

CAPE CANAVERAL AIR FORCE STATION,
LAUNCH COMPLEX 39,
HYPERGOL MAINTENANCE AND CHECKOUT AREA,
HYPERGOL MODULE PROCESSING SOUTH
(HMP South)
(John F. Kennedy Space Center)
Cape Canaveral
Brevard County
Florida

HAER FL-8-11-T-2

PHOTOGRAPHS

WRITTEN HISTORICAL AND DESCRIPTIVE DATA

Historic American Engineering Record
National Park Service
Department of the Interior
100 Alabama St., SW
Atlanta, GA 30303

HISTORIC AMERICAN ENGINEERING RECORD
CAPE CANAVERAL AIR FORCE STATION, LAUNCH COMPLEX 39
HYPERGOL MAINTENANCE AND CHECKOUT AREA,
(HMCA Complex)
HYPERGOL MODULE PROCESSING SOUTH,
(HMP South)

HAER No. FL-8-11-T-2

Location: John F. Kennedy Space Center, Industrial Area,
Brevard County, Florida.

USGS Orsino, Florida, Quadrangle, Universal
Transverse Mercator Coordinates: E 535124 N
3154204 Zone 17, NAD 1983.

Date of Construction: 1964

Present Owner: National Aeronautics and Space Administration (NASA)

Present Use: Not in use

Significance: The Hypergol Module Processing South (HMP South) (M7-1212) is eligible to the National Register of Historic Places in the context of the U.S. Space Shuttle Program (SSP) (1969-2011) under Criterion A for its significant associations in the area of Space Exploration. Since it has achieved exceptional national significance in the last 50 years, Criteria Consideration G applies. HMP South was built in 1964 as part of what was originally called the Fluid Test Complex, now called the Hypergol Maintenance and Checkout Area (HMCA Complex). Originally called the Hypergolic Test Building, HMP South's high bay test cells refurbished the Space Shuttle's Forward Reaction Control System (FRCS), performed hypergolic test loading, and hazardous systems tests and checkouts.

Report Prepared By: New South Associates, Stone Mountain,
Georgia

Date: March 14, 2013

Part I. HISTORICAL INFORMATION

List of Acronyms

| | |
|-------------------------------|--|
| CIF | Central Instrumentation Facility |
| EST | Environmental Systems Test Building |
| FRCS | Forward Reaction Control System |
| HAER | Historic American Engineering Record |
| He | Helium |
| HIM | Hardware Interface Module |
| HMCA | Hypergol Maintenance and Checkout Area |
| HMP | Hypergol Module Processing |
| KSC | Kennedy Space Center |
| LCC | Launch Control Center |
| LH ₂ | Liquid Hydrogen |
| LO ₂ | Liquid Oxygen |
| LRU | Line Replaceable Unit |
| MMH | Monomethyl Hydrazine |
| NASA | National Aeronautics and Space Administration |
| GN ₂ | Gaseous Nitrogen |
| N ₂ O ₄ | Nitrogen Tetroxide |
| O&C | Operations & Checkout |
| OMS | Orbital Maneuvering System |
| PRF | Parachute Refurbishment Facility |
| SCAPE | Self Contained Atmospheric Protective Ensemble |
| SSP | Space Shuttle Program |
| VAB | Vehicle Assembly Building |

A. HMP South and the Space Shuttle Program

HMP South was originally called the Hypergolic Test Building. It contained facilities for checkout of the hypergolic systems in the Gemini and Apollo spacecraft. The facility had two 40' square by 60' high test cells on opposite sides of a two-story central building that contained control rooms, an equipment room, locker rooms,

and a machine shop. Each test cell had overhead cranes with hook heights of 45'. The building was designed with special features to provide for safe handling of hazardous hypergolic fuels and oxidizers. The control room was designed to protect operators from possible explosions or fumes during tests. The test cells also had large capacity exhaust systems and a floor system that could collect and dilute hypergolic spills.¹

To support the SSP, the Fluid Test Complex facilities were modified in 1976 by Pan American Technical Services, Inc., of Cocoa Beach, Florida. At this time the name of the complex was changed to the Hypergol Maintenance and Checkout Area and the Hypergolic Test Building's name was changed to HMP South. Changes were made to the interiors of the buildings in the area, especially in the high bay work areas, to refurbish and checkout the Space Shuttle's Forward Reaction Control System (FRCS), Orbital Maneuvering Systems (OMS) pods, hypergolic systems, and other hazardous systems tests and checkouts.

Specifically, HMP South was modified to refurbish and checkout the hypergolic fuel modules of the Space Shuttle orbiter's FRCS, which is located in the orbiter's forward fuselage nose area.² The FRCS contained high-pressure gaseous helium storage tanks, pressure regulation and relief systems, hypergolic fuel and oxidizer tanks, an engine propellant distribution system, and thermal control systems. The FRCS engines provided thrust for attitude

¹ Pan American World Airways, Inc., "Analytical Report, John F. Kennedy Space Center, NASA, Kennedy Space Center, Florida - Master Plan." (KSC Master Planning Office, 1965), 34.

² For an explanation of hypergolic propellants as they relate to the SSP, see: HAER No. FL-8-11-T, page 4.

(rotational) maneuvers, including pitch, yaw, and roll, and for small velocity changes along the orbiter's axis.³

HMP South continued to service the orbiter's FRCS through the end of the SSP. The program ended in July of 2011, when the crew of *Atlantis* landed at KSC to complete the program's 135th mission (STS-135). Since the SSP's first launch in 1981, the program launched 355 astronauts from 16 countries. The five shuttles traveled more than 542 million miles and conducted over 2,000 experiments in the fields of Earth, astronomy, biological, and materials sciences. The shuttles docked with two space stations, including the Russian *Mir* and the International Space Station, and deployed 180 payloads such as satellites and spacecraft. With the return of the final mission, NASA Administrator Charles Bolden said, "the brave astronauts of STS-135 are emblematic of the shuttle program - skilled professionals from diverse backgrounds who propelled America to continued leadership in space with the shuttle's many successes."⁴

B. Physical History

1. Date of Construction

1964

2. Architect/Engineer

³ NASA, "Reaction Control System," NSTS Shuttle Reference Manual, 1988, <http://science.ksc.nasa.gov/shuttle/technology/sts-newsref/sts-racs.html>.

⁴ Michael Curie, Kyle Herring, and Candrea Thomas, "NASA's Proud Space Shuttle Program Ends With Atlantis Landing," NASA press release, http://www.nasa.gov/home/hqnews/2011/jul/HQ_11-240_Atlantis_Lands.html, accessed on March 8, 2012.

Tampa Bay Engineering Company, St. Petersburg, Florida⁵

3. Builder/Contractor/Supplier

Unknown

4. Original Plan and Construction

HMP South retains its original 1964 plan and construction, including a concrete frame structural system, concrete block walls, and two high bay test cells. The test cells each had three segmented doors, one on each of their exterior elevations, and both cells were equipped with an overhead crane with a hook height of 45'. The original first-floor plan for the central two-story building contained an equipment checkout room on the north and a mechanical room on the south. The second floor contained a control room. On the north side of the building was a 20'-0" x 20'-0" wing containing a locker room and restroom, separated from the main building by a passageway that provided access to all of the interior areas.

5. Additions and Alterations

HMP South was modified for the SSP in 1976. The modifications included the building's civil, architectural, structural, mechanical, and electrical systems. Civil site alterations to HMP South included new asphalt pavement, curbs and gutters, drainage grates, storm drains, and site contouring. Architectural changes included partition removal and modification of the original second-floor control rooms, entrance door replacements, new roofing, and a new roof penetration

⁵ Tampa Bay Engineering Company, "Fluid Test Complex, Hypergolic Test #1," construction drawings, March 5, 1963.

plan to accommodate new ventilation equipment. Structural changes included the installation of a new fixed test stand in the building's west test cell, which was used to service the shuttle's forward RCS system. Various mechanical and electrical systems were also changed and upgraded throughout the facility.⁶

Part II. Structural/Design/Equipment Information

A. General Statement

1. Character

HMP South was originally used to process and checkout the hypergolic fuels and other hazardous systems of the Gemini and Apollo spacecraft. It was later modified to process and checkout the Space Shuttle's FRCS. The concrete-frame and concrete-block building has a pair of high bay work cells on either side of a two-story central building, which contains equipment rooms and support areas.

2. Condition of Fabric

The condition of HMP South's fabric is good. The building was regularly maintained throughout its lifespan. It does exhibit minor signs of deterioration such as peeling paint and rust.

3. Descriptions of Interior and Exterior

HMP South is a spacecraft test facility with a reinforced concrete frame structure, painted 12" nominal concrete

⁶ Pan American Technical Services, Inc., "Fluid Test Complex, Modifications for Shuttle," construction drawings, January 1976.

block walls, a reinforced concrete foundation, and a gently sloping built-up roof. The building has an irregular footprint with overall dimensions of 110'-0" wide (east-west) and 68'-0" long (north-south). The building contains 7,100 square feet. The defining features of the building are two high-bay test cells that have exterior dimensions of 40'-0" wide x 40'-0" long x 60'-0" high. The test cells are arranged on either side of a central two story building that measures 32'-4" wide x 68'-0" long.

There is a central, one-story projection on the north elevation containing a locker room and restroom that measures 20'-0" wide x 20'-0" long.

The west test cell has three segmented vertical lift doors, one on each of the north, south, and west elevations. Likewise, the east test cell also has three segmented vertical lift doors, one on each of the north, south, and east elevations. The doors each measure 22'-0" wide x 40'-0" high. The doors are equipped with inflatable seals that exclude contaminants and seal the building in case of toxic spills. Other entrances include a number of single and double pedestrian doors on all elevations. There are no windows on the building.

The test cells are equipped with large capacity exhaust systems designed to reduce contaminants and remove toxic fumes from the interior. A large array of ventilation equipment is located on top of the building's two-story portion, between the two test cells' exterior walls.

The interior dimensions of HMP South's two test cells contain 38'-0" x 38'-0" of work space. The east test cell was used as support space for storage and secondary

operations. The west test cell space includes a two-level service area that processed and checked out the hypergolic fuel and oxidizer systems used in the Space Shuttle orbiter's FRCS system. The west test cell contains a stationary steel work platform that measures 10'-0" high x 24'-5" long x 36'-0" wide. There are steel staircases that lead up to the top level of the work platform on the northeast and northwest corners of the platform. The FRCS modules were maneuvered into place with an overhead 10-ton hydraulic bridge crane with a hook height of 45'.

The interior of the central building's first floor contains on the north side a locker room and restroom and an interior corridor connecting all interior areas. On the south side of main corridor is the Temperature Control System room. The second floor contains the Hardware Interface Module (HIM) room, which was originally a control room for the test cells. The HIM room contains cabinets of computer equipment that control the hardware used in the test cells. This room has a raised floor that can be opened to reach the HIM cables and connectors that run under it.

Part III. Operations and Process

The operations at HMP South included the refurbishment disassembly/assembly, testing, propellant loading, and pressurization of hypergolic fuel and oxidizer lines of the Space Shuttle orbiter's forward RCS. The building also houses the Temperature Control System room, which stored the thermal blankets used to maintain proper operating temperatures within the forward RCS.

The RCS module was moved into the west test cell via the north vertical lift door. Once inside the building the RCS was lifted with the overhead crane onto the elevated work platform and secured into place. Once in position, the RCS underwent an inspection and hook up of electrical testing cables and propellant lines. The thrusters were removed and inspected, and their regulators and valves were replaced if needed. Residual hypergolic propellants were drained and the systems were flushed and dried. All of the modules' line replaceable units (LRUs) were repaired or replaced, followed by an electrical and pneumatic checkout. The facility also inspected and repaired electrical and Temperature Control System repairs on the modules.⁷

Depending on launch and regular orbiter maintenance down periods, the OMS and FRCS module process time varied from one to six months. Once the systems were revalidated and in proper working order, they were closed out and removed from the test cells and transported to the Orbiter Processing Facility (OPF) for installation.⁸

At the height of the Space Shuttle Program the number of technicians working in HMP South varied widely depending on the schedule and task. For a small maintenance job, there were as few as two people working in the building. For larger jobs, such as moving the forward RCS module from the Orbiter Processing Facility to HMP South, there were as many as 20 people working in the facility.⁹ The hazardous nature of the toxic hypergolic fuels used in the modules required that technicians wear full-body SCAPE suits, and

⁷ Slovinac and Deming, "Hypergolic Maintenance and Checkout Area Historic District," 2007; Stan D. Johnson, Senior Systems Technician, interview with author, April 9, 2012.

⁸ Slovinac and Deming, "Hypergolic Maintenance and Checkout Area Historic District," 2007; Johnson, interview with author, 2012.

⁹ Johnson, interview with author, 2012.

vapor concentration monitors were used throughout the building.

Part IV. Sources of Information

A. Primary Sources

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B. Secondary Sources

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2004 "Hypergol Maintenance Facility - North Area (HMP North) (M7-961), Kennedy Space Center, Florida, Solid Waste Management Unit (SWMU) Assessment Report, PRL #118 (Revision 0) [KSC-TA-7110]. J-BOSC Environmental Health and Services, Environmental Compliance and Public Health Section, Kennedy Space Center.

C. Engineering Drawings and Plans

Tampa Bay Engineering Co.

1963 "NASA Merritt Island Launch Area, Merritt Island, FLA., Hypergolic Test #1." Construction Drawings.

D. Early Views

Kennedy Space Center. Photograph negative number LOC-63-7252, dated 1963. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number LOC-63-8567, dated 1963. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number LOC-63-9100, dated 1963. On file at Kennedy Space Center Archives.

Kennedy Space Center. Photograph negative number LOC-63-11411. On file at Kennedy Space Center Archives.

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E. Interviews

Johnson, Stanley D.

2012 United Space Alliance. Senior Systems Technician.
Interview with author.

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1963 view of HMP South under construction, view southwest.
(Courtesy KSC: Image LOC-63-8567)

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1963 aerial view of HMP South under construction, view southwest. (Courtesy KSC: Image LOC-63-11411)

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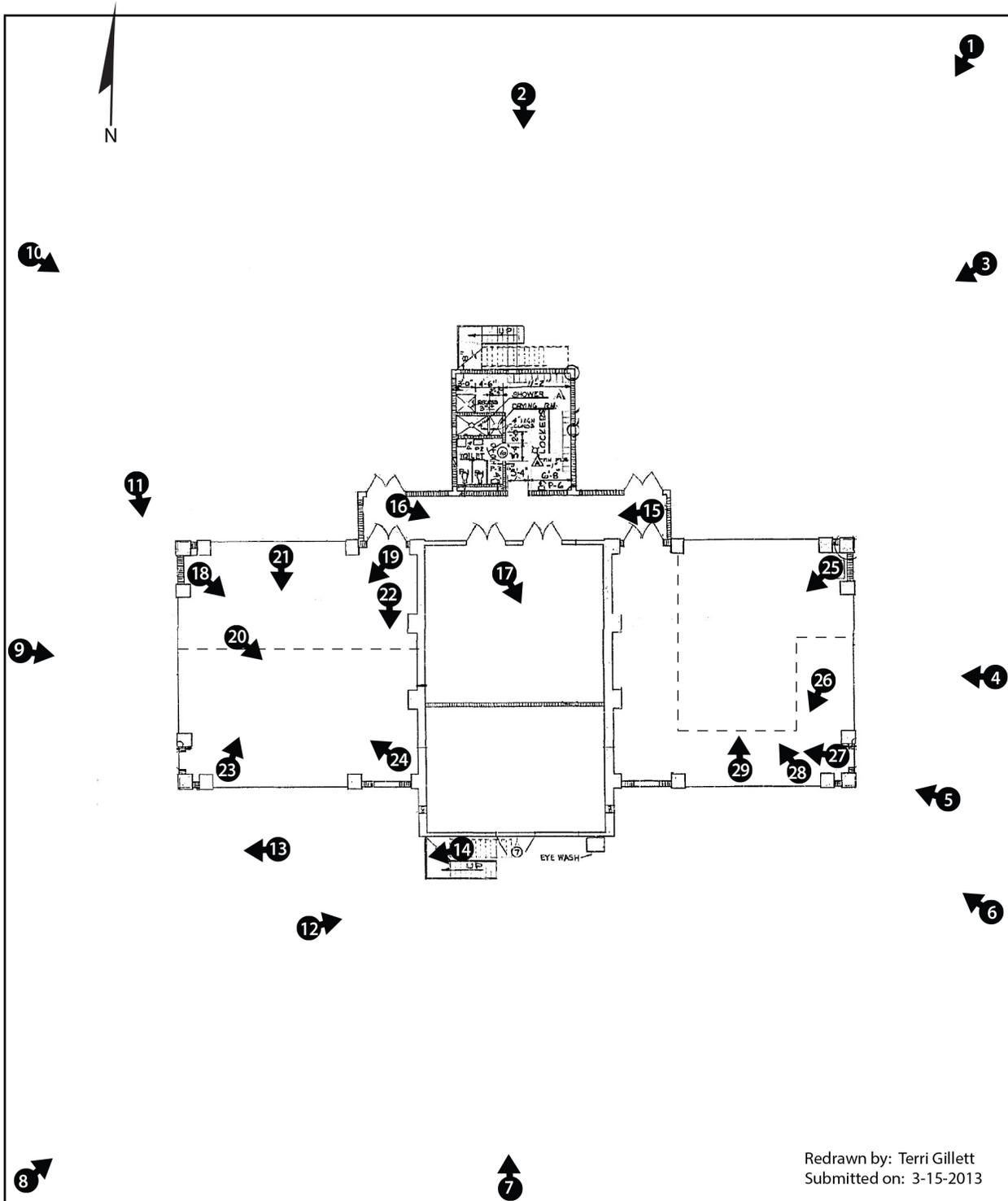
1964 aerial view of HMCA area under construction, showing HMP South in the foreground, view north. (Courtesy KSC: Image KSC-64C-0037)

CAPE CANAVERAL AIR FORCE STATION, LAUNCH COMPLEX 39,
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1964 view of HMP South shortly after construction. (Courtesy
KSC: Image KSC-64-3543)

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David Diener, Photographer

April 2012

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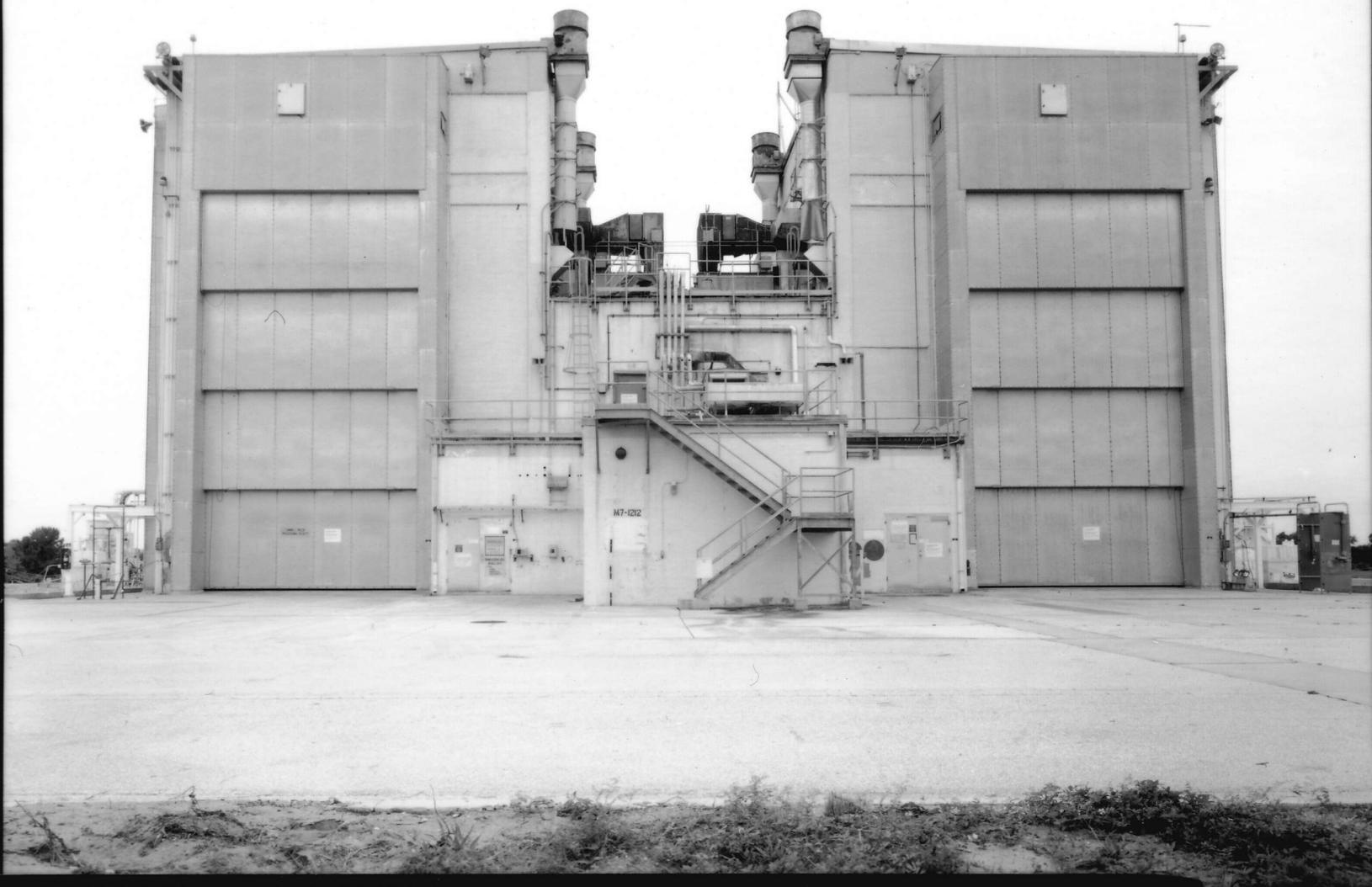
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ENGINEERING CO.; DRAWING IN POSSESSION OF KENNEDY
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KODAK 100T MX



Kodak 100T MX



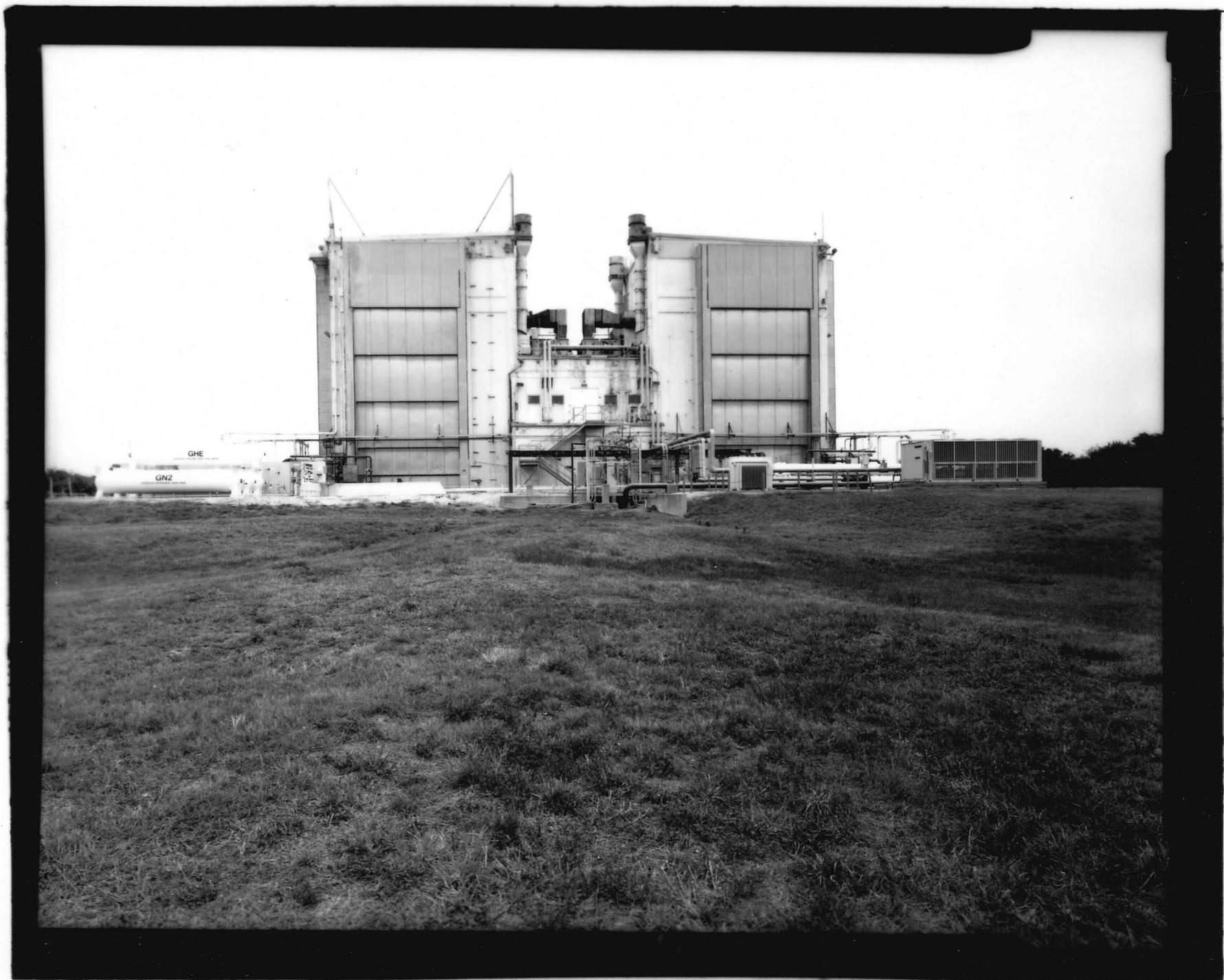


Kodak 100T MX





Kodak 100TMX







KODAK 100T MX

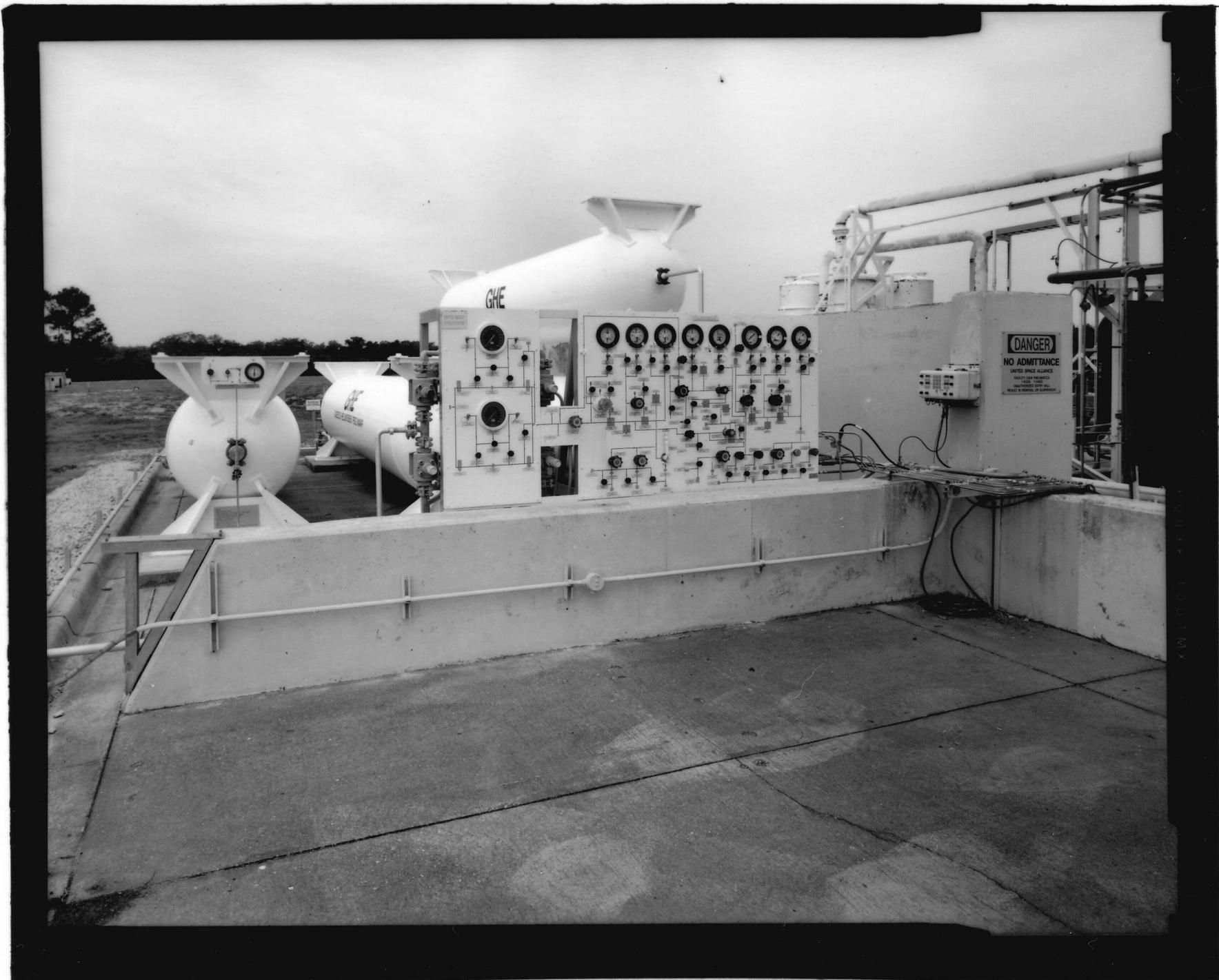


KODAK 100T MX





Kodak 100T MX





Kodak 100T MX

Kodak 100Tmx

WARNING
ELECTRICAL HAZARDOUS AREAS
DO NOT ENTER WITHIN THIS FACILITY
SEE PAGE 10 FOR WIRING ELECTRICAL CODE

DIVISION 2

WARNING

Kodak 100TMX



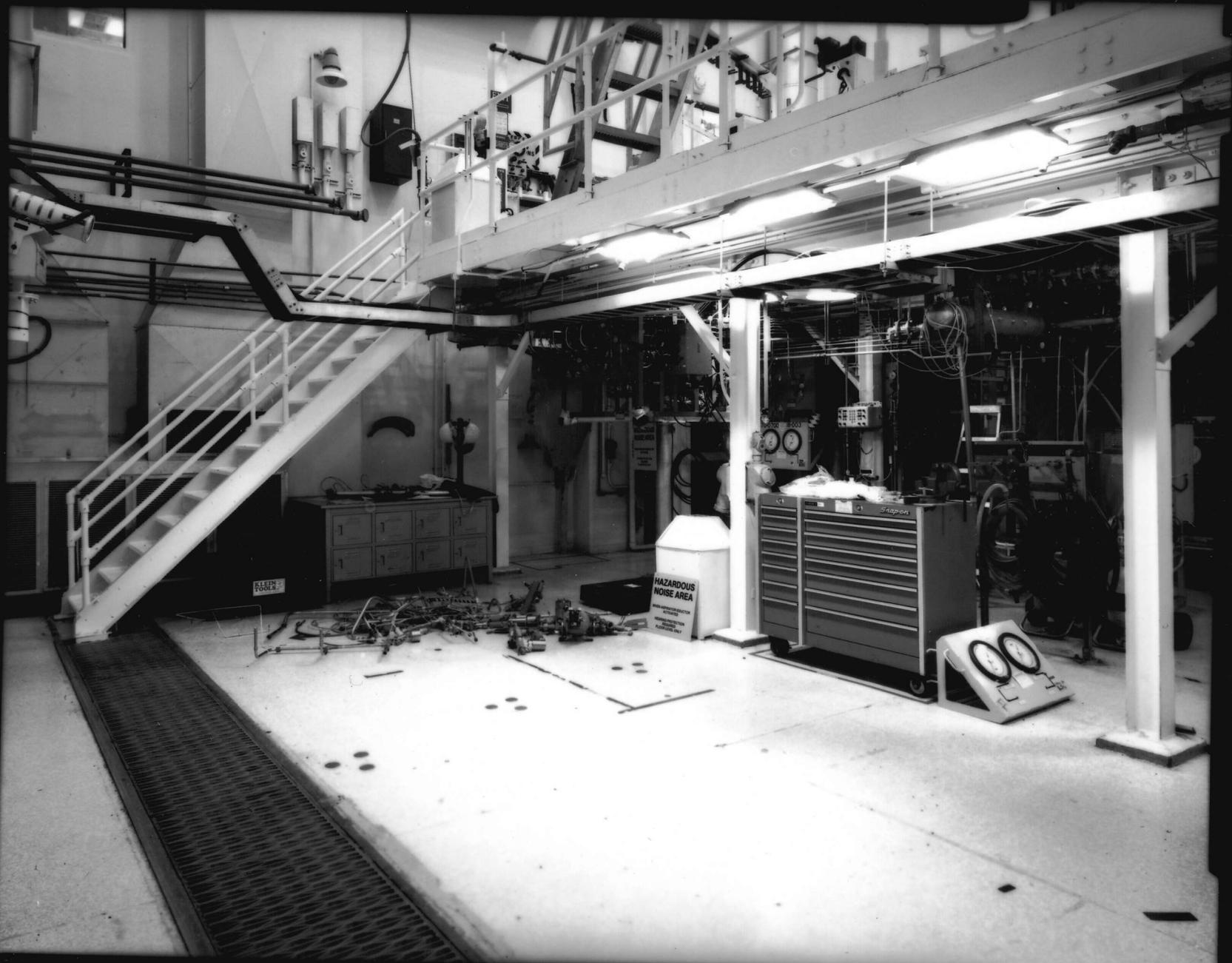
WARNING
DO NOT OPERATE
WITHOUT CONSULTING
A LICENSED ELECTRICIAN
OR QUALIFIED PERSONNEL

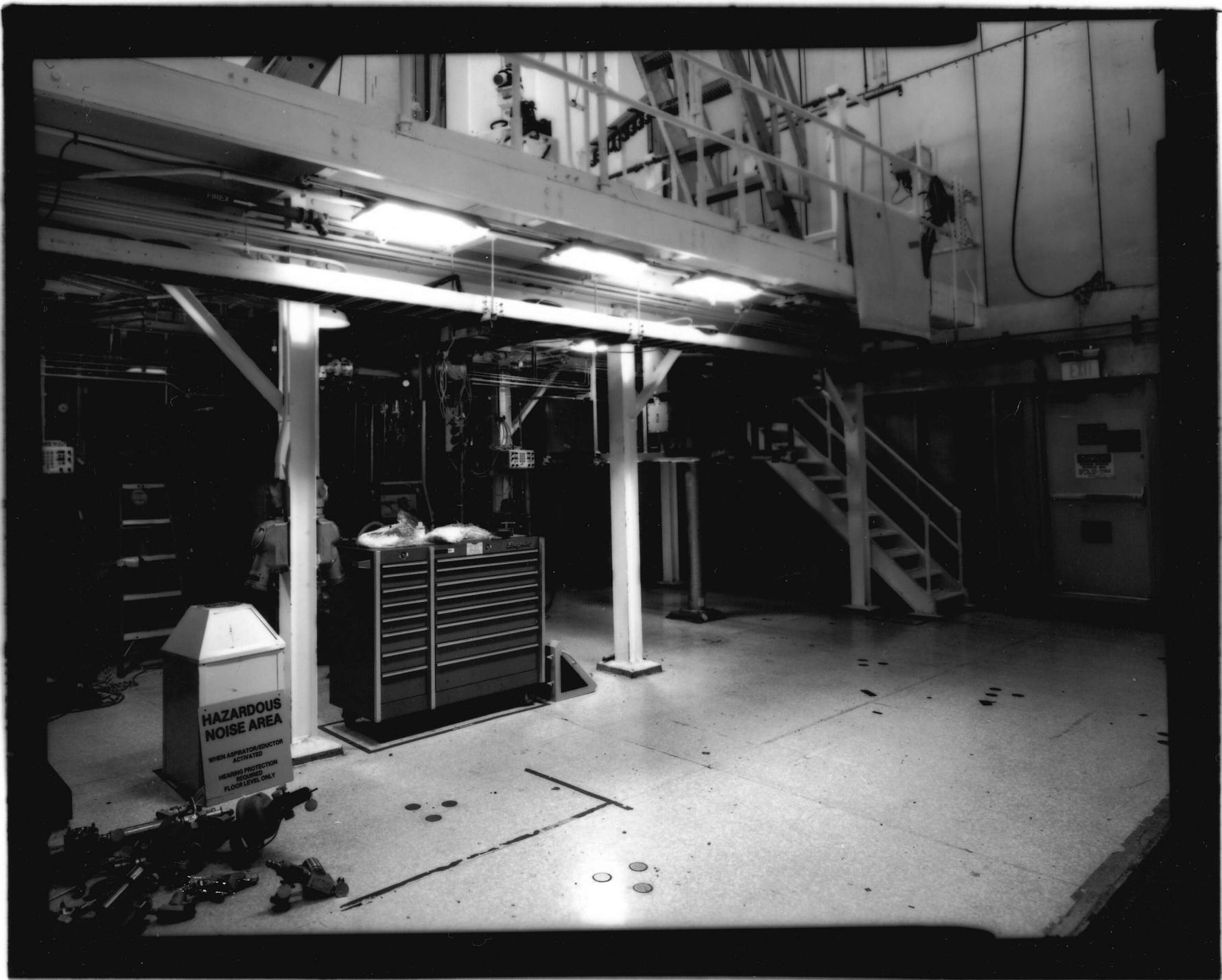
NO HAND ARMED ENTRY

DO NOT
OPERATE
OUTSIDE OF THIS
AREA

CAUTION
NO OPERATIONS
WITHIN 50
FEET



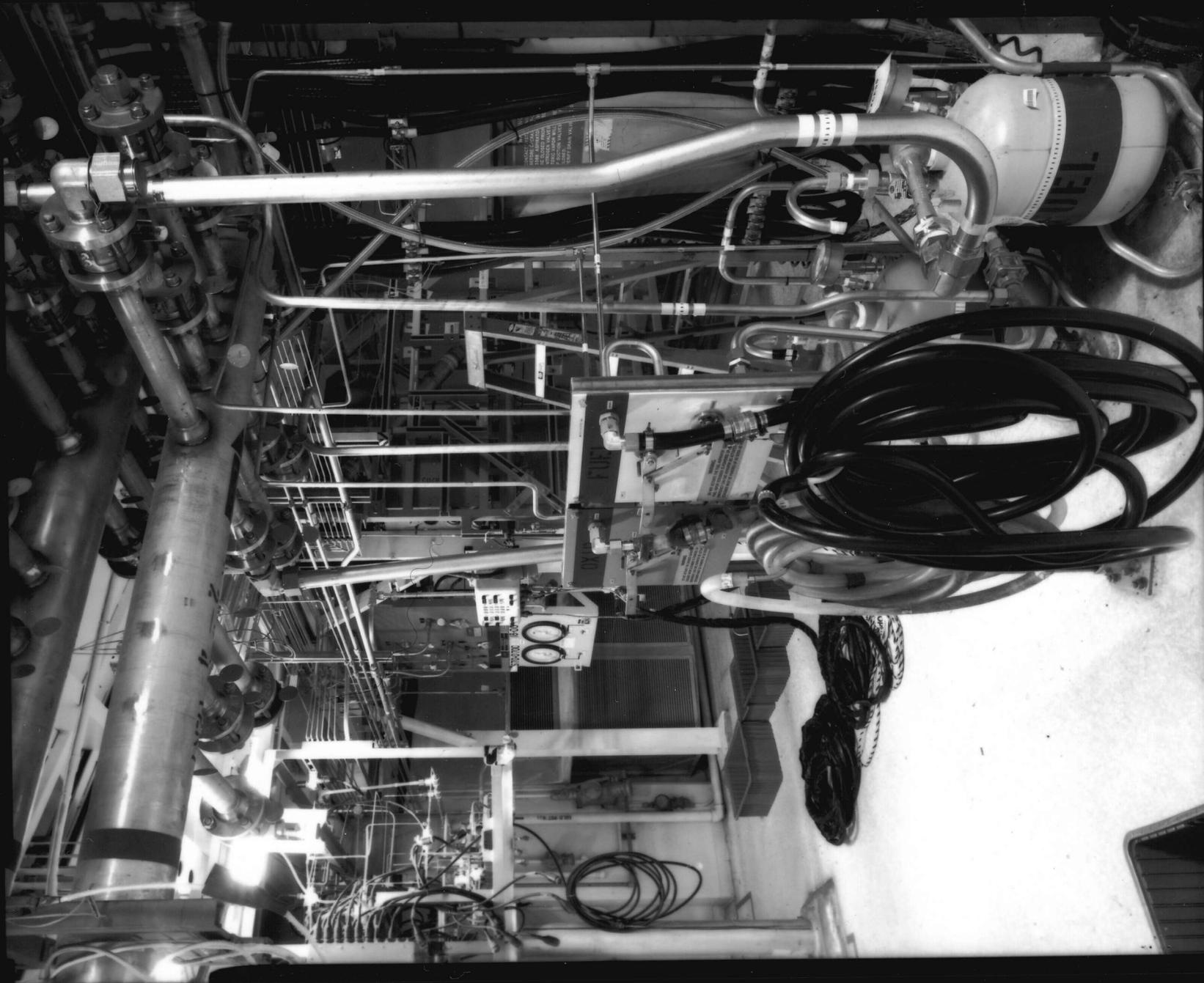




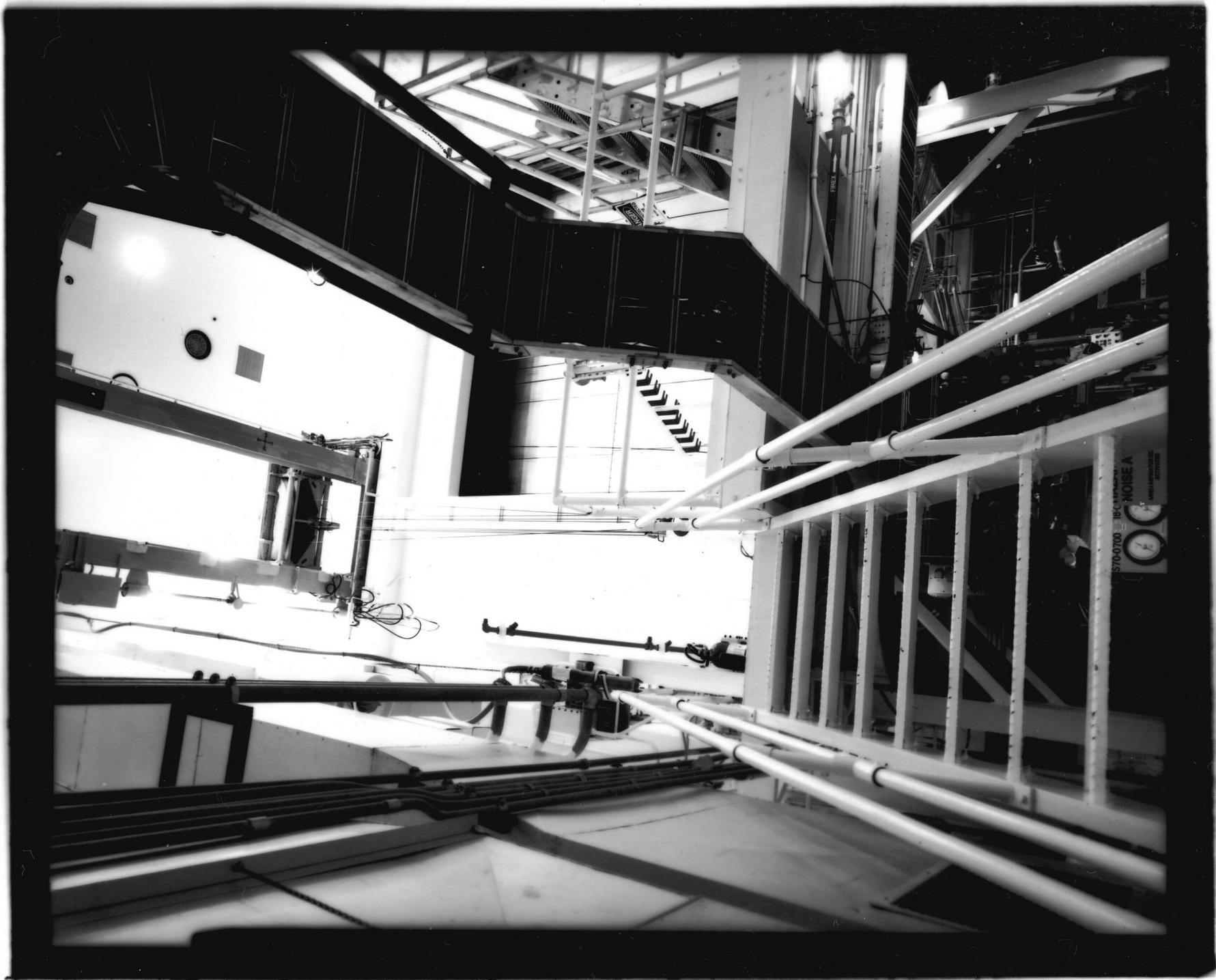
**HAZARDOUS
NOISE AREA**

WHEN ASPIRATOR/EXTRACTOR
ACTIVATED
HEARING PROTECTION
REQUIRED
FLOOR LEVEL ONLY

KODAK 100TMA

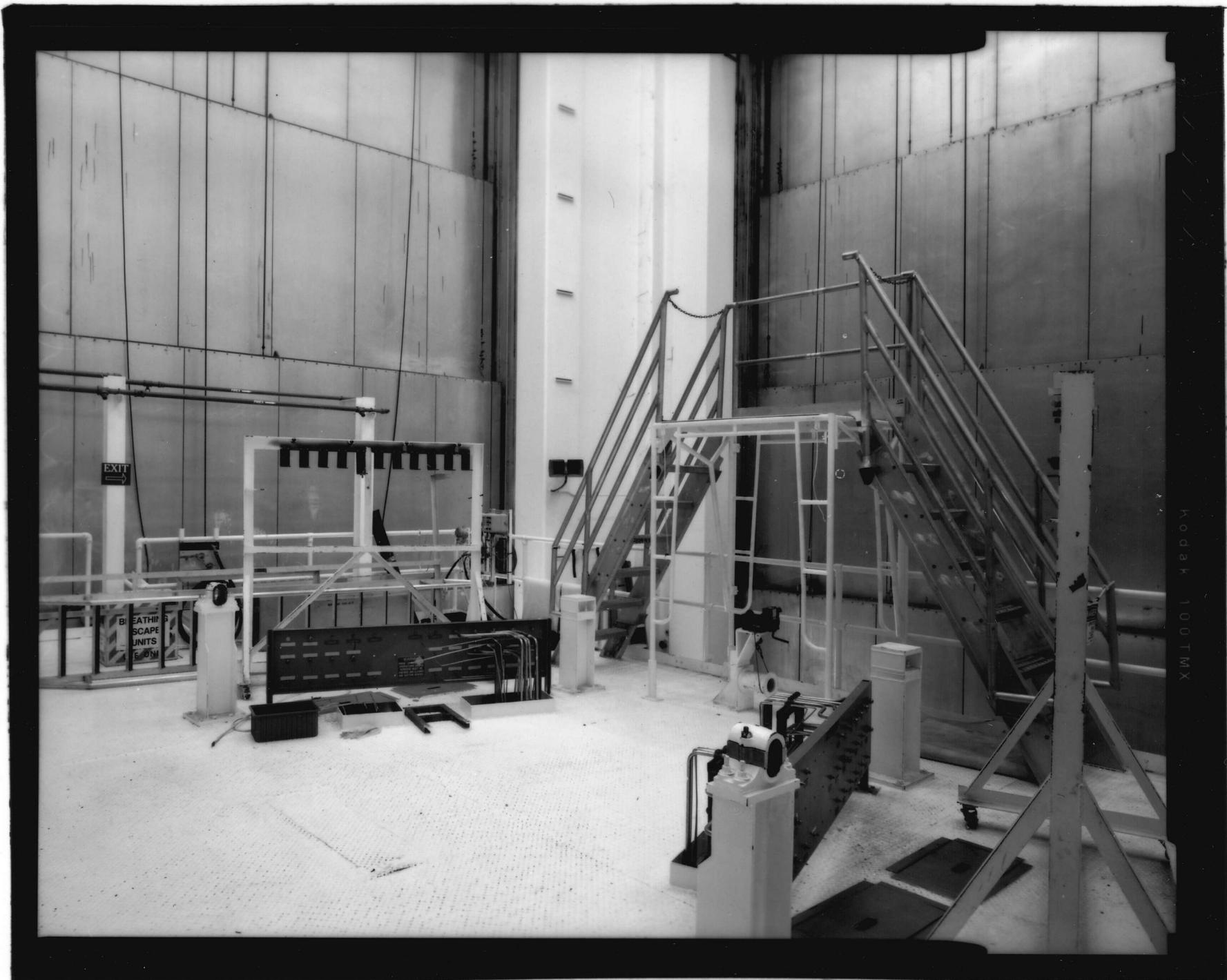






3700700 - IBC
NOISE A
CLASS 1
AC















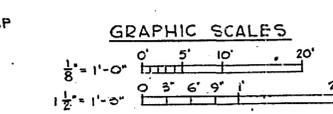
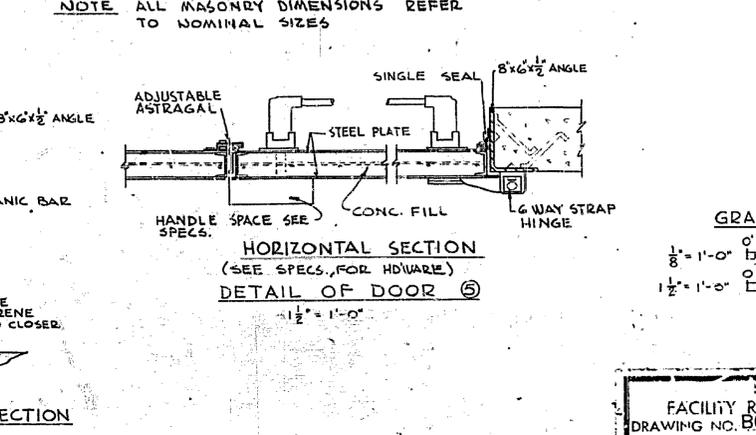
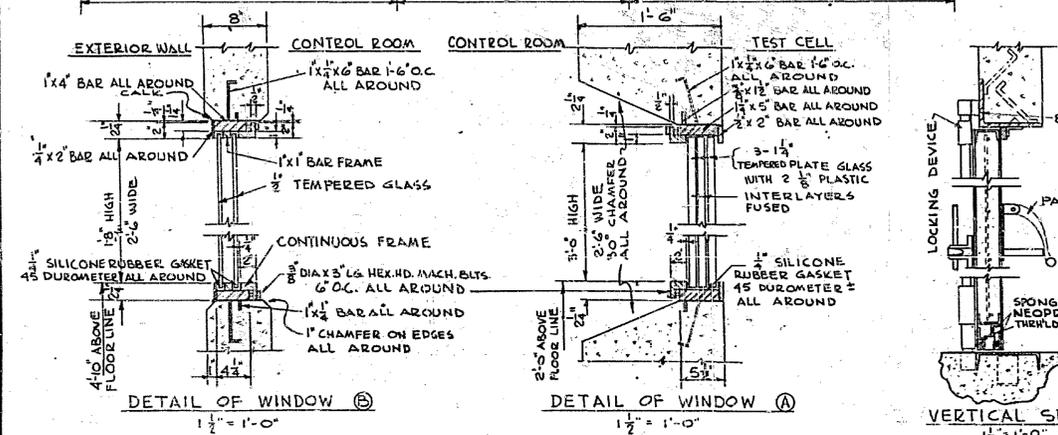
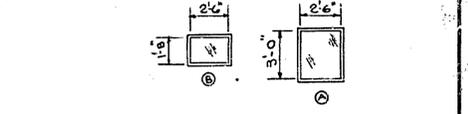
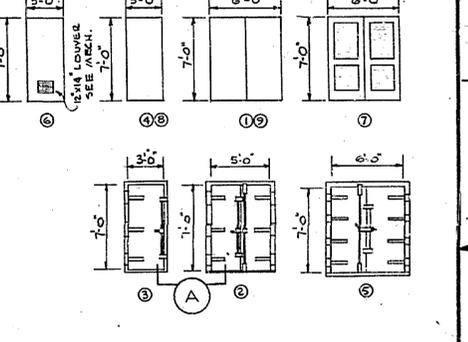
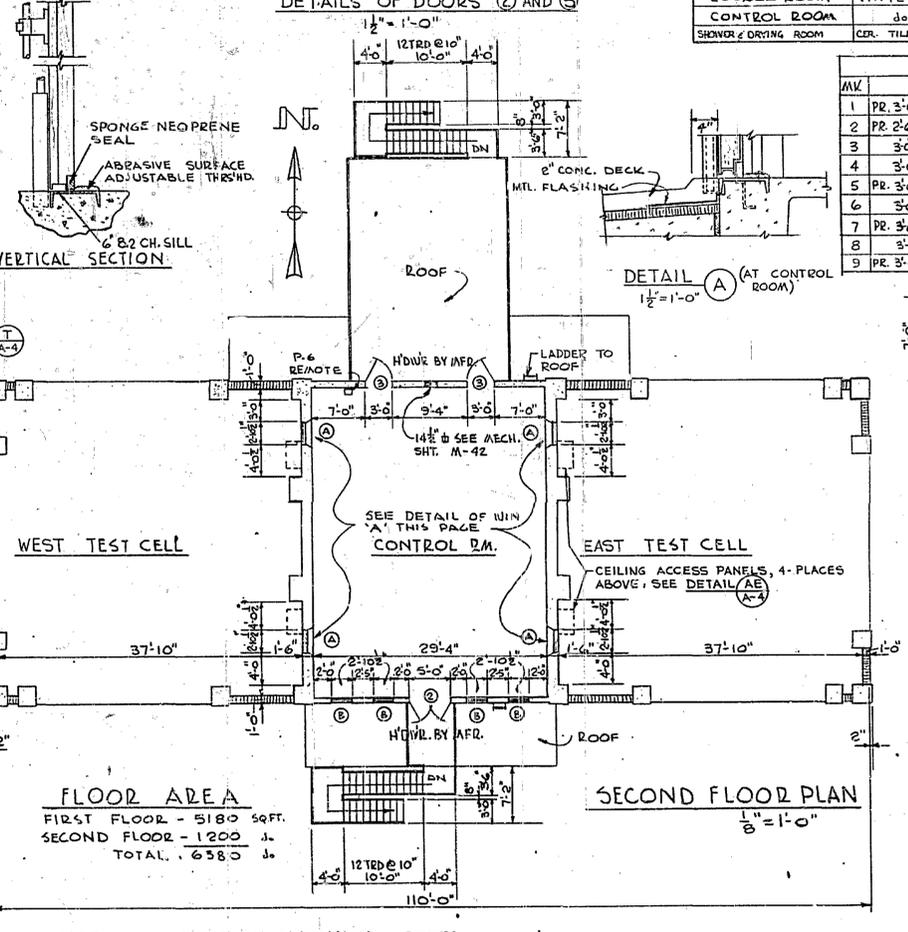
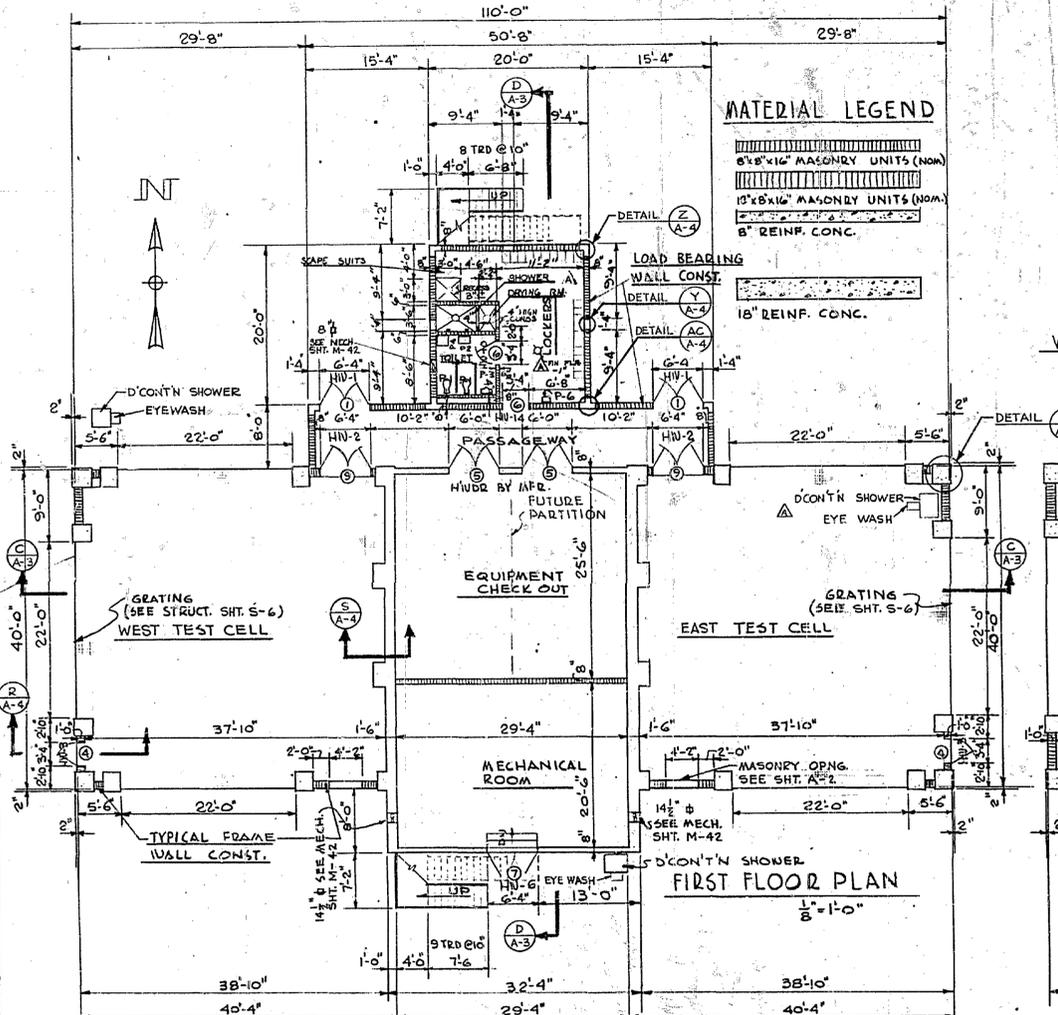
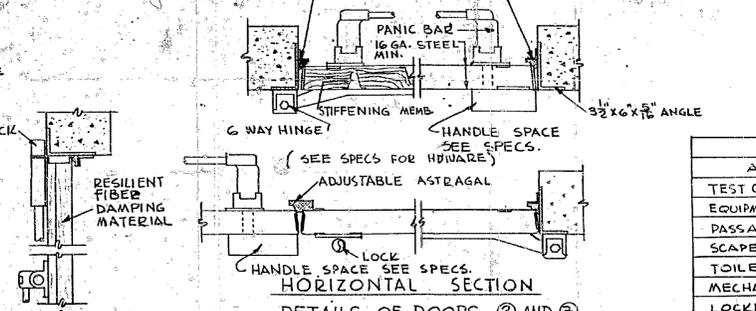
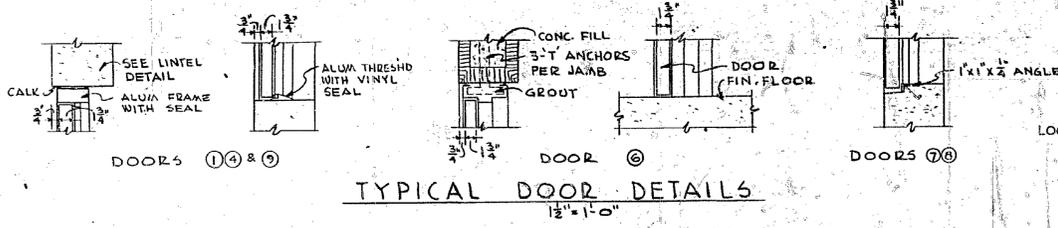
SAFETY
SHOWER
EYE WASH

| REVISIONS | | | | | |
|-----------|------|------|--------------------|---------|----------|
| NO. | SYN. | ZONE | DESCRIPTION | DATE | APPROVED |
| 1 | | | UP-DATED FOR "FRD" | 7/1/63 | |
| 2 | | | | 2/15/65 | |

| ROOM FINISH SCHEDULE | | | | | |
|----------------------|---------------|-----------|---------------------------|----------------|---------------------|
| AREA | FLOOR | BASE | WALL | CEILING | REMARKS |
| TEST CELL 1 & 2 | ALUM. GRATING | | CONC. OR CONC. BLK. | GYP. SOU. BD. | EPOXY FLOOR COATING |
| EQUIPMENT CHECK | VINYL ASB. | DUBBER | CONC. BLK. | | |
| PASSAGE WAY | do | do | do | do | |
| SCAPE SUITS | do | do | CONC. BLK. | | |
| TOILET | CER. TILE | CER. TILE | CONC. BLK. | 1/2" GYP. BRD. | 4'-0" TILE W/SCOT |
| MECHANICAL RM | CONCRETE | | REINF. CONC. & CONC. BLK. | | |
| LOCKER ROOM | VINYL ASB. | RUBBER | CONC. BLK. | GYP. SOU. BD. | |
| CONTROL ROOM | do | do | do | ACOUSTIC TILE | |
| SHOWER & DRYING ROOM | CER. TILE | CER. TILE | CONC. BLK. | 1/2" GYP. BRD. | 6'-0" TILE W/SCOT |

| DOOR SCHEDULE | | | | | | |
|---------------|--------------------------|------------------------|-------------------|-------------|-----------------------|------------------------|
| NO. | SIZE | TYPE | FRAME | THRESHD. | CLOSER | REMARKS |
| 1 | PR. 3'-0" x 7'-0" x 1/2" | HOLLOW ALUM. | ALUM. | SOLID ALUM. | YES, EACH LEAF | WEATHERSTRIP PANIC BAR |
| 2 | PR. 2'-6" x 7'-0" x 3/4" | INSULATED HOLLOW METAL | 1/2" x 1/2" ALUM. | C.I. | HARDWARE BY DOOR MFR. | SOUND RESIST |
| 3 | 3'-0" x 7'-0" x 3/4" | do | do | do | do | do |
| 4 | 3'-0" x 7'-0" x 1/2" | HOLLOW ALUM. | ALUM. | ALUM. | YES | WEATHERSTRIP PANIC BAR |
| 5 | PR. 3'-0" x 7'-0" x 3/4" | INSULATED HOLLOW METAL | 1/2" x 1/2" ALUM. | C.I. | HARDWARE BY DOOR MFR. | BLAST RESIST |
| 6 | 3'-0" x 7'-0" x 1/2" | FLUSH ALUM. | ALUM. | ALUM. | YES | LOWER SE ARCH. |
| 7 | PR. 3'-0" x 7'-0" x 1/2" | HOLLOW ALUM. | ALUM. | ALUM. | NO | LOUVERED |
| 8 | 3'-0" x 7'-0" x 1/2" | HOLLOW ALUM. | ALUM. | ALUM. | NO | WEATHERSTRIP |
| 9 | PR. 3'-0" x 7'-0" x 1/2" | do | do | ALUM. | YES, EA. LEAF | do |

| WINDOW SCHEDULE | | | | |
|-----------------|---------------|-------|-------------------------------|----------------------|
| NO. | SIZE | FRAME | GLASS | REMARKS |
| A | 2'-6" x 3'-0" | STEEL | 3-1/4" PL. GLAZ. 1/4" PLASTIC | SEE DETAIL THIS PAGE |
| B | 2'-6" x 1'-8" | do | 2-1/2" TEAF | SEE DETAIL THIS PAGE |



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER

TAMPA BAY ENGINEERING CO. 131 TREASURE ISLAND CWT. ST. PETERSBURG, FLA.
U. S. ARMY ENGINEER DISTRICT, JAX. CORPS OF ENGINEERS JACKSONVILLE, FLA.

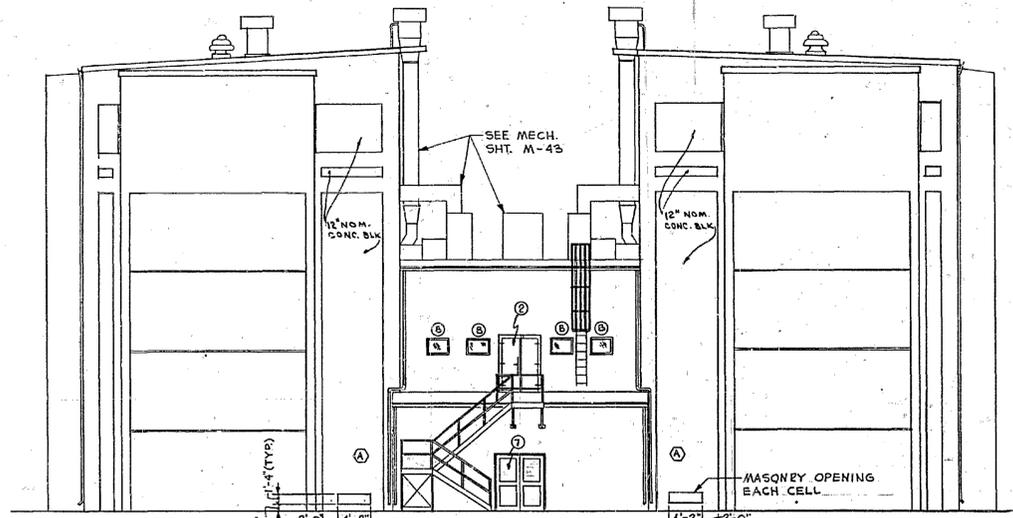
NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1

FIRST & SECOND FLOOR PLANS

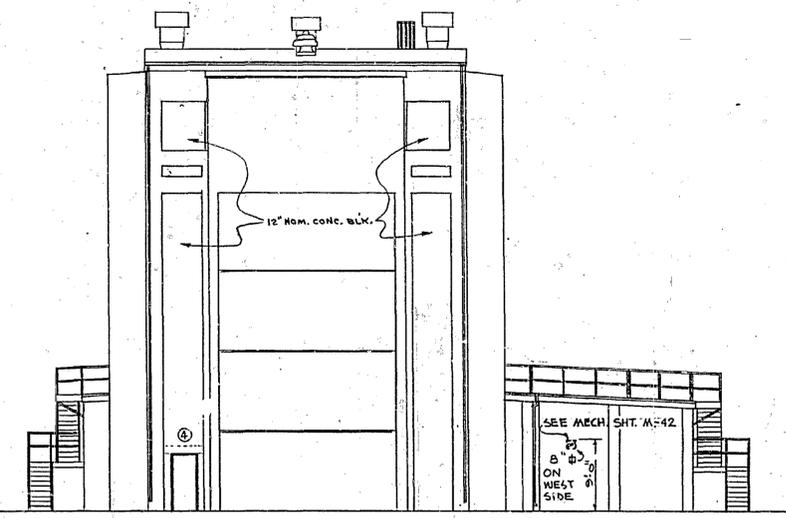
NASA-KCC
FACILITY RECORD DRAWING
DRAWING NO. B07.00.00.00A00100
DATE: 5 MARCH 1963 APPROVED: [Signature]
SCALE: 1/8" = 1'-0" DATED: 2-15-63 SHEET 40 OF 40

MICROFILMED FROM BEST AVAILABLE COPY.
DOES NOT MEET REQUIRED QUALITY STANDARDS

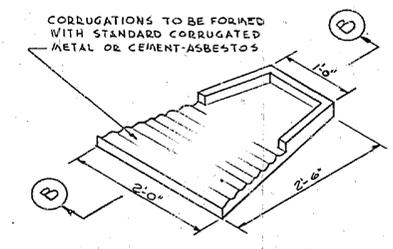
| REVISIONS | | | | | |
|-----------|-----|--------|--|---------|----------|
| NO. | BY | DATE | DESCRIPTION | DATE | APPROVED |
| 4 | (A) | 3/5/63 | REVISION TO "GRID LEVEL" ON SOUTH ELEV. ELEV. TO ALL MOD. TO CONF. NASA 1970 | 1/18/64 | |
| | (B) | | UP-DATED FOR "R.D." | 3/15/63 | |



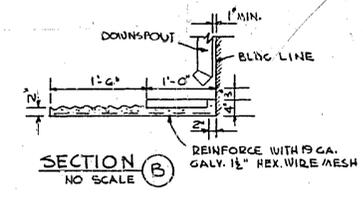
SOUTH ELEVATION $\frac{1}{8}'' = 1'-0''$



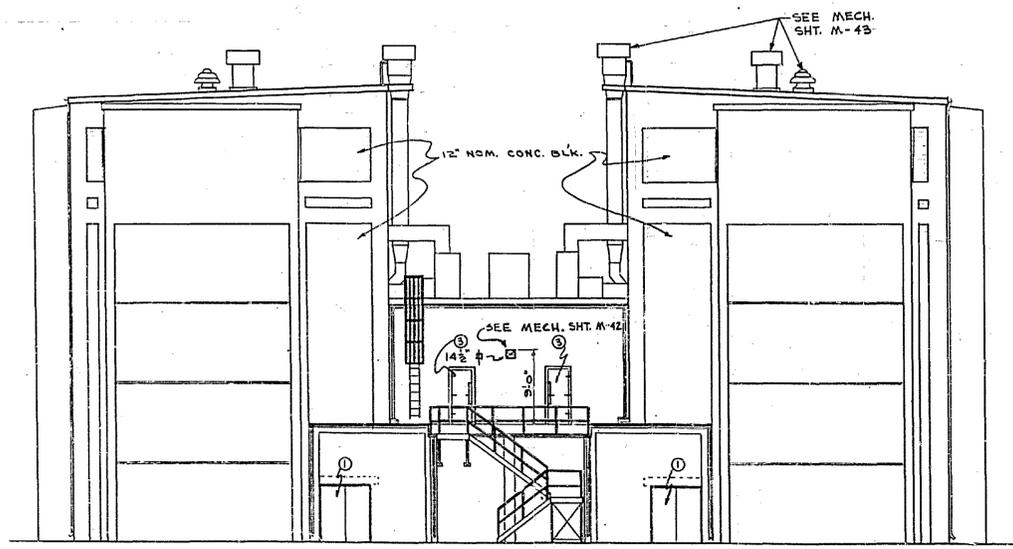
EAST ELEVATION $\frac{1}{8}'' = 1'-0''$
WEST ELEVATION SIMILAR EXCEPT OPPOSITE HAND



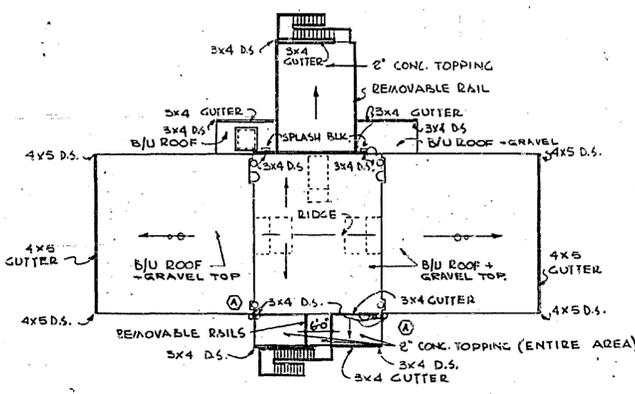
SKETCH-CONCRETE SPLASH BLOCK
NO SCALE



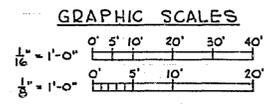
SECTION B
NO SCALE



NORTH ELEVATION $\frac{1}{8}'' = 1'-0''$
FOR HEIGHTS & DIMENSIONS SEE FLOOR PLANS & SECTIONS



NOTE: SLOPE ALL ROOFS $\frac{1}{2}''$ TO THE FOOT.
ROOF PLAN $\frac{1}{16}'' = 1'-0''$

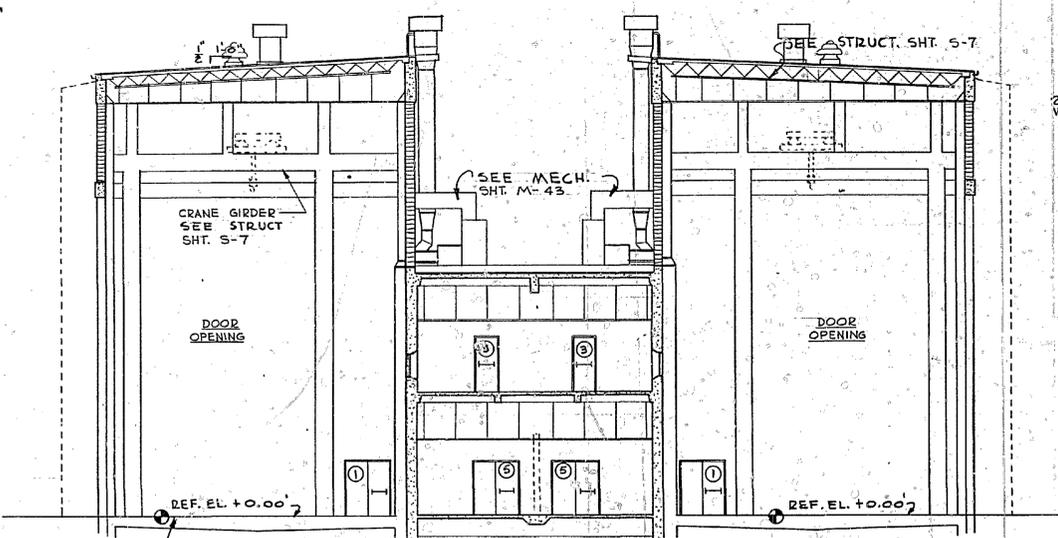


NASA KSC
FACILITY RECORD DRAWING
DRAWING NO. B07.00.00.00.A02.00
DATE _____ APPROVED *S. J. [Signature]*

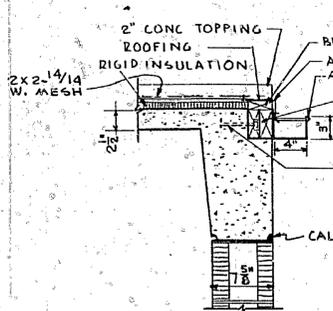
NATIONAL AERONAUTICS
AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER
TAMPA BAY ENGINEERING CO.
131 TREASURE ISLAND CRY.
ST. PETERSBURG, FLA.
U. S. ARMY ENGINEER DISTRICT, JAX.
CORPS OF ENGINEERS
MOBILEVILLE, TENN.
NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1
ARCHITECTURAL ELEVATIONS
INV. NO. ENG. (NASA) 00-123-63-35
DATED: 5 MARCH 1963
SCALE: AS NOTED
FILE NO. F 203-28,155
DATE: 2-15-63 SHEET 4020F

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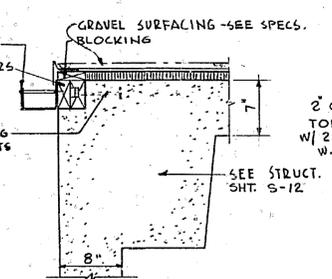
| REVISIONS | | | | | |
|-----------|------|------|-----------------------|---------|-------------|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| 1 | | | UP-DATED FOR "F.R.D." | 3/15/63 | [Signature] |



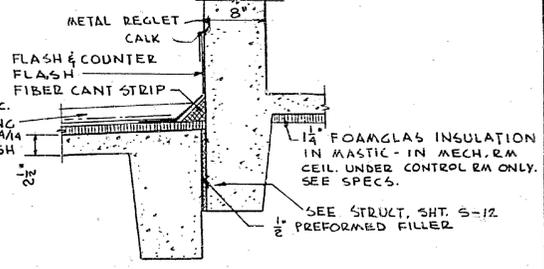
SECTION C-A-1
8'-0"



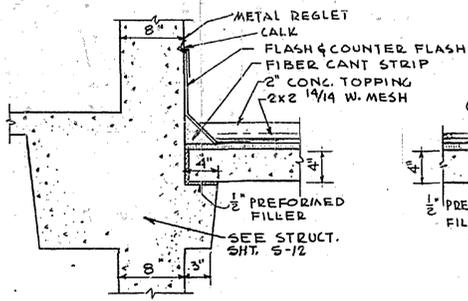
DETAIL E
1/2" = 1'-0"



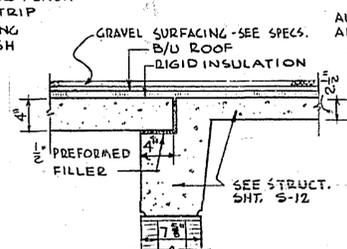
DETAIL F
1/2" = 1'-0"



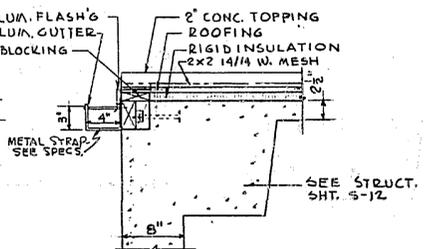
DETAIL G
1/2" = 1'-0"



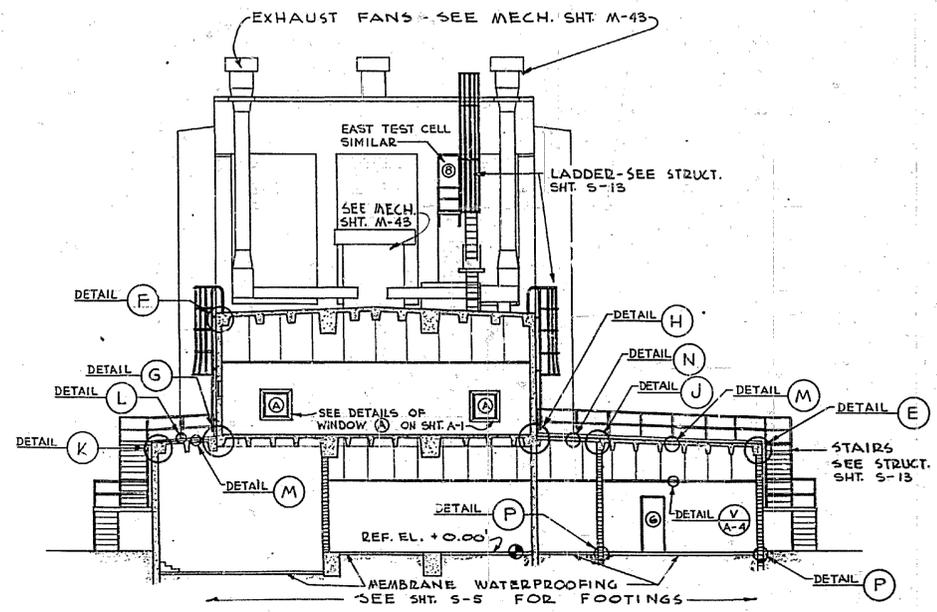
DETAIL H
1/2" = 1'-0"



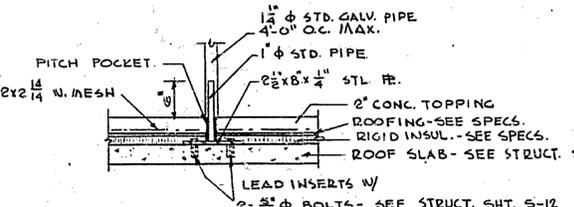
DETAIL J
1/2" = 1'-0"



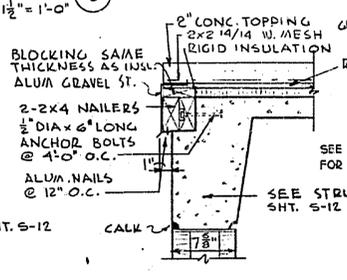
DETAIL K
1/2" = 1'-0"



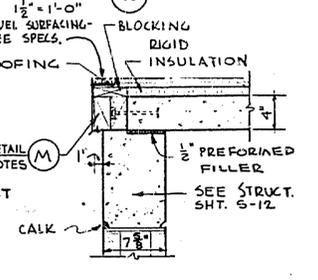
SECTION D-A-1
8'-0"



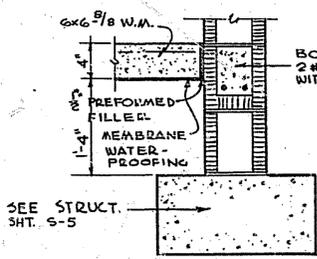
DETAIL L
1/2" = 1'-0"



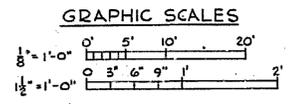
DETAIL M AT SIDES
1/2" = 1'-0"



DETAIL N AT SIDES
1/2" = 1'-0"



DETAIL P
1/2" = 1'-0"



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LAUNCH OPERATIONS CENTER

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151 TREASURE ISLAND CRY.
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U.S. ARMY ENGINEER DISTRICT, JAX.
CORPS OF ENGINEERS
JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1
SECTIONS & DETAILS

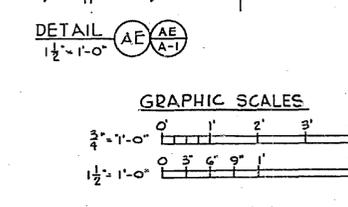
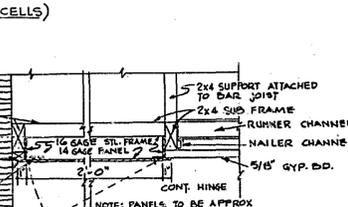
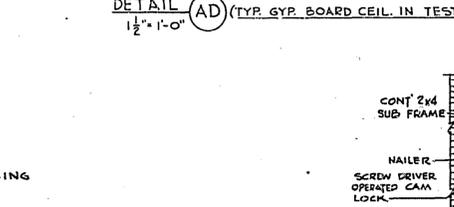
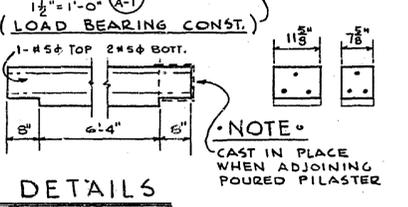
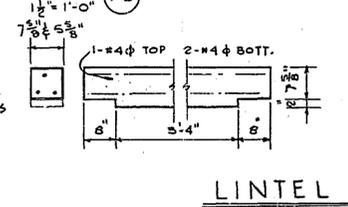
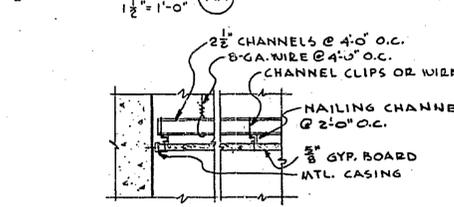
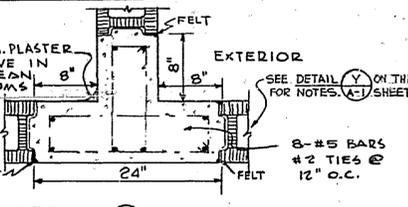
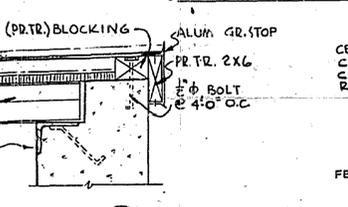
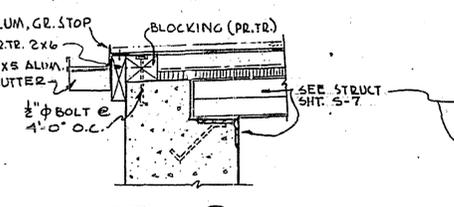
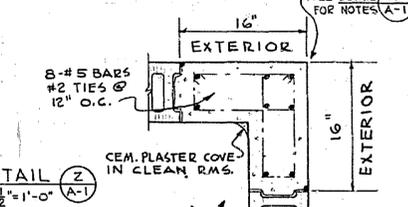
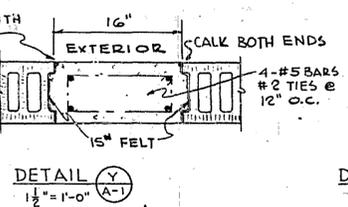
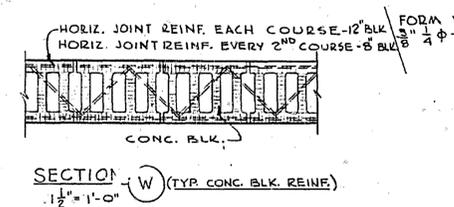
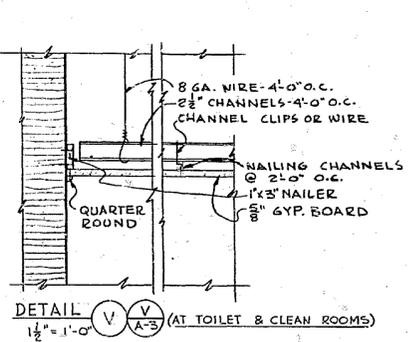
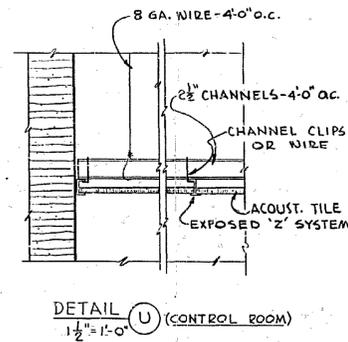
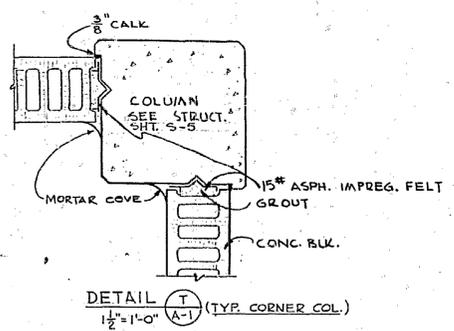
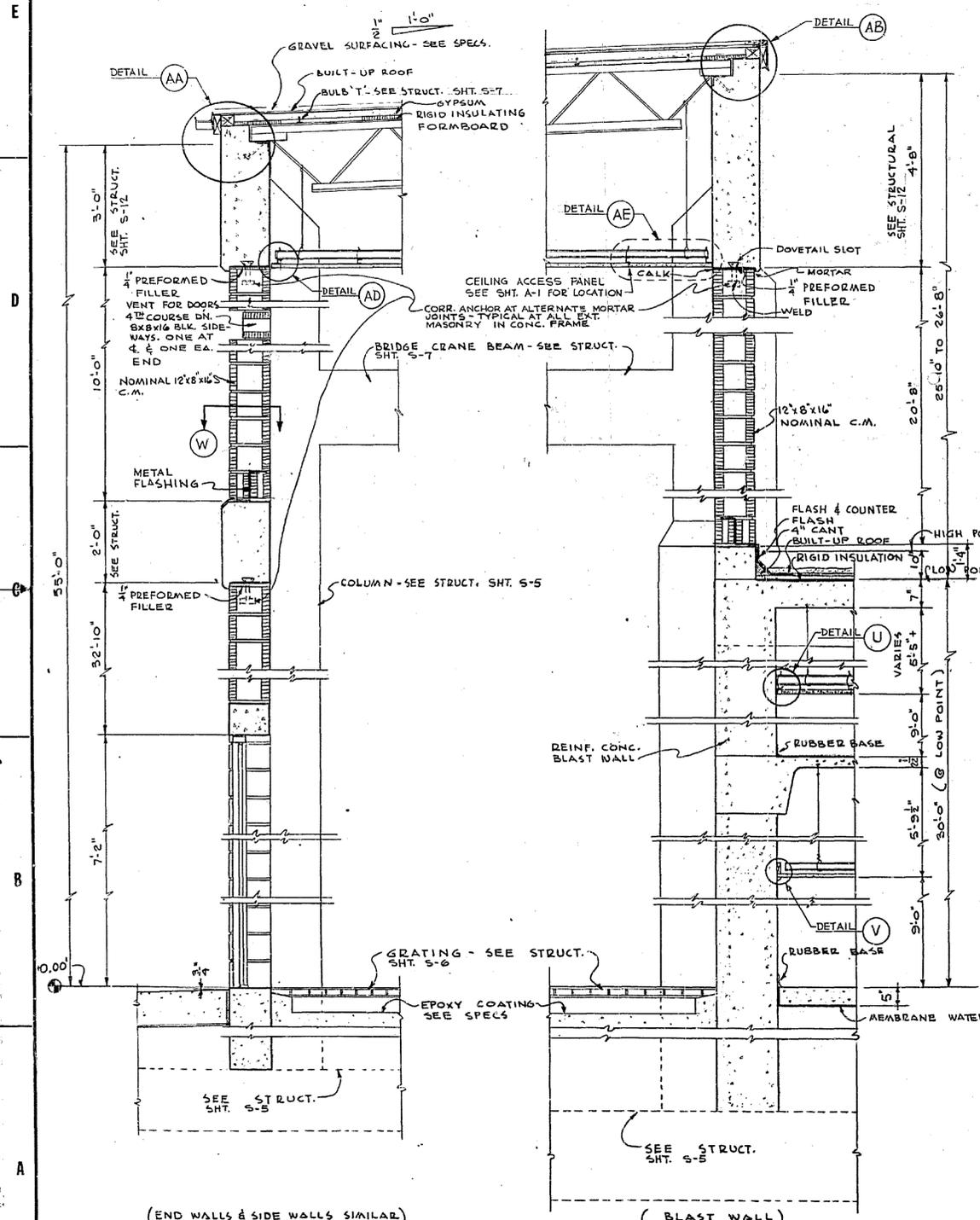
DATE: 3 MARCH 1963
SCALE: AS NOTED
DRAWING NO. 807.00.00.00.A003.00
APPROVED: [Signature]

NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. 807.00.00.00.A003.00
DATE: APPROVED: [Signature]

D.O. File No. 203-28-155 1 24-T

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| REVISIONS | | | | | |
|-----------|----|------|---|----------|----------|
| NO. | BY | DATE | DESCRIPTION | DATE | APPROVED |
| 3 | | | ADDED CEILING ACCESS PANEL ASSEMBLY TO COL. DETAIL 'AD' | 10/16/63 | |
| 2 | | | UP-DATED FOR "ERD." | 3/15/63 | |



NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LAUNCH OPERATIONS CENTER

TAMPA BAY ENGINEERING CO. 151 TREASURE ISLAND CWT. ST. PETERSBURG & FLA.

U.S. ARMY ENGINEER DISTRICT, INC. CORPS OF ENGINEERS JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA MERRITT ISLAND, FLA.

HYPERGOLIC TEST #1 SECTIONS & DETAILS

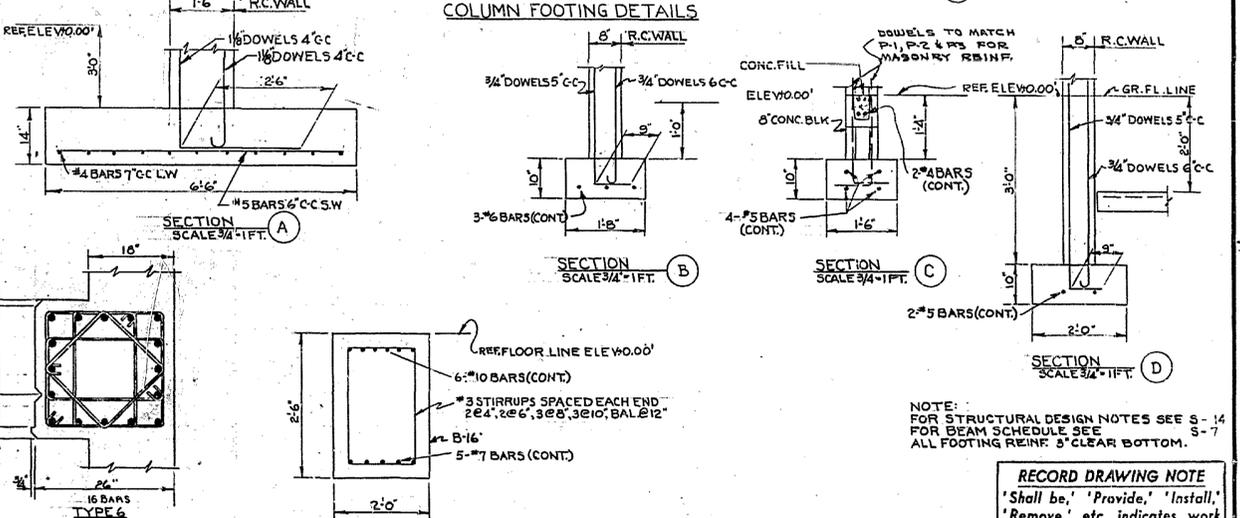
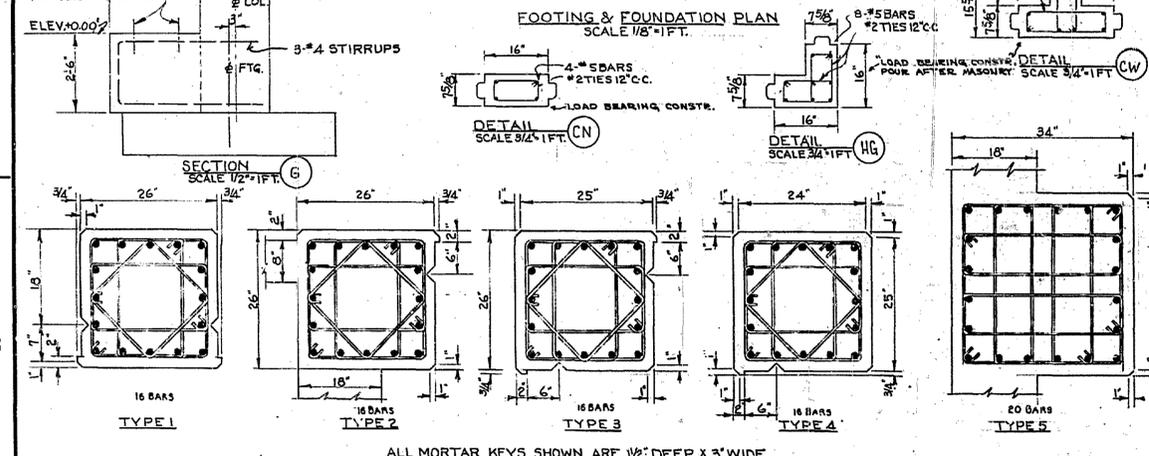
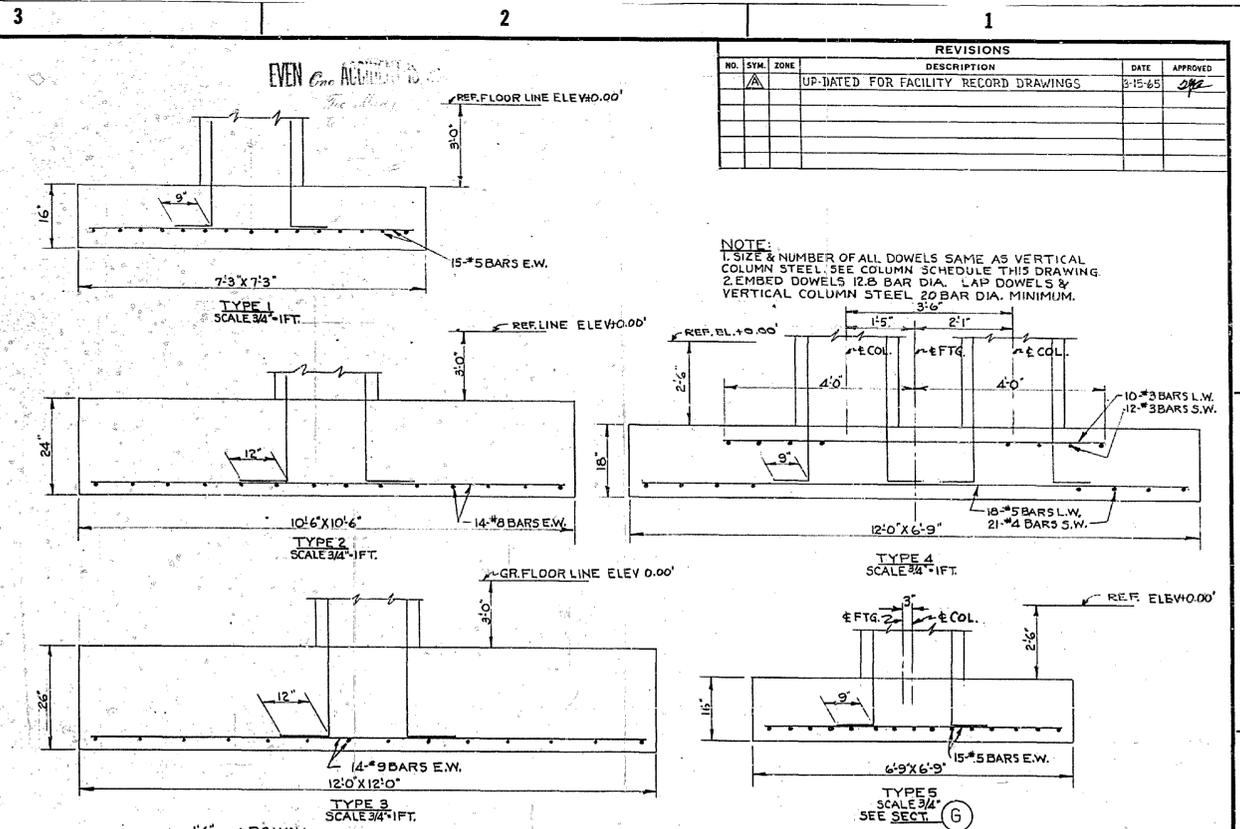
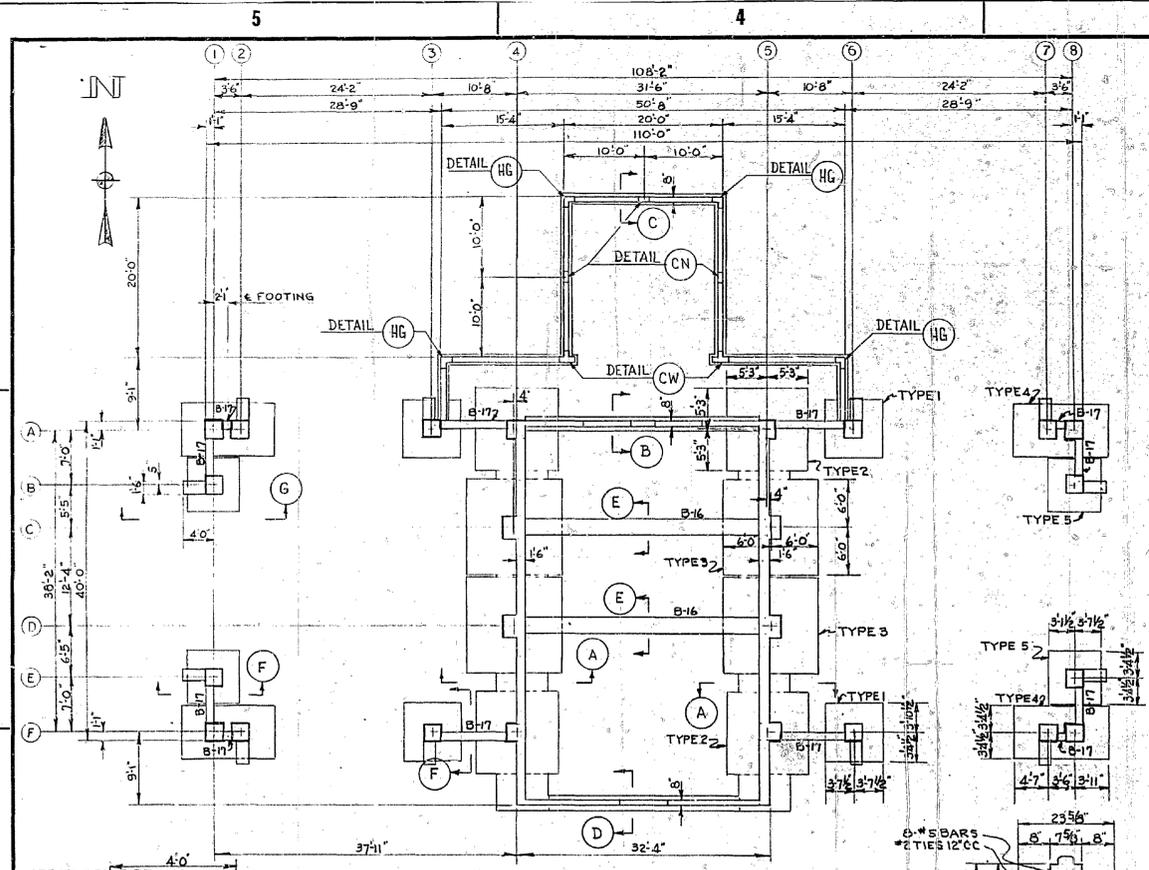
NASA-KSC FACILITY RECORD DRAWING DRAWING NO. 807.00.00.0A0004.00 DATE APPROVED [Signature]

INV. NO. ENG. DESIG. 80-153-63-35 DATED: 5 MARCH 1963 SCALE: 5/8 NOTED DATE: 2-15-63 SHEET 40/40

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| REVISIONS | | | | | |
|-----------|------|------|--------------------------------------|---------|--------------------|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| 1 | | | UPDATED FOR FACILITY RECORD DRAWINGS | 3-15-65 | <i>[Signature]</i> |

NOTE:
1. SIZE & NUMBER OF ALL DOWELS SAME AS VERTICAL COLUMN STEEL. SEE COLUMN SCHEDULE THIS DRAWING.
2. EMBED DOWELS 12" BAR DIA. LAP DOWELS & VERTICAL COLUMN STEEL 20" BAR DIA. MINIMUM.



| COLUMN FOOTING & LOAD SCHEDULE | | | | | | | | | | | | | COLUMN SCHEDULE | | | | | | | | | | | | | |
|--------------------------------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-----------------|----|----|----|----|----|----|----|----|----|----|----|----|---|
| LOADS IN KIPS | | | | | | | | | | | | | STEEL REIN. | | | | | | | | | | | | | |
| MARK | A1 | A2 | A3 | A4 | A5 | A6 | A7 | AB | B1 | B2 | C4 | C5 | MARK | A1 | A2 | A3 | A4 | A5 | A6 | A7 | AB | B1 | B2 | C4 | C5 | |
| LIVE LOAD | 14.1 | 13.1 | 13.2 | 15.0 | 15.0 | 13.2 | 13.1 | 14.1 | 6.4 | 6.4 | 24.2 | 24.2 | D-4 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 | 5 |
| DEAD LOAD | 65.8 | 106.0 | 118.7 | 244.0 | 244.0 | 118.7 | 106.0 | 65.8 | 104.0 | 104.0 | 311.1 | 311.1 | E-1 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| WIND LOAD | 33.0 | 23.0 | 21.0 | 33.0 | 33.0 | 21.0 | 28.0 | 33.0 | 21.0 | 21.0 | 0.0 | 0.0 | F-2 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| TOTAL LOAD | 112.9 | 147.1 | 152.9 | 292.0 | 292.0 | 152.9 | 147.1 | 112.9 | 131.4 | 131.4 | 357.3 | 357.3 | F-3 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |
| TYPE | 4 | 1 | 2 | 2 | 1 | 4 | 5 | 5 | 3 | 3 | | | F-4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 | 4 |

RECORD DRAWING NOTE
'Shall be,' 'Provide,' 'Install,' 'Remove,' etc. indicates work was accomplished under the contract.

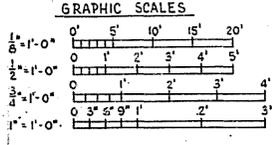
AS BUILT
APPROVED BY *[Signature]*
DATE *[Date]*

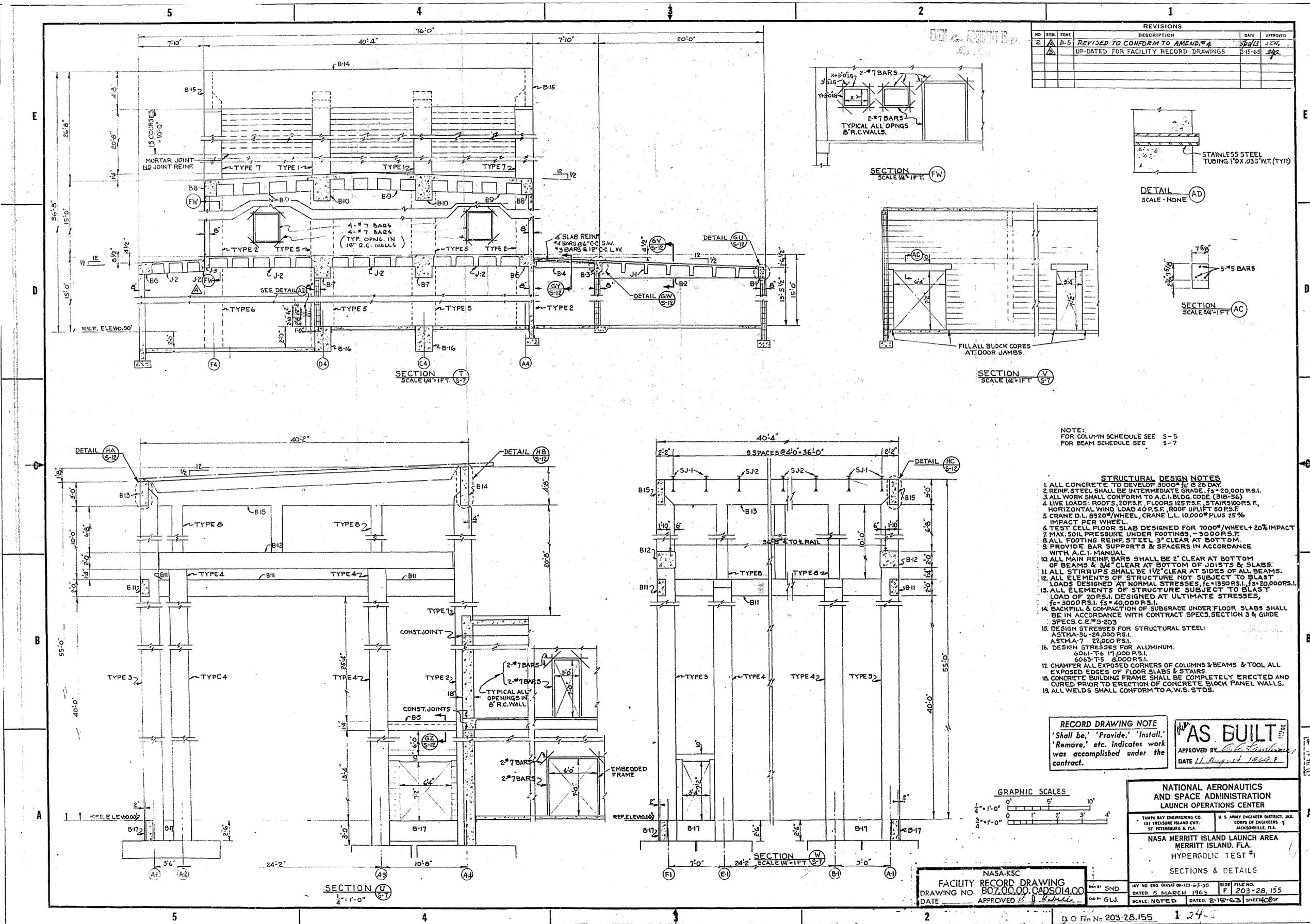
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER
TAMPA BAY ENGINEERING CO.
151 TREASURE ISLAND CWT.
ST. PETERSBURG 4, FLA.

NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1

FOUNDATION PLAN & DETAILS
DATE: 5 MARCH 1963
SCALE: NOTED
SHEET: 05 OF 07

NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. 807.00.00.0ADS005.00
DATE: APPROVED BY *[Signature]*





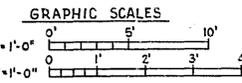
| REVISIONS | | | | | |
|-----------|------|------|---------------------------------------|---------|----------|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| 2 | A | D-5 | REVISED TO CONFORM TO AMEND.#4 | 2/13/63 | J.E.P. |
| 1 | A | | UP-DATED FOR FACILITY RECORD DRAWINGS | 3-15-63 | 2/2 |

NOTE:
FOR COLUMN SCHEDULE SEE S-5
FOR BEAM SCHEDULE SEE S-7

- STRUCTURAL DESIGN NOTES**
1. ALL CONCRETE TO DEVELOP 3000 P.S.I. @ 28 DAYS.
 2. REINF. STEEL SHALL BE INTERMEDIATE GRADE, $f_y = 20,000$ P.S.I.
 3. ALL WORK SHALL CONFORM TO A.C.I. BLDG. CODE (318-56).
 4. LIVE LOADS: ROOFS, 20 P.S.F. FLOORS 125 P.S.F. STAIRS 100 P.S.F. HORIZONTAL WIND LOAD 40 P.S.F. ROOF UPLIFT 50 P.S.F.
 5. CRANE D.L. 8920#/WHEEL, CRANE L.L. 10,000# PLUS 25% IMPACT PER WHEEL.
 6. TEST CELL FLOOR SLAB DESIGNED FOR 1000#/WHEEL + 20% IMPACT MAX. SOIL PRESSURE UNDER FOOTINGS, 3.000 P.S.F.
 7. ALL FOOTING REINF. STEEL 3" CLEAR AT BOTTOM.
 8. PROVIDE BAR SUPPORTS & SPACERS IN ACCORDANCE WITH A.C.I. MANUAL.
 9. ALL MAIN REINF. BARS SHALL BE 2" CLEAR AT BOTTOM OF BEAMS & 3/4" CLEAR AT BOTTOM OF JOISTS & SLABS.
 10. ALL STIRRUPS SHALL BE 1/2" CLEAR AT SIDES OF ALL BEAMS.
 11. ALL ELEMENTS OF STRUCTURE NOT SUBJECT TO BLAST LOADS DESIGNED AT NORMAL STRESSES $f_c = 1500$ P.S.I. $f_s = 20,000$ P.S.I.
 12. ALL ELEMENTS OF STRUCTURE SUBJECT TO BLAST LOAD OF 20 P.S.I. DESIGNED AT ULTIMATE STRESSES, $f_c = 3000$ P.S.I. $f_s = 40,000$ P.S.I.
 13. BACKFILL & COMPACTION OF SUBGRADE UNDER FLOOR SLABS SHALL BE IN ACCORDANCE WITH CONTRACT SPECS. SECTION 3 & GUIDE SPECS. C.E.#S-203.
 14. DESIGN STRESSES FOR STRUCTURAL STEEL: ASTM A-36 - 24,000 P.S.I. ASTM A-7 - 27,000 P.S.I.
 15. DESIGN STRESSES FOR ALUMINUM: 6061-T6 17,000 P.S.I. 6063-T5 8,000 P.S.I.
 16. CHAMFER ALL EXPOSED CORNERS OF COLUMNS & BEAMS & TOOL ALL EXPOSED EDGES OF FLOOR SLABS & STAIRS.
 17. CONCRETE BUILDING FRAME SHALL BE COMPLETELY ERECTED AND CURED PRIOR TO ERECTION OF CONCRETE BLOCK PANEL WALLS.
 18. ALL WELDS SHALL CONFORM TO A.W.S. STDS.

RECORD DRAWING NOTE
'Shall be,' 'Provide,' 'Install,' 'Remove,' etc. indicates work was accomplished under the contract.

AS BUILT
APPROVED BY: *C. L. Starnham*
DATE: 11 August 1963



NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. 807.00.00.005014.00
DATE: _____ APPROVED: *J. J. Ruppelle*

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION LAUNCH OPERATIONS CENTER

TAMPA BAY ENGINEERING CO. 151 TREASURE ISLAND CRY. ST. PETERSBURG 3, FLA.
U.S. ARMY ENGINEER DISTRICT, JAX. CORPS OF ENGINEERS 1 JACKSONVILLE, FLA.

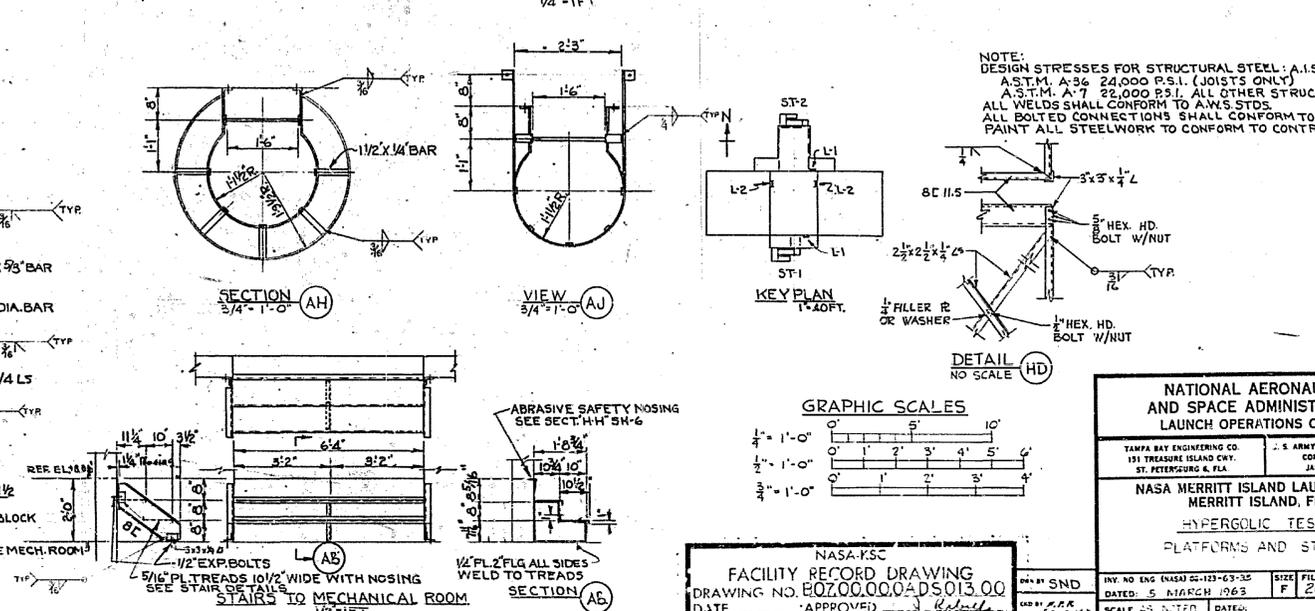
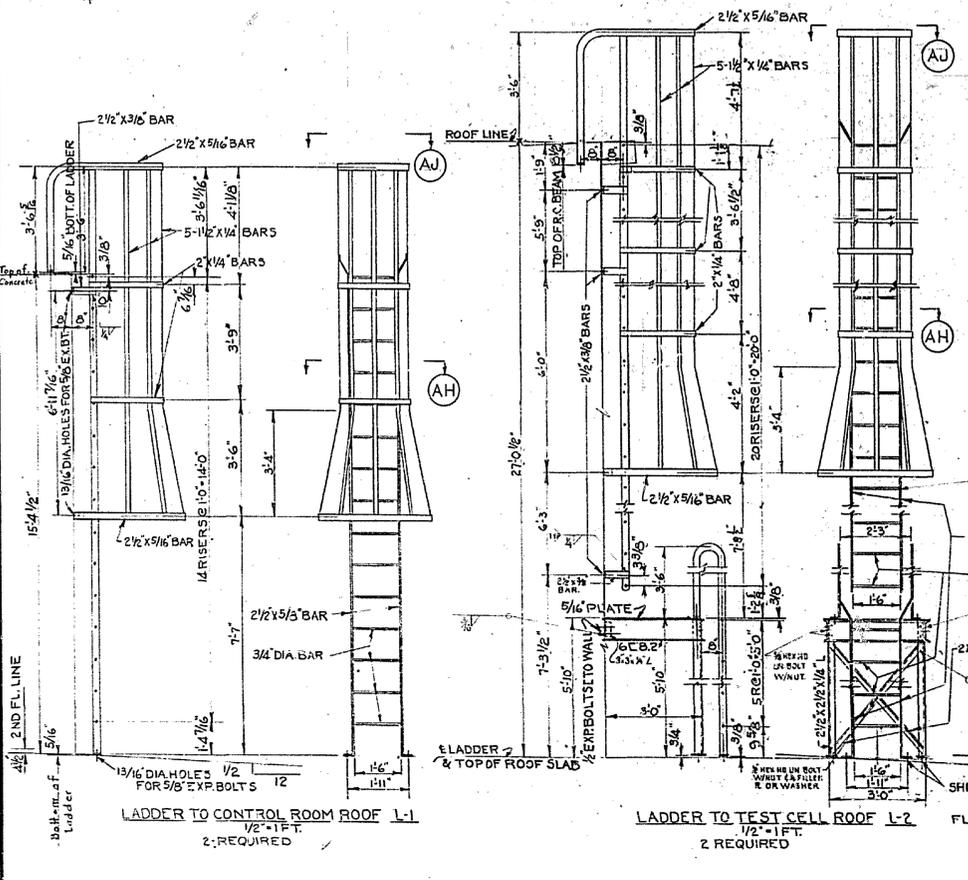
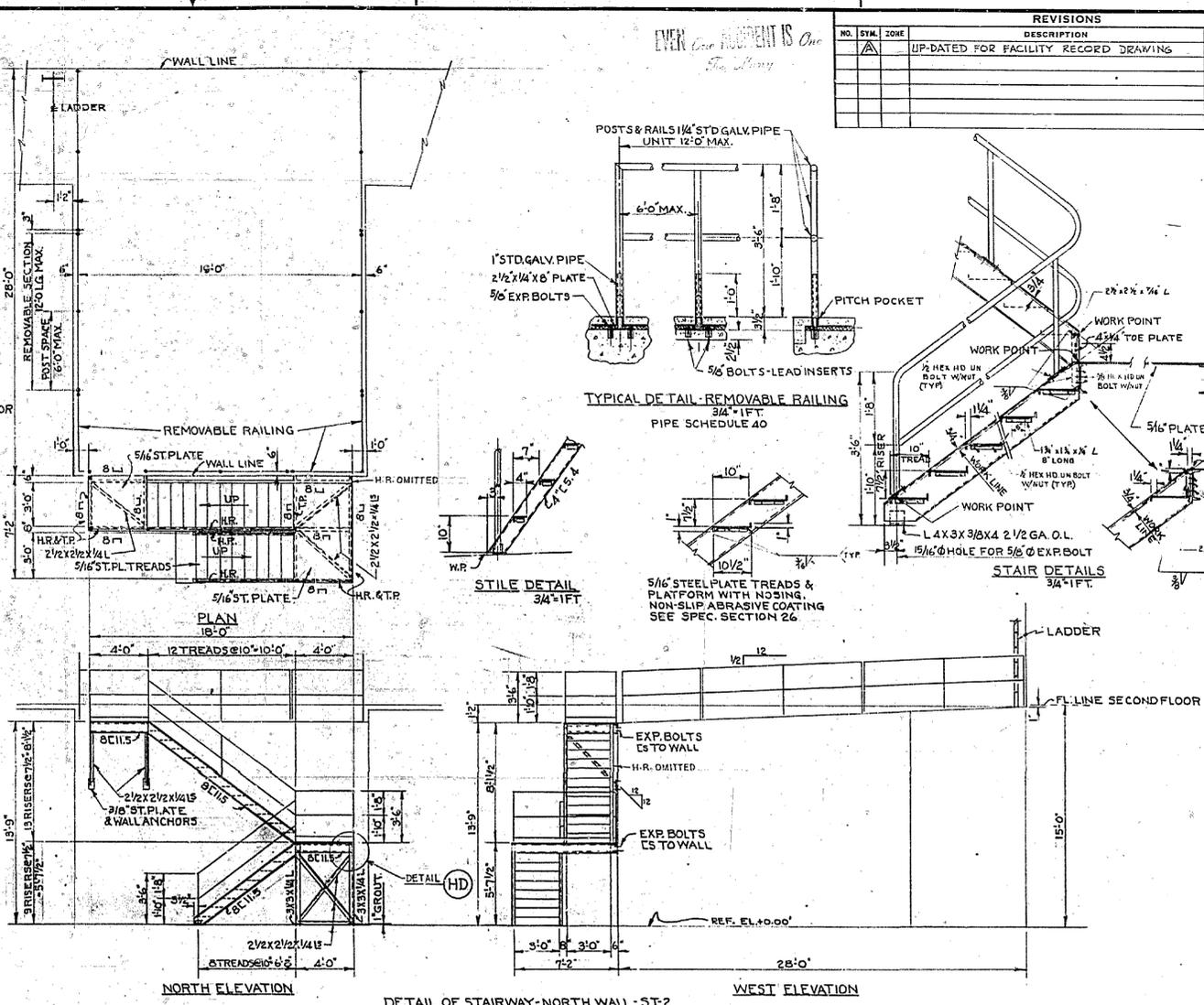
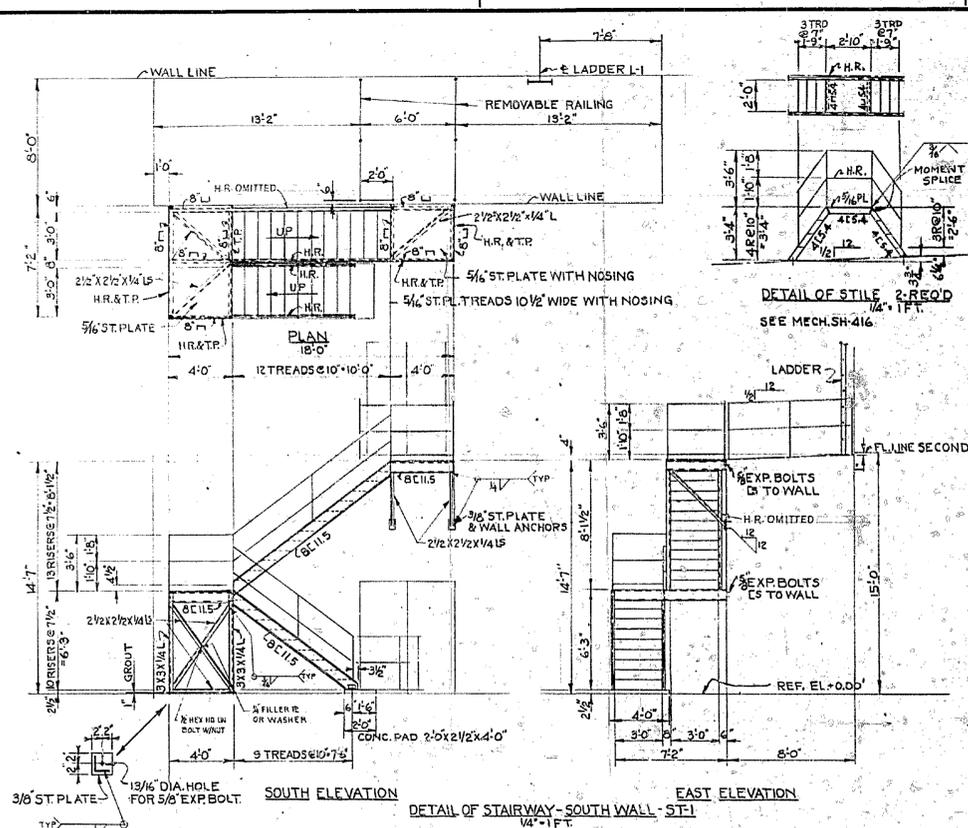
NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1

SECTIONS & DETAILS

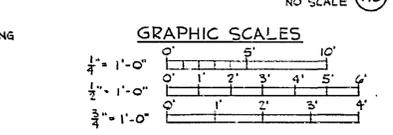
HW NO. ENG (NASA) 08-123-03-35 SIZE FILE NO.
DATED: 5 MARCH 1963 F 203-28,155
SCALE: NOTED DATE: 2-15-63 SHEET 4 OF 7

MICROFILMED FROM BEST AVAILABLE COPY;
DOES NOT MEET REQUIRED QUALITY STANDARDS

| REVISIONS | | | | | |
|-----------|------|------|--------------------------------------|---------|-------------|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| 1 | | | UP-DATED FOR FACILITY RECORD DRAWING | 3/15/65 | [Signature] |



NOTE:
DESIGN STRESSES FOR STRUCTURAL STEEL: A.I.S.C. NOV. 1961
A.S.T.M. A-36 24,000 P.S.I. (JOISTS ONLY)
A.S.T.M. A-7 22,000 P.S.I. ALL OTHER STRUCTURAL STEEL
ALL WELDS SHALL CONFORM TO A.M.S. STDS.
ALL BOLTED CONNECTIONS SHALL CONFORM TO A.I.S.C. STDS.
PAINT ALL STEELWORK TO CONFORM TO CONTRACT SPEC. 33.



NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. 203-28-155
DATE: 5 MARCH 1963

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER

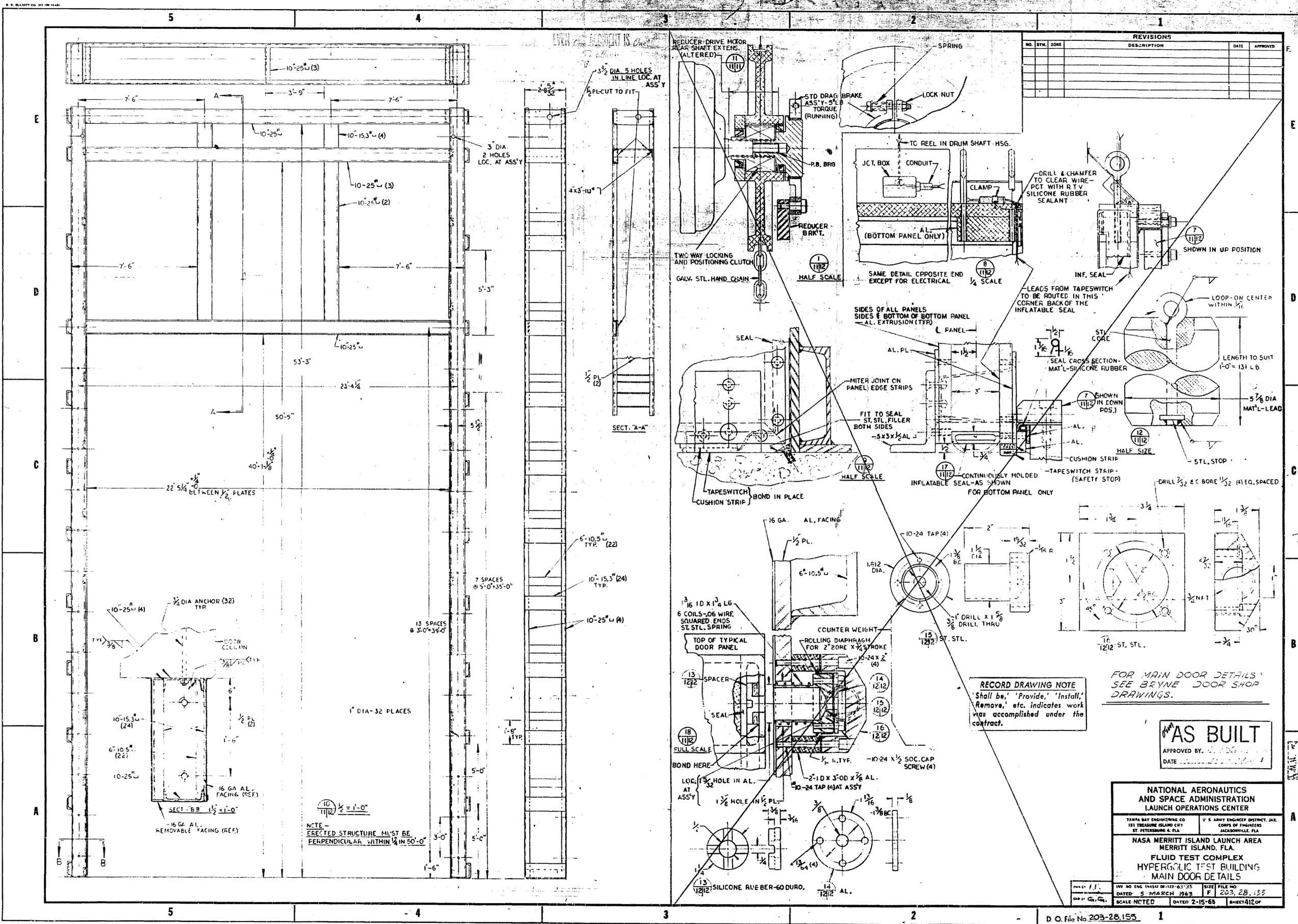
TAMPA BAY ENGINEERING CO.
151 TREASURE ISLAND CRY.
ST. PETERSBURG 6, FLA.

J. S. ARMY ENGINEER DISTRICT, JAL.
CORPS OF ENGINEERS
JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1
PLATFORMS AND STAIRS

SCALE: AS SHOWN
DATE: 5 MARCH 1963
SHEET 41 OF 42

MICROFILMED FROM BEST AVAILABLE COPY;
DOES NOT MEET REQUIRED QUALITY STANDARDS



| REVISIONS | | | |
|-----------|------|------|-------------|
| NO. | SYM. | ZONE | DESCRIPTION |
| | | | |
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RECORD DRAWING NOTE
 'Shall be,' 'Provide,' 'Install,'
 'Remove,' etc. indicates work
 was accomplished under the
 contract.

FOR MAIN DOOR DETAILS
 SEE BRYNE DOOR SHOP
 DRAWINGS.

AS BUILT
 APPROVED BY: _____
 DATE: _____

**NATIONAL AERONAUTICS
 AND SPACE ADMINISTRATION
 LAUNCH OPERATIONS CENTER**

TAMPA BAY ENGINEERING CO
 151 TREASURE ISLAND CRY
 ST. PETERSBURG, FLA.

U.S. ARMY ENGINEER DISTRICT, JAX.
 CORPS OF ENGINEERS
 JACKSONVILLE, FLA.

**NASA MERRITT ISLAND LAUNCH AREA
 MERRITT ISLAND, FLA.
 FLUID TEST COMPLEX
 HYPERGOLIC TEST BUILDING
 MAIN DOOR DETAILS**

REV. NO. 11
 DATED 5 MARCH 1963
 SCALE NOTED

REV. FILE NO.
 F 203, 28, 155
 DATED 2-15-63
 SHEET 412 OF

NOTE -
 ERRECTED STRUCTURE MUST BE
 PERPENDICULAR WITHIN 1/4" IN 50'-0"

10
 1/2" = 1'-0"

18
 FULL SCALE

13
 1/2" = 1'-0"

10
 1/2" = 1'-0"

10
 1/2" = 1'-0"

10
 1/2" = 1'-0"

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 1/2" = 1'-0"

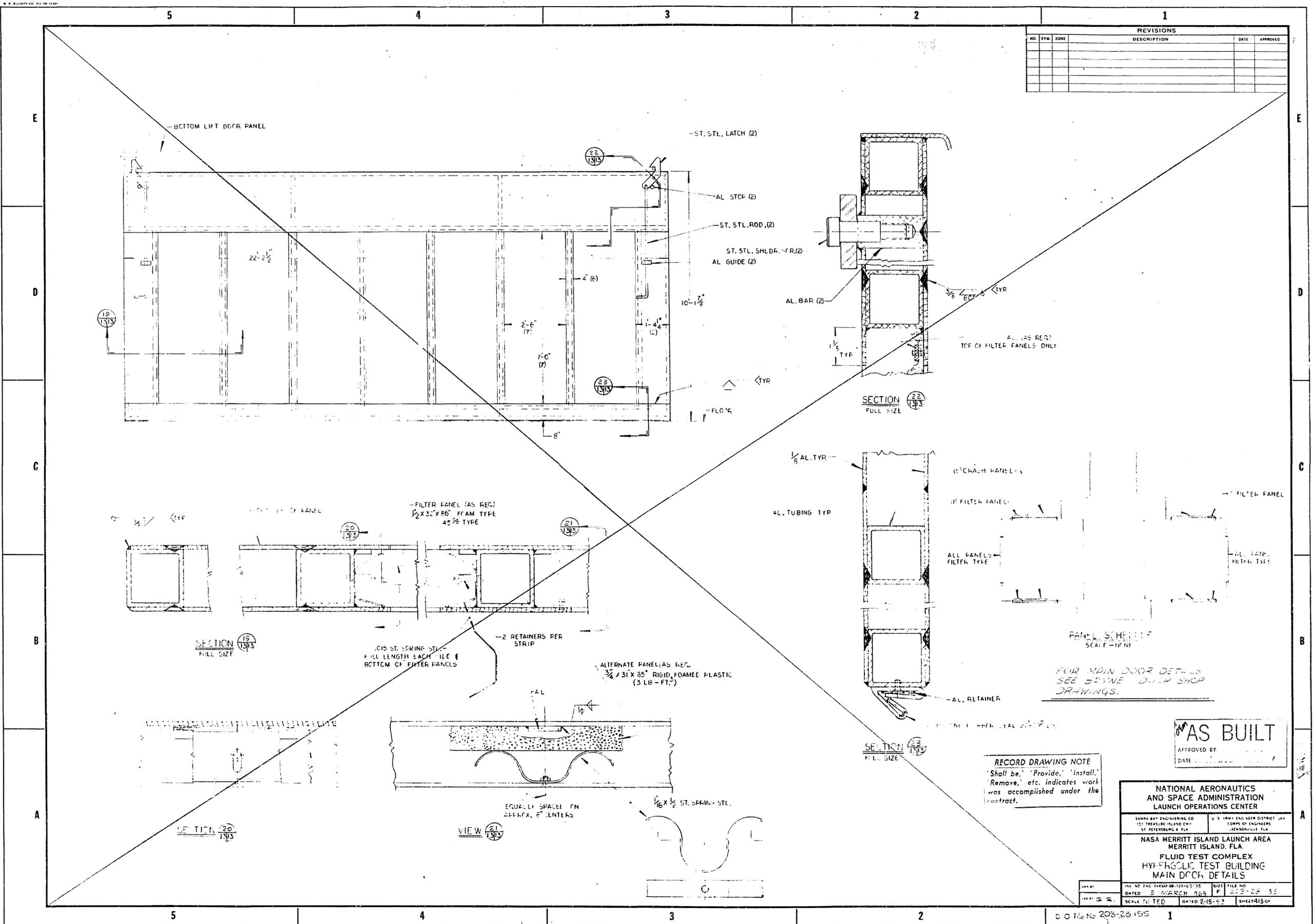
10
 1/2" = 1'-0"

10
 1/2" = 1'-0"

10
 1/2" = 1'-0"

10
 1/2" = 1'-0"

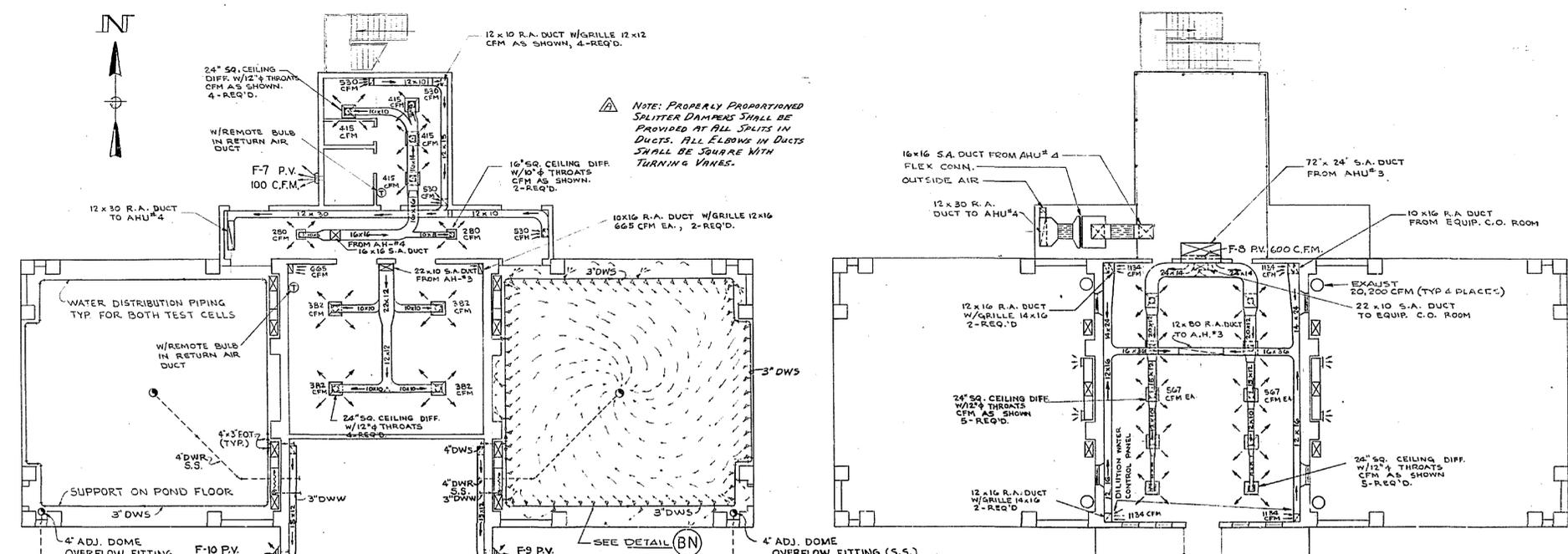
10
 1/2" = 1'-0"



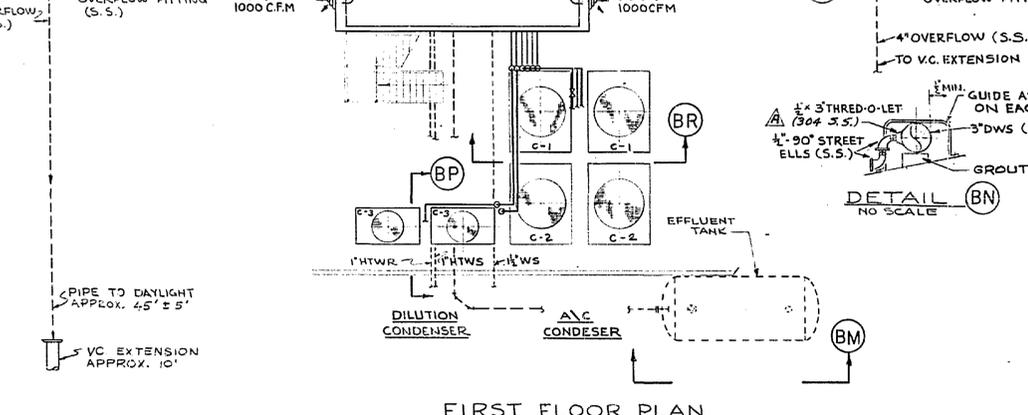
MICROFILMED FROM BEST AVAILABLE COPY; DOES NOT MEET REQUIRED QUALITY STANDARDS

F 5 1

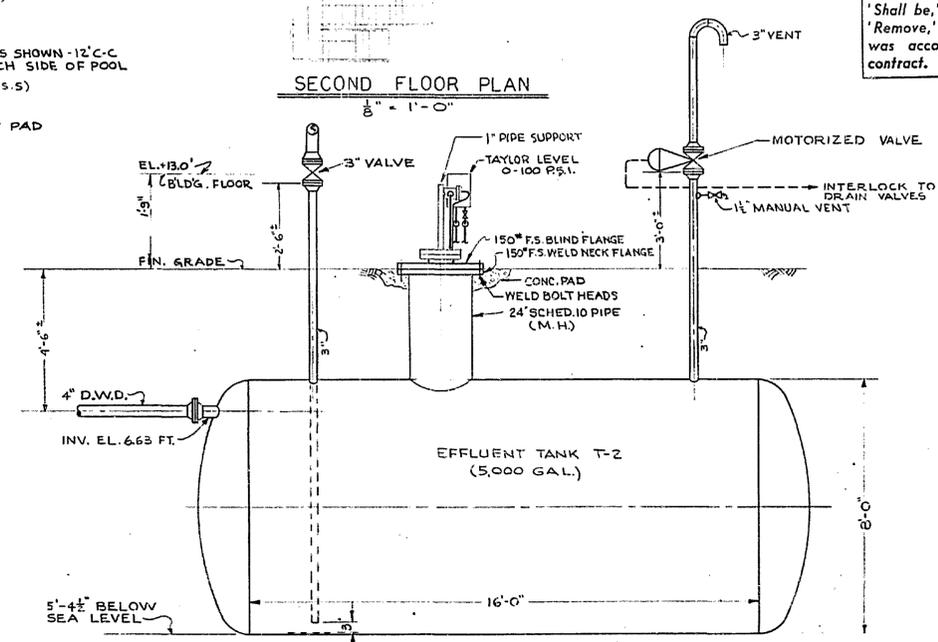
| REVISIONS | | | | |
|-----------|------|---------|----------------------------------|----------|
| NO. | SYM. | DATE | DESCRIPTION | APPROVED |
| 3 | A | 5/20/63 | REVISED TO CONFORM TO AMEND. # 4 | J.E.H. |
| | A | 5/15/63 | UP-DATED FOR 'F.E.D.' | J.P. |



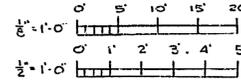
SECOND FLOOR PLAN
1/8" = 1'-0"



FIRST FLOOR PLAN
1/8" = 1'-0"



GRAPHIC SCALES



| SHEET | REFERENCE DWG'S. |
|-------|-------------------------------|
| M-23 | BLDG. SECTIONS |
| M-24 | ROOF PLAN AND SECTIONS |
| M-25 | EQUIP. ROOM PLAN AND SECTIONS |
| M-40 | FLOW DIAGRAMS AND SCHEDULES |

AS BUILT
APPROVED BY: [Signature]
DATE: 11 August 1963

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER

TAMPA BAY ENGINEERING CO.
151 TREASURE ISLAND CRY.
ST. PETERSBURG 6, FLA.

U. S. ARMY ENGINEER DISTRICT, JACKSONVILLE, FLA.
CORPS OF ENGINEERS
JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST #1
AIR CONDITIONING
FIRST AND SECOND FLOOR PLANS

INV. NO. TAG (NASA) 08-123-03-35
DATED: 4 MARCH 1963
SCALE: AS NOTED

SIZE: FILE NO.
F 203-28,155

DATE: 11 AUGUST 1963
DATED: 2-15-63 SHEET 14 OF 14

NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. B0700000ADM042.00
DATE: 11 AUGUST 1963
APPROVED: [Signature]

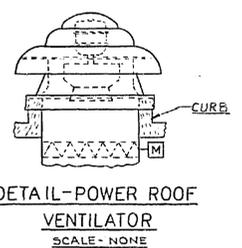
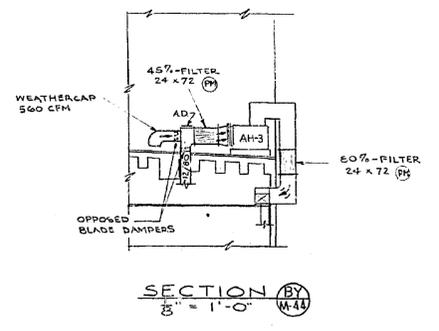
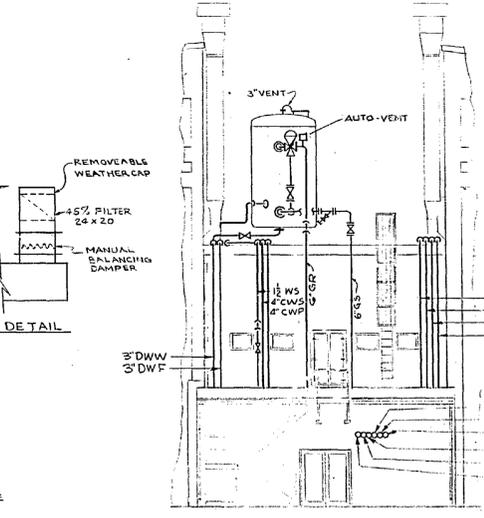
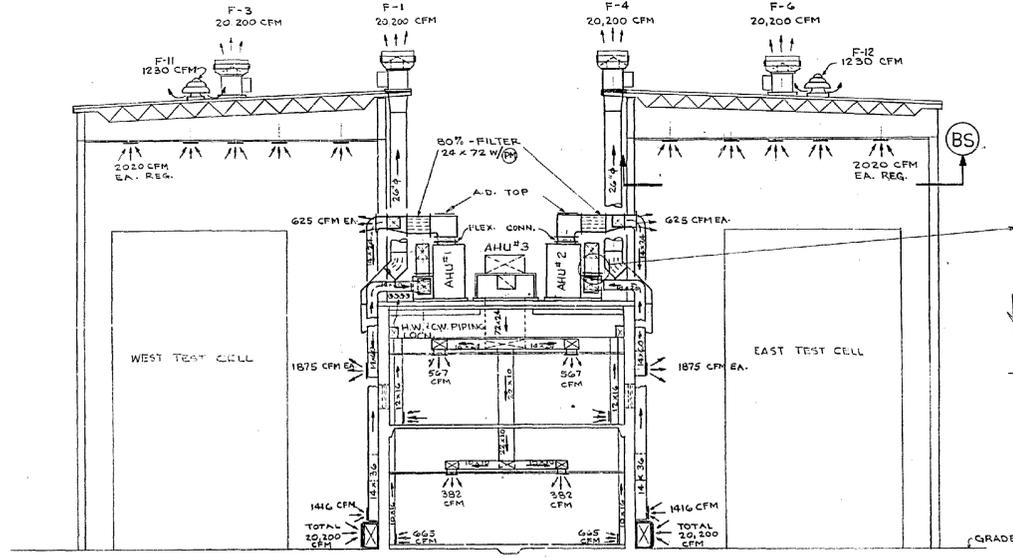
SECTION (BR)
1/8" = 1'-0"

SECTION (BP)
1/8" = 1'-0"

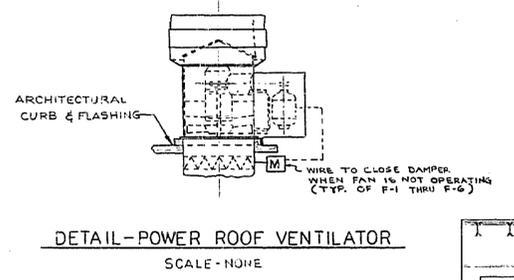
NOT REVISED TO AS BUILT CONDITIONS

MICROFILMED FROM BEST AVAILABLE COPY.
DOES NOT MEET REQUIRED QUALITY STANDARDS

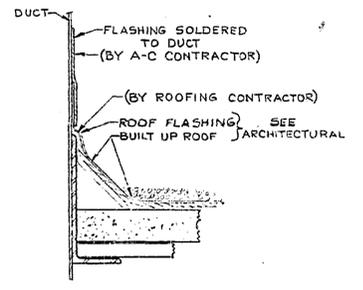
| REVISIONS | | | | | |
|-----------|------|------|--|---------|----------|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| 3 | A | B-3 | REVISED DUCTWORK TO ACC. MOD. TO CONT. NASA-1970 | 9/16/63 | 244 |
| | A | | UP-DATED FOR 'ERD' | 3/15/65 | 244 |



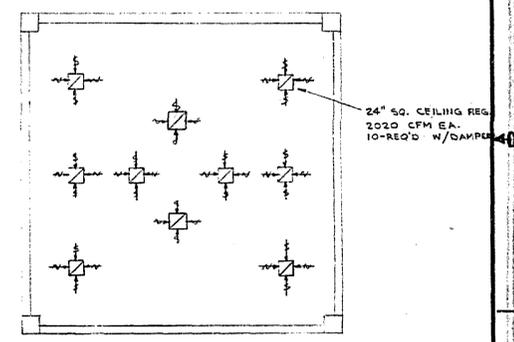
DETAIL-POWER ROOF VENTILATOR
SCALE - NONE



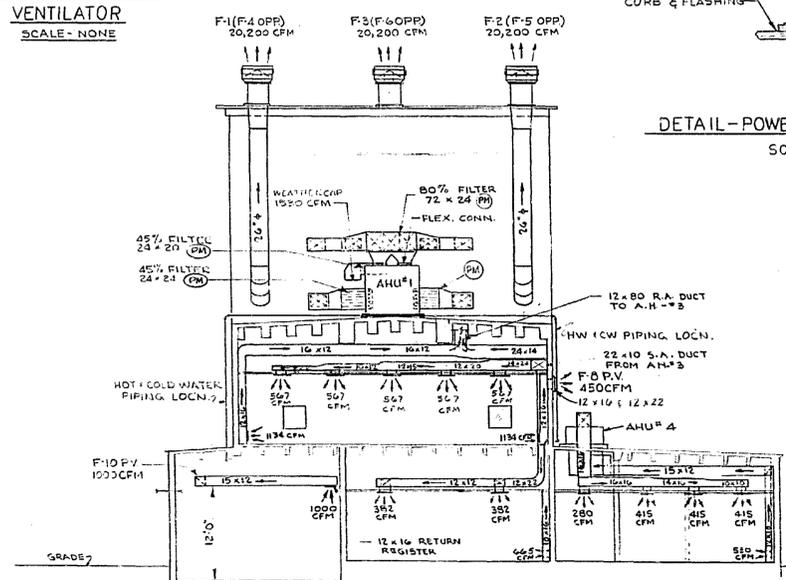
DETAIL-POWER ROOF VENTILATOR
SCALE - NONE



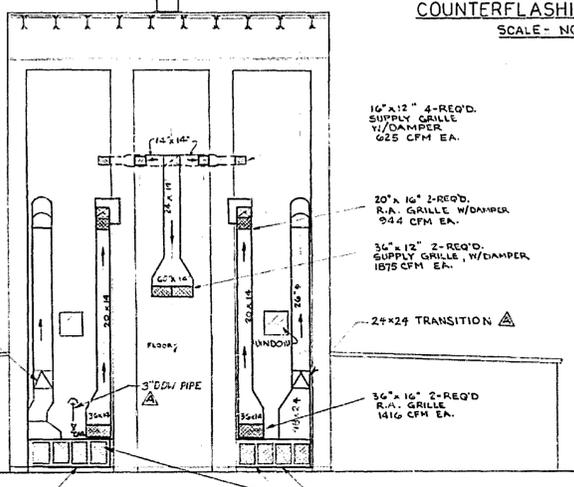
COUNTERFLASHING ON DUCT
SCALE - NONE



SECTION BS
TYPICAL WEST TEST CELL



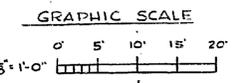
SECTION BU



SECTION BV

RECORD DRAWING NOTE
'Shall be,' 'Provide,' 'Install,' 'Remove,' etc. indicates work was accomplished under the contract.

AS BUILT
APPROVED BY: [Signature]
DATE: 11/23/65



NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. B0700000 ADM 4300
DATE: [Signature]

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER

TAMPA BAY ENGINEERING CO.
151 TREASURE ISLAND CRY.
ST. PETERSBURG 4, FLA.

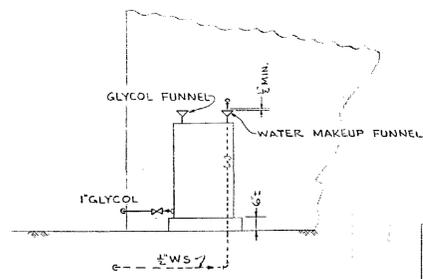
U. S. ARMY ENGINEER DISTRICT, JAC.
CORPS OF ENGINEERS
JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST*
HEATING, VENTILATION & AIR COND.

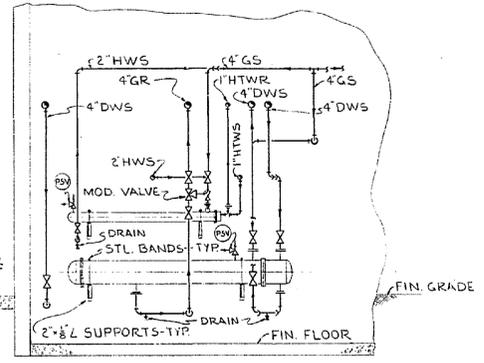
INV. NO. ENG. (NAS) 08-112-0
DATE: 8/11/64 1964
SCALE: AS NOTED

SIZE FILE NO.
F 203-28-157
DATE: 2-15-63 SHEET 4150P

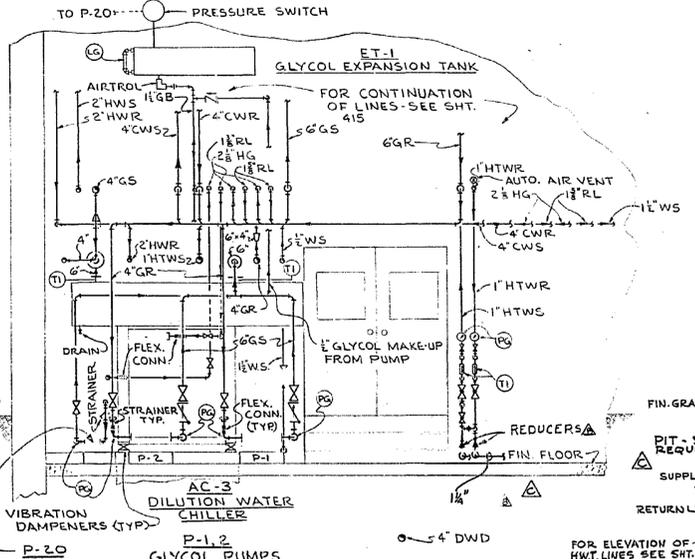
| REVISIONS | | | | | |
|-----------|------|------|---|----------|----------|
| NO. | SYM. | ZONE | DESCRIPTION | DATE | APPROVED |
| 1 | A | C5 | REVISED TO CONFORM TO AMEND. NO. 4 | 10/17/63 | JLM |
| 2 | A | | SIZES OF 1" PIPES ENTERING BLEED INDICATED; SHUT OFF PIPES & REDUCERS ARE TO BE MOD. TO FIRST FLANK UP TO PIT ADDED UNDER MOD. 2" REDUCED; PUMP PUMP DELETED TO BE MOD. TO CONC. AREA. (TYP.) | 11/14/63 | ZW |
| 3 | A | | UP DATED FOR FRD - (NC) | 3/15/65 | 272 |



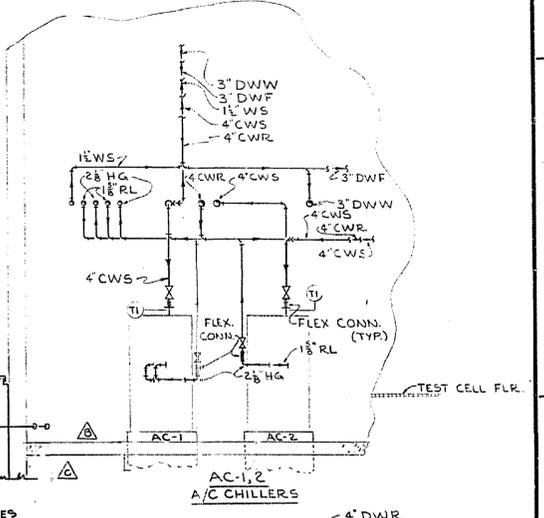
GLYCOL MIXING DRUM (50 GAL.)
SECTION "E-E"



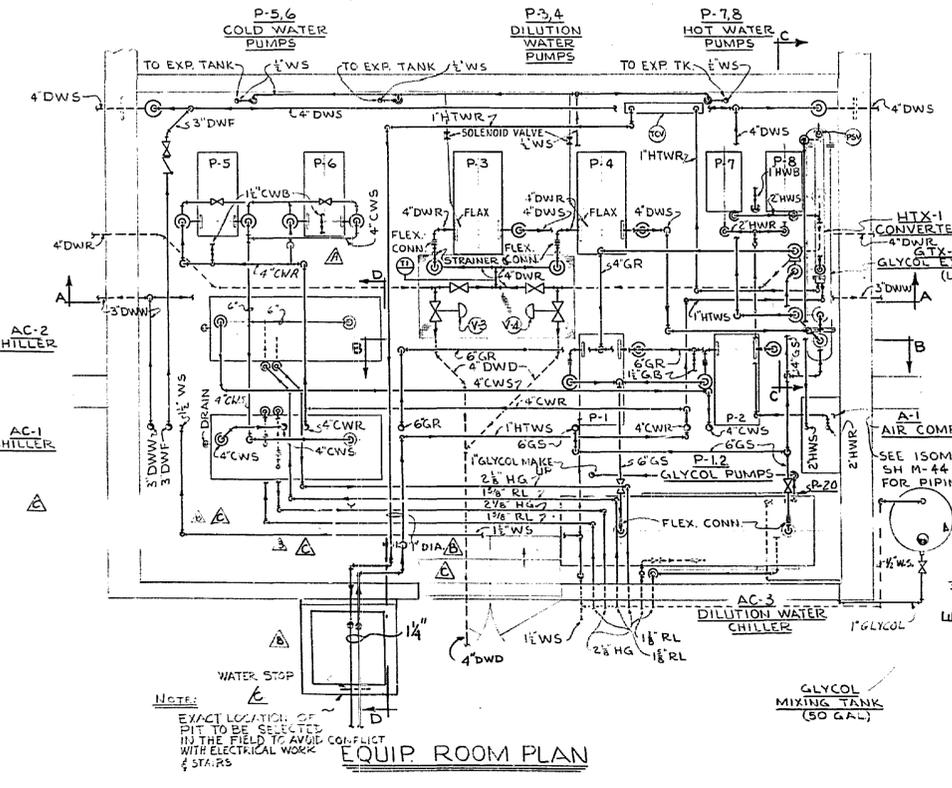
SECTION "C-C"
THIS DWG.



SECTION "BB"
THIS DWG.

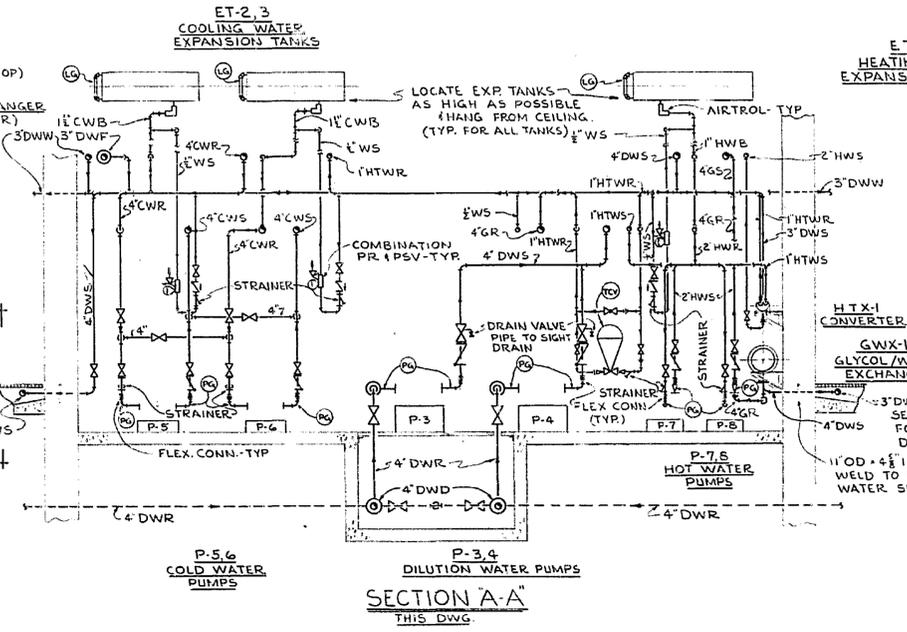


SECTION "D-D"
THIS DWG.

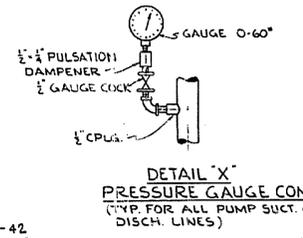


NOTE:
EXACT LOCATION OF PIT TO BE SELECTED IN THE FIELD TO AVOID CONFLICT WITH ELECTRICAL WORK & STAIRS

EQUIP. ROOM PLAN



SECTION "A-A"
THIS DWG.



DETAIL "X"
PRESSURE GAUGE CONN.
(TYP. FOR ALL PUMP SUCT. & DISCH. LINES)

LEGEND

| | |
|-------------------------------|---------------------------------|
| CWB --- COLD WATER BALANCE | GS --- GLYCOL SUPPLY |
| CWS --- COLD WATER SUPPLY | HTWS --- HIGH TEMP WATER SUPPLY |
| CWR --- COLD WATER RETURN | HWS --- HOT WATER SUPPLY |
| DWD --- DILUTION WATER DRAIN | HWR --- HOT WATER RETURN |
| DWF --- DILUTION WATER FILL | HS --- HOT WATER SUPPLY |
| DWR --- DILUTION WATER RETURN | WS --- MAKE UP WATER |
| DWS --- DILUTION WATER SUPPLY | |
| DWW --- DILUTION WATER WASH | |
| GB --- GLYCOL BALANCE | |
| GR --- GLYCOL RETURN | |

NASA-KSC
FACILITY RECORD DRAWING
DRAWING NO. 807.50.00.04.01.4500
DATE 2-15-63

AS BUILT
APPROVED BY: [Signature]
DATE 11 August 1964

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
LAUNCH OPERATIONS CENTER

TAMPA BAY ENGINEERING CO.
151 TREASURE ISLAND CRY.
ST. PETERSBURG 4, FLA.

U. S. ARMY ENGINEER DISTRICT, JAX.
CORPS OF ENGINEERS
JACKSONVILLE, FLA.

NASA MERRITT ISLAND LAUNCH AREA
MERRITT ISLAND, FLA.
HYPERGOLIC TEST 1
EQUIPMENT ROOM
PLAN AND SECTIONS

SCALE: AS NOTED
DATE: 2-15-63
SHEET 417 OF 417

MICROFILMED FROM BEST AVAILABLE COPY;
DOES NOT MEET REQUIRED QUALITY STANDARDS