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# Submittal Coversheet

## EL-008 – HANGAR 32 FINAL ELECTRICAL ASSESSMENT REPORT - WRC

| | | |
|---|---|---|
| CONTRACT NUMBER: AB-133W-15-CQ-058<br>NAAJ5744-20-00581 | | AHTNA PROJECT NUMBER: 20293 |
| ***PROJECT NAME:*** Hangers 32 and 33 Demolition, Renovation, and Safety Improvements | | ***DATE:***<br>04/06/2021 |
| ***CONTRACTOR:***<br>Ahtna Engineering Services | | ***CONSTRUCTION MANAGER:***<br>Duane Budd |
| ***ARCHITECT/DESIGNER:***<br>NA | | ***PREPARED BY:***<br>Amadeo Rossi |
| ***SUBCONTRACTOR:***<br>McKinstry | ***MANUFACTURER:***<br>N/A | ***SUPPLIER:***<br>N/A |
| ***CATEGORY & TYPE OF SUBMITTAL:***<br>Action (FYI) | ***SUBMITTAL PURPOSE & DESCRIPTION:***<br>Hangar 32 Final Electrical Assessment Report | |
| ***SPECIFICATION SECTION & TITLE:***<br>SOW | ***SPECIFICATION PARAGRAPH NO./DRAWING DESIGNATION & NAME:***<br>NA | |
| ***DRAWING NO. & DETAIL REFERENCES:***<br>N/A | ***LOCATION OF INSTALLATION:***<br>N/A | ***PHYSICAL SAMPLES SUBMITTED:***<br>N/A |
| ***FULL OR PARTIAL SUBMITTAL:***<br>Full | ***SUBMITTAL NUMBER:***<br>EL-008 | |

***SUBMITTAL DISTRIBUTION RECORD:***

***1.*** ) Ray Hermes – NOAA COR (ray.j.hermes@noaa.gov)

***2.*** ) Tania Gates – NOAA CO (tania.gates@noaa.gov)

***REMARKS:***

NOAA comments 1 through 8 were incorporated into the subject document. In regard to Comment No. 6, a good faith effort was made to investigate electrical features representing the majority of electrical circuits in the structure. It was not practical to investigate each switch, junction box, wiring devices and other electrical components due to unsafe electrical conditions, accessibility constraints, hidden conditions, shear number of devices, and the overall presence of ACM and LBP.

# NOAA WRC
# Hangar 32 Remediation
# Electrical Facility Assessment

SEATTLE, WASHINGTON
MARCH 26, 2021

FOR THE LIFE OF YOUR BUILDING

# NOAA WRC – Hangar 32
# Electrical Facility Assessment

## Project Explanation and Electrical Summary Exclusions:

The NOAA (National Oceanic and Atmospheric Administration) Western Regional Center located at Seattle has on its property Hangars 32 and 33 (Image #1). These hangars were built for the Navy in the mid-1930's before United State's involvement in World War II. Currently these hangars house several operations, namely: office, storage, and small-scale net assembly. Also, Hangar 32 includes PMEL buoy and Seafood Inspection operations.

Image #1 – NOAA WRC Site Map

NOAA has expressed an interest in renovating the hangars to bring them up to current building and electrical codes (National Electrical Code 2020, Washington Administrative Code 296-46B, Seattle Energy Code 2018, and International Building Code 2018). Within the building is hazardous building materials (i.e., asbestos, lead paint, etc.) and electrical equipment that is well beyond its life expectancy, installed incorrectly, or is abandoned. Electrical projects have occurred since the 1990's that replaced some of the aging gear. Most of that equipment will either remain in-place, removed due to being abandoned, or be removed due to renovating occurring in spaces they exist. The subject of this document is the evaluation of the electrical system in Hangar 32.

A good faith effort was made to investigate electrical features representing the majority of electrical circuits in the structure. It was not practical to investigate each switch, junction box, wiring devices and other electrical components due to unsafe electrical conditions, accessibility constraints, hidden conditions, shear number of devices, and overall presence of ACM and LBP

throughout the structure.

This Assessment of Hangar 32 doesn't include low voltage equipment – namely, I.T., data conduit, cable trays, Wi-Fi, security, access, data equipment and rooms, and data jacks. The assessment is restricted to all power conveying equipment, lighting fixtures, and lighting controls.

## Electrical Equipment Summary:

Electrical Service Equipment: The service is comprised of a Seattle City Light 300kVA transformer with a secondary of 480Y/277 volts and is dedicated to Hangars 32 and 33 (Image #2). The service entrance conduits and cables are two paralleled 3-1/2" underground conduits with four 500MCM cables in each. The main service equipment consists of a 1600 amp switchboard installed in the Hangar 32 North "Lean-To."

The 1600 amp Siemens main switchboard (Photo #1) was installed in 1991 with the main disconnect currently fused to 800 amps. The paralleled 500MCM cables are rated for 760 amps (2 x 380 amps). The switchboard contains seven circuit breakers with only two (400 amp each) in use – one feeding Hangar 32 and the other feeding Hangar 33 as well as electrical equipment on the south wall of Hangar 32 (Images #3 & #4).

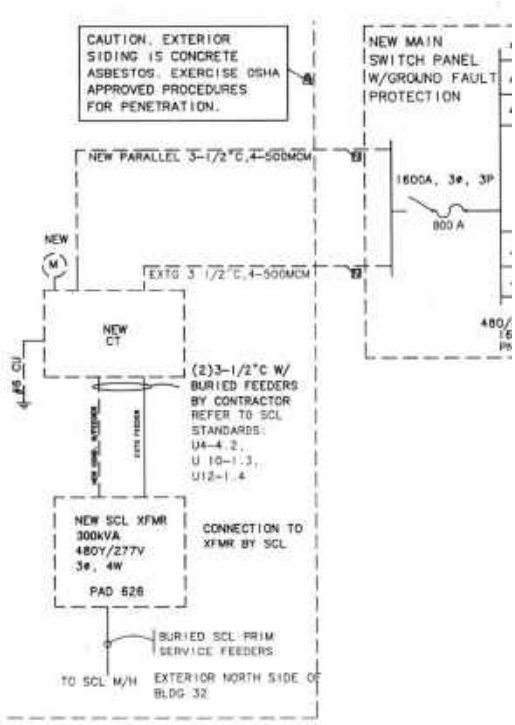



Image #2 - Hangars 32 & 33 Main Electrical Service One-Line (From 1991)

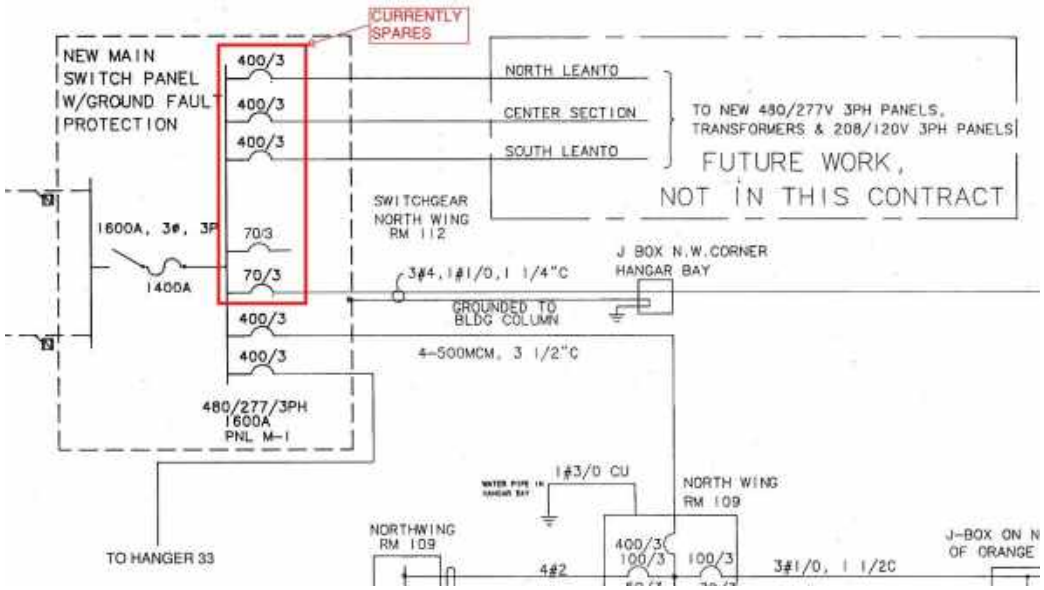



Image #3 - Hangar 32 Main Switchboard One-Line (From 1991)

Photo #1 - Hangars 32 & 33 Main Switchboard (Hangar 32 Main Electrical Room)

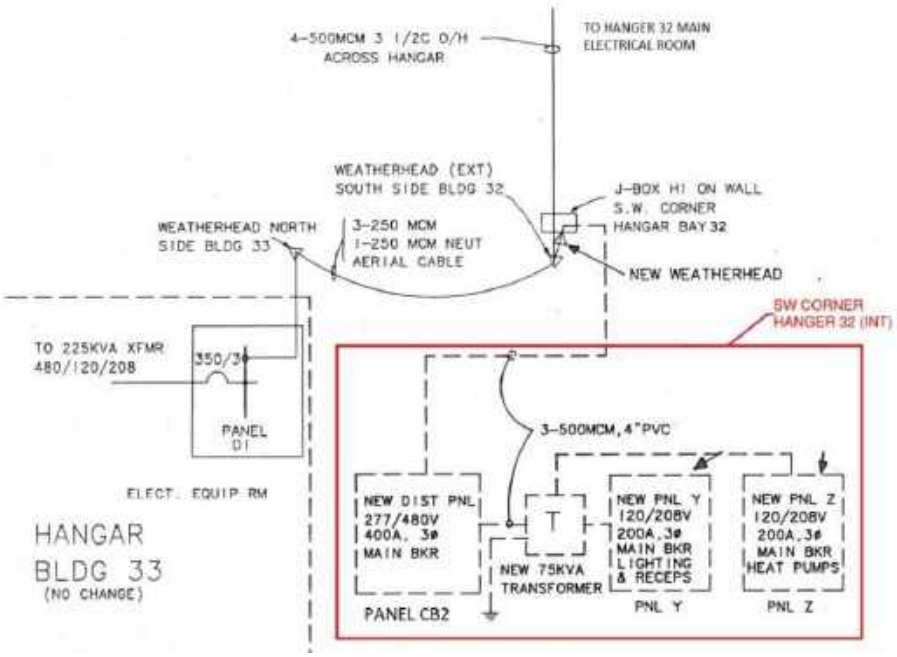



Image #4 - Hangar 33 Main Switchboard One-Line (From 1991)

The original (1930's) basis for the load distribution was by feeding custom 120/240 volt single phase panel configurations (Image #5) located in each of the stairwells in the four corners of both hangars. Redesign and construction converted these to 120/208 volt single phase. Most of these original panel systems are either in full or partial operation and/or are used as pull boxes to down stream electrical equipment. Using a panel for a pullbox of unrelated equipment is not in violation of the National Electrical Code (NEC 312.8) as long as it remains under a percentage of total fill and is labelled with its use.

The panels are fed by underslab feeders. In a pullbox below the panels are multiple feeder taps to downstream panels in other stairwells. While some of the wiring in Photo #2 appears newer most of it dates back to the 1930's.

IBC 1020.1 prohibits the use prohibits "exits" (stairways being one type) shall not be used for any other purpose than the "means of egress." Under emergency/catastrophic conditions electrical equipment, except those that aid in the exiting of the building, can hamper egress.

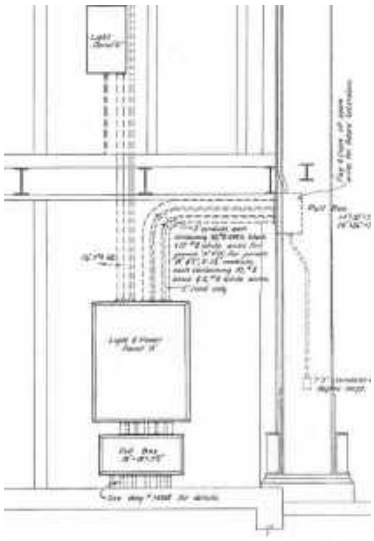


Image #5 – Hangar Stairwell Power Distribution Riser

REMOVE

Photo #2 - Hangar 32 Custom Stairwell Panel (Typical All Four Stairwells)

The single 400 amp disconnect (in the Main Switchboard) for Hangar 32 feeds two feedthrough distribution panels – one feeding various sub panels while the other feeds the customs panel pictured above. Both distribution panels are original and still in use.

In addition to the new and existing electrical equipment on the south side of the Hangar 32 warehouse is a row of panels and transformers installed in 1991. These are fed by the 400 amp 480Y/277 volt Panel CB2 in the SW corner of the warehouse. (See Image #5)

Photo #4 - Hangar 32 South Re-Feed

Photo #5 – Hangar 32 Panel CB2 (SW Corner)

Photo #4 illustrates how the overhead feeder to Hangar 33 is tapped below the weather-head and fed back into Hangar 32 to Panel CB2 (Photo #5). While this arrangement is unusual it's not against the electrical code. However, this set of weather-heads can be confusing to someone trying to determine if these lines are going in or out of the building. To eliminate this confusion a sign legible from ground level explaining the configuration should be added. "FEEDER TO HANGAR 33" for instance.

There's a considerable amount of abandoned-in-place equipment. This includes special outlets, disconnects, panels, conduits, junction boxes, etc. Some of the equipment has been repurposed as junction boxes. In addition, since the original construction, some equipment has been installed in an unworkman-like manner and against NEC 110.12.

There are two plywood office-type structures (one in the center of the Hangar 32 warehouse and

the other in the south end) installed well after the original construction that will be removed as part of this process. These are both fed overhead from panels at either end of the warehouse. A third structure in the warehouse, the net construction building, shall remain "as-is," as well as the wind tunnel, two freezers, parts room, crane, and paint booth.

Photo #6 – Unworkman-like and Abandoned Equipment (Center-North of Hangar 32

RELOCATE

Photo #7 – Installation Against Code (SE Corner of Hangar 32)

The issues in Photo #6 are in violation of NEC 110.12 requiring a "neat and workmanlike" installation. The newer panel in Photo #7 is facing the wall, making access to the panel difficult and violating the code-required (NEC Article 110.26) space in front for an electrician to safely work on the equipment.

## Hangars 32 Lighting Equipment:

The standard fixtures in the "Lean-To" spaces are 4' wrap-arounds and 2'x4' lay-in troffers (see Photos #8 & #9). Most, if not all, of these fixtures have been installed in the past few decades to replace the original fixtures. Since then many have been retrofitted with LED lamps. Each area is controlled by a switch mounted near the door. In several areas maintenance has been neglected as these spaces are presently not in use (i.e., kitchen, some offices, storage spaces, etc.). No timing, occupancy sensing, or dimming devices are present in any of the spaces.

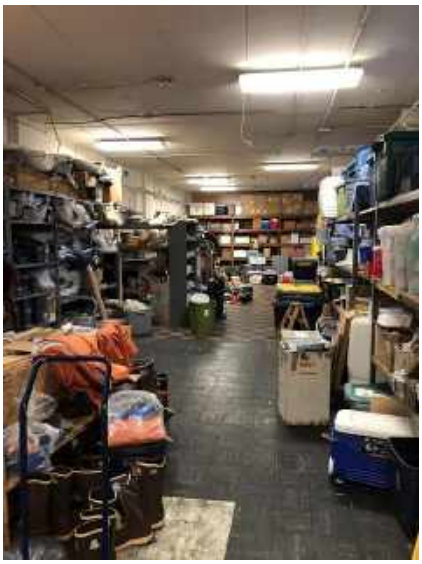


Photo #8 – 4’ Wrap-Around Fixtures (North Lean-To Level 1 Storage Room)

Photo #9 – 2’x4’ Lay-In Troffers (South Lean-Top Level 2 Office)

Hangar 32 warehouse areas are lit by 8’ industrial fixtures (Photo #10 blue arrow). Hangar 32 fixtures have been retrofitted with LED lamps and the spaces are equipped with motion detection. The previous fixtures (same photo, red arrow) are still present but not in use. The lighting levels are acceptable for the tasks.

The main doors exterior fixtures (Picture #11) appear to be LED’s. Only two of the original five are existing and, upon closer inspection, appear to be attached haphazardly. Also, they are constantly on with no apparent method to switch off.

Photos #10 – Hangar 32 Warehouse Fixtures (North)

Photos #11 – Exterior Fixtures (East Hangar 32)

## Analyses of the Existing Electrical & Lighting System:

It is standard engineering practice to consider replacing electrical equipment that is at least forty-years-old. By then circuit breakers have begun deteriorating in their efficiency, wiring and lug nut connections have gone through many cycles of heating and cooling – creating points of failure, exposed steel and copper parts have begun oxidizing, and grounding fails. All these can create unsafe conditions. Washington state code dictates that all unused wiring shall be removed from conduits.

The equipment that was installed in the 1990's appears to be good operational order with no apparent damage or oxidation. However, not all of the new equipment was installed in a safe, workmanlike manner, or is code-compliant, as illustrated above.

The attached thermographic inspection states all of the equipment, except Panel PNL-HH on the northeast side of level 2, pose no heating threat. Under my recommendations below PNL-HH is to be removed as part of the abatement process.

## Recommendations:

All of the electrical equipment mentioned above inside the Lean-To's and stairwells shall be removed to allow these areas to be properly abated – *excluding* the main switchboard and the service feeders to it. Since under-slab feeders can be impossible to be removed from the conduits

all of the power feeder conduits should be cut and capped at floor level and grouted to floor level. Testing of all existing feeders to remain shall be conducted.

Within the warehouse all of the panels, disconnects, feeders, wiring, above-grade conduits, junction boxes, and special purpose outlets shall be removed. The new panels and transformers on the south end shall remain and service any new loads on the first and second floor of the south Lean-To – including two new 100 amp 208Y/120 volt load centers installed on either end of the office/storage space.

At the center of the north wall of a 400 amp, 480Y/277 volt distribution panel shall be placed to support all equipment on the north end – including the Lean-To's. This will include the power supply to the net construction building. A 75kVA transformer shall feed a 225 amp 208Y/120 volt panel. The 208Y/120 volt panel shall subfeed the two 100 amp load centers on either end of the office/storage space on the second floor – similar to the south end. All other expected 208Y/120 volt loads on the first floor shall be fed from the either the new 480Y/277 and 208Y/120 volt panels. The new and existing 400 amp panels shall also feed any forklift outlets to remain, the net construction building the wind tunnel, two freezers, parts room, paint booth, roll-up door bay doors.

It has yet to be determined where any new power outlets or heaters connections will be located. Until these receptacle locations are determined use the following guidelines: In all office spaces locate one duplex receptacle every ten feet. In small storage spaces and hallways provide one duplex receptacle. In large storage spaces provide one every twenty feet. In all offices route an extra ¾" conduit from a new junction box for data mounted adjacent to the outlet up to wall and above the drop ceiling. Provide five ¾" conduits from above any new panel to the ceiling space above.

The new lighting in the Lean-To's and stairwell shall use either 4' LED strip fixtures or 2'x4' LED troffers, depending on the nature of the installation. Egress lighting shall be either LED "bug-eyes" or standard fixtures with battery backup functionality. While the existing unused pendant fixtures in the warehouse should be removed, the warehouse LED strip fixtures with motion-detection can remain as this meets the current Seattle Energy Code (SEC) C405.2. However, the removal of the two-story structure in the center of the warehouse will mandate new fixtures.

Seattle Energy Code C405.2.1 dictates that occupancy sensors shall be included in all spaces present in the Lean-To's. Utility rooms (electrical and mechanical) are excluded from this requirement. SEC C405.2.4.1 dictates daylight responsive controls that control dimming in spaces next to vertical fenestration with more than two fixtures in the two dimming zones.

Match the existing 8' industrial fixtures with LED's. In addition, provide seismic supports for all warehouse fixtures. The exterior fixtures over the hangar doors should be replaced and mounted correctly. Also required are battery backed up fixtures over all exterior egress doors (SEC C405.2.5). Controls and maximum wattages for these areas shall be determined by the SEC C405.4.2.

## Additional Information:

The PMEL buoy and Seafood Inspection operations are to remain "as-is."

During our initial site walk conversation expressing concern about the proximity of the small water tank in Photo #12 to the adjacent electrical equipment. National Electrical Code Article 110.26 describes the space about electrical equipment required to be kept clear for both the equipment and the people servicing it. In this case it is 30 inches wide and 36 inches deep. Article 110.26(E)(1)(a) states that nothing shall be above the electrical equipment considered a "foreign system" (i.e., water tanks, for instance) shall exist lower than 6 feet. Being next to electrical equipment doesn't qualify as intruding into the electrical space. However, it is understandable that a piece of equipment as this in such close proximity to electrical gear would be disconcerting. While it not required to be relocated NOAA can have it moved to a better location.

Photo #12 – Water Tank and Electrical Equipment

(South of Warehouse Wall of Hangar 32)

## Final Observations and Recommendations:

1) The sum total of load change to the electrical service should be negative due to the removal of many structures, electrical equipment, and conversion of light fixtures LED. An extensive load study should be part of the design process to ensure there is plenty of available load on the service.
2) Grounding and bonding connectivity should be thoroughly adhered to as it is unclear if the existing equipment is currently complying.

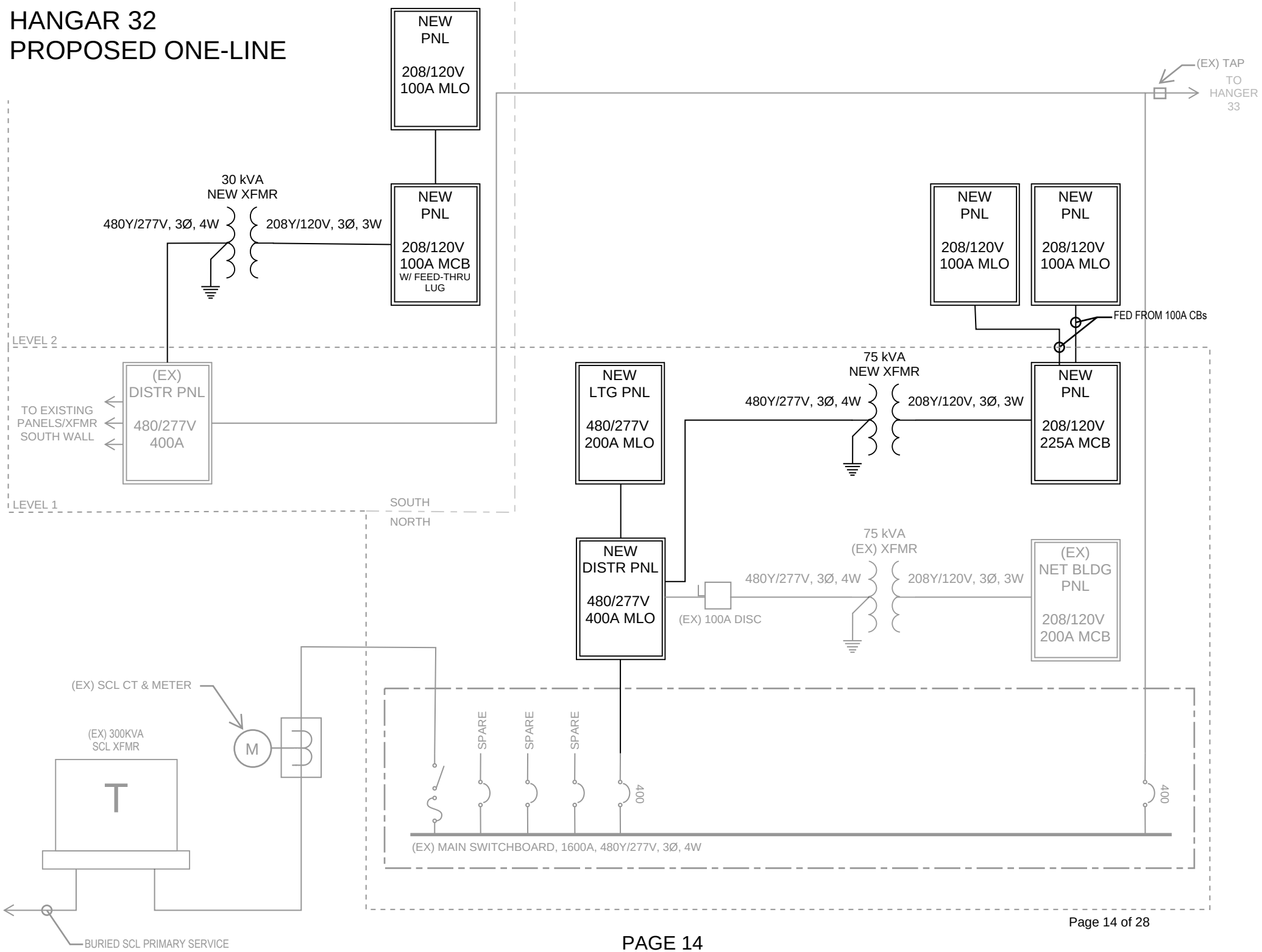
## Scope of Work:

Below is a scope of work by line item. It should be considered general instructions for the intention of removing and replacing the electrical equipment in Hangar 32.

| # | Category | Description |
|---|---|---|
| 1 | Electrical Service | Demo of existing warehouse equipment (outlets, structure feeders, conduits, etc.) |
| 2 | Electrical Branch | Demo of Lean-To electrical equipment (panels, receptacles, lighting, power connections) |
| 3 | Electrical Service Equipment | Demo all switchgear identified in report |
| 4 | Electrical Distribution (North Side) | Add new 400A 277/480 panel, 75kVA transformer, 200 amp 277/480 lighting panel, 225A 120/208 panel, (2) 100 amp panels and associated feeders |
| 5 | Electrical Distribution | Refeed existing equipment to remain |
| 5 | Electrical Distribution (South Side) | Add new 75kVA transformer, (2) 100 amp 120/208 panels, and associated feeders |
| 6 | Electrical Branch (North Lean-To) | Outlets, lighting fixtures, power and lighting controls, equipment connections, branch wire & conduit. |
| 7 | Electrical Branch (South Lean-To) | Outlets, lighting fixtures, power and lighting controls, equipment connections, branch wire & conduit. |
| 8 | Warehouse Lighting | Provide new lighting fixtures and controls |
| 9 | Warehouse Lighting | Provide seismic protection for existing fixtures |
| 10 | Exterior Lighting | Area Lighting and controls |

The Hangar 32 One-Line (Page 14) represents the proposed electrical switchgear layout and is intended to be diagrammatic and schematic only.

# HANGAR 32
# PROPOSED ONE-LINE



CAUTION. EXTERIOR SIDING IS CONCRETE ASBESTOS. EXERCISE OSHA APPROVED PROCEDURES FOR PENETRATION.

AVOID ACCIDENTS AT ALL COST. EXERCISE SAFETY PRECAUTIONS. CONDUCT SAFETY BRIEFINGS.

NEW MAIN SWITCH PANEL W/GROUND FAULT PROTECTION

400/3
400/3
400/3
70/3
400/3
400/3

NORTH LEANTO
CENTER SECTION
SOUTH LEANTO

TO NEW 480/277V 3PH PANELS, TRANSFORMERS & 208/120V 3PH PANELS

FUTURE WORK, NOT IN THIS CONTRACT

480/277/3PH
1600A
PNL M-1

1600A, 3ø, 3P
1400A

NEW PARALLEL 3-1/2"C, 4-500MCM

EXTG 3 1/2"C, 4-500MCM

NEW
M

NEW CT

#6 CU

(2)3-1/2"C W/ BURIED FEEDERS BY CONTRACTOR
REFER TO SCL STANDARDS:
U4-4.2,
U 10-1.3,
U12-1.4

NEW COND. W/FEEDER
EXTG FEEDER

NEW SCL XFMR
1,600A
480Y/277V
3ø, 4W

PAD 626

CONNECTION TO XFMR BY SCL

BURIED SCL PRIM SERVICE FEEDERS

TO SCL M/H

EXTERIOR NORTH SIDE OF BLDG 32

4-500MCM 3 1/2C O/H ACROSS HANGAR

SWITCHGEAR NORTH WING RM 112

3#4, 1#1/0, 1 1/4"C

GROUNDED TO BLDG COLUMN

4-500MCM, 3 1/2"C

J BOX N.W.CORNER HANGAR BAY

S.W. CORNER HANGAR BAY

480V
30/3
MCB 100/3
PANEL A

3#4, 1 1/4C

75KVA, 480, 208/120/3PH/4W
S.W. CORNER HANGAR BAY

XFMR T-1

4#2/0, 2"C

S.W. HANGAR BAY

208V
225/3
100/2
100/2
PANEL B

3#2, 2"C

3#2, 1 1/4C

WIREWAY S.W. HANGAR BAY

2-100A FUSES IST FLR S.W. STAIRWAY

3#2, 2 1/2"FLEX

FU-1

125/2
PANEL B-1

S.E. CORNER HANGAR BAY ON BROWN BLDG

100/2
PANEL J

S.E. HANGAR BAY

S5

3#2, 1 1/4C

2-100A FUSES IST FLR S.E. STAIRWAY

FU-2

100/2
PANEL I-1

S.E. STAIRWAY 2ND FLR

WATER PIPE IN HANGAR BAY

1#3/0 CU

NORTH WING RM 109

NORTHWING RM 109

400/3
100/3
50/3
50/3
100/3
70/3

4#2
4#6

3#1/0, 1 1/2C

3#6, 1"C

J-BOX RM 109

2"NIPPLE

PANEL F1
100A/1PH

PANEL F

N.W. HANGAR FENCED MACHINE SHOP AREA

PANEL F4

4#4, 2"C

J BOX ON ROOF OF ORANGE BLDG

LIGHTS
277V

PANEL F3

SOUTH WING 2ND FLR HALLWAY

1 1/2"C

PANEL F5

2ND FLR ORANGE BLDG 100A/3

J-BOX ON NORTH SIDE OF ORANGE BLDG

WIND TUNNEL MOTOR 30KW

VAR. SPEED DR

3#6, 1"FLEX

IST FLR ORANGE BLDG – 75KVA 480, 208/120/3PH

XFMR T-2

IST FLR-ORANGE BLDG

225/3
100/3
70/3

8#2, 2"C

4#2, 1 1/2C

NEXT TO PAN K

J-BOX

PANEL K

PANEL M

2ND FLR ORANGE BLDG 225A/3PH

4#2, 1 1/2C

2ND FLR-N.W.STAIRWAY

PANEL G-G

100/2

2ND FLR NE STAIR

PANEL H-H

100/2

OLD CKT BKR ENCLOS IST FLR N.E.STAIR

OLD J-BOX IST FLR N.E. STAIRWAY

CB-1
150/2

(2 OF 3 POLES)

WIRED THRU OLD UNUSED SAFETY SW. IST FLR N.E. STAIRWAY

S-6

20/3
PANEL D

125A/3PH N.E. HANGAR BAY

TO WALK IN COOLER N.E. HANGAR BAY

WEATHERHEAD (EXT) SOUTH SIDE BLDG 32

J-BOX HI ON WALL S.W. CORNER HANGAR BAY

WEATHERHEAD NORTH SIDE BLDG 33

3-250 MCM
1-250 MCM NEUT
AERIAL CABLE

NEW WEATHERHEAD

TO 225KVA XFMR 480/120/208

350/3
PANEL D1

S.W.CORNER OF HANGAR BAY

ELECT. EQUIP RM

HANGAR BLDG 33 (NO CHANGE)

3-500MCM, 4"PVC

PROVIDE TRANSIENT SURGE PROTECTION

NEW DIST PNL 277/480V 400A, 3ø MAIN BKR

NEW 75KVA TRANSFORMER

NEW PNL Y 120/208V 200A, 3ø MAIN BKR LIGHTING & RECEPS

PNL Y

NEW PNL Z 120/208V 200A, 3ø MAIN BKR HEAT PUMPS

PNL Z

45KVA, 480/208/3PH

NORTHWING RM 109

XFMR T-3

3#1, 2"FLEX

RM 109

FUSED 150A, 3PH

S2

WIREWAY IN HANGAR BAY RM 109

NORTHWING RM 109

4#2, 1 1/2C

225/3
100/2
100/3
100/3

3#2, 1 1/2C

4#2, 1 1/2C

PANEL C

PANEL F2

INSIDE FENCED MACHINE SHOP AREA-HANGAR BAY, NORTH

PANEL LIB
100A/3PH

PANEL LIA

WIREWAY IST FLR STAIRWAY

J-BOX-HANGAR BAY AT RM 109

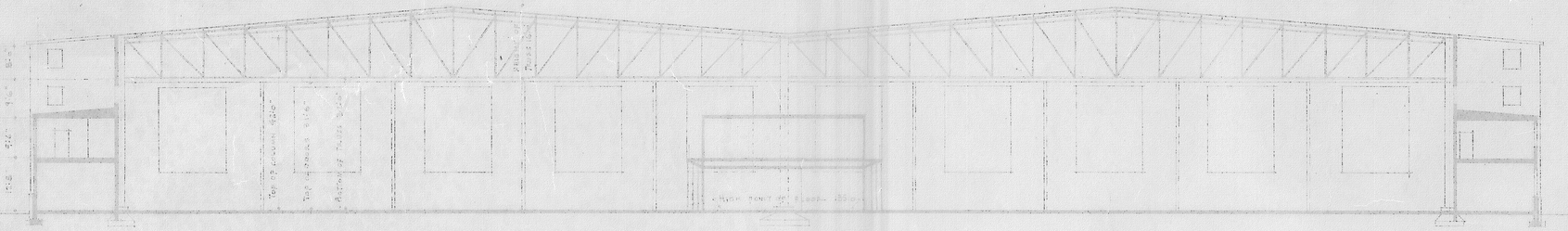
# SINGLE LINE POWER DISTRIBUTION DIAGRAM

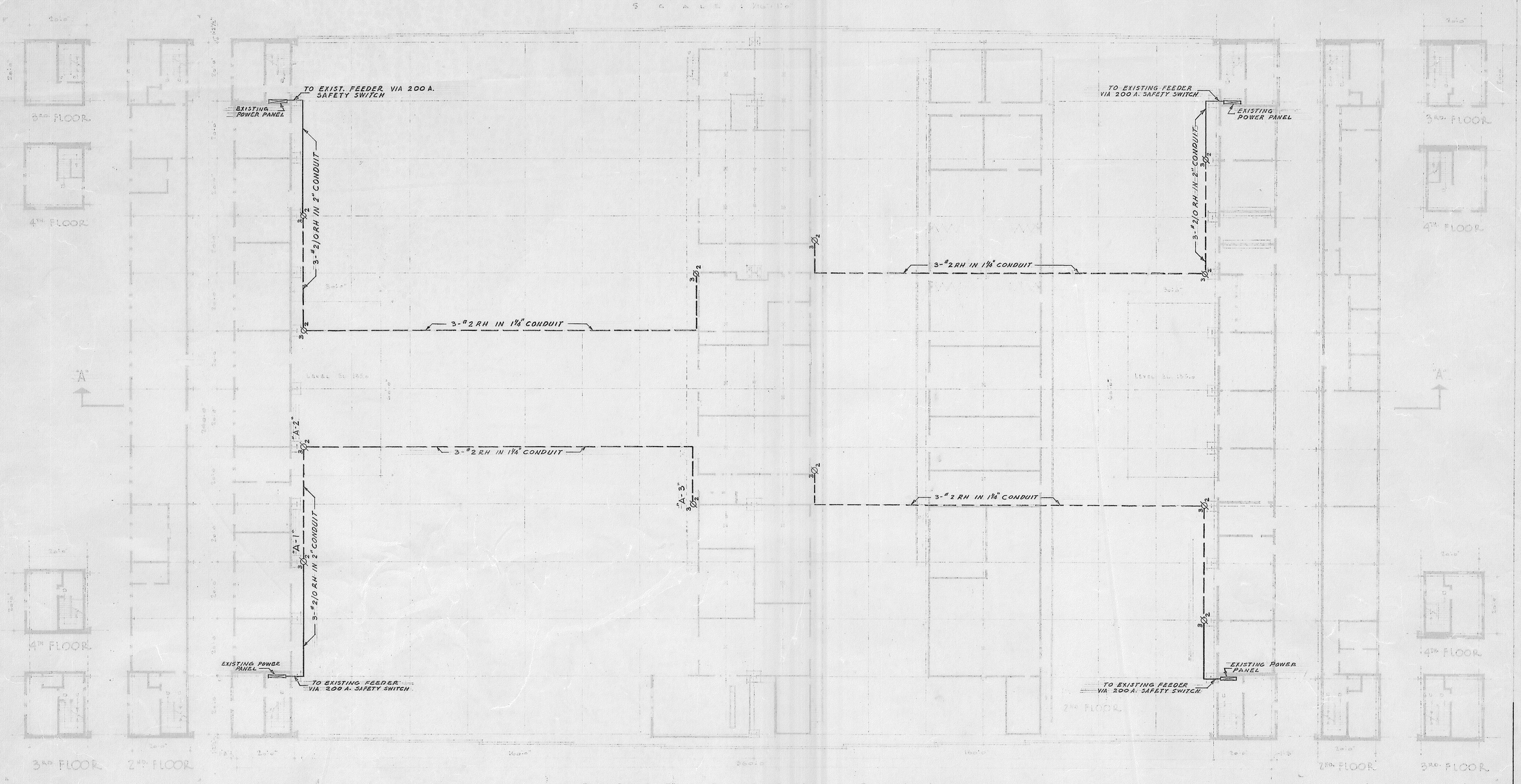
| NO. | REVISIONS | DATE |
|---|---|---|
| 4 | | |
| 3 | | |
| 2 | | |
| 1 | UPGRADE FOR NEW TENANTS | 2/13/91 |

FACILITIES AND LOGISTICS DIVISION
ENGINEERING AND FACILITIES MANAGEMENT
WESTERN ADMINISTRATIVE SUPPORT CENTER
SEATTLE WASHINGTON

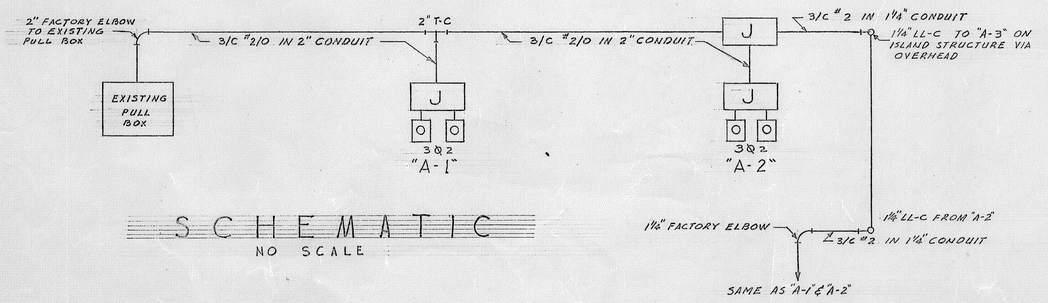
PROJECT: NMFS F10 LABORATORY REMODELING
BUILDING: BUILDING 32
7600 SAND POINT WY NE
SEATTLE, WA 98115
DRAWING: ELECT. DIST. PLAN
1-LINE DIAG.
TYPE
SEQUENCE
E-4

APPROVED: ARCH | STRUC | MECH | ELECT
DRAWN DATE 2/14/91
DSGN HSA DATE 2/14/91
DRAWING FILE NO. EWA 90340




FIRST FLOOR PLAN
SCALE: 1/16" = 1'-0"




SCHEMATIC
NO SCALE

## NOTES

1. REMOVE ALL EXISTING CONDUIT NOT CONSISTANT IN SIZE AS REQUIRED BY THIS PROJECT.
2. ALL OUTLETS TO BE MOUNTED 5 FEET ABOVE FLOOR LEVEL.
3. ALL RECEPTICLES MUST BE RATED AT 45 AMPS, NOT TO EXCEED 60 AMPS.

## LEGEND

| | |
|---|---|
| 3Ø2 | TWO - 3 PHASE - 220 VOLT RECEPTICLES - 45 AMP RATING |
| ——— | EXISTING CONDUIT RUN |
| - - - | NEW CONDUIT RUN |
| LL-C | LL CONDULET |
| LB-C | LB CONDULET |
| T-C | TEE CONDULET |
| J | JUNCTION BOX |

| REVISION | DATE | BRIEF | BY | APPRVD |
|---|---|---|---|---|
| P.W. DWG. No. 2870 | | DEPARTMENT OF THE NAVY BUREAU OF Y&D<br>U.S. NAVAL AIR STATION SEATTLE, WASHINGTON | | |
| DRAWN BY R.L. MUSSELMAN, AD | | INSTALLATION OF 220 VOLT 3 PHASE POWER CIRCUITS IN HANGARS #32 & #33 FOR ATE-3 POWER UNITS | | |
| TRACED BY | | | | |
| CHECKED BY | | | | |
| IN CHARGE R.G.H. | | APPROVED [signature] DATE 30 AUG 1957<br>PUBLIC WORKS OFFICER | | |
| SATISFACTORY TO | | SCALE - AS NOTED SPEC. | | |
| DATE | | SHEET 1 OF 1 NOV<br>Y&D DRAWING No. | | |

# SPECIFICATION

UNDER THIS SPECIFICATION IT IS THE INTENTION TO PURCHASE, ONE OIL INSULATED, SELF COOLED OUTDOOR TYPE SELF CONTAINED POWER AND LIGHTING TRANSFORMER AND APPARATUS COMPLETELY ASSEMBLED AND CONNECTED AS SHOWN BY THE SCHEMATIC WIRING DIAGRAM AND THIS TRANSFORMER IS TO SUPPLY SIMULTANEOUSLY, - 200-KVA AT 230 VOLTS, 3 PHASE. AND, 3-EACH 100.K-V-A AT 230/115, VOLT, SINGLE PHASE LIGHTING LOADS.

THE TRANSFORMER SHALL CARRY THE LOADS ABOVE SPECIFIED WITHOUT EXCEEDING A GUARANTEED TEMPERATURE RISE OF 50 DEGREES-C., ABOVE A 40 DEGREE-C, AMBIENT TEMPERATURE AS MEASURED BY THE RISE OF RESISTANCE METHOD, IN ACCORDANCE WITH-A,I,E,E, AND N,E,M,A, RULES.

THE 2300-V, PRIMARY WINDING SHALL HAVE, 4-FULL CAPACITY 2½%, TAPS ABOVE THE NORMAL RATED VOLTAGE AND 4- FULL CAPACITY 2½% TAPS BELOW NORMAL RATED VOLTAGE AND TO BE EQUIPED WITH A HAND OPERATING LEVER OR WHEEL WITH POSITION INDICATING MARKINGS AND TO BE INSTALLED IN THE 2300-VOLT PRIMARY COMPARTMENT APPROXIMATELY WHERE SHOWN ON DRAWING.

THE TRANSFORMER TANK SHALL BE MADE OF COPPER BEARING SHEET STEEL AND HAVE SUFFICIENT CROSS SECTION TO FORM A RIGID AND SUITABLE TANK. TUBES OF COPPER BEARING STEEL, SINGLY OR IN RADIATOR FORM SHALL BE WELDED TO TOP AND BOTTOM OF TANK FOR THE RADIATION OF HEAT. THE TOP COVER TO BE OF COPPER BEARING STEEL PLATE WITH HANDHOLES OVER OR ABOVE TERMINAL BOARD OF TRANSFORMER. A CONSERVATOR TANK TO BE PROVIDED AND TO HAVE A GLASS SIGHT GUAGE ON ONE END AND TO BE OF SAME GRADE STEEL AS TRANSFORMER TANK. ALL COVERS TO BE OIL TIGHT WITH GASKETS OF OIL RESISEING MATERIAL. THE TRANSFORMER TRUCK SHALL HAVE SUITABLE WHEELS OR ROLLERS.

THE APPARATUS COMPARTMENTS TO BE WELDED TO THE TRANSFORMER TANK AND TO BE WEATHERPROOF AND OF SUFFICIENT THICKNESS TO SUPPORT ANY OR ALL EQUIPMENT THAT MAY BE MOUNTED THEREON. THE COMPARTMENT COVERS OR DOORS SHALL BE REINFORCED OR RIBBED FOR STIFFNESS AND TO BE CUPPED OVER EDGES OF COMPARTMENT, SUITABLE HINGES SHALL BE WELDED ON AND THERE SHALL BE SWING EYE BOLTS WITH WINGNUTS FOR FASTENING. WEATHERPROOF GASKETS SHALL BE PROVIDED, ALSO A HASP FOR PADLOCKING.

CABLE POTHEADS AS SHOW SHALL BE FURNISHED COMPLETE AND ASSEMBLED INCLUDING CONDUIT COUPLING. THEY SHALL BE SO ATTACHED TO THE COMPARTMENT HOUSING SO AS TO MAKE A WATER AND WEATHERPROOF INSTALLATION. THE CONTRACTOR SHALL FURNISH THE NECESSARY QUANITY OF COMPOUND TO FILL ALL POTHEADS ALLOWING FOR AND INCLUDING FOR SHRINKAGE. THE COMPOUND SHALL HAVE ALL THE REQUIRMENTS OF ARTICLE -11 OF SECTION 2, NAVY SPECIFICATION 9-Y-D.

THE OIL CIRCUIT BREAKER SHALL BE OF THE LATEST DESIGN AND HAVE THE FOLLOWING RATING-- 15000-VOLT, - 600-AMP, AND HAVE AN INTERRUPTING CAPACITY OF 50,000-KV-A, AND SHALL HAVE TRIPLE TRIP COILS TO BE CONNECTED FOR TRIPPING BY CURRENT TRANSFORMERS THROUGH RELAYS AND FOR REMOTE TRIPPING. CLOSING TO BE MANUAL WITH A REMOVABLE HANDLE AS SHOWN BY DRAWING. THE OIL CIRCUIT BREAKER SHALL CONFORM TO THE REQUIRMENTS OF THE N, E, M, A., AND THE RULES OF THE A, I, E, E., AS WELL AS THE NAVY SPECIFICATION - 9-Y-D.

THERE SHALL BE THREE 5000-V., 200/5-A., CURRENT TRANSFORMERS WITH DOUBLE SECONDARIES FOR METERING AND TRIPPING: THERE SHALL ALSO BE TWO 2500-V,- 230 V, - POTENTIAL TRANSFORMERS PROVIDED WITH FUSE PROTECTION ON THE PRIMARY WINDING.

THREE 5000-V, 600-A, DISCONNECTING SWITCHES SHALL BE FURNISHED WITH THE NECESSARY RODS, LINKS AND BELL CRANKS FOR MANUAL GANG OPERATION, AND SHALL BE OF THE BEST INSULATED TYPE FOR THE SAFETY OF THE OPERATOR.

THE THREE OVERLOAD RELAYS SHALL BE OF THE INDUCTION TYPE AND HAVE VISIBLE SETTING INDICATOR. THERE SHALL BE A 3-ELEMENT 230-V- 5-AMP., WATT-HOUR METER, AND IS TO BE MOUNTED IN THE LOW TENSION COMPARTMENT.

THE CONTRACTOR SHALL FURNISH AND INSTALL THE APPARATUS IN THE COMPARTMENTS AS DESIGNATED AND SHALL MAKE ALL WIRING CONNECTIONS AS SHOWN BY THE DRAWING. THE SECONDARY WIRING FROM THE CURRENT AND POTENTIAL TRANSFORMERS, TO THE RELAYS, METER, AND OIL CIRCUIT BREAKER TRIP COILS SHALL NOT BE LESS THAN No- 12 GA. V.C, AND BRAIDED FLAMEPROOF 2500-VOLT SWITCHBOARD WIRE., CONNECTING BLOCKS SHALL BE PROVIDED AS INDICATED.

BARRIERS OF ½" TRANSITE OR EQUAL INSULATING QUALITY ARE TO BE PLACED BETWEEN DISCONNECTING SWITCHES AND IN FRONT OF OIL CIRCUIT BREAKER AND SHALL BE OF SUITABLE LENGTH TO GUARD DISCONNECTING SWITCHES WHEN OPENED.

THE INSULATION OF THE PRIMARY AND SECONDARY WINDINGS OF THE TRANSFORMER AND THAT OF THE BUSHINGS TO WHICH THE WINDINGS ARE TO BE CONNECTED SHALL BE OF SUCH DESIGN SO AS TO PROTECT THE WINDINGS AGAINST IMPULSE FAILURES. THE IMPULSE CONDITIONS TO BE CONSIDERED AS OF AVERAGE SEVERITY.

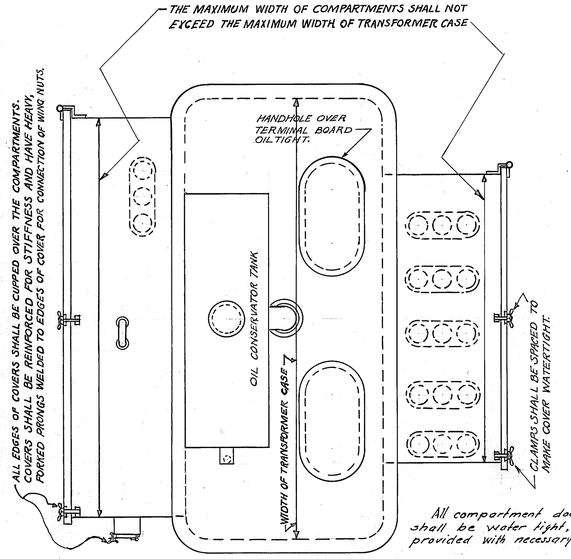
THE OIL TO BE FURNISHED FOR THIS TRANSFORMER SHALL PASS THE STANDARD DIELECTRIC TESTS, AND THE DIELECTRIC STRENGTH SHALL NOT BE LESS THAN 20,000-VOLTS AND TO BE CHEMICALLY FREE FROM MINERAL ACIDS OR ALKALIS

## TESTS—

THE TESTS ON THE COMPLETED TRANSFORMER SHALL BE MADE IN ACCORDANCE WITH THE RULES OF THE A,I,E,E, AND ALL TESTS TO BE MADE AT THE MANUFACTURERS PLANT IN THE PRESENCE OF A GOVERNMENT INSPECTOR AT NO ADDITIONAL COST TO THE PURCHASER.

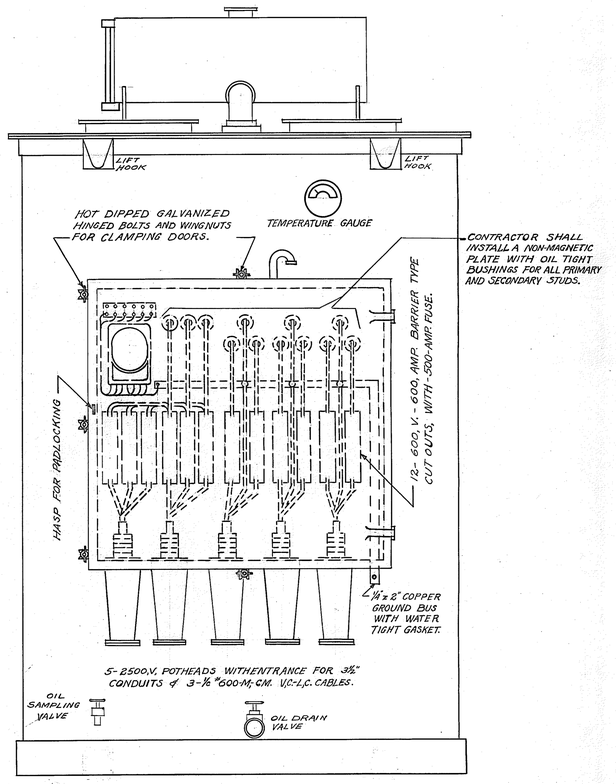
THE TRANSFORMER SHALL WITHSTAND THE FOLLOWING TESTS.

(a) 15,000-VOLTS FOR ONE MINUTE BETWEEN HIGH AND LOW VOLTAGE WINDINGS WITH THE LATTER GROUNDED TO THE CORE AND CASE.
(b) 15,000-VOLTS FOR ONE MINUTE BETWEEN HIGH VOLTAGE WINDING AND CORE.
(c) 10,000- VOLTS FOR ONE MINUTE BETWEEN LOW VOLTAGE WINDING AND CORE.
(d) INDUCED VOLTAGE TEST AT TWICE THE NORMAL VOLTAGE DEVELOPED IN THE WINDING FOR A PERIOD OF 7200 CYCLES BUT NOT MORE THAN ONE MINUTE, THE FREQUENCY DURING THIS TEST TO BE SUCH THAT THE EXCITING CURRENT SHALL NOT EXCEED 30% OF THE FULL LOAD CURRENT AND NOT TO EXCED 500 CYCLES PER SECOND.
(e) TEMPERATURE RISE TEST, FROM HEAT RUN TEST BASED ON 40°C, AMBIENT TEMP., SHALL NOT EXCEED 55°-C. FOR SIX HOUR RUN AT FULL LOAD.
(f) CORE LOSS VALUES BY CORE LOSS METER.
(g) IMPEDENCE TESTS.
(h) EFFICIENCY TESTS AT ¼-½-¾-¼ & ⅝ LOADS AT UNITY AND 80% POWER FACTOR:, A CERTIFIED COPY OF THE ABOVE TESTS SHALL BE FURNISHED WITH EQUIPMENT UPON DELIVERY TO THE PURCHASER.

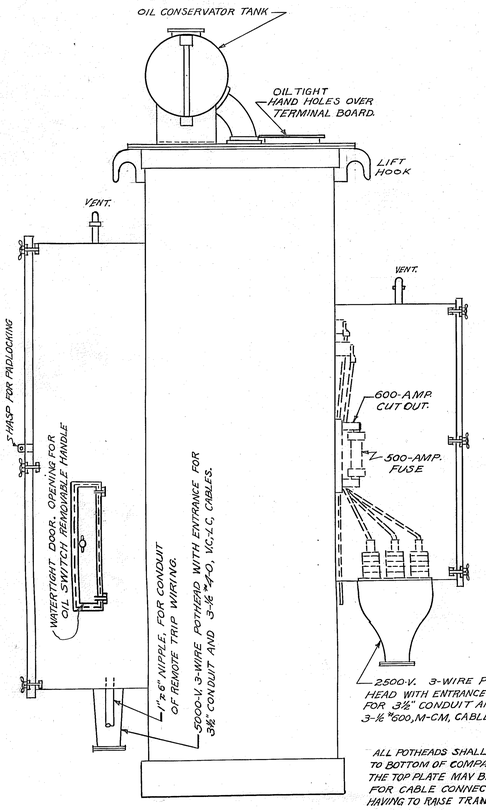



TOP AND POTHEAD ARRANGMENT

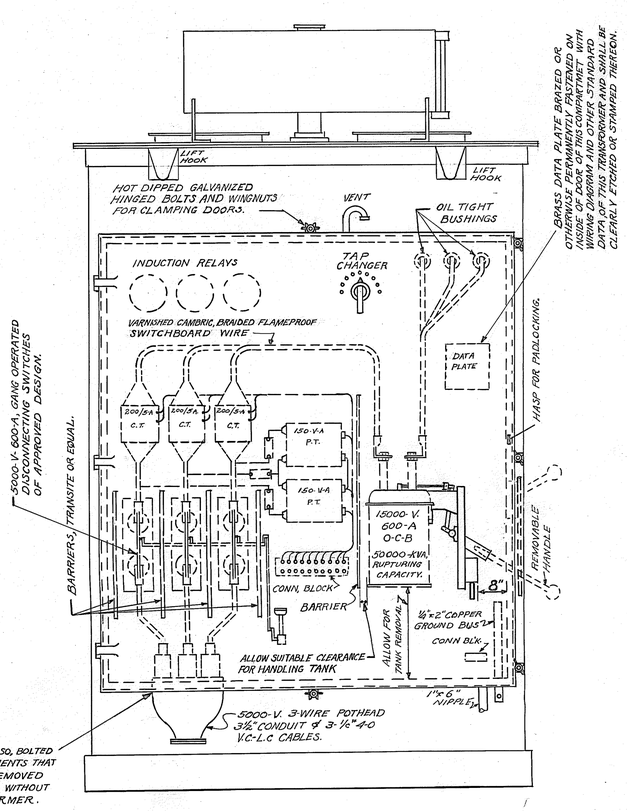
PLAN.




ELEVATION - SECONDARY SIDE

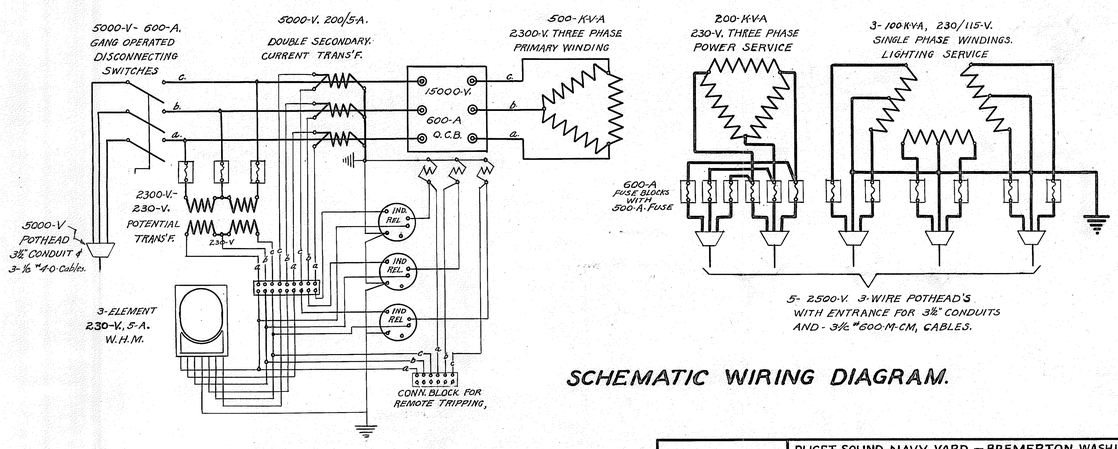



END ELEVATION




ELEVATION PRIMARY SIDE

Note-
For Sub-station - see Dwg. #14252
For Floor Plan, Bldgs. 32 & 33 - see Dwg. #14240




SCHEMATIC WIRING DIAGRAM.

| | | | |
|---|---|---|---|
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | | | |
| | 1 | Rack | 12-16-38 |
| | 1 | PWD | " |
| | 5 | NAS | " |
| | 25 | Purch | " |

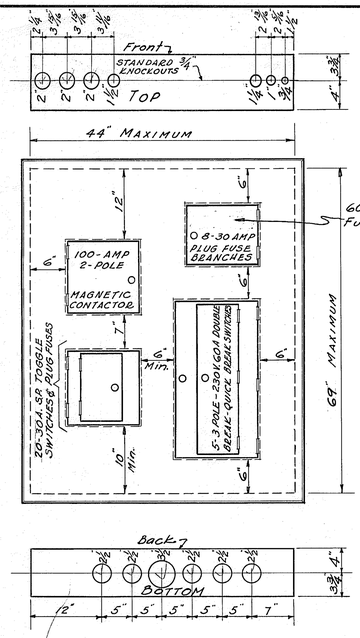
DRAWN BY- L.E.B.
TRACED BY- L.E.B.
CHECKED BY- J.B.Lexin
CHIEF DR'FTM- E.C.K.
IN CHARGE. J.H.

P.W. DRAWING No- 14239

PUGET SOUND NAVY YARD — BREMERTON WASHINGTON.
NAVAL AIR STATION - SEATTLE WASHINGTON.
500-KV-A. TRANSFORMER, SUB-STATION.
LANDPLANE HANGARS No- 32 & 33.
ELECTRIC POWER & LIGHTING.

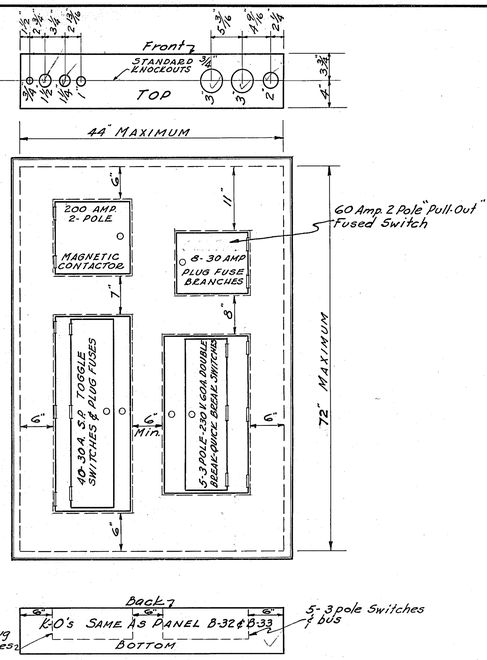
Approved 12/16/ 1938
PUBLIC WORKS OFFICER.

FILE- 13-34-234



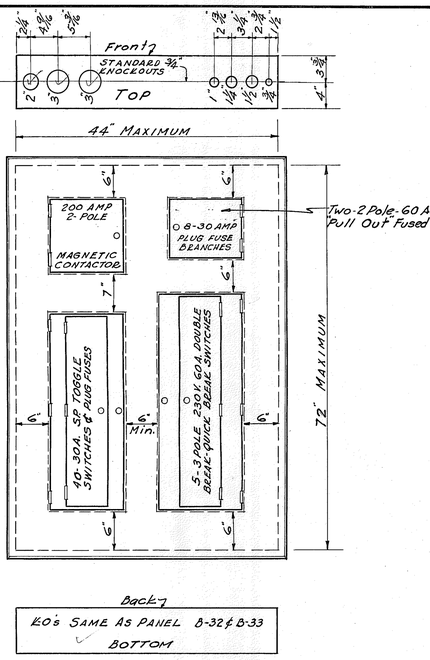

2-REQUIRED WITH KNOCKOUTS IN TOP & BOTTOM AS DETAILED.

## PANELS B-32 & B-33



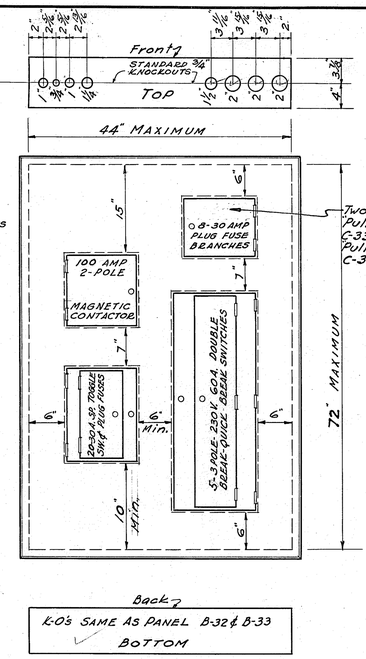

2-REQUIRED WITH KNOCKOUTS IN TOP & BOTTOM AS DETAILED.

## PANELS A-32 & A-33



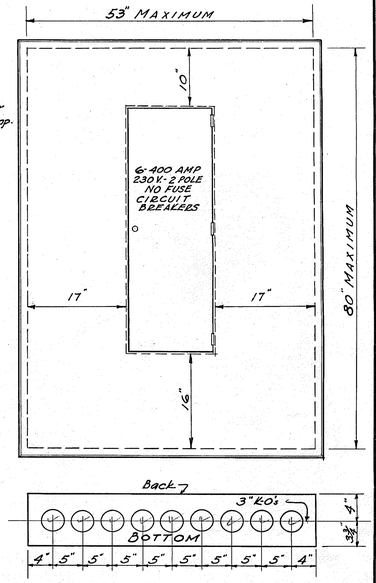

2-REQUIRED WITH KNOCKOUTS IN TOP & BOTTOM AS DETAILED.

## PANELS D-32 & D-33



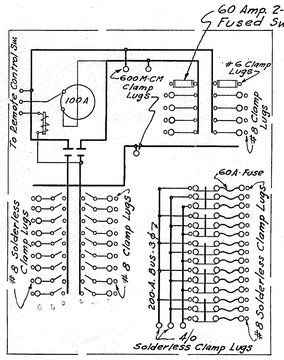

2-REQUIRED WITH KNOCKOUTS IN TOP & BOTTOM AS DETAILED.

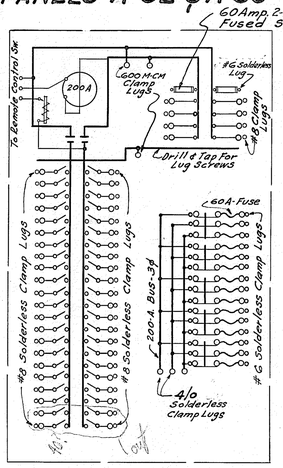
## PANELS C-32 & C-33

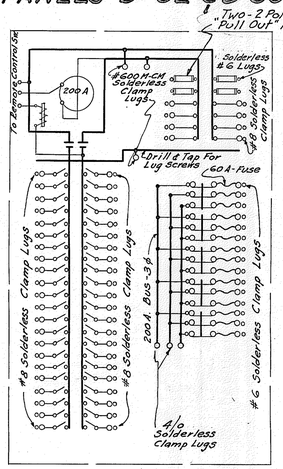


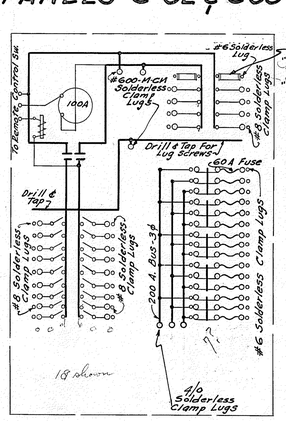

1 REQUIRED WITH KNOCKOUTS IN BOTTOM AS DETAILED.

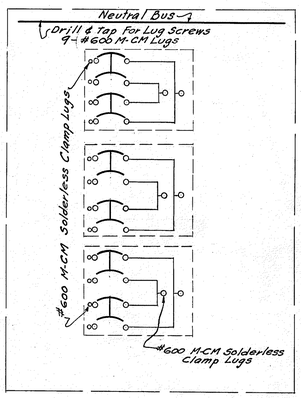
## MAIN LIGHTING PANEL "O"

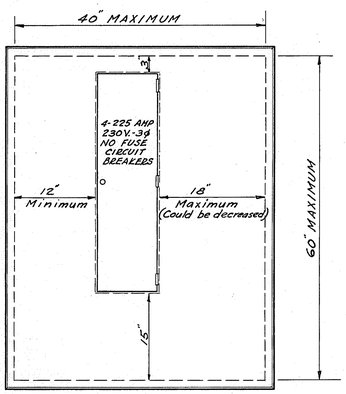


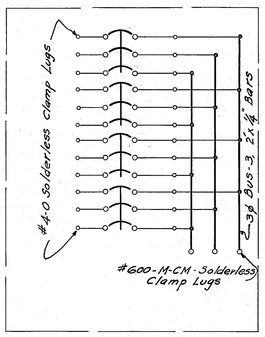



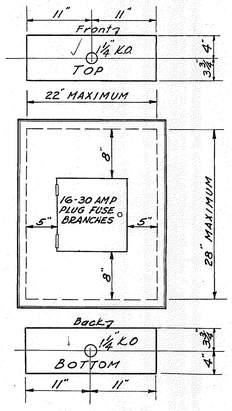



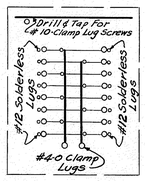




2 REQUIRED - 230 V.-3¢ POWER PANEL WITH KNOCKOUTS IN BOTTOM AS DETAILED.

## MAIN POWER PANELS P-1 & P-2




8-REQUIRED - IN ADDITION TO 1¼" KNOCKOUTS AS DETAILED, PROVIDE ADDITIONAL STANDARD ¾" KNOCKOUTS IN ALL FOUR SIDES.

Note-
For Floor Plan, Bldgs. 32 & 33 - see Dwg. #14240

## PANELS G-32 & G-33
## PANELS H-32 & H-33
## PANELS I-32 & I-33
## PANELS J-32 & J-33

| | | |
|---|---|---|
| 25 | Purch | 1-30-39 |
| 5 | PDE | 1-27-39 |

ISSUED

DRAWN BY
TRACED BY B.G.S.
CHECKED BY BR
CHIEF DFTMN
IN CHARGE

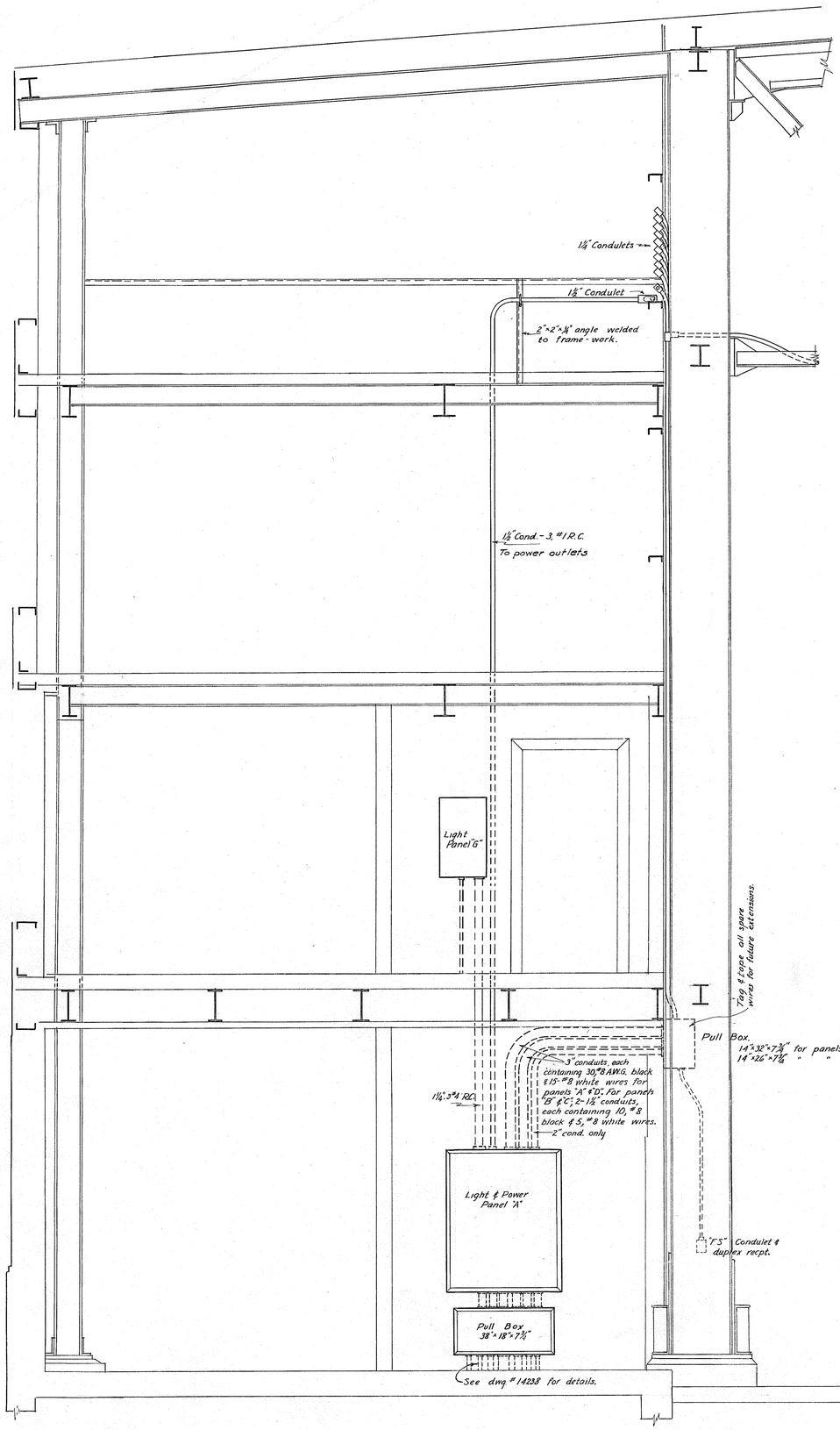
P.W. DRAWING No. 14245

PUGET SOUND NAVY YARD
BREMERTON WASHINGTON
NAVAL AIR STATION
SEATTLE WASHINGTON

# LIGHT & POWER PANELS
## BLDGS. No. 32 & No. 33

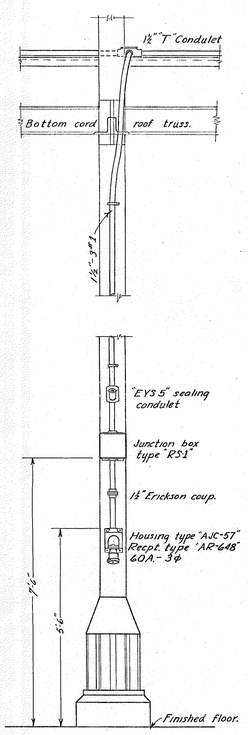
Approved 1/25/1939
Public Works Officer

13-34-236
13-34-236

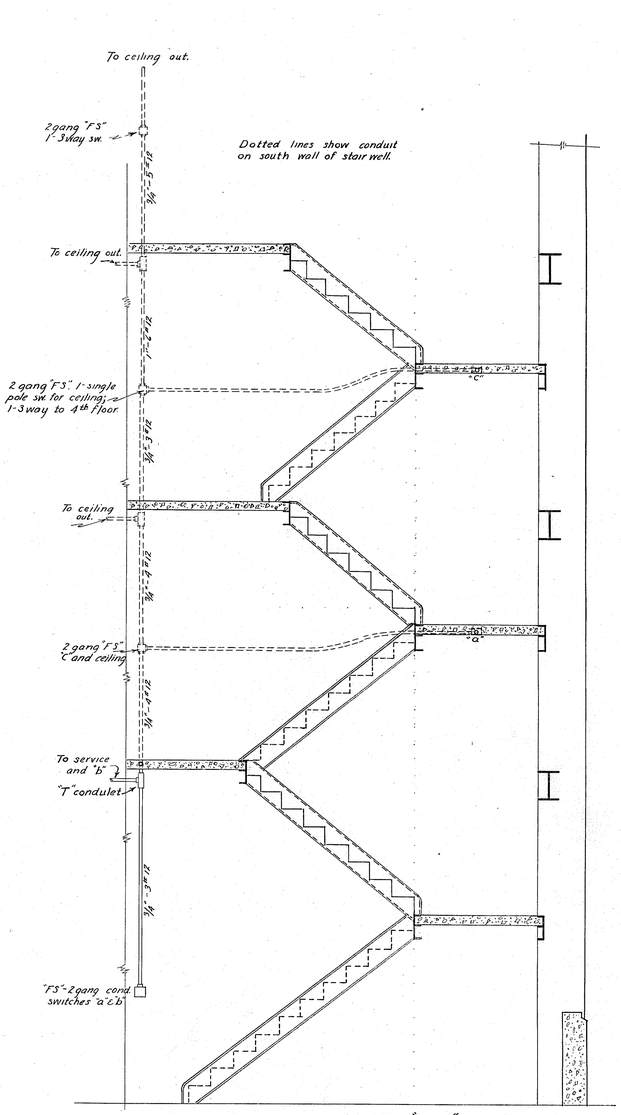



SECTION "C-C"
Scale, ½"-1'-0"

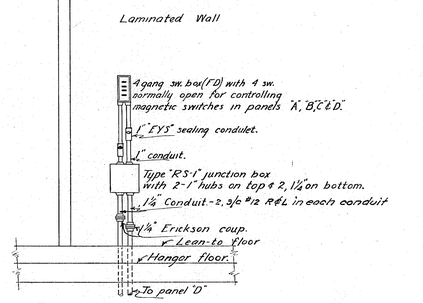
For Floor Plan-See Dwg. #14240




SECTION "D-D"
Scale - ½"-1'-0"




SECTION "F-F"
Scale - ⅜"-1'-0"




SECTION "E-E"
Scale - ½"-1'-0"

| | | |
|---|---|---|
| 3 | NAS | 6-15-39 |
| 4 | NAS | 3-9-39 |
| 1 | PDE | " |

SCALE AS NOTED

P.W. DRAWING No. 14246

DRAWN BY TL
TRACED BY TL
CHECKED BY Beatty
CHIEF DFTSM. [illegible]
IN CHARGE [illegible]

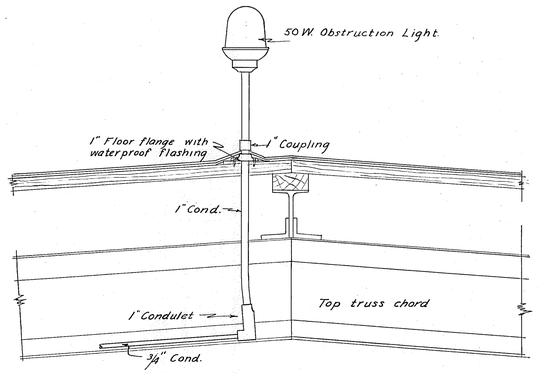
PUGET SOUND NAVY YARD
BREMERTON, WASH.
NAVAL AIR STATION
SEATTLE, WASH.

# ELECTRICAL SECTIONS OF BUILDINGS No. 32 & 33

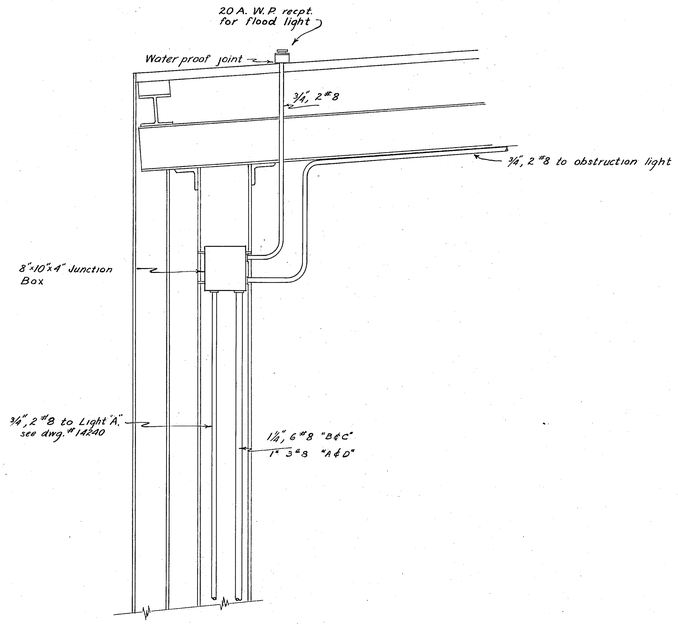
APPROVED 3/7/39
PUBLIC WORKS OFFICER

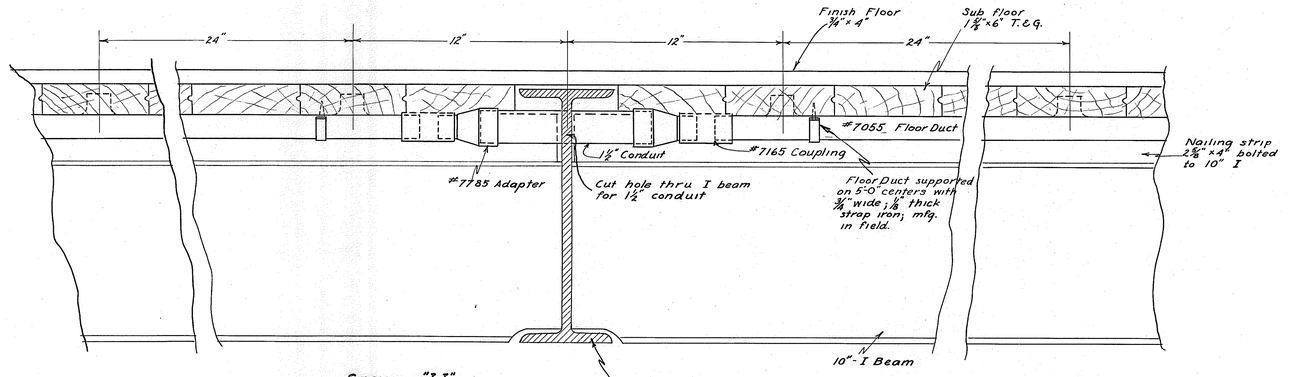
13-34-237

M

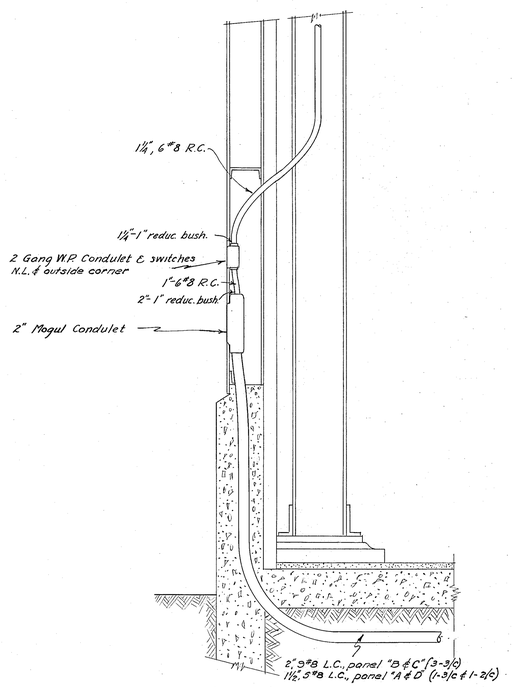



SECTION "H-H"
SCALE 1"=1'-0"

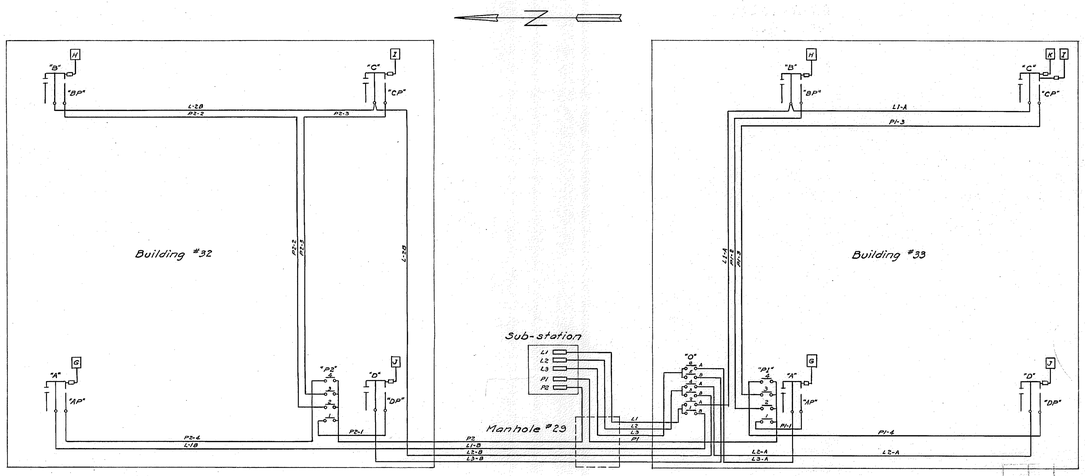



SECTION "J-J"
TYPICAL FLOOR DUCT ASSEMBLY
Scale, 3"=1'-0"




SECTION "G-G"
SCALE, 3/4"=1'-0"




FEEDER DIAGRAM
Scale, None

Floor Plan - Dwg.# 14240
Feeders & Panel Arrangement Bldg. 33 - Dwg.# 14250
" " " " " 32 - " #14251
Electrical Conduit Distribution " 32 - " #14243
" " " " 33 - " #14244
Sub-station layout - see Dwg.# 14252
Manhole #29 - see Dwg.# 14252

LIGHTING FEEDERS 230/115 V. 1φ

| Feeder L1 | | | Feeder L2 | | | Feeder L3 | | |
|---|---|---|---|---|---|---|---|---|
| Panel | Watts | Total | Panel | Watts | Total | Panel | Watts | Total |
| A32 | 48900 | | B32 | 29700 | | D32 | 49200 | |
| G32 | 18050 | | H32 | 17250 | | J32 | 20450 | |
| | | 66950 | C32 | 29200 | | | | 69650 |
| B33 | 29700 | | I32 | 21050 | | A33 | 48900 | |
| H33 | 20500 | | | | 37200 | G33 | 19750 | |
| C33 | 29200 | | D33 | 49200 | | | | 68650 |
| I33 | 18525 | | J33 | 20450 | | | | |
| K33 | 3600 | | | | 69650 | | | |
| | | 101525 | | | | | | |
| | | | | | | | | |
| Total | | 174475 | | | 166850 | | | 138300 |

POWER FEEDERS 230V. 3φ

| Feeder P1 | | | Feeder P2 | | |
|---|---|---|---|---|---|
| Panel | Watts | Total | Panel | Watts | Total |
| AP | 25000 | | AP | 25000 | |
| BP | " | | BP | " | |
| CP | " | | CP | " | |
| DP | " | | DP | " | |
| | | | | | |
| Total | | 100000 | Total | | 100000 |
| | | | | | |
| | | | | | |

4 NAS 3-9-39
1 PDE "

| | |
|---|---|
| Drawn By | TL |
| Traced By | TL |
| Checked By | Beatty |
| Chief Draftsman | |
| In Charge | |
| P. W. Drawing No. | 14247 |
| Scale as noted | |

PUGET SOUND NAVY YARD
BREMERTON, WN.
NAVAL AIR STATION
SEATTLE, WASH.

# ELECTRICAL SECTIONS OF BUILDINGS No. 32-33

Approved 3/1/39
Public Works Officer

13-34-238

# Thermography Inspection at

## NOAA Sand Point
## Hangar 32

## NOAA Building 32
## 63rd Ave NE
## Seattle, WA 98115

## January 19th-29th, 2021

## By

## Jeff Ochsner

| Inspection Site Information | |
|---|---|
| Customer | NOAA Western Regional Center |
| Address | 7600 Sand Point Way NE |
| Contact person | Duane Budd 425-922-2078 / Don Krigsvald 360-350-2221 |
| Thermographer | Jeff Ochsner 206-947-5500 |
| Thermographer | Jeff Ochsner 206-947-5500 |

## INSPECTION STANDARDS

All readings shown in this report reflect the conditions found at time of testing. Ambient air temperature, electrical load on equipment, and other environmental conditions can affect readings, so temperatures shown are estimates. The guidelines used to evaluate site conditions are as follows:

**Circuit Breakers (per NETA 2006 Guidelines)**:

| Temperature Difference based on comparison between similar components under similar loading | Temperature Difference based upon comparisons between component and ambient air temperatures | Recommended Action |
|---|---|---|
| 1˚C - 3˚C | 1˚C - 10˚C | Possible deficiency; warrants further investigation |
| 4˚C - 15˚C | 11˚C - 20˚C | Indicates probable deficiency; repair as time permits |
| -- -- -- | 21˚C - 40˚C | Monitor until corrective measures can be accomplished |
| >15˚C | >40˚C | Major discrepancy; repair immediately |

- Microhm or millivolt drop values shall not exceed the high levels of the normal range as indicated in the manufacturer's published data. If manufacturer's data is not available, investigate any values which deviate from adjacent poles or similar breakers by more than 50 percent of the lowest value.

**Transformers:**

- Check for unusual thermal imbalances between phase connection points, report to customer when identified

**Disconnects:**

- Check for thermal imbalances in fuses, connection points, report imbalances to customer when identified

This report includes a complete listing of all equipment scanned, and visual documentation and analysis of all thermal anomalies discovered during the inspection.

For conditions reported, the following ratings system is used to establish a priority level for recommended action:

| | |
|---|---|
| **0:** No abnormality | No action |
| **1:** Low grade fault | To be monitored – Plan new inspection within 90 days |
| **2:** Medium grade fault | Repair at scheduled shutdown |
| **3:** Severe fault | Repair immediately |

## Equipment List

| LOCATION | ID TAG # | EQUIPMENT DESCRIPTION | RECOMMENDED ACTION | REMARKS |
|---|---|---|---|---|
| Bldg. 32 NW Corner/Room 112 | 641 | Switchboard 800A Fused – 480V 3PH, 4W | NONE | |
| Bldg. 32 NW Corner/Room 112 | 642 | Switchboard 800A Fused – 480V, 3PH, 4W | NONE | |
| Bldg. 32 NW Corner/Room 109 | 643 | PNL-F 400A Main Breaker,480V, 3PH, 4W | NONE | (5)K.O. Seals needed - Very Old, Remove/Replace |
| Bldg. 32 NW Corner/Room 109 | 644 | PNL-F1 Main Lug 100A, 480V, 3PH, 4W | NONE | |
| Bldg. 32 NW Corner/Room 109 | 645 | 45 KVA Transformer 480V→208V | NONE | |
| Bldg. 32 NW Corner/Room 109 | 646 | Disconnect S-2 , 150A, 208V, 3PH<br>Feeds PNL-F2 | NONE | Very Old, Remove/Replace |
| Bldg. 32 NW Corner/Room 109 | 647 | PNL-F2 150A Main Breaker, 208V, 3PH, 4W | NONE | K.O. seals needed, 3",1",3/4", ½"<br>CKT-26,28,30 has 2wires per, wrong size wire for 100A 3-pole |
| Bldg. 32 - NE Corner | 648 | PNL-DD Main Lug 120/208V, 3PH, 4W<br>Fed from 75KVA Transformer | NONE | Panel does not have main breaker or disconnecting means. Needs ½" K.O. seal |
| Bldg. 32 - NE Corner | 649 | Disconnect T-32NL 100A 480V, 3PH, 3W | NONE | Disconnect is not fused, missing bushing on line side, missing mounting screws to hold to wall. Fed from? |
| Bldg. 32 - NE Corner | 650 | 75 KVA Transformer | NONE | |
| Bldg. 32 - NE Corner | 651 | PNL-D 125A 120/208V, 3PH, 4W | NONE | Main lugs used to splice #2 and #6 STR copper conductors. Fed from? |
| Bldg. 32 - NE Stair – 2nd Floor | 652 | PNL-HH 100A 120/208V 3W | Low Grade Fault | CKT-18 To be monitored –<br>Plan new inspection within 90 days<br>Dan Krigsvold removed hot breaker(#18), Re-terminated wire to ckt-20 |
| Bldg. 32 - NE Stair – 2nd Floor | 653 | PNL-GG 100A 120/208V 3W | NONE | |
| Bldg. 32 - NE Stair – 2nd Floor | 654 | 150A Breaker Feeds Security<br>Fed from Panel D (splice box) | NONE | Very old – Plexiglass cover<br>Remove/Replace - Wrong size wire |
| Bldg. 32 – Center - West | 655 | PNL-K 225A 3PH, 4W | NONE | Old – Remove/Replace<br>Many code violations |
| Bldg. 32 – Center - West | 656 | 75 KVA Transformer T-2 480V→208V | NONE | |
| Bldg. 32 – South of Center | 657 | 60A Disconnect 480V, 3PH<br>(Rope Strength Tester) | NONE | Code Violations – wire size too small<br>(2)#10 wires on each lug of load side |
| Bldg. 32 – South of Center | 658 | Disconnect 60A 480V, 3PH | NONE | Code Violations-#12AWG Doubled up w/#6AWG on Line side lugs.<br>Remove/Replace |
| Bldg. 32 – South of Center | 659 | Disconnect 30A 480V, 3PH | NONE | Code Violations- 250V fuses,<br>Remove/Replace – Very old |
| Bldg. 32 – South of Center – West wall | 660 | 100A PNL, 120/208V, 3PH, 4W<br>(new Sq D PNL fed from 30KVA XFMR) | NONE | |
| Bldg. 32 – South of Center – West wall | 661 | 30 KVA Transformer 480V→120/208V | NONE | |
| Bldg. 32 - SE (Brown Structure) | 662 | PNL- AB 125A 120/208V 3PH, 4W, Main Lug<br>(new Sq D QO PNL) | NONE | Code Violation- needs correct lug (#4-#14AWG) for ground. |
| Bldg. 32 - SE | 663 | PNL-CB1 100A, 208V, 4W, Main Breaker | NONE | |
| Bldg. 32 - SE | 664 | Disconnect S-5 125A Fused, 208V, 3PH, | NONE | Code Violation-Line side lugs not rated for (2)#2AWG, Load side not rated for #6 and #2AWG- Very old – Remove/Replace |
| Bldg. 32 – SE Stair Room 132C | 665 | PNL-C 3PH, Sub to P2 | NONE | Very old, Remove/Replace |
| Bldg. 32 – SE Stair Room 132C | 666 | FU-2 (2)100A Fuses 208V | NONE | Very old, Remove/Replace |

| | | | | |
|---|---|---|---|---|
| Bldg.32 | 667 | Light Panel C Single Phase Bottom Right | NONE | Very old, Remove/De-Energized |
| Bldg.32 | 668 | Panel Top Right (8)Glass Fuses 120/208V | NONE | Very old, Remove/Replace |
| Bldg.32 | 669 | PNL-Z 200A, 120/208V, 3PH, 4W, Main Breaker | NONE | |
| Bldg.32 | 670 | PNL-Y 200A, 120/208V, 3PH, 4W, Main Breaker | NONE | |
| Bldg. | 671 | 75 KVA Transformer TT1 | NONE | |
| Bldg.32 | 672 | PNL#5 225A, 120/208V | NONE | |
| Bldg.32 | 673 | 75 KVA Transformer #5 480→208V | NONE | |
| Bldg.32 - South Wall - West | 674 | PNL-AA 225A, 120/208V, 3PH, 4W, Main Breaker | NONE | |
| Bldg.32 - South Wall - West | 675 | PNL-A 100A 277/480V, 3PH, 4W, Main Breaker | NONE | Code Violation- Line side main breaker (2)#4AWG on each lug |
| Bldg.32 - South Wall - West | 676 | 75 KVA Transformer T-1 480→208V | NONE | Top of transformer damaged |
| Bldg.32 - South Wall - West | 677 | PNL-CB2 400A, 277/480V, 3PH, 4W, Main Breaker | NONE | |
| Bldg.32 SW Room 149D | 678 | PNL-FU-1 (2)150A Fuses 120/208V | NONE | Very old, Remove/Replace |
| Bldg.32 SW Room 149D | 679 | PNL-D | NONE | Very old - Remove – De-Energized |
| Bldg.32 SW Room 149D | 680 | PNL-P2 | NONE | Very old - Remove – De-Energized |
| Bldg.32 - SW - Stair – 2nd floor | 681 | PNL-JJ 100A 1PH, 3W, 120/208V, Main Breaker | NONE | Splices in panel |
| Bldg.32-South-2nd floor-Hall/Center | 682 | PNL-F3 100A 277/480V, 3PH, 4W, Main Lugs | NONE | Code Violation- 480V PNL w/ 120/208V colors(Blk,Rd,Blu) |
| Bldg.32-South-2nd floor-East | 683 | PNL-II 100A 120/208V, 1PH, 3W, Main Breaker | NONE | |
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March 25, 2021

Duane Budd

**Ahtna Environmental, Inc.**
900 SW 16th Street
Suite 330
Renton, WA 98057

## Project: NOAA Hangar 32 Electrical ROM Level Budget Proposal

Dear Duane,

Thank you for the opportunity to provide our proposal for this project. McKinstry employs an integrated services model to deliver thousands of building solutions across the Puget Sound. We are excited to apply our experience at developing and executing a variety of projects to address your current needs. We were asked to provide Rough Order of Magnitude (ROM) Level Budget pricing for the electrical scope for the NOAA Hangars 32 & 33 project. Below are the project details and our recommendations.

### REFERENCED DOCUMENTS

- Electrical Facility Assessment Report, dated 2-8-21, prepared by McKinstry Engineering
- Email dated 3-1-21 from Ahtna confirming the building area square footages.
- Asset Summary and History Report – NOAA Phase III NOAA Hangars – PWAW053 dated September 2019
  5309 – Building 32
  5310 – Building 33
- Single Line Power Distribution Diagram Sheet E-4, Drawing File No. EWA 90340, dated 2-13-1991.

### ESTIMATE ASSUMPTIONS

- We used historical data to provide a cost/square foot analysis from similar projects over the past few years.
- The electrical costs are broken down by system to further assist with evaluation.
- Lock-Out-Tag-out (LOTO) procedures include de-energizing and identifying all electrical systems to be removed and disposed of by others. Raceways, wiring, and equipment to be identified with spray paint and or labeling for demolition contractor.
- All the existing electrical systems have exceeded their anticipated life expectancy and the estimate is based on providing all new equipment, wiring, and devices.
- The Service and Distribution costs include new Main Electrical Switchboards, Distribution Panelboards, grounding system, and all associated feeder conduit and wire.
- Convenience Power costs include new branch circuit wiring and devices thru ought the warehouse and office areas.
- Interior and Exterior Lighting costs include Light Fixtures, branch circuit conduit and wire, and manlifts.
- Lighting controls to include automatic controls as required to meet the 2015 Seattle Energy Code.

# NOAA Hangars 32 Electrical ROM Level Budget

## PRICING SUMMARY

### Electrical ROM Level Budget Cost Estimate

| NOAA HANGAR 32 | | | | | | |
|---|---|---|---|---|---|---|
| ELECTRICAL COST BUDGET - ROM LEVEL | | | | | | |
| 3/25/2021 | | | | | | |
| **DESCRIPTION** | **QUANTITY** | **UOM** | **LABOR $** | **MATERIAL $** | **EQUIPMENT $** | **TARGET BUDGET** |
| HANGAR 32 - BUILDING GSF: | 101,300 | SF | | | | |
| Warehouse Area | 80,340 | SF | | | | |
| **Division 26 - Electrical** | | | | | | |
| LOTO \| Make safe for demolition and disposal by others | 80,340 | SF | $ 0.53 | $ - | $ - | $ 42,580 |
| Service and Distribution | 80,340 | SF | $ 2.52 | $ 2.25 | $ 0.08 | $ 389,649 |
| Convenience Power | 80,340 | SF | $ 1.06 | $ 1.43 | $ 0.04 | $ 203,260 |
| Interior Lighting | 80,340 | SF | $ 1.96 | $ 2.94 | $ 0.09 | $ 400,897 |
| Exterior Lighting | 80,340 | SF | $ 0.47 | $ 0.70 | $ 0.07 | $ 99,622 |
| Lighting Controls | 80,340 | SF | $ 0.72 | $ 0.91 | $ 0.02 | $ 132,561 |
| | | | | | **HANGAR 32 - Warehouse Area SUBTOTAL:** | **$ 1,268,569** |
| | | | | | COST/SF: | $ 15.79 |
| Office Area | 20,960 | SF | | | | |
| **Division 26 - Electrical** | | | | | | |
| LOTO \| Make safe for demolition and disposal by others | 20,960 | SF | $ 1.19 | $ - | $ - | $ 24,942 |
| Service and Distribution | 20,960 | SF | $ 5.66 | $ 5.06 | $ 0.18 | $ 228,464 |
| Convenience Power | 20,960 | SF | $ 2.40 | $ 3.21 | $ 0.10 | $ 119,682 |
| Interior Lighting | 20,960 | SF | $ 4.41 | $ 6.62 | $ 0.20 | $ 235,381 |
| Lighting Controls | 20,960 | SF | $ 1.62 | $ 2.04 | $ 0.04 | $ 77,552 |
| | | | | | **HANGAR 32 - Office Area SUBTOTAL:** | **$ 686,021** |
| | | | | | COST/SF: | $ 32.73 |
| | | | | | | |
| | | | | | **HANGAR 32 - TOTAL COST:** | **$ 1,954,589** |
| | | | | | COST/SF: | $ 19.30 |

## CLARIFICATIONS

- MC Cable to be an approved wiring method where applicable and local code allows.
- EMT conduit fittings to be steel set-screw.
- Construction waste to be deposited in a GC-provided dumpster located on the floor in which work is being performed.
- Work to be performed during normal working hours 6am-2:30pm.
- Includes Prevailing Wages.
- Includes LOTO and make safe of all electrical systems for removal and disposal by others.
- Payment terms are net 30 days
- This proposal is good for 45 days

## EXCLUSIONS

1. Applicable sales, use and B&O tax
2. Performance and Payment Bonds
3. Electrical Engineering and Design Fees.
4. Preconstruction Services.
5. Landscape repair and restoration.
6. Utility company charges.
7. Roof penetrations, waterproofing.
8. Moving, placing and (re)-calibrating owner equipment.
9. Mechanical and plumbing control devices, including wiring, conduit, and components.
10. Concrete Housekeeping pads.
11. Staking | Surveying.
12. Hidden conditions.
13. Opening and repairing walls and ceilings for electrical work.
14. Patching and painting.
15. Electric Door Hardware.
16. Temporary power and lighting.
17. Job Site security | fencing.
18. Mechanical HVAC Equipment wiring and connections.
19. Mechanical Control System | BMS
20. Removal and disposal of waste or scrap from the job site | dumpster fees.
21. Handling and abatement of hazardous material including but not limited to asbestos, lead, and PCB's.
22. Demolition.
23. Lightning Protection System.
24. Emergency Generator and Distribution System.
25. Electric Vehicle Charging Stations and associated infrastructure.
26. Photovoltaic System.
27. Erosion controls | SWPPP | All Civil work, excavation, trenching, backfill, compaction, dewatering, etc.
28. Overtime and shift premiums.
29. Permits.
30. Structural and Seismic Engineering
31. Material cost escalation.
32. Plywood and specialty backing.
33. Low voltage systems (Fire Alarm, Telecom, Paging, CCTV, security |access control, audio visual, DAS, etc.)
34. Any work not specifically included in this proposal.

Should you have any questions or require additional information, please feel free to call me at 206.832.8569.

Sincerely,

**McKinstry Co., LLC.**

*Mark Undseth*

Mark Undseth | Sr. Project Manager | Electrical Construction
206.775.6561 | marku@McKinstry.com