipment NOT Engaged in Excavation:	
1. Vehicle/Equipment operated by:	
- If Damage by Boats, Barges, Drilling Rigs, or Other Maritime Equipment or Vessels Set Adrift or Which Have Otherwise Lost Their Mooring:	
2. Select one or more of the following IF an extreme weather event was a factor:	
- Hurricane	
- Tropical Storm	
- Tornado	
- Heavy Rains/Flood	
- Other	
- If Other, Describe:	
- If Routine or Normal Fishing or Other Maritime Activity NOT Engaged in Excavation:	
- If Electrical Arcing from Other Equipment or Facility:	
- If Previous Mechanical Damage NOT Related to Excavation:	
Complete Questions 3-7 ONLY IF the "Item Involved in Incident" (from PART C, Question 3) is Pipe or Weld.	
3. Has one or more internal inspection tool collected data at the point of the Incident?	
3a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	
Most recent year run:	
- Ultrasonic	
Most recent year run:	
- Geometry	
Most recent year run:	
- Caliper	
Most recent year run:	
- Crack	
Most recent year run:	
- Hard Spot	
Most recent year run:	
- Combination Tool	
Most recent year run:	
- Transverse Field/Triaxial	
Most recent year run:	
- Other:	
Most recent year run:	
Describe:	
4. Do you have reason to believe that the internal inspection was completed BEFORE the damage was sustained?	
5. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Incident?	
- If Yes:	
Most recent year tested:	

Test pressure (psig):	
6. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Incident :	
Most recent year conducted:	
- If Yes, but the point of the Incident was not identified as a dig site:	
Most recent year conducted:	
7. Has one or more non-destructive examination been conducted at the point of the Incident since January 1, 2002?	
7a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Most recent year conducted:	
- Guided Wave Ultrasonic	
Most recent year conducted:	
- Handheld Ultrasonic Tool	
Most recent year conducted:	
- Wet Magnetic Particle Test	
Most recent year conducted:	
- Dry Magnetic Particle Test	
Most recent year conducted:	
- Other	
Most recent year conducted:	
Describe:	
If - If Intentional Damage:	
8. Specify:	
- If Other, Describe:	
- If Other Outside Force Damage:	
9. Describe:	

G5 – Material Failure of Pipe or Weld	**Use this section to report material failures ONLY IF the "Item Involved in Incident" (from PART C, Question 3) is "Pipe" or "Weld."**
	*Only one **sub-cause** can be selected from the shaded left-hand column

Material Failure of Pipe or Weld – Sub-Cause:	
1. The sub-case selected below is based on the following *(select all that apply)*:	
- Field Examination	
- Determined by Metallurgical Analysis	
- Other Analysis	
- If "Other Analysis", Describe	
- Sub-cause is Tentative or Suspected; Still Under Investigation *(Supplemental Report required)*	
- If Construction-, Installation- or Fabrication- related:	
2. List contributing factors: *(select all that apply)*	
- If Fatigue or Vibration related:	
Specify:	
- If Other, Describe:	
- Mechanical Stress	
- Other	
- If Other, Describe:	
- If Original Manufacturing-related (NOT girth weld or other welds formed in the field):	
2. List contributing factors: *(select all that apply)*	
- If Fatigue or Vibration related:	
Specify:	
- If Other, Describe:	
- Mechanical Stress	
- Other	
- If Other, Describe:	
- If Environmental Cracking-related:	
3. Specify:	
- If Other, Describe:	
Complete the following if any Material Failure of Pipe or Weld sub-cause is selected.	
4. Additional Factors (*select all that apply*):	
- Dent	

- Gouge	
- Pipe Bend	
- Arc Burn	
- Crack	
- Lack of Fusion	
- Lamination	
- Buckle	
- Wrinkle	
- Misalignment	
- Burnt Steel	
- Other	
- If Other, Describe:	
5. Has one or more internal inspection tool collected data at the point of the Incident?	
5a. If Yes, for each tool used, select type of internal inspection tool and indicate most recent year run:	
- Magnetic Flux Leakage	
Most recent year run:	
- Ultrasonic	
Most recent year run:	
- Geometry	
Most recent year run:	
- Caliper	
Most recent year run:	
- Crack	
Most recent year run:	
- Hard Spot	
Most recent year run:	
- Combination Tool	
Most recent year run:	
- Transverse Field/Triaxial	
Most recent year run:	
- Other	
Most recent year run:	
Describe:	
6. Has one or more hydrotest or other pressure test been conducted since original construction at the point of the Incident?	
- If Yes:	
Most recent year tested:	
Test pressure (psig):	
7. Has one or more Direct Assessment been conducted on the pipeline segment?	
- If Yes, and an investigative dig was conducted at the point of the Incident:	
Most recent year conducted:	
- If Yes, but the point of the Incident was not identified as a dig site:	
Most recent year conducted:	
8. Has one or more non-destructive examination(s) been conducted at the point of the Incident since January 1,2002?	
8a. If Yes, for each examination conducted since January 1, 2002, select type of non-destructive examination and indicate most recent year the examination was conducted:	
- Radiography	
Most recent year conducted:	
- Guided Wave Ultrasonic	
Most recent year conducted:	
- Handheld Ultrasonic Tool	
Most recent year conducted:	
- Wet Magnetic Particle Test	
Most recent year conducted:	
- Dry Magnetic Particle Test	
Most recent year conducted:	
- Other	
Most recent year conducted:	
Describe:	
G6 - Equipment Failure - only one **sub-cause** can be selected from the shaded left-hand column	

Equipment Failure – Sub-Cause:	Compressor or Compressor-related Equipment
- If Malfunction of Control/Relief Equipment:	
1. Specify:	
- Control Valve	
- Instrumentation	
- SCADA	
- Communications	
- Block Valve	
- Check Valve	
- Relief Valve	
- Power Failure	
- Stopple/Control Fitting	
- Pressure Regulator	
- ESD System Failure	
- Other	
- If Other, Describe:	
- If Compressor or Compressor-related Equipment:	
2. Specify:	Appurtenance Failure
- If Other, Describe:	
- If Threaded Connection/Coupling Failure:	
3. Specify:	
- If Other, Describe:	
- If Non-threaded Connection Failure:	
4. Specify:	
- If Other, Describe:	
- If Defective or Loose Tubing or Fitting:	
- If Failure of Equipment Body (except Compressor), Vessel Plate, or other Material:	
- If Other Equipment Failure:	
5. Describe:	
Complete the following if any Equipment Failure sub-cause is selected.	
6. Additional factors that contributed to the equipment failure *(select all that apply)*	
- Excessive vibration	
- Overpressurization	
- No support or loss of support	
- Manufacturing defect	
- Loss of electricity	
- Improper installation	
- Mismatched items (different manufacturer for tubing and tubing fittings)	
- Dissimilar metals	
- Breakdown of soft goods due to compatibility issues with transported gas/fluid	
- Valve vault or valve can contributed to the release	
- Alarm/status failure	
- Misalignment	
- Thermal stress	
- Other	Yes
- If Other, Describe:	Air compressor lube oil in air system
G7 – Incorrect Operation - only one **sub-cause** can be selected from the shaded left-hand column	
Incorrect Operation – Sub-Cause:	
- If Damage by Operator or Operator's Contractor NOT Related to Excavation and NOT due to Motorized Vehicle/Equipment Damage:	
- If Underground Gas Storage, Pressure Vessel, or Cavern Allowed or Caused to Overpressure:	
1. Specify:	
- If Other, Describe:	
- If Valve Left or Placed in Wrong Position, but NOT Resulting in an Overpressure:	
- If Pipeline or Equipment Overpressured:	

- If Equipment Not Installed Properly:	
- If Wrong Equipment Specified or Installed:	
- If Other Incorrect Operation:	
2. Describe:	
Complete the following if any Incorrect Operation sub-cause is selected.	
3. Was this Incident related to: *(select all that apply)*	
- Inadequate procedure	
- No procedure established	
- Failure to follow procedure	
- Other:	
- If Other, Describe:	
4. What category type was the activity that caused the Incident:	
5. Was the task(s) that led to the Incident identified as a covered task in your Operator Qualification Program?	
5a. If Yes, were the individuals performing the task(s) qualified for the task(s)?	

G8 - Other Incident Cause - only one **sub-cause** can be selected from the shaded left-hand column	
Other Incident Cause – Sub-Cause:	
- If Miscellaneous:	
1. Describe:	
- If Unknown:	
2. Specify:	

PART - H NARRATIVE DESCRIPTION OF THE INCIDENT

The employee was starting the unit. During the start up 2 of the unit's 8 starting air check valves were sluggish in closing which allowed combustion gasses to enter the starting air system.

A combustible mixture of air and air compressor lube oil had accumulated in the starting air system piping and was ignited by the combustion gasses from the unit.

There was no unintentional release of natural gas during the event but Spectra Energy has judged this to be a significant occurrence.

File Full Name

PART I - PREPARER AND AUTHORIZED SIGNATURE

Preparer's Name	Dwayne Teschendorf
Preparer's Title	Senior Technical Advisor
Preparer's Telephone Number	713-627-5573
Preparer's E-mail Address	deteschendorf@spectraenergy.com
Preparer's Facsimile Number	713-386-4468
Authorized Signature's Name	Rick Kivela
Authorized Signature Title	Director of Operational Compliance
Authorized Signature Telephone Number	713-627-6388
Authorized Signature Email	rwkivela@spectraenergy.com
Date	05/29/2012

Appendix 5

a I-ƛyƴŝyI-yŏŜ /ĸŜŏʅƚƛăƴ

Removed

File Available at PHMSA

Appendix E

Maintenance Operations Log Removed

File Available at PHMSA

Appendix F

Unit Start-up Procedures Removed

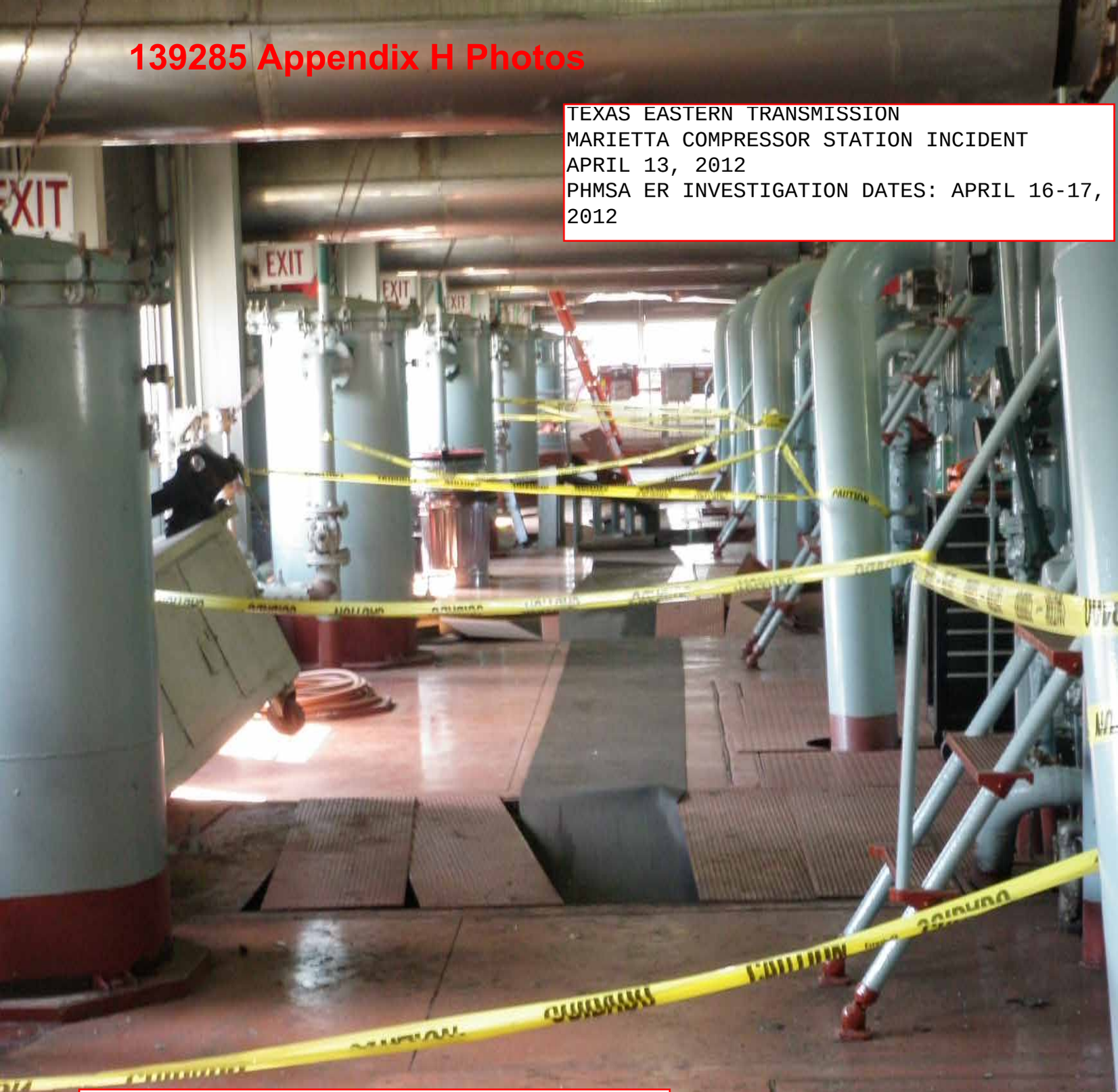
File Available at PHMSA

Appendix G

Station Operating Pressure Removed

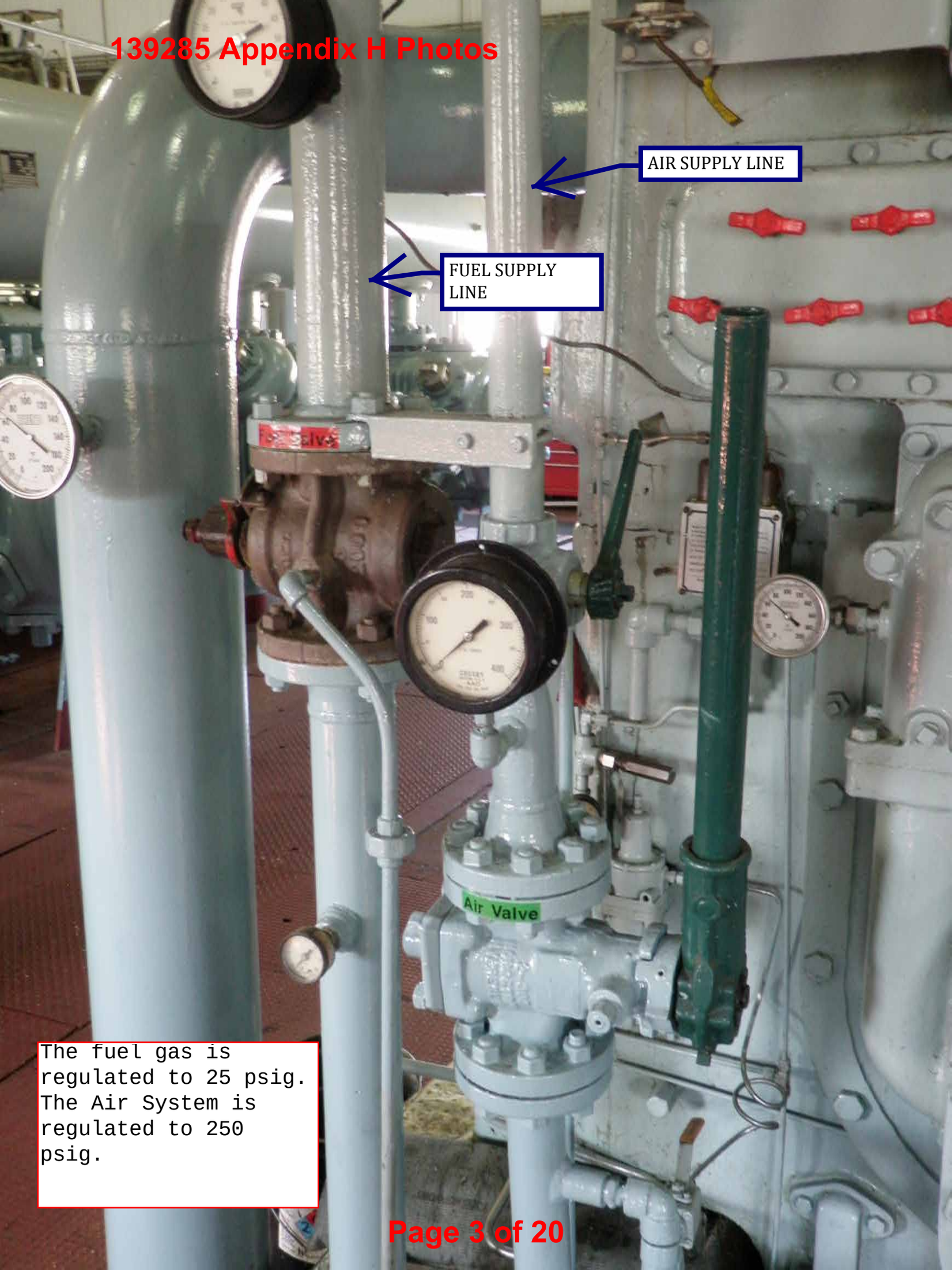
File Available at PHMSA

TEXAS EASTERN TRANSMISSION
MARIETTA COMPRESSOR STATION INCIDENT
APRIL 13, 2012
PHMSA ER INVESTIGATION DATES: APRIL 16-17, 2012

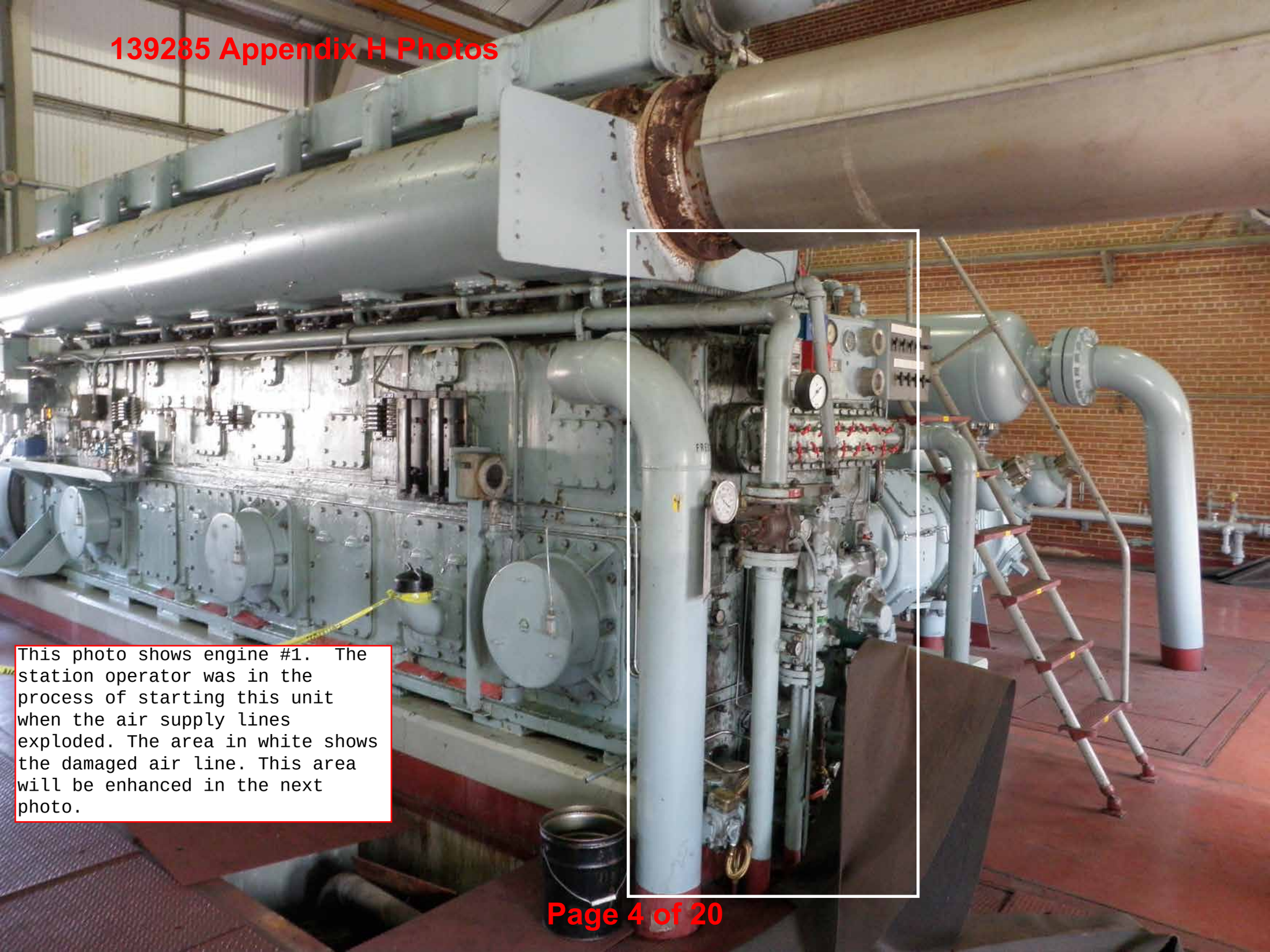


This photo shows the condition inside the Marietta Compressor Station following the incident that occurred April 13, 2012. Note the floor panels that were dislodged by the explosion throughout the length of the building. Air piping running under the floor was ruptured in many locations throughout the length of the building.

There are 7 engines total within the compressor building. All of the engines are CLARK HBA8 naturally aspirated reciprocating 8 cylinder engines that were installed in 1958. This photo shows engine #2. This engine was not damaged in the explosion. The area outlined in white shows the typical configuration of the fuel supply line and the air supply line. This area will be enhanced in the next photo to show more detail.

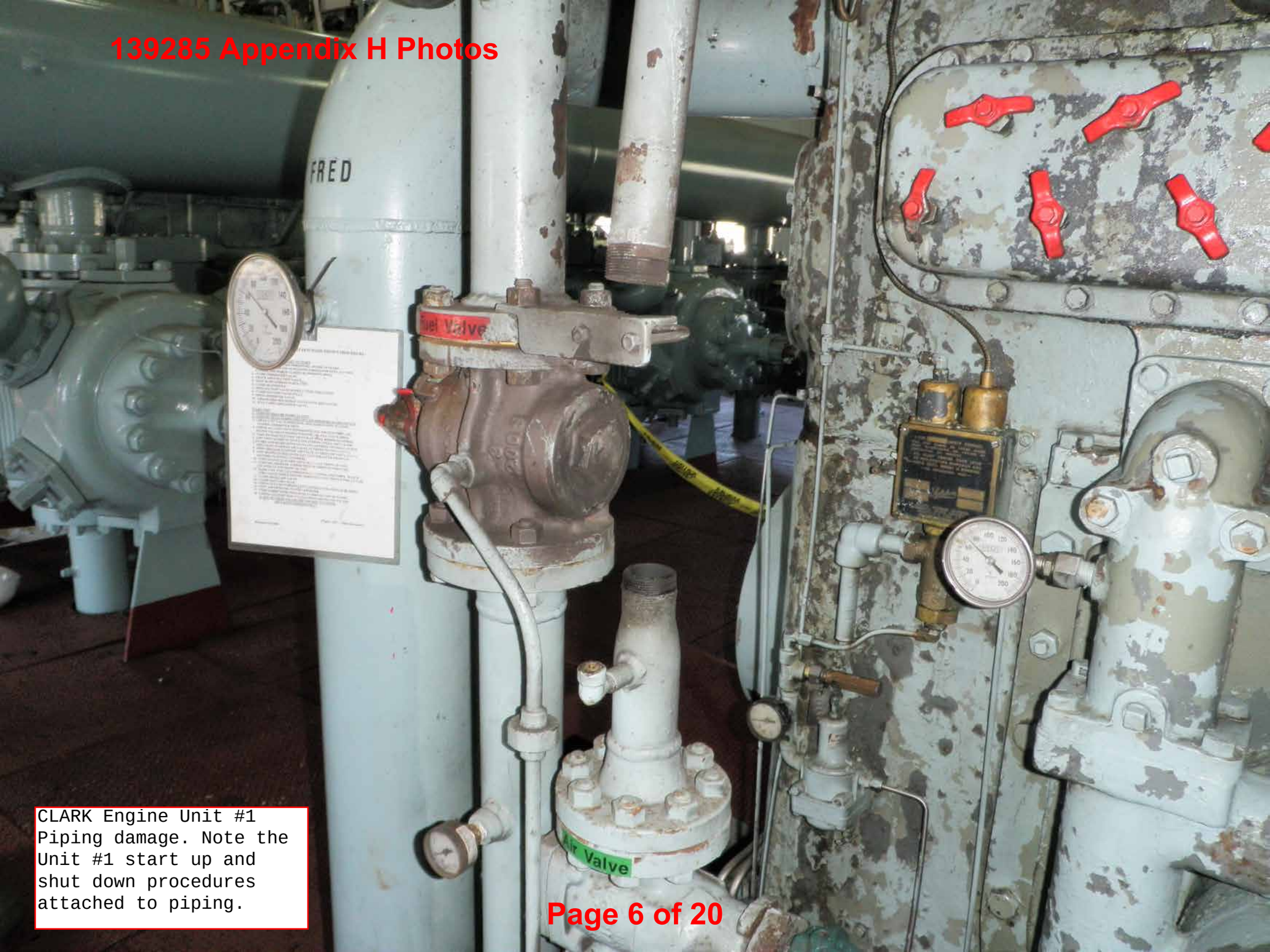


The fuel gas is regulated to 25 psig. The Air System is regulated to 250 psig.

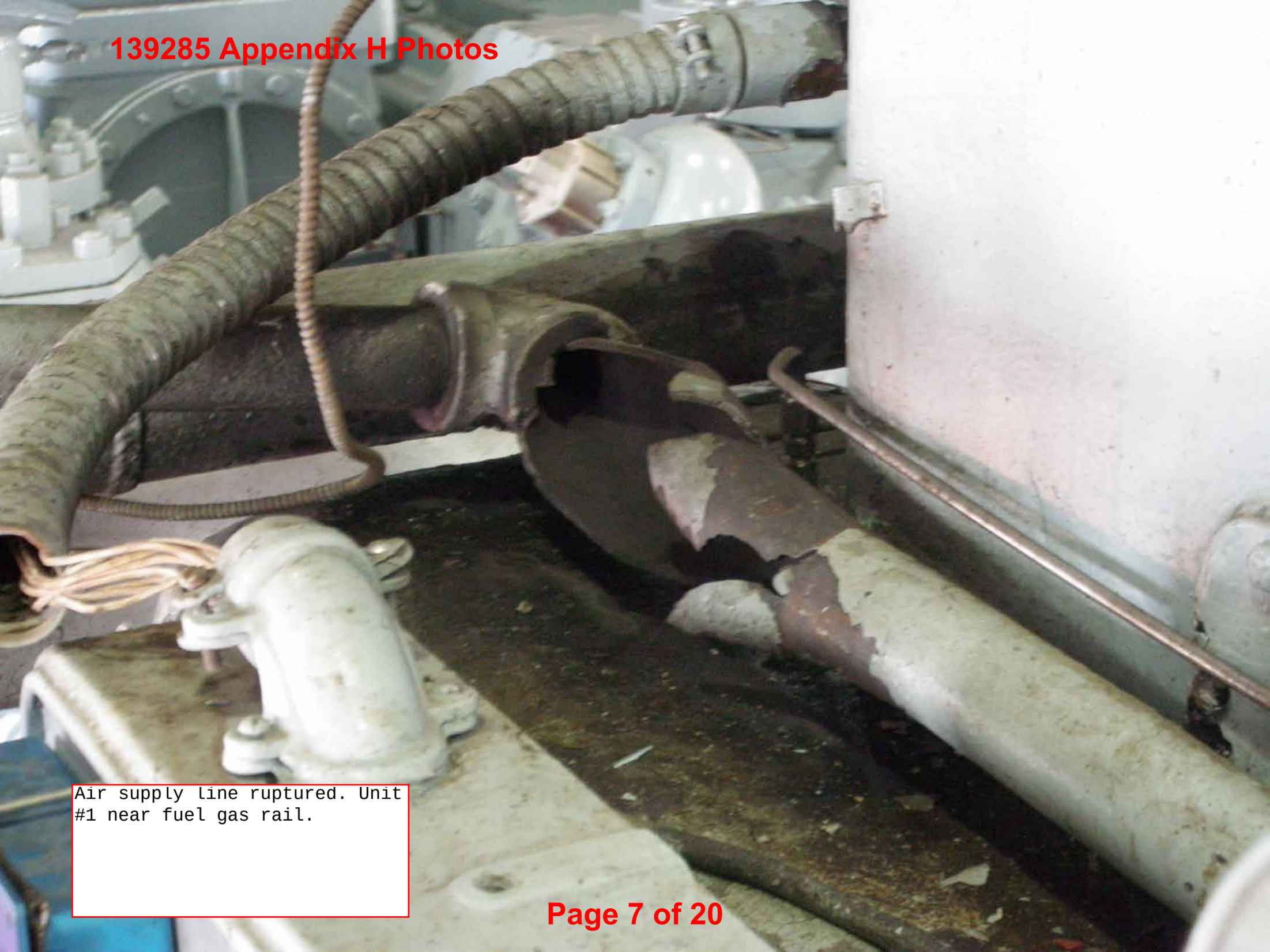


This photo shows engine #1. The station operator was in the process of starting this unit when the air supply lines exploded. The area in white shows the damaged air line. This area will be enhanced in the next photo.

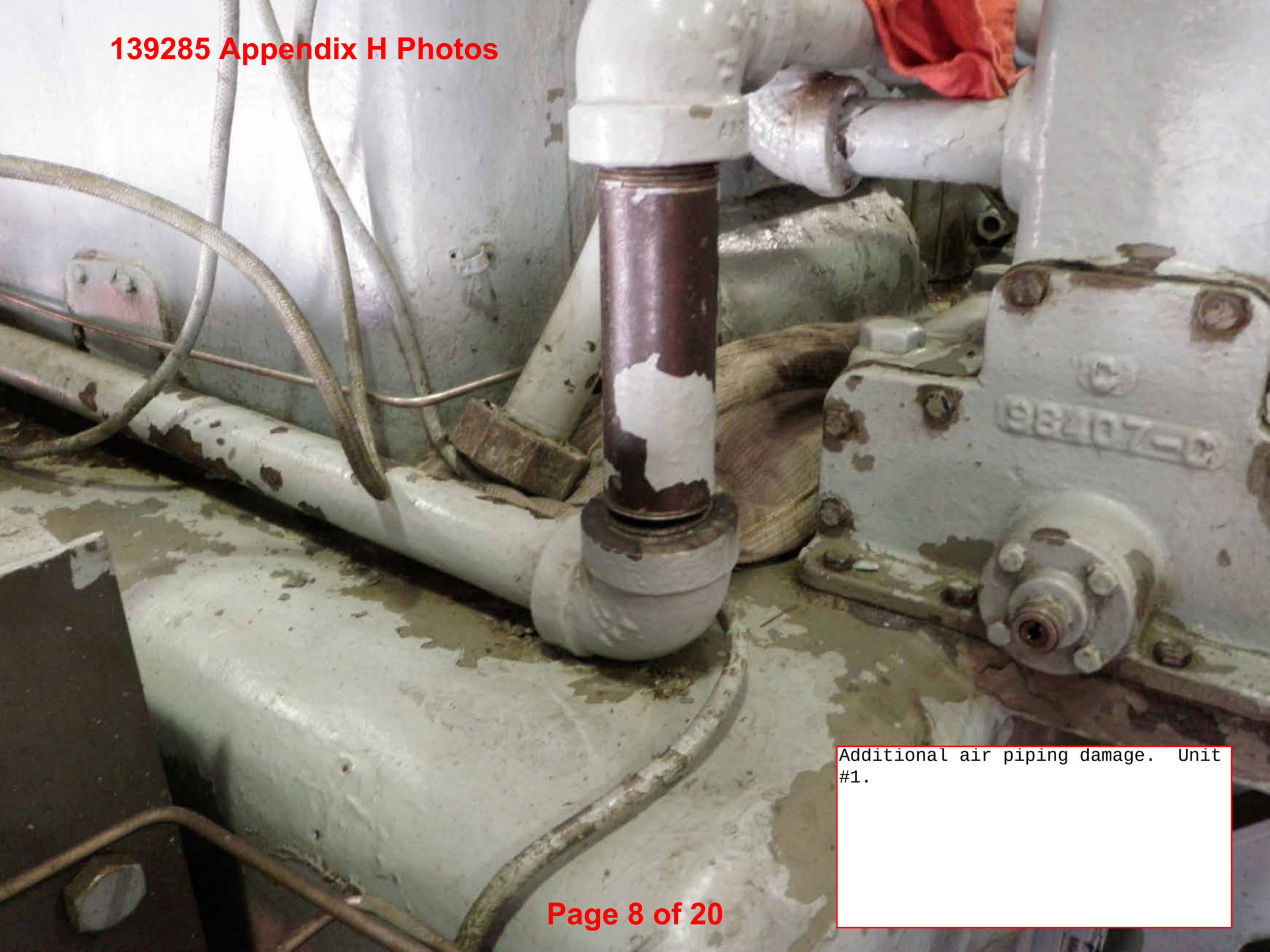

This photo shows the damage to the air piping on unit #1.
FRED
Air Valve



CLARK Engine Unit #1 Piping damage. Note the Unit #1 start up and shut down procedures attached to piping.



Air supply line ruptured. Unit #1 near fuel gas rail.



Additional air piping damage. Unit #1.

The cause of the incident was due to the failure of the "Air Start Check Valve" and the "Air Start Valve" on Engine #1. The Air Start Valves are designed to regulate starting air into the engine cylinders during start up and the Air Start Check Valves are designed to prevent hot combustion gases and combustible fuel air mixtures from back flowing into the air supply line during start up operations. Upon examining the Air Start Valves on Engine #1, it was noted that the valve was slow to respond when opened manually. When the valve was disassembled, soot deposits were found around the valve stem preventing the valve from operating freely as designed. Soot and carbon deposits were also found on the Air Start Valve. This indicates that hot exhaust gases had made it past the Air Start Check Valve and were in direct contact with the Air Start Valve. It is believed that condensate oil build up in the air supply piping (500 deg F flashpoint) may have been ignited by the hot exhaust gases that were impinging on the Air Start Valve thus causing the incident. The following photo show the Air Start Check Valve and the Air Start Valve. Upcoming photos will show the location of these valves on the engine.

139285 A

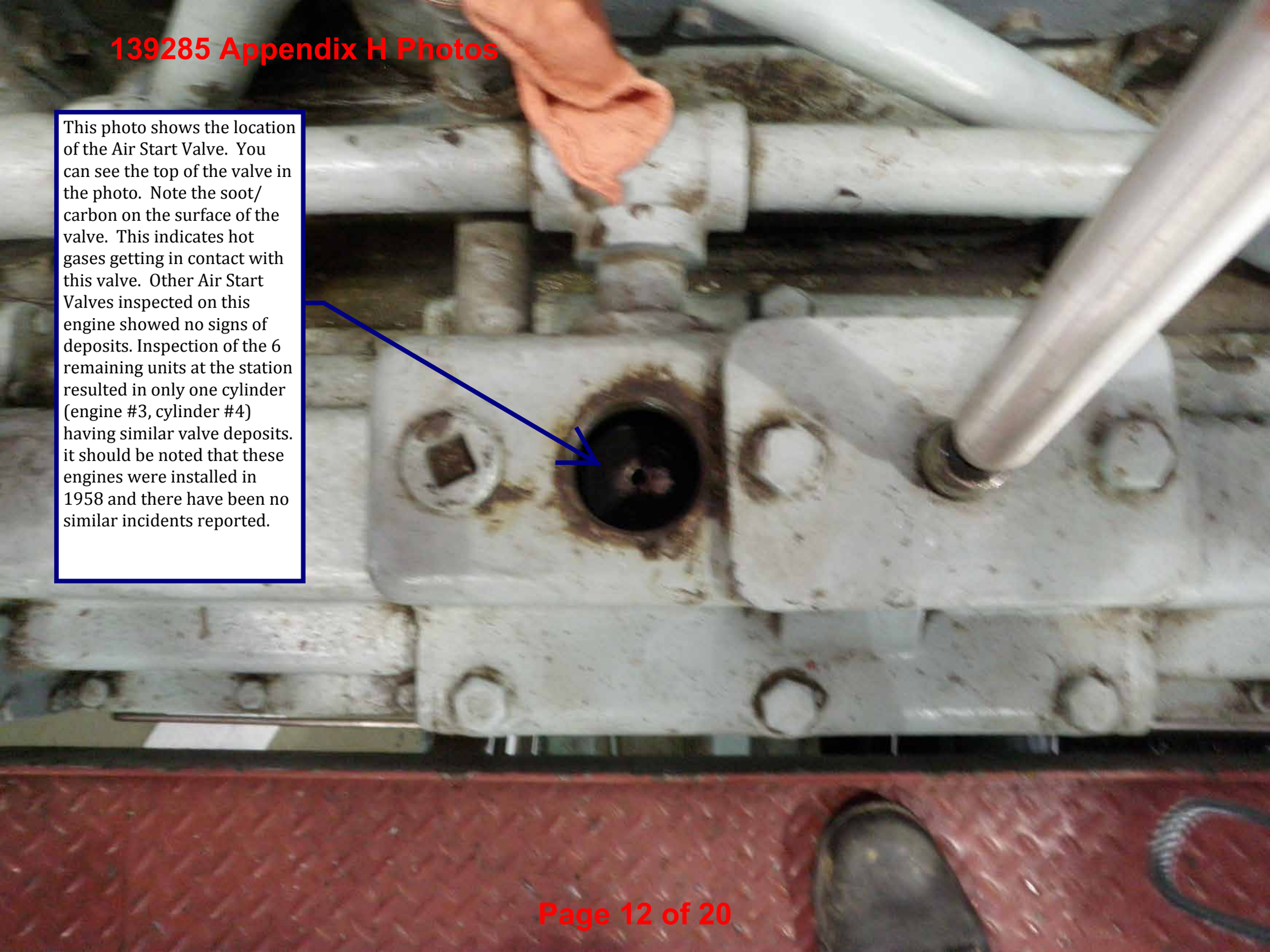
AIR START CHECK VALVE

AIR START VALVE

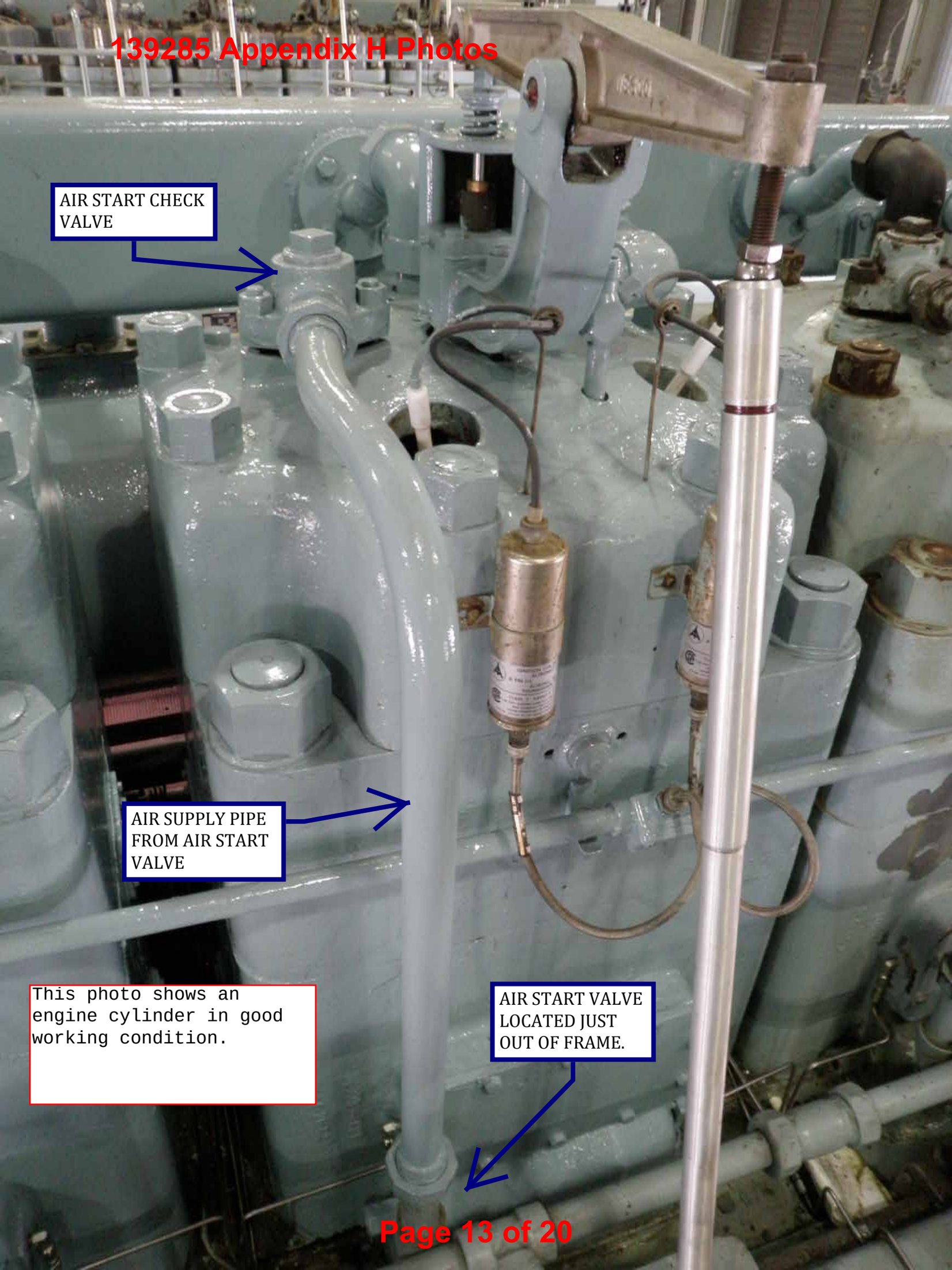
The air start valve is operated directly from the cam of the engine. As the valve opens it allows air to flow to the air start check valve. Air pressure at 250 psig overcomes the spring tension on the air start check valve and air enters the cylinders. The air pressure causes the cylinders to begin to rotate.

AIR START CHECK VALVE

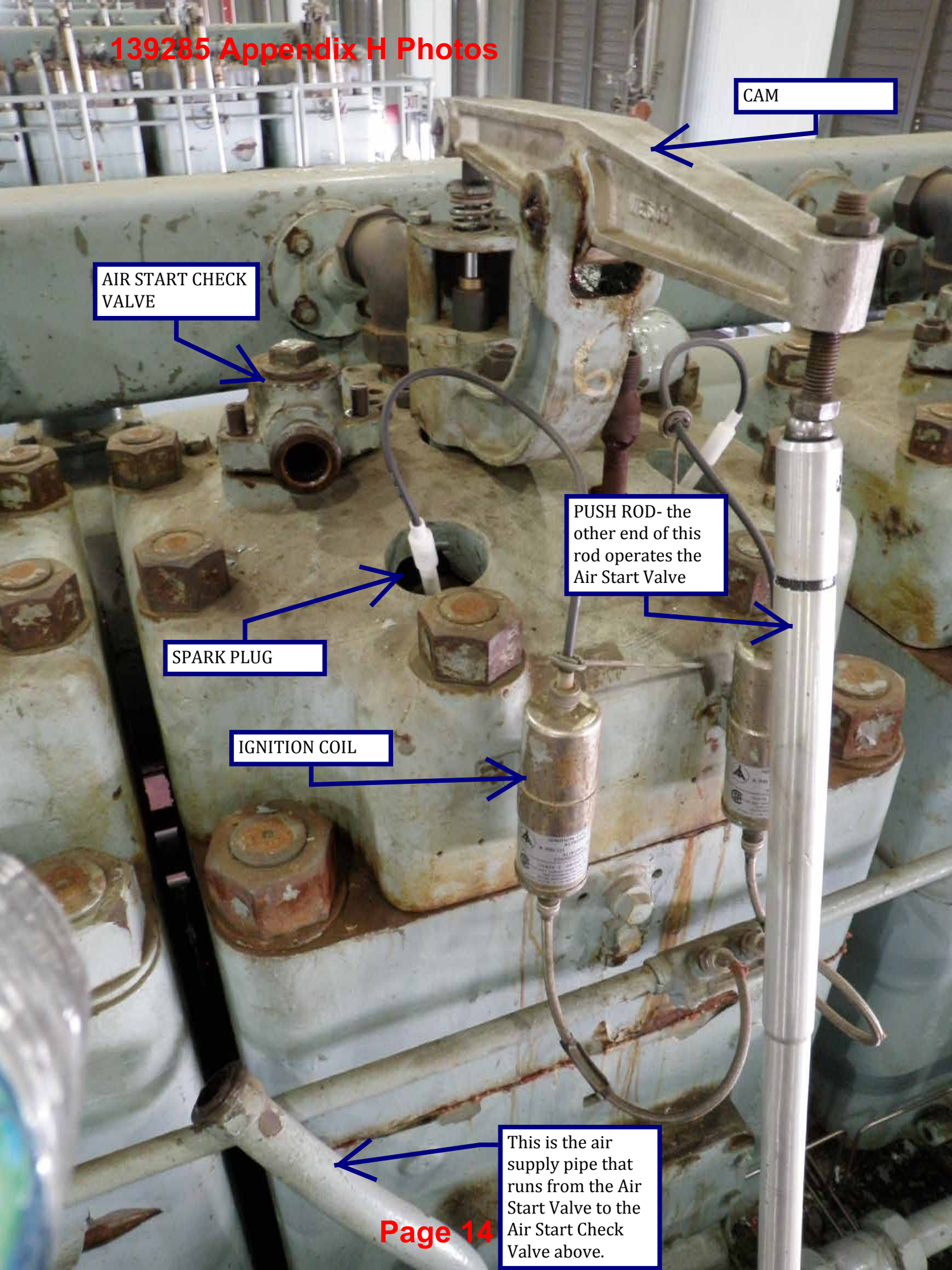
AIR START VALVE

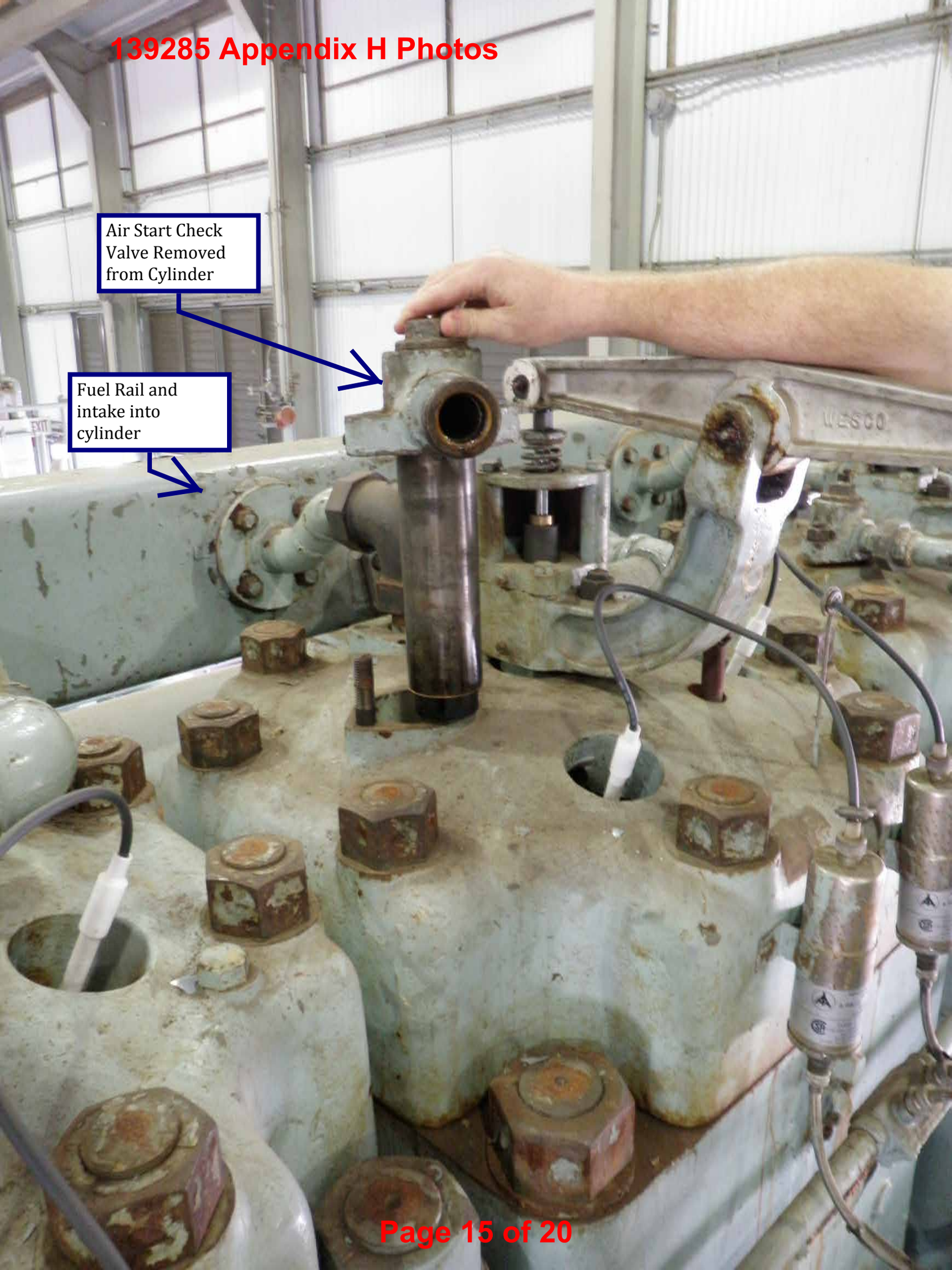


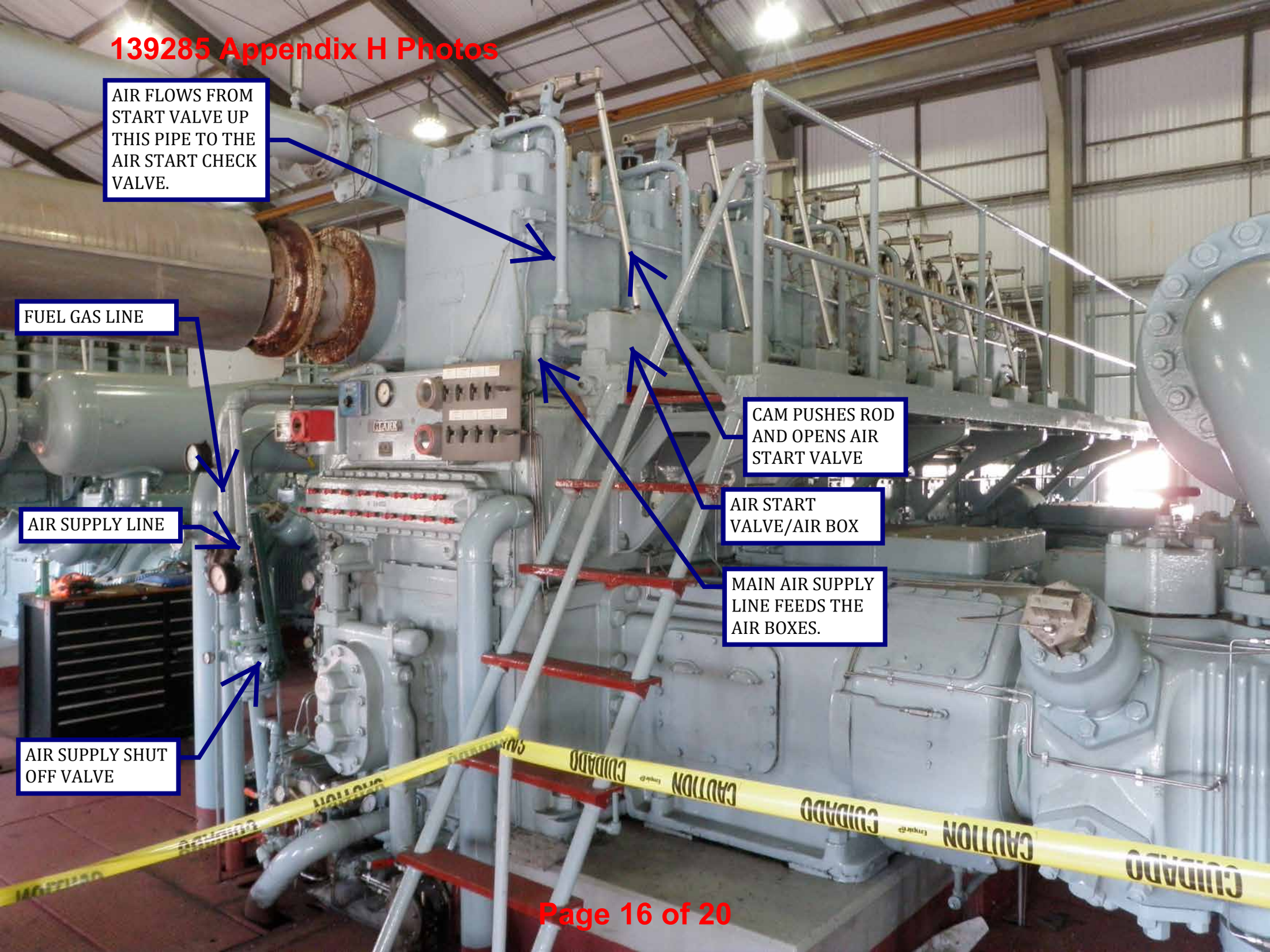
This photo shows the location of the Air Start Valve. You can see the top of the valve in the photo. Note the soot/ carbon on the surface of the valve. This indicates hot gases getting in contact with this valve. Other Air Start Valves inspected on this engine showed no signs of deposits. Inspection of the 6 remaining units at the station resulted in only one cylinder (engine #3, cylinder #4) having similar valve deposits. it should be noted that these engines were installed in 1958 and there have been no similar incidents reported.



This photo shows an engine cylinder in good working condition.


CAM
AIR START CHECK VALVE
PUSH ROD- the other end of this rod operates the Air Start Valve
SPARK PLUG
IGNITION COIL
This is the air supply pipe that runs from the Air Start Valve to the Air Start Check Valve above.


Air Start Check Valve Removed from Cylinder
Fuel Rail and intake into cylinder

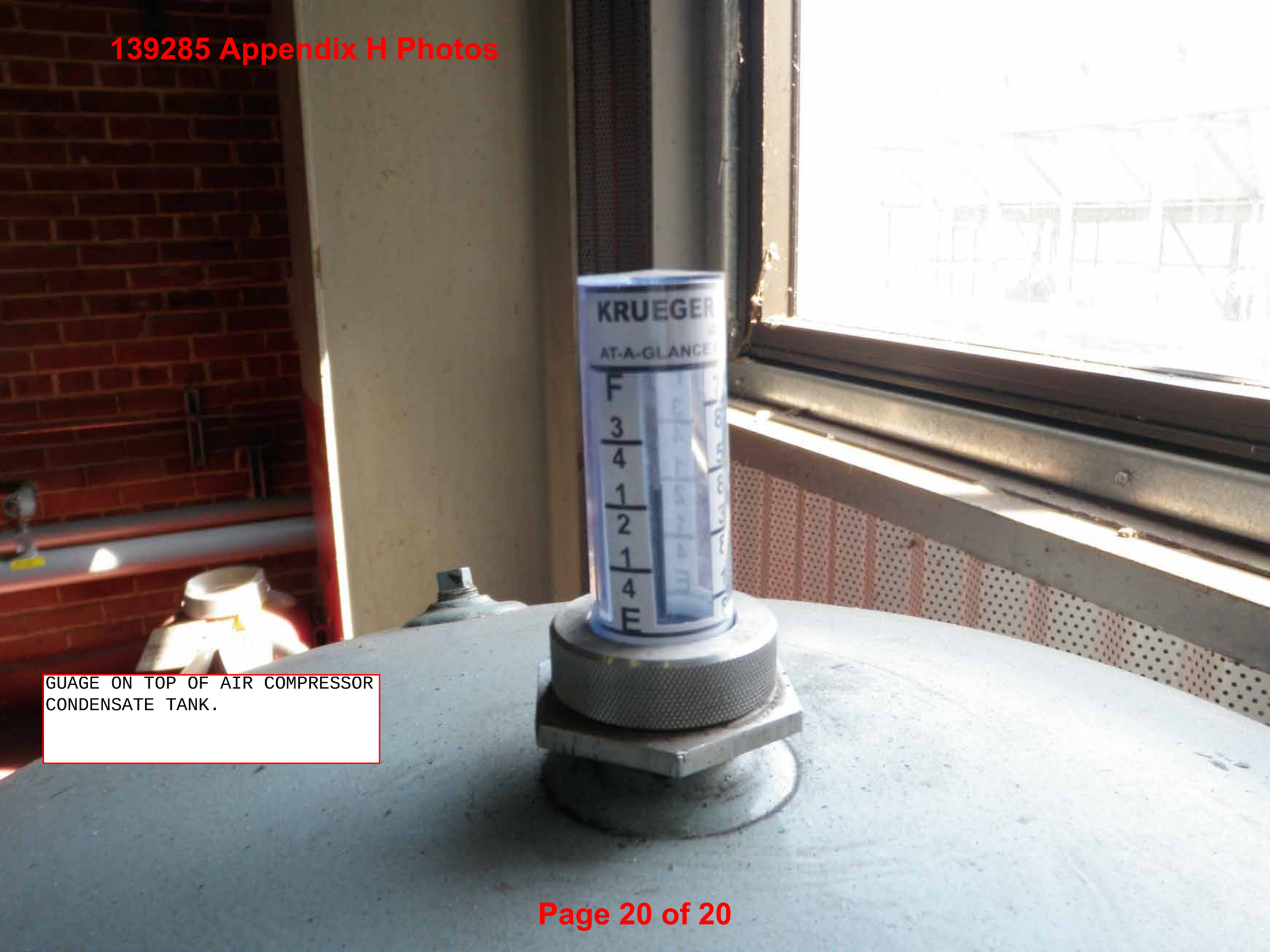

AIR FLOWS FROM START VALVE UP THIS PIPE TO THE AIR START CHECK VALVE.
FUEL GAS LINE
AIR SUPPLY LINE
AIR SUPPLY SHUT OFF VALVE
CAM PUSHES ROD AND OPENS AIR START VALVE
AIR START VALVE/AIR BOX
MAIN AIR SUPPLY LINE FEEDS THE AIR BOXES.
CAUTION
CUIDADO

139285 Appendix H Photos

AIR SUPPLY MANIFOLD. THIS MANIFOLD IS USED TO CONTROL THE FLOW AND PRESSURE OF AIR TO DIFFERENT PARTS OF THE STATION. AIR IS USED FOR ENGINE STARTUP (250 PSIG) AND GENERL SERVICE AIR (100 PSIG)

COMPRESSED AIR IS STORED IN THESE COLLECTORS LOCATED OUTSIDE OF THE MARIETTA COMPRESSOR BUILDING. CONDENSATES (COMPRSSOR OIL AND WATER)THAT COLLECT IN THESE VESSELS ARE DRAINED INTO A HOLDING TANK AT THE BEGINNING OF EACH SHIFT (12 HR PERIOD). THE HOLDING TANK IS LOCATED INSIDE THE COMPRESSOR BUILDING NEAR THE AIR MANIFOLD.


AIR COMPRESSOR MANIFOLD
AIR COMPRESSOR CONDENSATE TANK
2 to 49
PPM PCBs
EXIT



GUAGE ON TOP OF AIR COMPRESSOR CONDENSATE TANK.