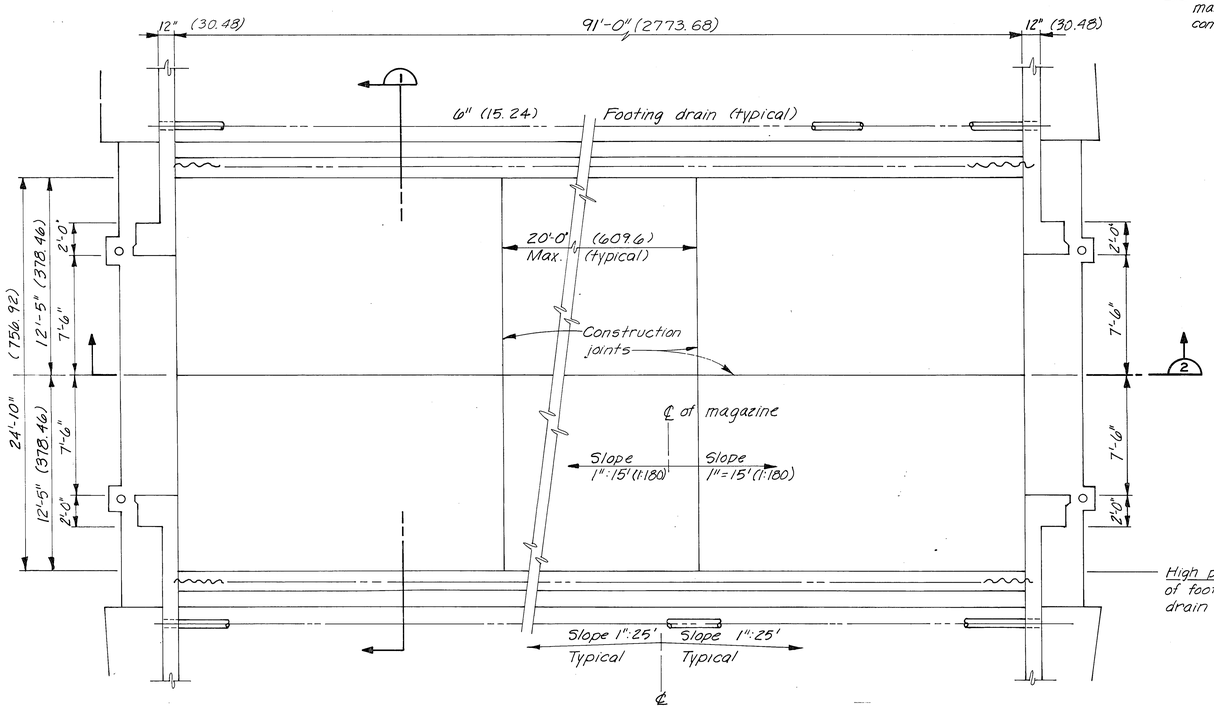
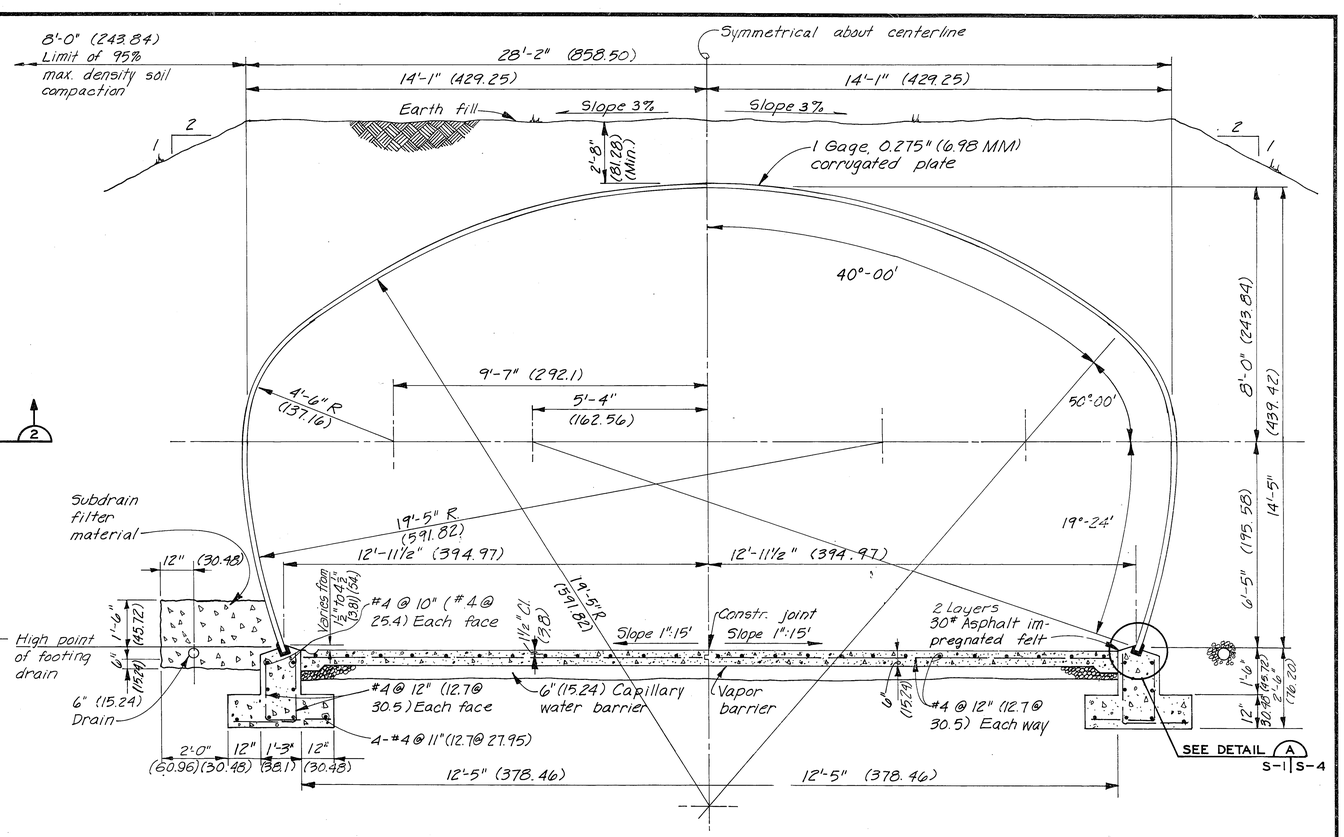


PLAN

SCALE: 1/4 INCH = 1 FOOT

12" 0 5'

(1=48)

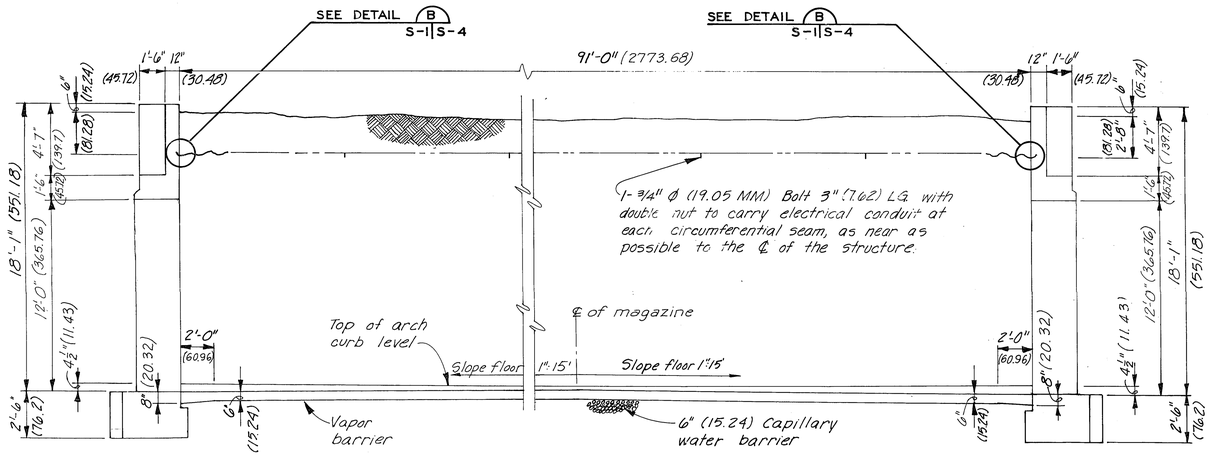


SECTION 1

SCALE: 1/2 INCH = 1 FOOT

12" 0 1' 2' 3' 4'

(1=24)



SECTION 2

SCALE: 1/4 INCH = 1 FOOT

12" 0 5'

(1=48)

General Notes:

1. Minimum length 21'-0" for additional length add corrugated steel plates of 10'-0" and or 12'-0" net lengths.
2. Not used.
3. Reinforcing steel and all metal shall be made electrically continuous by tying or welding.
4. Reinforcing steel shall be ASTM A615 or A617 with the following grades:
   Ties - Grade 40
   All Other - Grade 60
5. Dimensions shown in parentheses are centimeters unless otherwise noted.
6. Arch shall be stabilized during backfilling operations to prevent buckling and distortion. See Arch manufacturer for recommended stabilizing procedure.
7. All concrete shall have a minimum compressive strength of 4,000 psi at 28 days.

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: J.B.G. JR.
DRAWN BY: S.A.M.-A.J.A.
CHECKED BY: B.N.H.
SUBMITTED BY:
CHIEF BL.DGS. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
COL. C. E., DISTRICT ENGINEER

MUNITION STORAGE IGLOOS
MAGAZINE, STEEL, OVAL-ARCH (25'-11" SPAN) EARTH COVERED
PLAN AND SECTIONS

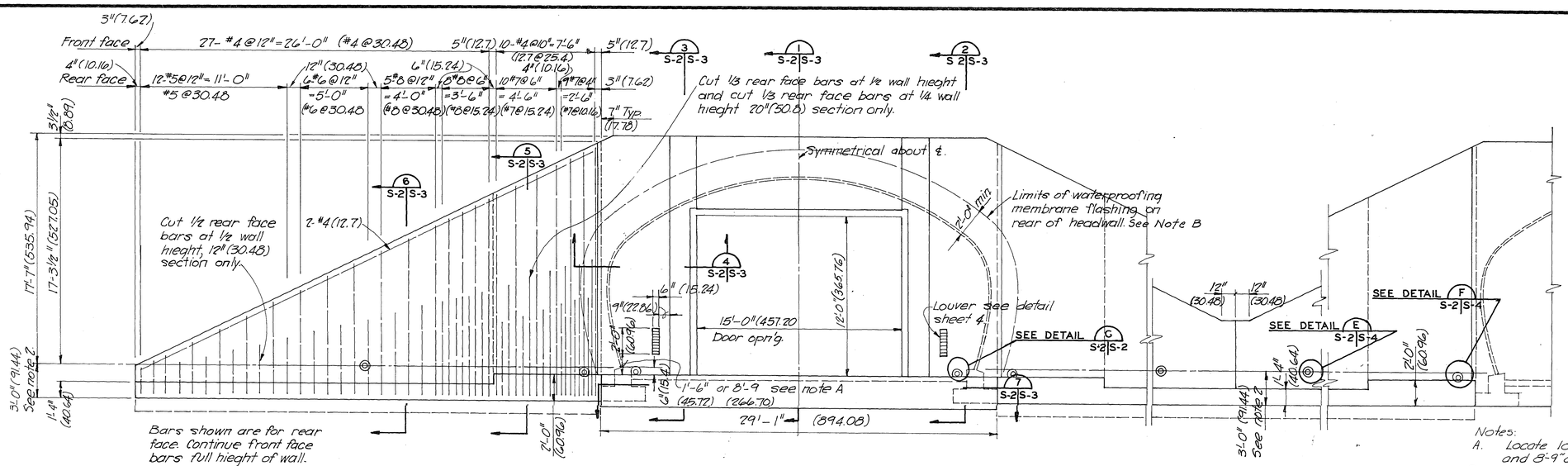
APPROVED:
CHIEF ENGINEERING DIVISION
DATE: 347-78-48(16)

SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET S-1

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

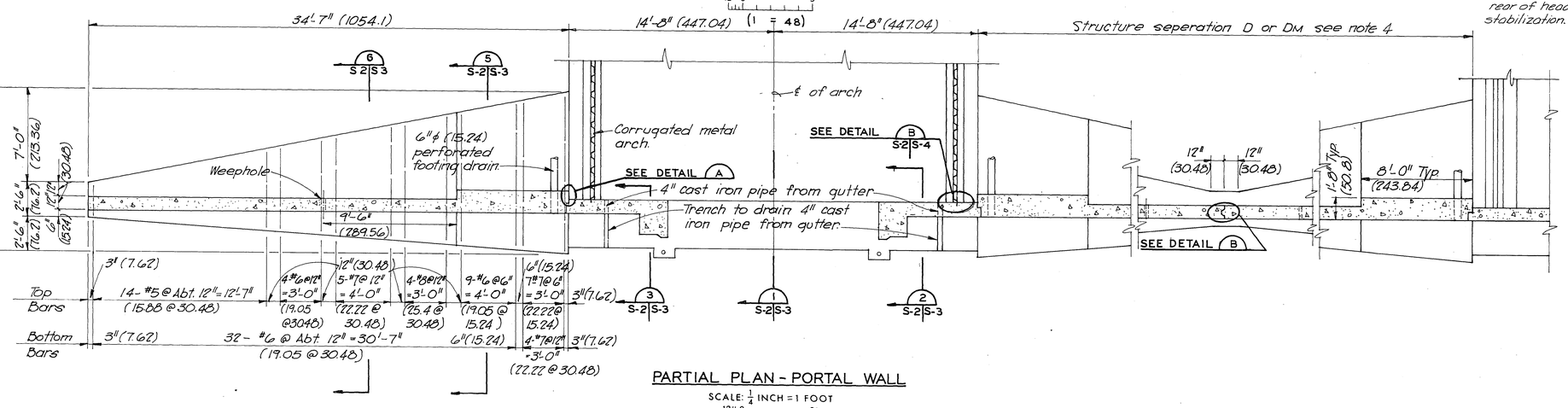
$$ — THINK VALUE ENGINEERING — $$

GPO 767-653



PARTIAL ELEVATION - PORTAL WALL

SCALE: ¼ INCH = 1 FOOT (1 = 48)



PARTIAL PLAN - PORTAL WALL

SCALE: ¼ INCH = 1 FOOT (1 = 48)

Designer notes:

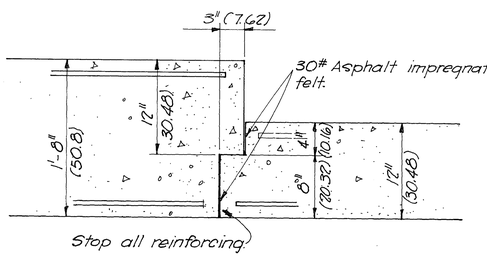
1. Headwall footings shall extend down to frost depth.
2. At designers option, arch footings shall extend to full frost penetration depth, or provide non-frost-susceptable material under arch footings to full depth of frost penetration.
3. Footings are sized for a soil bearing capacity of 3000 P.S.F.
4. $D = 1.25\ W^{1/3}$
   - D = Minimum separation in feet
   - 1.25 = Constant
   - W = Equivalent weight of TNT in pounds

   $D_M = 0.5\ W_{KG}^{1/3}$
   - D_M = Minimum separation in meters.
   - 0.5 = Constant
   - W_{KG} = Equivalent weight of TNT. in kilograms.

Notes:

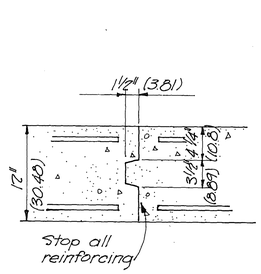
A. Locate louvers 1'-6" above floor on one side and 8'-9" above floor on opposite side.

B. Any devices used for stabilizing the structure (See Note 6 Sht. S-1) that remain as part of the structure shall be waterproofed. Waterproofing shall include rear of headwalls 2'-0" beyond any devices used for stabilization.



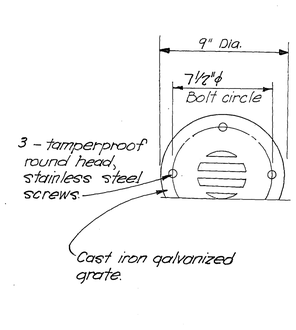
DETAIL A

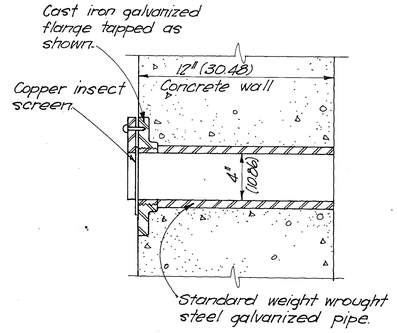
SCALE: 1½ INCHES = 1 FOOT (1 = 8)



DETAIL B

SCALE: 1½ INCHES = 1 FOOT (1 = 8)





DETAIL G

SCALE: 3 INCHES = 1 FOOT (1 = 4)

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: J.B.G. JR.
DRAWN BY: K.G.D. - A.J.A.
CHECKED BY: B.N.H.
SUBMITTED BY:
CHIEF BLDGS. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
CHIEF ENGINEERING DIVISION
DATE: 347-78-48 (17)
APPROVED:
COL. C. E., DISTRICT ENGINEER

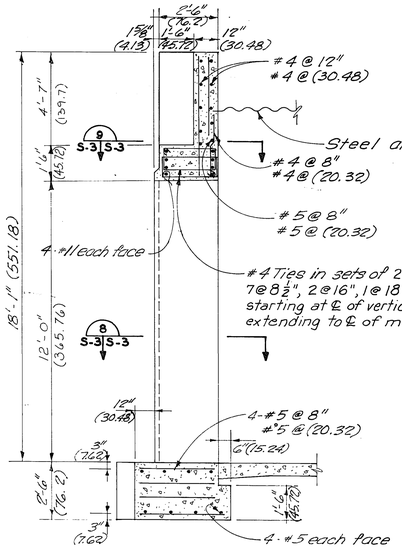
MUNITION STORAGE IGLOOS
MAGAZINE, STEEL, OVAL-ARCH (25'-11" SPAN) EARTH COVERED PORTAL WALL-PLAN, ELEV. & DETAILS

SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET S-2

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

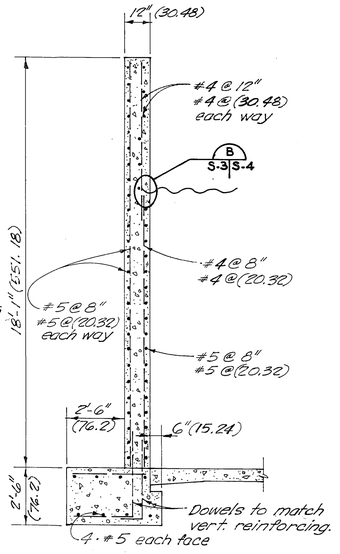
$$ — THINK VALUE ENGINEERING — $$

GPO 767-653



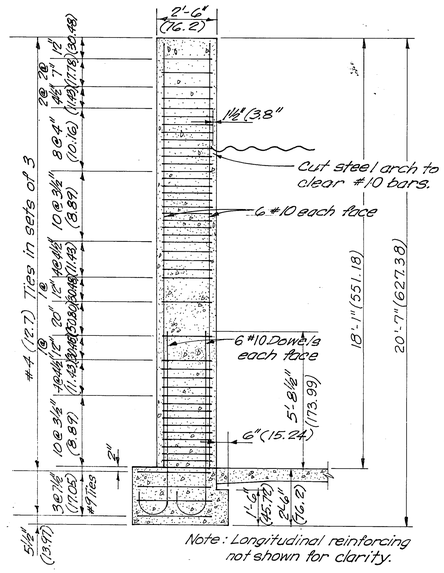
SECTION 1 S-2 S-3

SCALE: ⅜ INCH = 1 FOOT



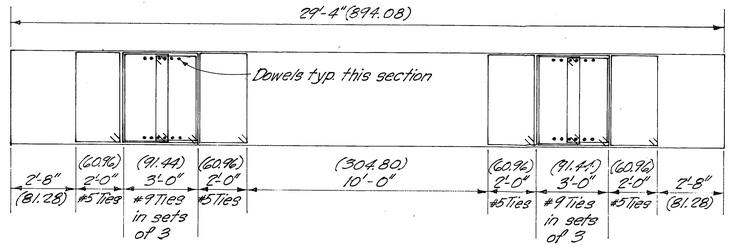
SECTION 2 S-2 S-3

SCALE: ⅜ INCH = 1 FOOT



SECTION 3 S-2 S-3

SCALE: ⅜ INCH = 1 FOOT

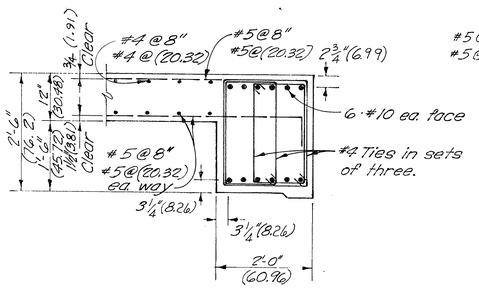


SECTION 7 S-2 S-3

SCALE: ⅜ INCH = 1 FOOT

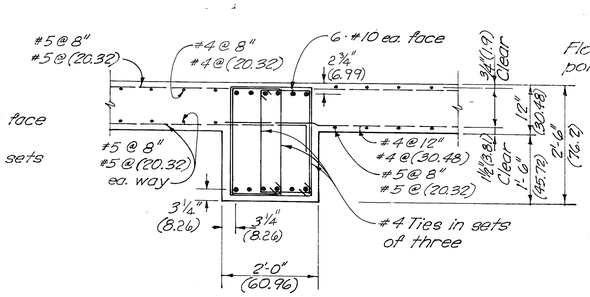
SECTION 4 S-2 S-3

SCALE: ⅜ INCH = 1 FOOT



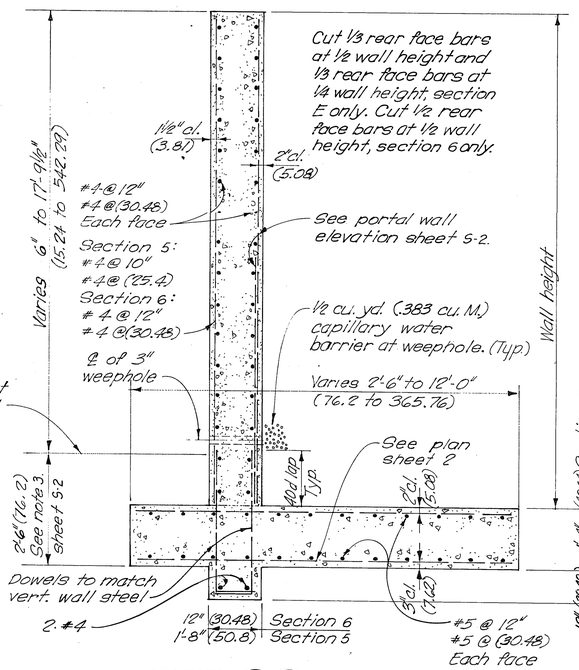
SECTION 8 S-3 S-3

SCALE: ¾ INCH = 1 FOOT



SECTION 9 S-3 S-3

SCALE: ¾ INCH = 1 FOOT



SECTION 5 6 S-2 S-3 S-2 S-3

SCALE: ½ INCH = 1 FOOT

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

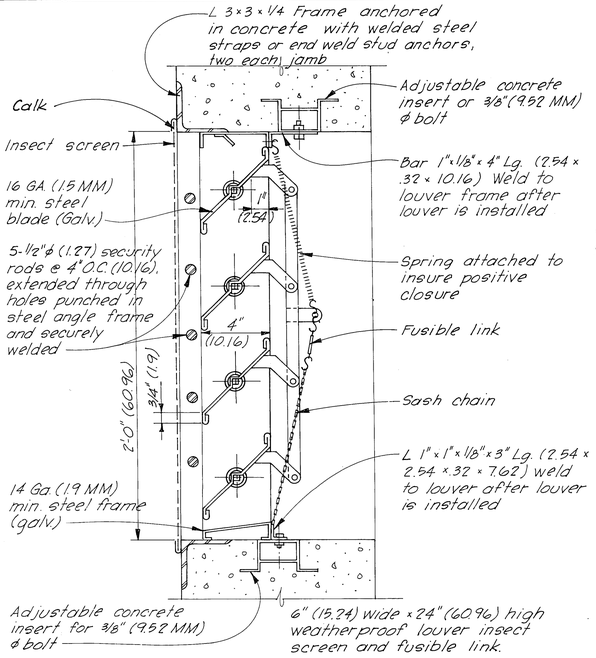
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: J.B.G. J.R.	MUNITION STORAGE IGLOOS
DRAWN BY: A.J.A.	MAGAZINE, STEEL, OVAL-ARCH
CHECKED BY: B.N.H	(25'-11" SPAN) EARTH COVERED
SUBMITTED BY: CHIEF BLDGS. SECTION	PORTAL WALL-PLAN, ELEV. & SECTIONS
RECOMMENDED: CHIEF DESIGN BRANCH	APPROVED: CHIEF ENGINEERING DIVISION — DATE: 347-78-48(18)
APPROVED: COL. C. E., DISTRICT ENGINEER	SCALE: AS SHOWN — SPEC. NO. DACA45 — DRAWING NUMBER 33-15-02 — SHEET S-3

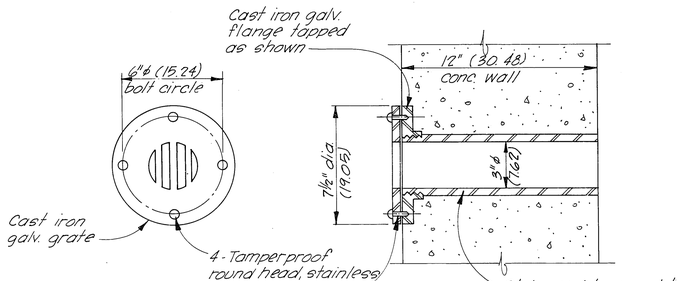
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45 MODIFICATION No.

$$ — THINK VALUE ENGINEERING — $$

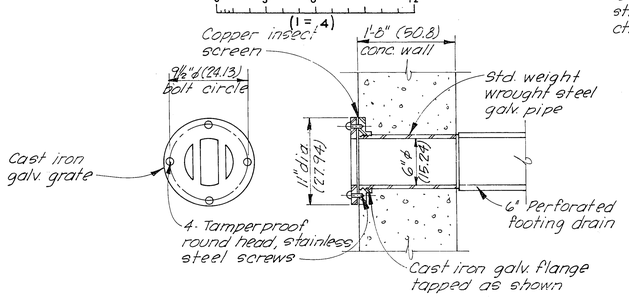
GPO 767-653



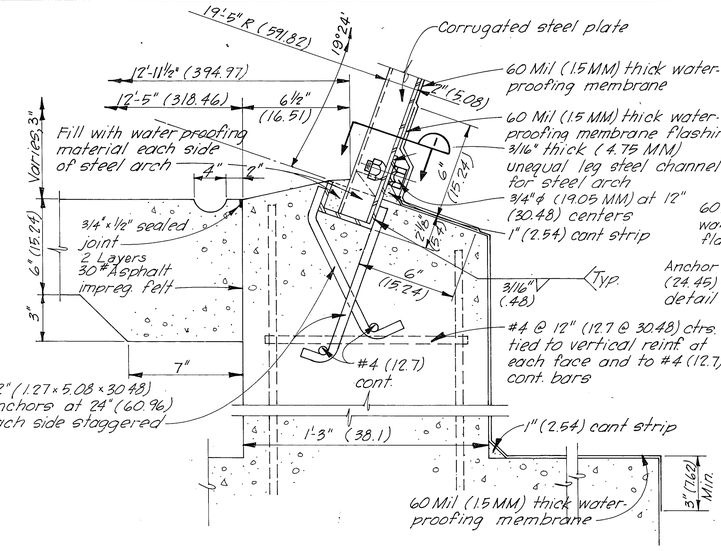
LOUVER DETAIL
SCALE: 3 INCHES = 1 FOOT
(1 = 4)



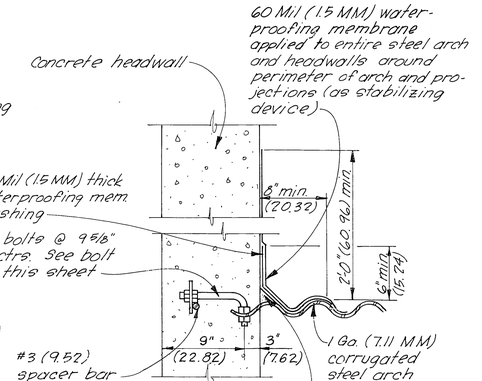
DETAIL E
S-2 | S-4
SCALE: 3 INCHES = 1 FOOT
(1 = 4)



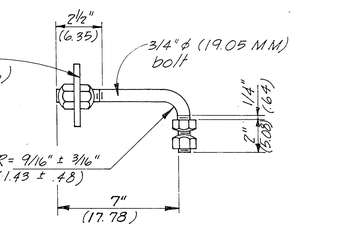
DETAIL F
S-2 | S-4
SCALE: 1½ INCHES = 1 FOOT
(1 = 8)



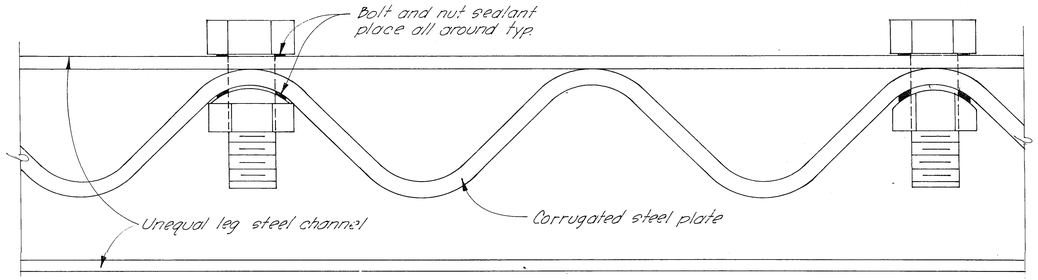
DETAIL A
S-1 | S-4
SCALE: 3 INCHES = 1 FOOT
(1 = 4)



DETAIL B
S-1,2,3 | S-4
SCALE: 1½ INCHES = 1 FOOT
(1 = 8)

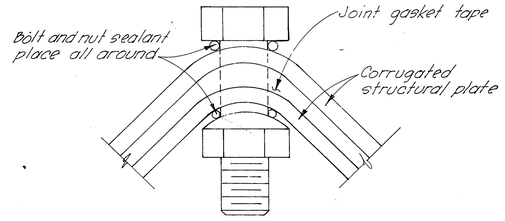


BOLT DETAIL
SCALE: 3 INCHES = 1 FOOT
(1 = 4)



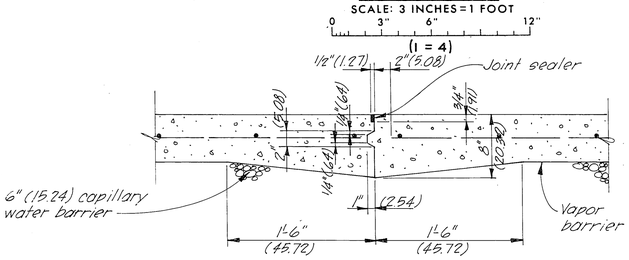
Typical both sides of steel arch

SECTION 1

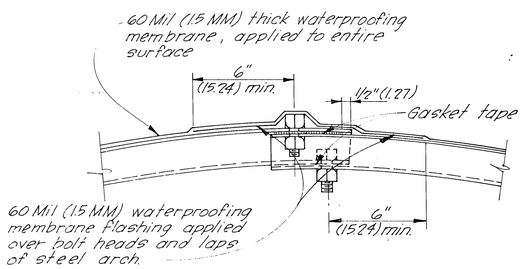


(Typical all connections)

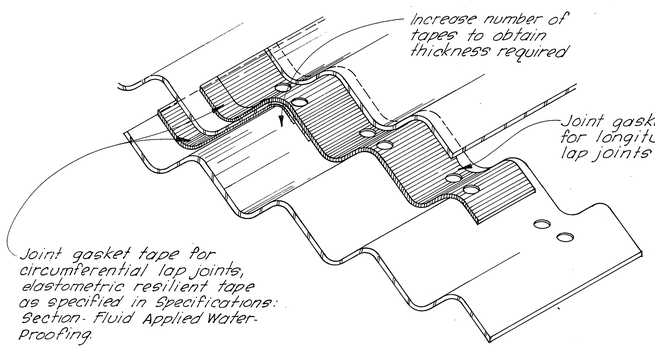
BOLT AND NUT SEALANT DETAIL FOR CRESTS
NO SCALE



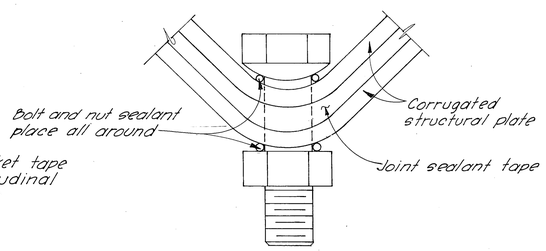
FLOOR CONSTRUCTION JOINT
NO SCALE



TYPICAL SPLICE DETAIL
NO SCALE



JOINT TAPE INSTALLATION DETAIL
NO SCALE



(Typical all connections)

BOLT AND NUT SEALANT DETAIL FOR VALLEYS
NO SCALE

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

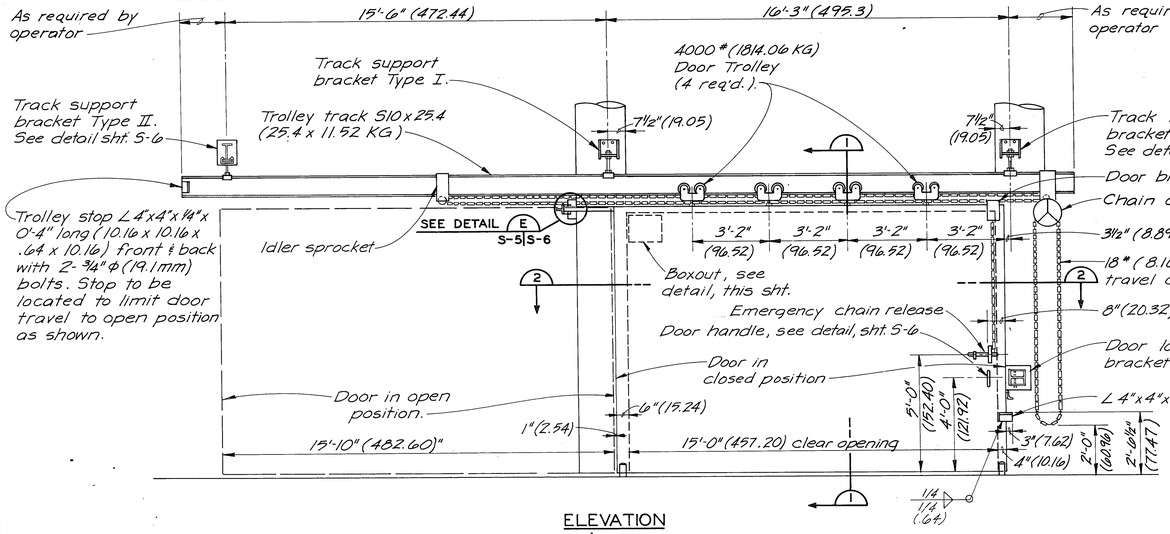
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: J.B.G. J.R.
DRAWN BY: D.K.P. - A.J.A.
CHECKED BY: B.N.H.
SUBMITTED BY:
CHIEF BL.DGS. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
COL. C. E., DISTRICT ENGINEER

MUNITION STORAGE IGLOOS
MAGAZINE, STEEL, OVAL-ARCH (25'-11" SPAN) EARTH COVERED
MISCELLANEOUS DETAILS

APPROVED: CHIEF ENGINEERING DIVISION
DATE: 347-78-48 (19) Addend
SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET S-4

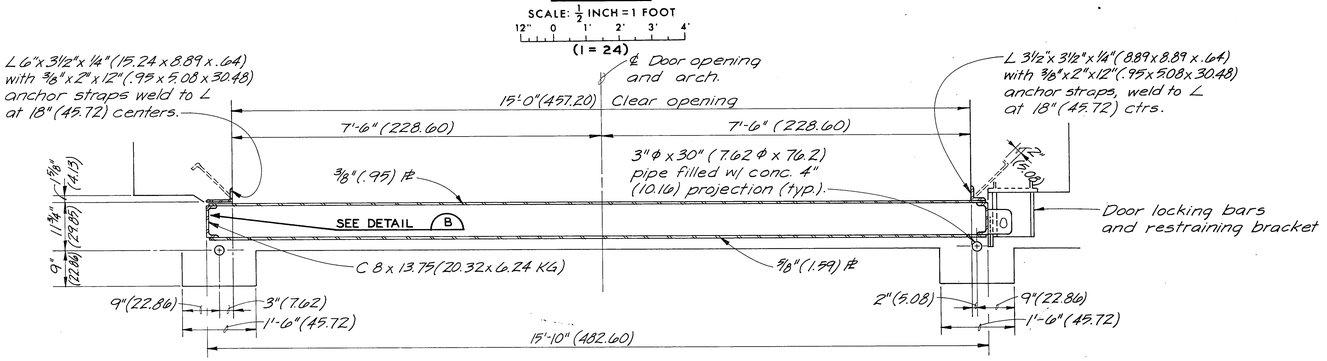
THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.



ELEVATION

SCALE: ½ INCH = 1 FOOT

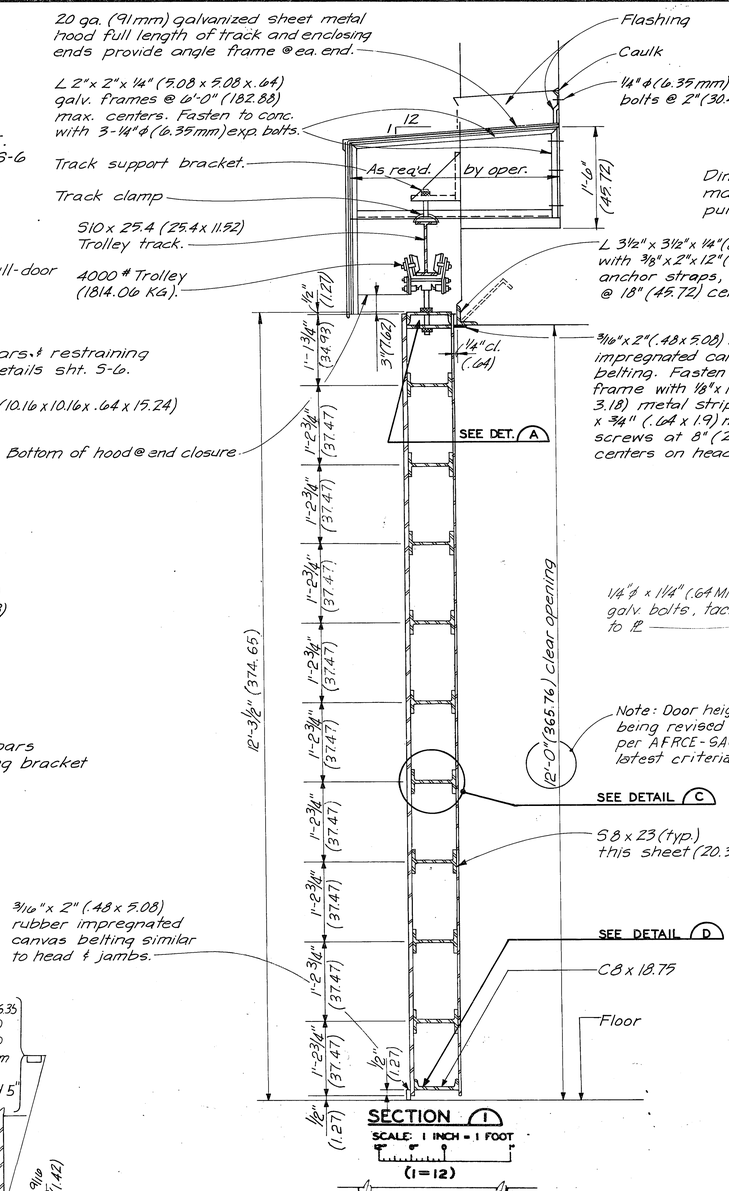
(1 = 24)



SECTION (2)

SCALE: 1 INCH = 1 FOOT

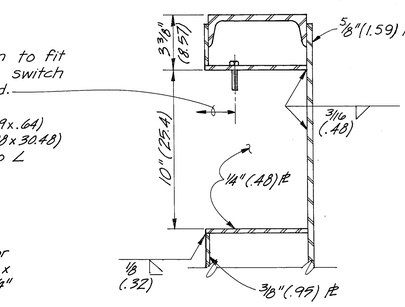
(1 = 12)



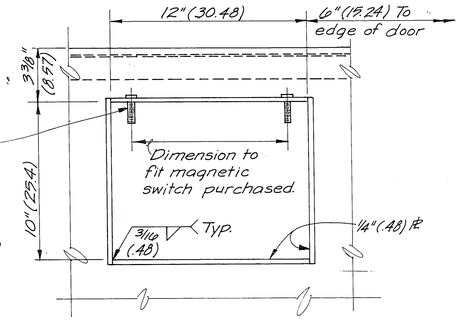
SECTION (1)

SCALE: 1 INCH = 1 FOOT

(1 = 12)



SECTION

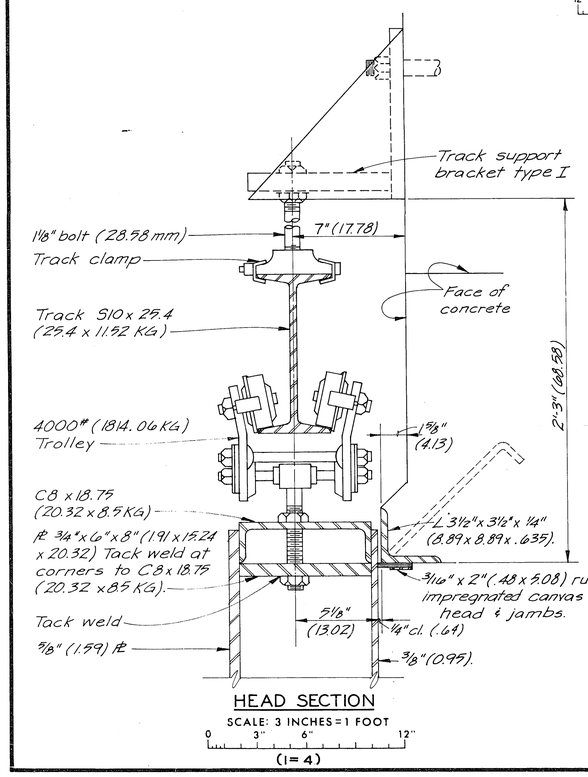


INSIDE ELEVATION

BOXOUT DETAILS

SCALE: 3 INCHES = 1 FOOT

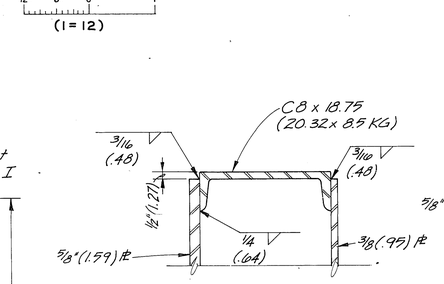
(1 = 4)



HEAD SECTION

SCALE: 3 INCHES = 1 FOOT

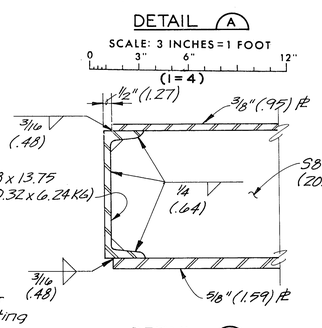
(1 = 4)



DETAIL A

SCALE: 3 INCHES = 1 FOOT

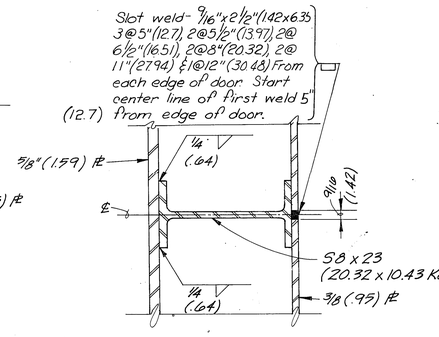
(1 = 4)



DETAIL B

SCALE: 3 INCHES = 1 FOOT

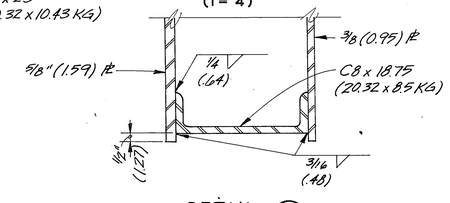
(1 = 4)



DETAIL C

SCALE: 3 INCHES = 1 FOOT

(1 = 4)

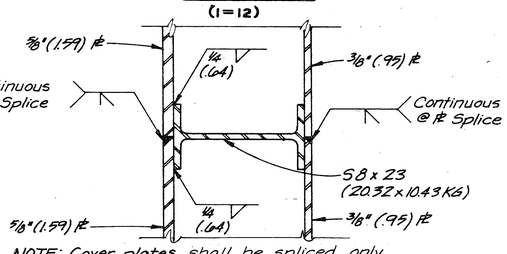


DETAIL D

SCALE: 3 INCHES = 1 FOOT

(1 = 4)

3/16" x 2" (.48 x 5.08) rubber impregnated canvas belting similar to head & jambs.



NOTE: Cover plates shall be spliced only as required by the size of plates available. Location of splice(s) shall be determined by the contractor and the splice shall conform to this detail.

COVER PLATE SPLICE DETAIL

SCALE: 3 INCHES = 1 FOOT

(1 = 4)

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: B.N.H.
DRAWN BY: J.L.R. A.J.A.
CHECKED BY: J.B.G.
SUBMITTED BY:
CHIEF BLDGS. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
COL. C. E., DISTRICT ENGINEER

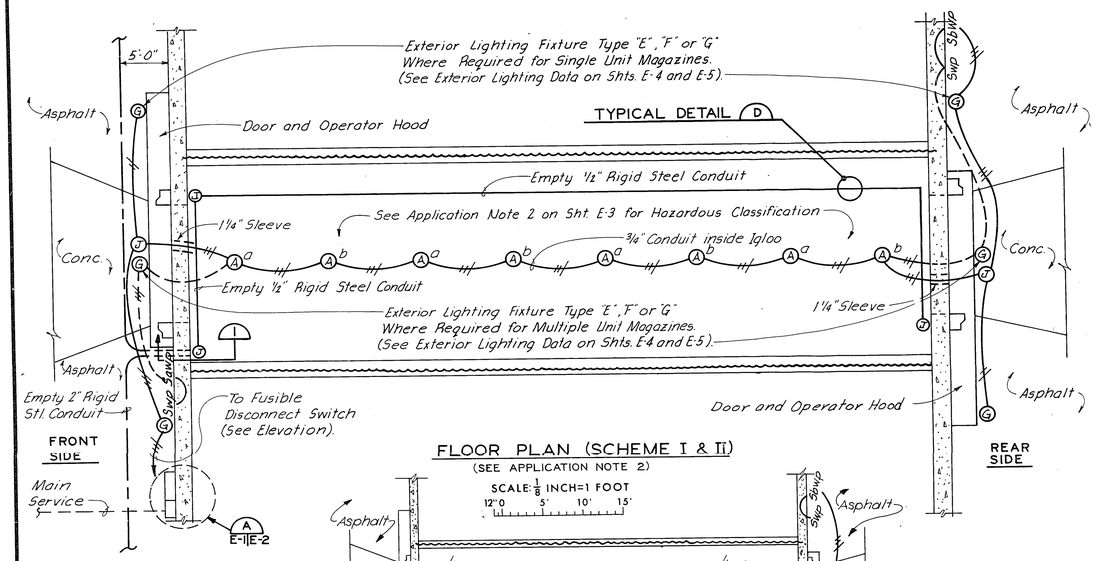
MUNITION STORAGE IGLOOS
MAGAZINE, STEEL, OVAL-ARCH (25'-11" SPAN) EARTH COVERED
PLAN AND SECTIONS

APPROVED: CHIEF ENGINEERING DIVISION
DATE: 3-27-78 - 48 (20)
SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET S-5

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

$$ — THINK VALUE ENGINEERING — $$

GPO 767-653

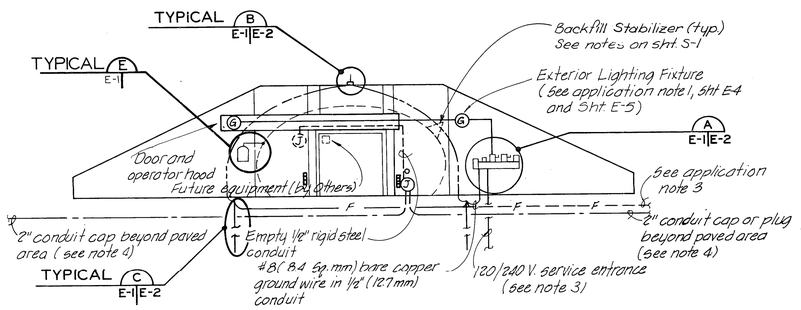


LEGEND:

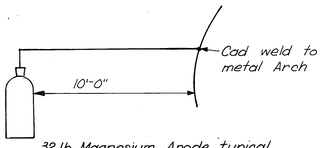
Ⓐ Ⓑ Ⓓ	200W ceiling mount incandescent luminaire suitable for use in Class I, Division I, Group C hazardous areas, in Class II, Division I, Group G hazardous areas, or in nonhazardous environments, respectively. See Sh. E 3
Ⓗ a Ⓘ b Ⓚ	100W ceiling mount high pressure sodium luminaire suitable for use in Class I, Division I, Group C hazardous areas, in Class II, Division I, Group G hazardous areas, or in nonhazardous environments, respectively. See Sh. E 3. Small letters denote switching arrangement.
Ⓔ Ⓕ Ⓖ	Surface mounted exterior luminaire - 70W high pressure sodium (HPS), 35 W low pressure sodium (LPS), or 250W quartz iodine respectively. See sheets E 4 and E 5
	Duplex convenience outlet, weatherproof with Ground Fault Protection
Ⓙ	Junction box, cast metal with threaded walls or hubs.
	Conduit run. Note: Any conduit run not otherwise indicated and contains two No. 12 AWG. (3.3 sq. mm) wires in a 1/2 in. (12.7mm) conduit. A greater number of wires are shown with cross lines as follows.
	The long cross line identifies the grounded (neutral) conductor and the short cross lines identify the phase conductors. Unless otherwise indicated, all conductors are No. 12 AWG. (3.3 sq. mm).
	Auxiliary empty rigid steel conduit run concealed in or installed 2'-0" below finished grade. Sized as indicated.
	Conduit terminated with a plugged coupling.
	Secondary surge arrestor (S. A.), 650 V, weatherproof housing.
	Lightning air terminal. Extend 2'-0" (61) above protected object.
	Ground rod.
—F—	Facility counterpoise system, No. 1/0 AWG. (53.5 sq. mm) bare copper wire.
2'-6" (76.2)	Unless otherwise indicated, the parenthetic metric dimensions shown are in centimeters and are minimum acceptable.
	6" x 6" x 4'-0" (min.) NEMA 3R wireway.
wp Sa	Weatherproof switch, 125 V, 20A, Letter "a" denotes switching arrangement.

NOTES:

1. The conduit system on the front of structure is to have supports spaced not more than 8'-0" (243.8). Supports on each side of construction joints shall not exceed 5'-0" (152).
2. Running thread coupling connections are not permitted for the rigid conduit systems. All boxes are to be cast type.
3. For the 120/240 volt, single phase, 3-wire service; install conduit 2'-0" (61) below finished grade and terminate with a plugged coupling not less than 5'-0" (152) beyond paved area. Service pole by others shall not be less than 50 ft. (15.2m) from the structure(s). Preferred arrangement is to install the main service disconnect means on a power or service pole located within 50 ft. (15.2m) of the structure(s) (or 100 ft. max.) However, if the electrical service and distribution will not be installed as a part of this project, the main disconnect shall be located on the exterior walls of the center structure(s). See details.
4. For future installation by others of a telephone type cable, install conduit with a pull wire, 2'-0" (61) below finished grade and terminate with a plugged coupling not less than 5'-0" (152) beyond paved area.
5. If pad mounted transformers are used, minimum size will be 15 KVA.
6. For door well heating cable, wattage capacity and number of loops shall be as required. The hot sections of the cable shall be extended the full length of the door.
7. Circuit breakers and panelboard shall have an interrupting capacity of 10,000 symmetrical amps min.
8. Thermostat control shall energize the door well heaters when the outside temperature is below 32°F and de-energize the Doorwell heaters when the outside temperature is above approximately 37°F. Thermostat enclosure shall be weatherproof.
9. All wire and conduit sizes assume use of copper conductors and 75°C rated insulation.
10. For exterior lighting details see sheets E 3 - E 5.
11. During the arch assembly, an extra length bolt shall be installed at each circumferential lap for the future installation of the special conduit system. See Detail D for typical method. Other holes in the steel arch will not be permitted.

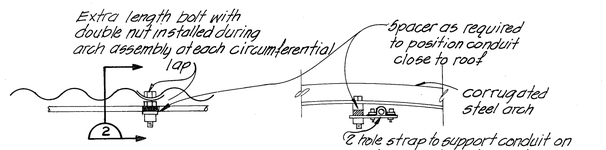


FRONT ELEVATION
SINGLE IGLOO ONLY
NO SCALE



32 lb. Magnesium Anode typical 10 places (4 spaced equal distances along each sides and 2 at the top between the backfill baffles)

DETAIL E
NO SCALE

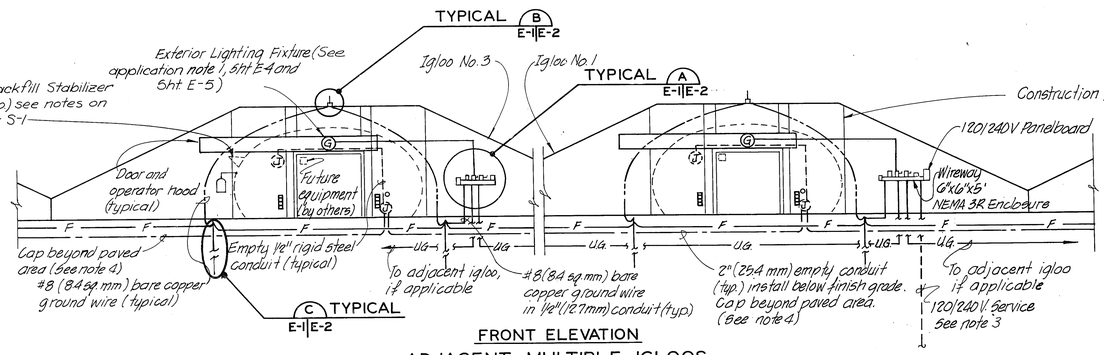


DETAIL D
NO SCALE

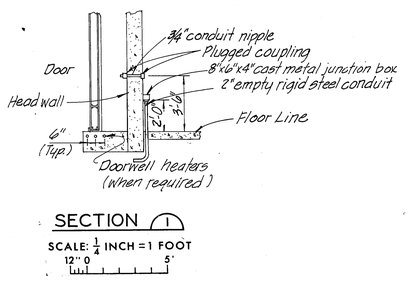
SECTION 2

APPLICATION NOTES:

1. Details, notes, plans, etc. on these sheets shall be deleted, crossed out, or modified as required to fit specific applications.
2. Selection of single or multiple igloo format should be carefully evaluated. Conduit should be provided under concrete paving if the installation of future igloos alongside would be probable.
3. For some applications having low soil conductivity, the counterpoise systems of individual scattered igloos may have to be interconnected.
4. Three different lighting arrangements are available: Scheme I - incandescent source for interior lighting, quartz iodine for exterior; Scheme II - incandescent interior, HPS or LPS exterior; Scheme III - HPS interior, HPS or LPS exterior. Because of energy considerations, Scheme III is preferred. If instant start operation or color discrimination is critical, Scheme I or II could be utilized. See sheets E 3 - E 5.
5. Conductor size of feeders is governed by voltage drop (3% max.) considerations rather than ampacity. No derating will be necessary in segment "a".
6. Columns in the feeder and service schedules contain ratings, sizes, loads pertaining to lighting schemes I, II, and III. The inapplicable figures should be deleted in accordance with the scheme selected.
7. For some applications, only 2 or 3 igloos may be involved; however, since additional structures may be added later, the conduit sizes in the Feeder Schedule should not be reduced without specific approval.
8. Equipment within the structure must be suitable for the specific hazardous classification. See Application Note 2 on Sh. E 3.
9. Sizing of feeders for the multi-igloo arrangement is valid for a spacing of 100 ft. max., center to center. Sizes should be adjusted as required if the facewall width or spacing exceeds this.



FRONT ELEVATION
ADJACENT MULTIPLE IGLOOS
NO SCALE



SECTION 1
SCALE: 1/4 INCH = 1 FOOT
12" 0 5'

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

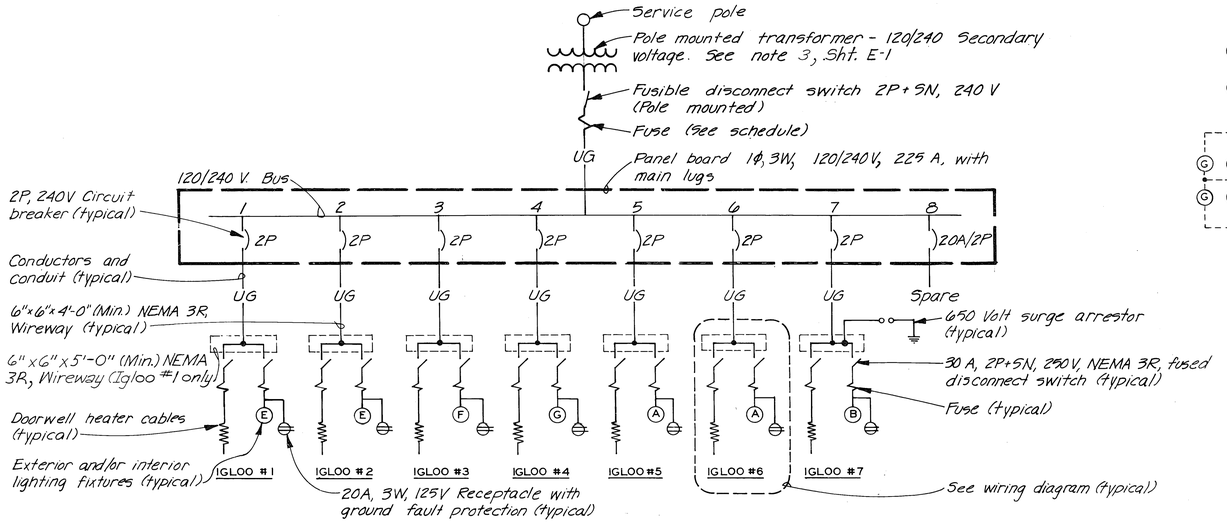
DESIGNED BY: J.E.S. / D.L.V.
DRAWN BY: T.S.A.
CHECKED BY:
SUBMITTED BY:
CHIEF ELEC. FAC. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
COL. C. E., DISTRICT ENGINEER

MUNITION STORAGE IGLOOS
MAGAZINE STEEL OVAL-ARCH EARTH COVERED
ELECTRICAL PLAN & DETAILS
SHEET NO. 1

APPROVED: CHIEF ENGINEERING DIVISION
DATE: 3-17-78-48 (21)
SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 35-15-02
SHEET E-1

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

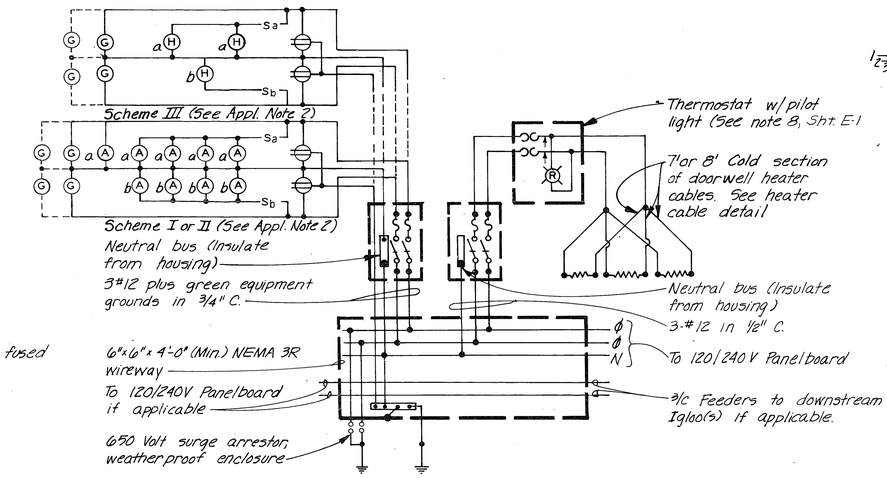
GPO 767-653



ONE LINE DIAGRAM

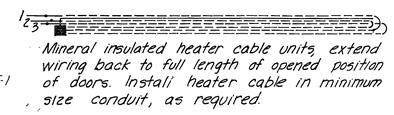
120/240 VOLT MULTIPLE IGLOO SERVICE

Note: See service schedules for size of material and equipment not shown.



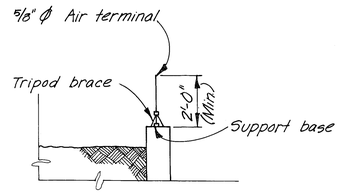
WIRING DIAGRAM

NO SCALE



Mineral insulated heater cable units, extend wiring back to full length of opened position of doors. Install heater cable in minimum size conduit, as required.

DOORWELL HEATER DETAIL



AIR TERMINAL DETAILS

SCALE: 3/8 INCH = 1 FOOT

12" 0 2' 4' 6'

MAIN SERVICE SCHEDULE

(See Application Notes 4,6 & 9 Sh. E-1)

Transformer Size (KVA) (A, B) / (C)	Number of Igloos	Load (KW) (I)°/(II)°/(III)°	Fusible Disconnect Switch Size	Fusible Disconnect Fuse Size (Amps)	Conductor Size (AWG)	Conduit Size (Inch)
5	1	4. 8/4. 5/3. 3**	30/30/30	30/30/20	#8/ #8/ #8	1/ 1/ 1
10	2	9. 6/9. 0/6. 6	60/60/60	60/60/40	#6/ #6/ #6	1/ 1/ 1
15	3	14. 4/13. 5/9.9	100/100/60	100/80/60	#3/ #3/ #4	1½/1½/1
25	4	19. 2/18. 0/13. 2	200/200/100	125/110/80	#1/ #2/ #3	1½/1½/1½
25/25/25	5	24. 0/22. 5/16. 5	200/200/100	150/150/100	#1/0/#1/0/#2	1½/1½/1½
37½/30/25	6	28. 8/27. 0/19. 8	200/200/200	175/175/125	#2/0/#2/0/#1	1½/1½/1½
37½/37½/30	7	33. 6/31. 5/23. 1	200/200/200	200/200/150	#4/0/#3/0/#1/0	2/ 2/ 1½

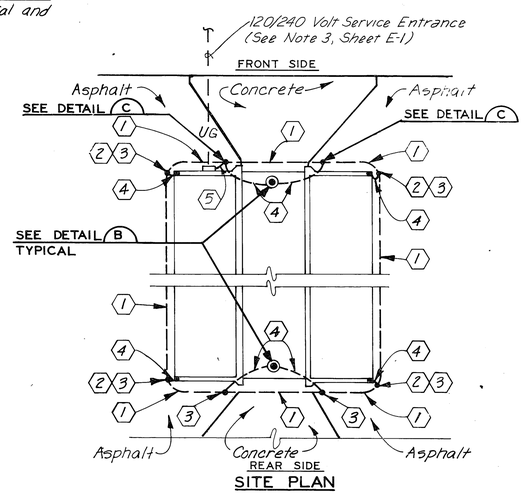
*See Application Note 6 **If structure is single igloo format rather than multiple these figures would be 5. 3/4. 7/3. 5

FEEDER SCHEDULE

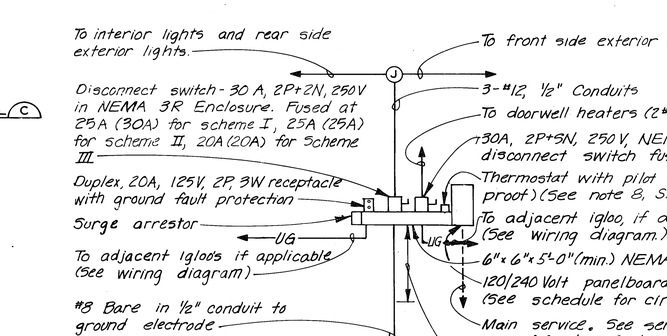
(See Application Notes 4,5,6,7 & 9 on Sh. E-1)

To Igloo (Number)	Approx. Distance (Feet)	Load (KW) (I)°/(II)°/(III)°	Circuit Breaker Rating (Amps)	Conductor Size (AWG)	Conduit Size (Inches) Segment °° a	b	c
2(R)	98	4. 8/4. 5/3. 3	30 / 30 / 30	#8/#8/#8	2	---	---
3(L)	98	↑ ↑ ↑	↑ ↑ ↑	#8/#8/#8	2	---	---
4(R)	196			#6/#6/#8	---	1½	---
5(L)	196			#6/#6/#8	---	1½	---
6(R)	294	↓ ↓ ↓	↓ ↓ ↓	#4/#4/#6	---	---	1½
7(L)	294	4. 8/4. 5/3. 3	30 / 30 / 30	#4/#4/#6	---	---	1½

*See Application Note 6 **See Application Note 7



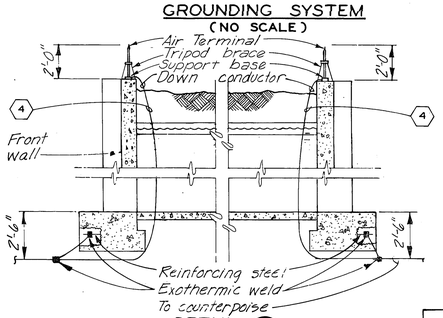
SITE PLAN



EQUIPMENT ARRANGEMENT 120/240V SERVICE

GROUNDING SYSTEM

(NO SCALE)

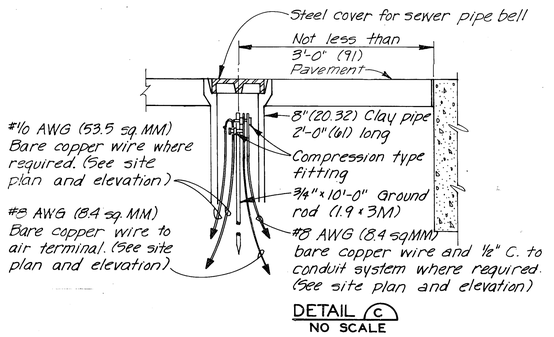


DETAIL B

NO SCALE

DETAIL A

NO SCALE



DETAIL C

NO SCALE

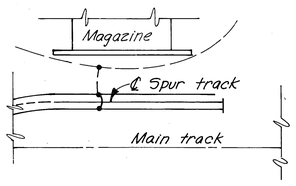
GROUNDING NOTES

1. #1/0 Bare stranded copper conductor, 3'-0" to 8'-0" from foundation, 2'-6" below finished grade.
2. 3/4" x 10'-0" Copper clad ground rod.
3. Connection of thermo or thermo chemical type.
4. #8 Bare stranded copper conductor.
5. #8 Bare stranded copper conductor and 1/2" conduit.

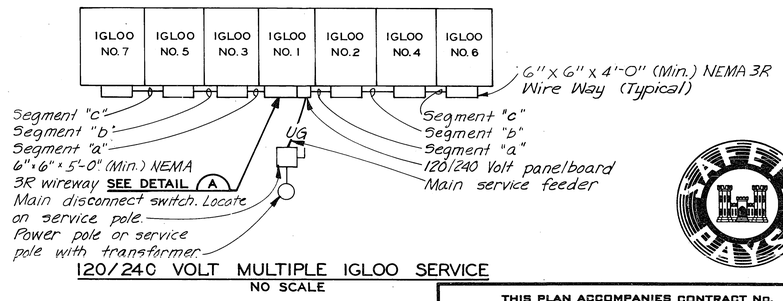
APPROX. DEMAND - LOAD PER UNIT				
Lighting (Watts) Exterior *	Lighting (Watts) Interior	Receptacles (Watts)	Door Heater Cable (Watts)	Approx. Total (KW)
Scheme I - Quartz iodine / Incandescent				
500 (1000)	1600	200	2500±	4. 8 (5. 3)
Scheme II - HPS/ Incandescent				
190 (380)	1600	200	2500±	4. 5 (4. 7)
Scheme III - HPS/ HPS				
190 (380)	390	200	2500±	3. 3 (3. 5)

*Table is for multiple type Igloos; figures in parenthesis are for single Igloos.

When spur or main track is 25'-0" or less from the counter-poise, a connection shall be made between the track rails and the counter-poise using a #1/0 bare copper conductor.



RAILROAD GROUNDING DETAIL



120/240 VOLT MULTIPLE IGLOO SERVICE

NO SCALE

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

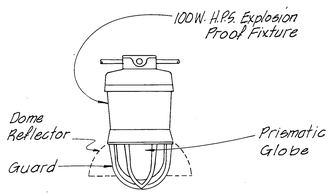
U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: J.E.S./D.L.V.
DRAWN BY: S.A.M.-A.J.A.
CHECKED BY: B.N.H.
SUBMITTED BY:
CHIEF ELEC FAC. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
CHIEF ENGINEERING DIVISION
DATE: 3 Dec 78
APPROVED:
COL. C. E., DISTRICT ENGINEER

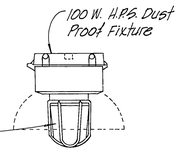
MUNITION STORAGE IGLOOS
MAGAZINE, STEEL OVAL-ARCH (25'-11" SPAN) EARTH COVERED
ELEC. PLANS & DETAILS - SHT. NO. 2

SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET E-2

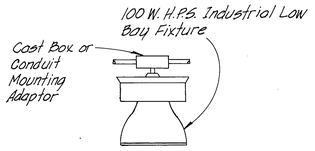
THIS PLAN ACCOMPANIES CONTRACT NO. DACA45 MODIFICATION NO.



LUMINAIRE "H"
Class I, Div. I,
Group C Areas



LUMINAIRE "I"
Class II, Div. I,
Group G Areas



LUMINAIRE "K"
Nonhazardous
Applications

CANDLEPOWER TABLE
LUMINAIRE "H"
100 W HPS

C of E Format →		Horizontal Angles 270	(180) 0	90
Vertical Angles ↓	IES Format	180	(270) 90	0
0	90	25	25	25
5	85	100	←→	100
10	80	200	←→	200
15	75	330	←→	330
20	70	550	←→	550
25	65	880	←→	880
30	60	1200	←→	1200
35	55	1485	←→	1485
40	50	1605	←→	1605
45	45	1730	←→	1730
50	40	1870	←→	1870
55	35	1980	←→	1980
60	30	2120	←→	2120
65	25	2280	←→	2280
70	20	2330	←→	2330
75	15	2390	←→	2390
80	10	2365	←→	2365
85	5	2340	←→	2340
90	0	2375	2375	2375

Avg. Candlepower = 1481.8 Candela

CANDLEPOWER TABLE
LUMINAIRE "I"
100W HPS

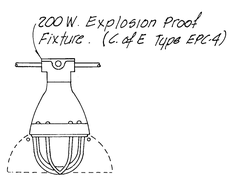
C of E Format →		Horizontal Angles 270	(180) 0	90
Vertical Angles ↓	IES Format	180	(270) 90	0
0	90	275	275	275
5	85	385	←→	385
10	80	440	←→	440
15	75	770	←→	770
20	70	1100	←→	1100
25	65	1285	←→	1285
30	60	1385	←→	1385
35	55	1495	←→	1495
40	50	1620	←→	1620
45	45	1740	←→	1740
50	40	1880	←→	1880
55	35	1950	←→	1950
60	30	1935	←→	1935
65	25	1850	←→	1850
70	20	1750	←→	1750
75	15	1650	←→	1650
80	10	1565	←→	1565
85	5	1512	←→	1512
90	0	1540	1540	1540

Avg. Candlepower = 1375.7 Candela

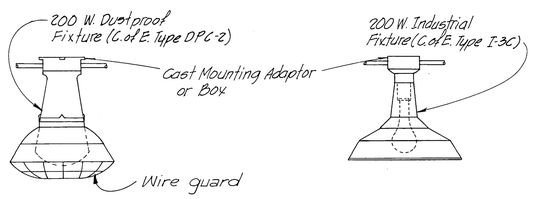
CANDLEPOWER TABLE
LUMINAIRE "K"
100W HPS

C of E Format →		Horizontal Angles 270	(180) 0	90
Vertical Angles ↓	IES Format	180	(270) 90	0
0	90	5	5	5
5	85	35	←→	35
10	80	65	←→	65
15	75	100	←→	100
20	70	155	←→	155
25	65	260	←→	260
30	60	700	←→	700
35	55	1455	←→	1455
40	50	2080	←→	2080
45	45	2305	←→	2305
50	40	2320	←→	2320
55	35	2190	←→	2190
60	30	2090	←→	2090
65	25	1980	←→	1980
70	20	1855	←→	1855
75	15	1735	←→	1735
80	10	1640	←→	1640
85	5	1745	←→	1745
90	0	1880	1880	1880

Avg. Candlepower = 1294.5 Candela



LUMINAIRE "A"
Class I, Div. I
Group C Areas



LUMINAIRE "B"
Class II, Div. I,
Group C Areas

LUMINAIRE "D"
Nonhazardous
Applications

CANDLEPOWER TABLE
LUMINAIRE "A"
200W INCANDESCENT

C of E Format →		Horizontal Angles 270	(180) 0	90
Vertical Angles ↓	IES Format	180	(270) 90	0
0	90	0	0	0
5	85	120	←→	120
10	80	160	←→	160
15	75	320	←→	320
20	70	360	←→	360
25	65	400	←→	400
30	60	440	←→	440
35	55	480	←→	480
40	50	530	←→	530
45	45	570	←→	570
50	40	630	←→	630
55	35	670	←→	670
60	30	750	←→	750
65	25	780	←→	780
70	20	750	←→	750
75	15	720	←→	720
80	10	740	←→	740
85	5	750	←→	750
90	0	770	770	770

Avg. Candlepower = 523.2 Candela

CANDLEPOWER TABLE
LUMINAIRE "B"
200W INCANDESCENT

C of E Format →		Horizontal Angles 270	(180) 0	90
Vertical Angles ↓	IES Format	180	(270) 90	0
0	90	0	0	0
5	85	20	←→	20
10	80	120	←→	120
15	75	240	←→	240
20	70	390	←→	390
25	65	360	←→	360
30	60	360	←→	360
35	55	450	←→	450
40	50	510	←→	510
45	45	630	←→	630
50	40	750	←→	750
55	35	870	←→	870
60	30	720	←→	720
65	25	740	←→	740
70	20	800	←→	800
75	15	890	←→	890
80	10	910	←→	910
85	5	930	←→	930
90	0	1020	1020	1020

Avg. Candlepower = 563.7 Candela

CANDLEPOWER TABLE
LUMINAIRE "D"
200W INCANDESCENT

C of E Format →		Horizontal Angles 270	(180) 0	90
Vertical Angles ↓	IES Format	180	(270) 90	0
0	90	0	0	0
5	85	10	←→	10
10	80	65	←→	65
15	75	165	←→	165
20	70	395	←→	395
25	65	535	←→	535
30	60	620	←→	620
35	55	700	←→	700
40	50	750	←→	750
45	45	820	←→	820
50	40	875	←→	875
55	35	945	←→	945
60	30	975	←→	975
65	25	995	←→	995
70	20	1020	←→	1020
75	15	1040	←→	1040
80	10	1085	←→	1085
85	5	1105	←→	1105
90	0	1110	1110	1110

Avg. Candlepower = 695.3 Candela

HIGH PRESSURE SODIUM (HPS) LUMINAIRE:

The fixture shall be an explosion proof type rated for use in Class I, Division I Group C hazardous areas, a dustproof type rated for use in Class II, Division I, Group G hazardous areas, or an industrial type low bay unit suitable for nonhazardous areas as indicated. Each unit shall have the following features:

The housing and all exposed parts and hardware shall be formed from non-corroding materials or shall have corrosion-resistant finishes.

The assembly or separate adapters or boxes, must be suitable for mounting to a conduit system supported from a steel arch ceiling. The wiring entrance shall accommodate 3/4 in. threaded conduit.

A heat and shock resistant glass diffuser (globe, lens, refractor) is to be furnished. It must have a prismatic surface to provide controlled light distribution and minimal glare. A prismatic polycarbonate diffuser will be acceptable for the industrial type of luminaire.

The reflector for explosionproof or dustproof fixtures must be dome type of either porcelain enameled steel or reinforced fiberglass construction. For the industrial type luminaire an arrangement consisting of either a polished or anodized aluminum reflector or a prismatic glass/metal reflector combination will be acceptable without a diffuser.

Cast metal guards are to be included on explosionproof units, wire guards are acceptable on dustproof units.

The lampholder, ballast, and wiring shall be suitable for operation at the ambient temperates applicable for the particular hazardous classification (for the industrial fixture - normal lamp operating temperature plus 104° F (40° C) externally.) The socket should be shock absorbing type (luminaire "H" and "I").

The ballast is to be a high power factor type (over 90%) rated for operation at - 20° F (- 29° C) or lower and under a ± 10% line variation with the resultant change in lumen output (lamp wattage) not to exceed + 12%.

A 100 watt lamp shall be furnished with each unit (LUI00/BD, LUI00/BU, LUH00, or C100 as applicable).

The unit should provide photometric performance characteristic of IES Type V distribution as indicated in the candlepower table when the unit is operated at rated voltage of 120V nominal.

INCANDESCENT LUMINAIRE:

The fixture shall be an explosionproof type rated for use in Class I, Division I, Group C hazardous areas, a dustproof type rated for use in Class II, Division I, Group G hazardous areas, or an industrial type, low bay unit suitable for nonhazardous areas as indicated. Each unit shall have features as specified on Corps of Engineers drawing series 40-06-04, sheet 8B, 8A, or 3 respectively.

A 200 watt lamp shall be furnished with each unit.

APPLICATION NOTES:

1. Data and details on this sheet should be deleted, crossed out, or modified as required for a specific application.
2. Unless the criteria furnished for design of a particular facility has stipulated a Class II environment, the data pertaining to Class I luminaires shall be utilized. The nonhazardous fixture shall not be used unless written authorization has been furnished by the responsible officials.
3. The arrangement shown will provide an average illumination level, horizontally measured of approximately 5 footcandle (54 lux) on a 3 ft. work plane. If somewhat higher levels are required, a 300 W. incandescent (PS30, 6110 lumens) or a 150 W. HPS (16000 lumens) unit could be used. Illumination and candlepower would be raised by a factor of 1.52 or 1.68 respectively (lumens new unit/lumens original unit). Wiring and conduit sizes would also have to be adjusted.

NOTES:

1. Catalog literature and photometric data for proposed luminaires shall be furnished to the Contracting Officer for review (see specs). Photometric data should identify the candlepower distribution pattern characteristic of the luminaire in either a tabular format as shown or a curve/graph format. To be considered equivalent photometrically, the average value of candlepower of the proposed luminaire must be 90% or more of the average noted under the candlepower table shown on this sheet.
2. The values listed in the candlepower table are for fixtures without guards. Cast guards will reduce the candlepower (and thus illumination) approximately 7-1/2% on the average for luminaire "A", "H", or "I". The wire guard would cause a reduction of 1% approximately.
3. Spare lamps in an amount equivalent to not less than 5% of the total number of luminaires installed in the project shall be delivered to the Contracting Officer.

LUMINAIRE PARAMETERS

Luminaire	A	B	D	H	I	K
Lamp Type	200W/A25	200W/PS30	200W/A25	LUI00	LUI00	LUI00
Rated Life (Hours)	750	750	750	12000	12000	12000
Initial Lumens	4010	3710	4010	9500	9500	9500
Input Watts	210	200	200	130	130	130
Maint. Factor	0.70	0.70	0.65	0.70	0.70	0.65
Coeff. of Util.	0.53	0.57	0.59	0.61	0.60	0.66°
Corps of Engrs. Dwg. Series 40-06-04	Sh. 8 B	Sh. 8 A	Sh. 3	---	---	---

°0.66 for reflector units; 0.48 refractor types; 0.62 combination reflector-refractor types

METRIC EQUIVALENTS

CABLE			CONDUIT		
U.S. (AWG) (kcm)	Exact. Equiv. (mm^2)	Ampacity Equiv. (mm^2) + ‡	U.S. (inch)	Exact Equiv. (mm)	Standard Size (mm)
12	3.3	2.5	---	---	11
10	5.3	4	1/2	12.7	13.5
8	8.4	10	---	---	16
6	13.3	16	3/4	19.1	21
4	21.1	25	1	25.4	29
3	26.6	25 35	1-1/4	31.8	36
2	33.6	25* 35	1-1/2	38.1	42
1	42.4	35 50	2	50.8	48
1/0	53.5	50 50*	3	76.2	
2/0	67.4	50* 70			
3/0	85.0	70* 95			
4/0	107	95 95*			
250	127	95* 120			
300	152	120 150			
350	173	120* 150*			
500	253	150* 240			
600	304	185* 240*			

Conversions:
1 inch = 25.4 mm
1 kcm = 0.5067 mm^2
1 foot = 0.3048 m
1 f.c. = 10.76 lux

\+ Standard metric sizes equiv. to 60° c. U. S. Cable
‡ Standard metric sizes equiv. to 75° c. U. S. Cable
* Ampacity is within 10% of U. S. value
(Based on 1978 NEC and 1974 German code)

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

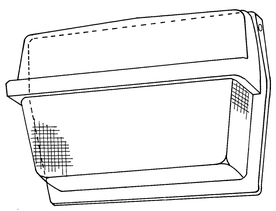
DESIGNED BY: D. L. V.
DRAWN BY: T. S. A.
CHECKED BY:
SUBMITTED BY:
CHIEF ELEC. FAC. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
CHIEF ENGINEERING DIVISION
DATE: 347-78-48(52)
APPROVED:
COL. C. E., DISTRICT ENGINEER

MUNITION STORAGE IGLOOS
MAGAZINE STEEL OVAL-ARCH (25'-11" SPAN) EARTH COVERED
INTERIOR LIGHTING & MISC.

SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET E-3

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

GPO 767-653



STYLE I
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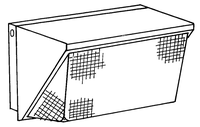

STYLE II
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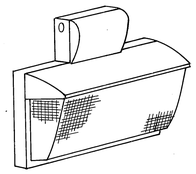


STYLE III
EPA=1.5±

CANDLEPOWER TABLE - LUMINAIRE "E"
70 WATT HIGH PRESSURE SODIUM

		Horizontal Angles																			
Vertical Angles	Corps Format →	(265) 275	(255) 285	(245) 295	(235) 305	(225) 315	(215) 325	(205) 335	(195) 345	(185) 355	(175) 5	(165) 15	(155) 25	(145) 35	(135) 45	(125) 55	(115) 65	(105) 75	(95) 85	90
	IES Format ↓	(185) 175	(195) 165	(205) 155	(215) 145	(225) 135	(235) 125	(245) 115	(255) 105	(265) 95	(275) 85	(285) 75	(295) 65	(305) 55	(315) 45	(325) 35	(335) 25	(345) 15	(355) 5	(360) 0
0	90	3	3	11	23	38	56	93	113	131	149	263	359	549	711	843	812	677	579	591
5	85	3	3	12	26	44	68	113	135	195	282	455	683	1023	1395	1512	1418	1188	1043	1070
15	75	6	6	17	30	50	75	107	147	213	569	798	930	1202	1341	1463	1389	1194	1067	1038
25	65	21	23	30	44	65	95	134	192	278	498	567	878	1133	1278	1415	1230	1053	999	978
35	55	39	41	53	71	105	153	219	294	432	509	621	674	906	1274	1239	1134	966	909	888
45	45	69	77	96	126	183	251	330	413	542	618	573	525	656	914	927	785	761	720	708
55	35	129	146	180	231	297	368	458	569	638	645	597	548	528	591	659	696	711	723	717
65	25	240	255	302	354	425	498	575	609	650	657	639	605	567	537	534	555	569	569	569
75	15	387	395	422	453	498	534	572	605	630	644	647	644	623	594	576	558	554	549	551
85	5	510	506	513	518	528	540	546	561	567	575	579	584	584	585	587	591	594	594	594
90	0	557	554	557	554	557	555	557	557	558	560	560	560	560	560	558	560	560	561	561

Average Candlepower = 525.7 Candela

CANDLEPOWER TABLE LUMINAIRE "F"
35 WATT LOW PRESSURE SODIUM

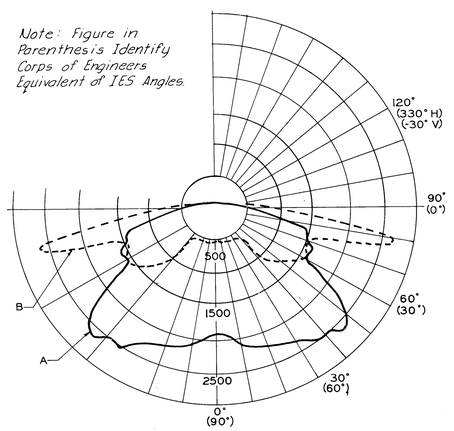
		Horizontal Angles																			
Vertical Angles	Corps Format →	(265) 275	(255) 285	(245) 295	(235) 305	(225) 315	(215) 325	(205) 335	(195) 345	(185) 355	(175) 5	(165) 15	(155) 25	(145) 35	(135) 45	(125) 55	(115) 65	(105) 75	(95) 85	90
	IES Format ↓	(185) 175	(195) 165	(205) 155	(215) 145	(225) 135	(235) 125	(245) 115	(255) 105	(265) 95	(275) 85	(285) 75	(295) 65	(305) 55	(315) 45	(325) 35	(335) 25	(345) 15	(355) 5	(360) 0
5	85	0	0	0	4	16	34	71	83	56	97	217	286	303	300	290	313	365	404	412
15	75	0	0	2	9	18	35	72	119	123	185	343	443	459	413	435	532	664	715	722
25	65	13	14	16	21	29	51	103	147	150	238	375	501	565	619	707	811	899	923	934
35	55	25	27	28	37	53	94	133	168	184	282	397	504	615	765	859	933	994	1014	1026
45	45	44	44	52	79	118	158	182	203	222	313	425	535	644	763	874	961	1010	1032	1043
55	35	128	144	174	208	236	265	281	286	301	374	483	598	694	785	870	941	990	1020	1024
65	25	344	342	344	352	354	360	351	351	379	446	527	635	723	800	859	896	928	948	954
75	15	400	395	391	390	388	384	380	400	437	478	521	573	625	680	724	747	774	788	790
85	5	410	411	413	417	425	436	450	465	476	490	504	523	537	547	553	557	562	564	562
90	0	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481

Average Candlepower = 431.0 Candela

LUMINAIRE "G" CANDLEPOWER DISTRIBUTION
250 WATT QUARTZ IODINE

A = Lateral Distribution in 77° (13°) Vertical Cone
B = Vertical Distribution in Vertical Plane @ 45° (45°) Horizontal

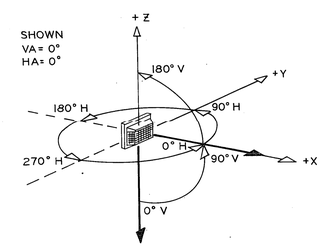
Note: Figure in Parenthesis Identify Corps of Engineers Equivalent of IES Angles.



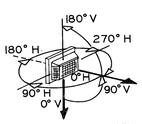
Average Candlepower = 1080.2 Candela

Values shown above pertain to right hemisphere. The left half of the luminaire is symmetrical.

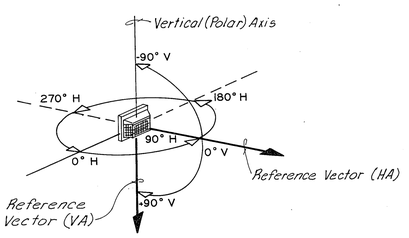
A. Lateral Distrib. Horiz. Angles Corps of Eng.	A. Lateral Distrib. Horiz. Angles IES Format	A. Lateral Distrib. Candle Power Values	B. Vertical Distrib. Vert. Angles Corps of Eng.	B. Vertical Distrib. Vert. Angles IES Format	B. Vertical Distrib. Candle Power
90	0	1900	-15	95	220
85	5	1945	-5	105	310
75	15	2190			
65	25	2255	0	90	440
55	35	2550	5	85	770
			10	80	2020
50	40	2500			
45	45	2715	13	77	2715
40	50	2460	15	75	2450
35	55	1965	20	70	1500
30	60	1550	25	65	1475
			30	60	1550
25	65	1610	35	55	1425
20	70	1435	40	50	1325
15	75	1435	45	45	1150
10	80	920			
5	85	720	50	40	770
			55	35	580
0	90	425	60	30	565
355	95	315	65	25	560
345	105	160	70	20	560
335	115	110			
325	125	80	75	15	535
			80	10	540
315	135	50	85	5	540
305	145	30	90	0	480
295	155	20			
285	165	10			
275	175	10			
270	180	10			



REFERENCE AXES FOR AIMING ANGLES
NO SCALE



IES FORMAT



CORPS OF ENGINEERS FORMAT
REFERENCE AXES FOR CANDLEPOWER DATA
NO SCALE

WALL MOUNT LUMINAIRE:

The unit shall be a heavy duty weatherproof type constructed of die cast aluminum. Style I, II, or III may be furnished at the Contractors option. Each unit shall have the following features:

The housing and all exposed parts and hardware shall be formed from non-corroding materials or shall have corrosion-resistant finishes.

The assembly must have provisions for mounting on a concrete or sheet steel surface. The back portion of the housing shall be tapped to accommodate threaded conduit of 3/4 in. min.

Access for relamping or for gasket or ballast replacement is to be by means of a hinged door or cover. If bottom hinged, a metal safety strap, cable, or retaining chain must be included.

A tempered heat and impact resistant borosilicate glass diffuser is to be furnished. It must have a prismatic surface to provide controlled light distribution and minimal glare. A vandal resistant, prismatic polycarbonate (Lexan or equal) diffuser may be substituted at the Contractor's option.

The reflector must be formed from an aluminum sheet, either Alzak or anodized to an asymmetric contour.

The lampholder, ballast, and wiring shall be suitable for operation at high ambient temperatures (normal lamp operating temperature internally plus 110°F (43°C) ambient externally).

The ballast is to be a high power factor type (over 90%) rated for operation at -20°F (-29°C) or lower and under a ± 10% line voltage variation with minimal change (± 4% max.) in lumen output. A regulator or reactor ballast should be furnished for high pressure sodium luminaires; a reactance type ballast will be acceptable for low pressure sodium units.

The appropriate lamp shall be furnished with each unit - 250Q/CL for the quartz iodine luminaires, LU70 for the H. P. S., and S0X35 for the LPS units.

The unit should have photometric characteristics as indicated in the applicable candlepower table with an illumination pattern similar to that shown by the isofootcandle curves (see Note 2) when operated at rated voltage of 120V nominal.

NOTES:

1. Catalog literature and photometric data shall be submitted to the Contracting Officer on proposed luminaires (including "test luminaires"). The preferred format for photometric data is the candlepower table. The luminaire must have been tested in accordance with IES procedures and with readings taken at no more than 45° intervals (10° preferred). The data should identify the lamp number lumen rating, test date, and test format (horizontal polar axis or vertical polar axis). If the candlepower test data lists values only for one horizontal and one vertical position (one plane and one cone), additional photometric data in the form of illumination curves (isofootcandle charts) or illumination grids (footcandle printouts) is to be included. If illumination data represents maintained levels rather than initial, the appropriate parameters such as lamp lumen depreciation, dirt factor, group relamping interval, etc. (see "Design Luminaire" data) should be noted.
2. It was necessary to utilize a specific manufacturer's fixture in making calculations and estabiishing reference illumination grids and charts. Any other unit which conforms to the specifications listed and has similar photometric characteristics will be acceptable. To be considered equivalent, the average value of candlepower must be within 10% of the average listed on this sheet for the corresponding luminaire or the average illumination should be 90% or more of the average shown on the illumination charts on sheet E 5.
3. The illumination charts shown on Sh. E 5 portray the distribution patterns applicable to the specific luminaires listed in the "Design Luminaire" data. The solid curves identify the illumination levels that will be projected 6 inches above ground from a single luminaire mounted 15 feet above reference grade, considered on a horizontal measurement basis. The values above the curves denote the illumination levels existing when the unit is initially installed; the figures in parenthesis below the curves are the corresponding values of maintained illumination (see "Design Luminaire" data). The dashed lines represent resultant conditions when the mounting height is lowered to 13 feet (illumination values are identical for corresponding dashed and solid curves).
4. The illumination grid on Sh. E 5 was calculated using the two-luminaire arrangement illustrated on that sheet. Figures at grid points represent maintained values of horizontal illumination. The figures shown above curves are initial values.
5. Reference grade for mounting heights and photometric data is equivalent to the bottom of the door opening and the interior floor level.
6. Spare lamps in an amount equal to not less than 5% of the total luminaires installed shall be furnished in packaging recommended by the manufacturer for storage.
7. Dimensions listed in feet can be converted to meters by applying the multiplier of 3.048. Footcandle values will read in lux if a 10.76 multiplier is applied.
8. If higher wattage luminaires should be required in special cases, the HPS curves could be adapted, with moderate accuracy, for use with 100W units (9500 lumens) or 150W (16000 lumens) by applying a multiplier of 1.6 or 2.8 respectively. The LPS curves would be valid for a 55W (8000 lumens) unit if a multiplier 1.7 were applied.
9. The wiring table on Sh. E 2 is based on 3% max. voltage drop in the lines. Actual lumen output of the luminaires will be reduced 1-2% from the levels indicated on the illumination curves for the HPS and LPS sources and approx. 9% for the quartz iodine.

APPLICATION NOTES:

1. The designer should select one of the three exterior light options and edit accordingly (delete, modify, or cross out).
2. For applications where instant start characteristics are essential, the quartz iodine unit (luminaire "G") should be used. High pressure sodium (HPS) will deliver 50% to 80% of rated illumination in one minute (varies with mfr., temperature, etc.), approx. 95% in two minutes. The low pressure sodium unit will deliver 50% output in approx. 4 minutes, 95% in approx. 7 minutes. Restrike to full output is instantaneous with quartz, essentially so for LPS (if outage is 2 min. or less), but approx. 4 min. for HPS.
3. Color discrimination suffers somewhat under HPS light, but virtually disappears under LPS unless light from another source (such as interior lights) is present. Contribution from a separate source amounting to 10% of the LPS light level is sufficient to restore color rendition. If accurate color discrimination is critical, use the quartz luminaire.
4. If the above characteristics are not critical, the more energy-efficient LPS or HPS units should be used in lieu of the quartz type. The HPS unit is preferred in the absence of other instructions.

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

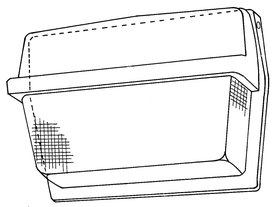
DESIGNED BY: D.L.V.
DRAWN BY: T.S.A.
CHECKED BY:
SUBMITTED BY:
CHIEF ELEC. FAC. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
CHIEF ENGINEERING DIVISION
DATE: 27-78-48 (24)
APPROVED:
COL. C. E., DISTRICT ENGINEER

MUNITION STORAGE IGLOOS
MAGAZINE STEEL OVAL-ARCH. (25'-11"SPAN) EARTH COVERED
EXTERIOR ELECTRICAL
SHEET I

SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET E-4

THIS PLAN ACCOMPANIES CONTRACT NO. DACA45 MODIFICATION NO.

GPO 767-653



STYLE I
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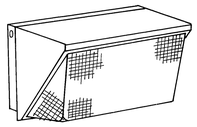

STYLE II
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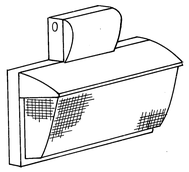


STYLE III
EPA = 1.5 ±

CANDLEPOWER TABLE - LUMINAIRE "E"
70 WATT HIGH PRESSURE SODIUM

	Horizontal Angles																				
Vertical Angles	Corps Format →		(265) 275	(255) 285	(245) 295	(235) 305	(225) 315	(215) 325	(205) 335	(195) 345	(185) 355	(175) 5	(165) 15	(155) 25	(145) 35	(135) 45	(125) 55	(115) 65	(105) 75	(95) 85	90
	IES Format ↓		(185) 175	(195) 165	(205) 155	(215) 145	(225) 135	(235) 125	(245) 115	(255) 105	(265) 95	(275) 85	(285) 75	(295) 65	(305) 55	(315) 45	(325) 35	(335) 25	(345) 15	(355) 5	(360) 0
0	90	3	3	11	23	38	56	93	113	131	149	263	359	549	711	843	812	677	579	591
5	85	3	3	12	26	44	68	113	135	195	282	455	683	1023	1395	1512	1418	1188	1043	1070
15	75	6	6	17	30	50	75	107	147	213	569	798	930	1202	1341	1463	1389	1194	1067	1038
25	65	21	23	30	44	65	95	134	192	278	498	567	878	1133	1278	1415	1230	1053	999	978
35	55	39	41	53	71	105	153	219	294	432	509	621	674	906	1274	1239	1134	966	909	888
45	45	69	77	96	126	183	251	330	413	542	618	573	525	656	914	927	785	761	720	708
55	35	129	146	180	231	297	368	458	569	638	645	597	548	528	591	659	696	711	723	717
65	25	240	255	302	354	425	498	575	609	650	657	639	605	567	537	534	555	569	569	569
75	15	387	395	422	453	498	534	572	605	630	644	647	644	623	594	576	558	554	549	551
85	5	510	506	513	518	528	540	546	561	567	575	579	584	584	585	587	591	594	594	594
90	0	557	554	557	554	557	555	557	557	558	560	560	560	560	560	558	560	560	561	561

Average Candlepower = 525.7 Candela

CANDLEPOWER TABLE LUMINAIRE "F"
35 WATT LOW PRESSURE SODIUM

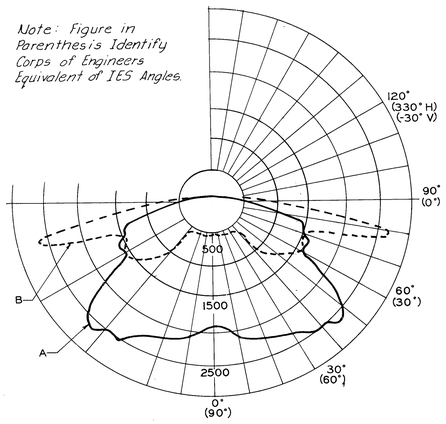
	Horizontal Angles																				
Vertical Angles	Corps Format →		(265) 275	(255) 285	(245) 295	(235) 305	(225) 315	(215) 325	(205) 335	(195) 345	(185) 355	(175) 5	(165) 15	(155) 25	(145) 35	(135) 45	(125) 55	(115) 65	(105) 75	(95) 85	90
	IES Format ↓		(185) 175	(195) 165	(205) 155	(215) 145	(225) 135	(235) 125	(245) 115	(255) 105	(265) 95	(275) 85	(285) 75	(295) 65	(305) 55	(315) 45	(325) 35	(335) 25	(345) 15	(355) 5	(360) 0
5	85	0	0	0	4	16	34	71	83	56	97	217	286	303	300	290	313	365	404	412
15	75	0	0	2	9	18	35	72	119	123	185	343	443	459	413	435	532	664	715	722
25	65	13	14	16	21	29	51	103	147	150	238	375	501	565	619	707	811	899	923	934
35	55	25	27	28	37	53	94	133	168	184	282	397	504	615	765	859	933	994	1014	1026
45	45	44	44	52	79	118	158	182	203	222	313	425	535	644	763	874	961	1010	1032	1043
55	35	128	144	174	208	236	265	281	286	301	374	483	598	694	785	870	941	990	1020	1024
65	25	344	342	344	352	354	360	351	351	379	446	527	635	723	800	859	896	928	948	954
75	15	400	395	391	390	388	384	380	400	437	478	521	573	625	680	724	747	774	788	790
85	5	410	411	413	417	425	436	450	465	476	490	504	523	537	547	553	557	562	564	562
90	0	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481	481

Average Candlepower = 431.0 Candela

LUMINAIRE "G" CANDLEPOWER DISTRIBUTION
250 WATT QUARTZ IODINE

A = Lateral Distribution in 77° (13°) Vertical Cone
B = Vertical Distribution in Vertical Plane @ 45° (45°) Horizontal

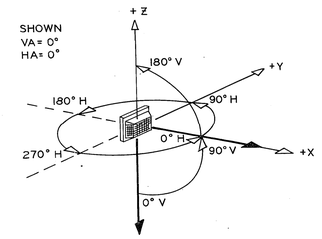
Note: Figure in Parenthesis Identify Corps of Engineers Equivalent of IES Angles.



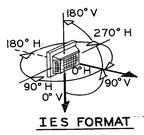
Average Candlepower = 1080.2 Candela

A. Lateral Distrib.			B. Vertical Distrib.		
Horiz. Angles		Candle	Vert. Angles		
Corps of Eng.	IES Format	Power Values	Corps of Eng.	IES Format	Candle Power
90	0	1900	-15	95	220
85	5	1945	5	105	310
75	15	2190			
65	25	2255	0	90	440
55	35	2550	5	85	770
			10	80	2020
50	40	2500			
45	45	2715	13	77	2715
40	50	2460	15	75	2450
35	55	1965	20	70	1500
30	60	1550	25	65	1475
			30	60	1550
25	65	1610	35	55	1425
20	70	1435	40	50	1325
15	75	1435	45	45	1150
10	80	920			
5	85	720	50	40	770
			55	35	580
0	90	425	60	30	565
355	95	315	65	25	560
345	105	160	70	20	560
335	115	110			
325	125	80	75	15	535
			80	10	540
315	135	50	85	5	540
305	145	30	90	0	480
295	155	20			
285	165	10			
275	175	10			
270	180	10			

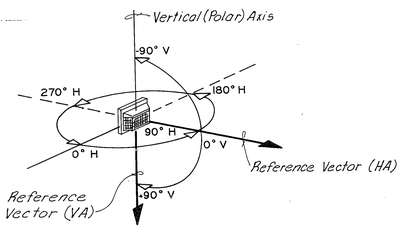
Values shown above pertain to right hemisphere. The left half of the luminaire is symmetrical.



REFERENCE AXES FOR AIMING ANGLES
NO SCALE



IES FORMAT



CORPS OF ENGINEERS FORMAT
REFERENCE AXES FOR CANDLEPOWER DATA
NO SCALE

WALL MOUNT LUMINAIRE:

The unit shall be a heavy duty weatherproof type constructed of die cast aluminum. Style I, II, or III may be furnished at the Contractors option. Each unit shall have the following features:

The housing and all exposed parts and hardware shall be formed from non-corroding materials or shall have corrosion-resistant finishes.

The assembly must have provisions for mounting on a concrete or sheet steel surface. The back portion of the housing shall be tapped to accommodate threaded conduit of 3/4 in. min.

Access for relamping or for gasket or ballast replacement is to be by means of a hinged door or cover. If bottom hinged, a metal safety strap, cable, or retaining chain must be included.

A tempered heat and impact resistant borosilicate glass diffuser is to be furnished. It must have a prismatic surface to provide controlled light distribution and minimal glare. A vandal resistant, prismatic polycarbonate (Lexan or equal) diffuser may be substituted at the Contractor's option.

The reflector must be formed from an aluminum sheet, either Alzak or anodized to an asymmetric contour.

The lampholder, ballast, and wiring shall be suitable for operation at high ambient temperatures (normal lamp operating temperature internally plus 110°F (43°C) ambient externally).

The ballast is to be a high power factor type (over 90%) rated for operation at -20°F (-29°C) or lower and under a ± 10% line voltage variation with minimal change (± 4% max.) in lumen output. A regulator or reactor ballast should be furnished for high pressure sodium luminaires; a reactance type ballast will be acceptable for low pressure sodium units.

The appropriate lamp shall be furnished with each unit - 250Q/CL for the quartz iodine luminaires, LU70 for the H. P. S., and S0X35 for the LPS units.

The unit should have photometric characteristics as indicated in the applicable candlepower table with an illumination pattern similar to that shown by the isofootcandle curves (see Note 2) when operated at rated voltage of 120V nominal.

NOTES:

1. Catalog literature and photometric data shall be submitted to the Contracting Officer on proposed luminaires (including "test luminaires"). The preferred format for photometric data is the candlepower table. The luminaire must have been tested in accordance with IES procedures and with readings taken at no more than 45° intervals (10° preferred). The data should identify the lamp number lumen rating, test date, and test format (horizontal polar axis or vertical polar axis). If the candlepower test data lists values only for one horizontal and one vertical position (one plane and one cone), additional photometric data in the form of illumination curves (isofootcandle charts) or illumination grids (footcandle printouts) is to be included. If illumination data represents maintained levels rather than initial, the appropriate parameters such as lamp lumen depreciation, dirt factor, group relamping interval, etc. (see "Design Luminaire" data) should be noted.
2. It was necessary to utilize a specific manufacturer's fixture in making calculations and estabiishing reference illumination grids and charts. Any other unit which conforms to the specifications listed and has similar photometric characteristics will be acceptable. To be considered equivalent, the average value of candlepower must be within 10% of the average listed on this sheet for the corresponding luminaire or the average illumination should be 90% or more of the average shown on the illumination charts on sheet E 5.
3. The illumination charts shown on Sh. E 5 portray the distribution patterns applicable to the specific luminaires listed in the "Design Luminaire" data. The solid curves identify the illumination levels that will be projected 6 inches above ground from a single luminaire mounted 15 feet above reference grade, considered on a horizontal measurement basis. The values above the curves denote the illumination levels existing when the unit is initially installed; the figures in parenthesis below the curves are the corresponding values of maintained illumination (see "Design Luminaire" data). The dashed lines represent resultant conditions when the mounting height is lowered to 13 feet (illumination values are identical for corresponding dashed and solid curves).
4. The illumination grid on Sh. E 5 was calculated using the two-luminaire arrangement illustrated on that sheet. Figures at grid points represent maintained values of horizontal illumination. The figures shown above curves are initial values.
5. Reference grade for mounting heights and photometric data is equivalent to the bottom of the door opening and the interior floor level.
6. Spare lamps in an amount equal to not less than 5% of the total luminaires installed shall be furnished in packaging recommended by the manufacturer for storage.
7. Dimensions listed in feet can be converted to meters by applying the multiplier of 3.048. Footcandle values will read in lux if a 10.76 multiplier is applied.
8. If higher wattage luminaires should be required in special cases, the HPS curves could be adapted, with moderate accuracy, for use with 100W units (9500 lumens) or 150W (16000 lumens) by applying a multiplier of 1.6 or 2.8 respectively. The LPS curves would be valid for a 55W (8000 lumens) unit if a multiplier 1.7 were applied.
9. The wiring table on Sh. E 2 is based on 3% max. voltage drop in the lines. Actual lumen output of the luminaires will be reduced 1-2% from the levels indicated on the illumination curves for the HPS and LPS sources and approx. 9% for the quartz iodine.

APPLICATION NOTES:

1. The designer should select one of the three exterior light options and edit accordingly (delete, modify, or cross out).
2. For applications where instant start characteristics are essential, the quartz iodine unit (luminaire "G") should be used. High pressure sodium (HPS) will deliver 50% to 80% of rated illumination in one minute (varies with mfr., temperature, etc.), approx. 95% in two minutes. The low pressure sodium unit will deliver 50% output in approx. 4 minutes, 95% in approx. 7 minutes. Restrike to full output is instantaneous with quartz, essentially so for LPS (if outage is 2 min. or less), but approx. 4 min. for HPS.
3. Color discrimination suffers somewhat under HPS light, but virtually disappears under LPS unless light from another source (such as interior lights) is present. Contribution from a separate source amounting to 10% of the LPS light level is sufficient to restore color rendition. If accurate color discrimination is critical, use the quartz luminaire.
4. If the above characteristics are not critical, the more energy-efficient LPS or HPS units should be used in lieu of the quartz type. The HPS unit is preferred in the absence of other instructions.

DATE	DESCRIPTION	MADE	APPR'D
	REVISIONS		

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: D.L.V.
DRAWN BY: T.S.A.
CHECKED BY:
SUBMITTED BY:
CHIEF ELEC. FAC. SECTION
RECOMMENDED:
CHIEF DESIGN BRANCH
APPROVED:
CHIEF ENGINEERING DIVISION
APPROVED:
COL. C. E., DISTRICT ENGINEER

MUNITION STORAGE IGLOOS
MAGAZINE STEEL OVAL-ARCH.
(25'-11"SPAN) EARTH COVERED
EXTERIOR ELECTRICAL
SHEET I

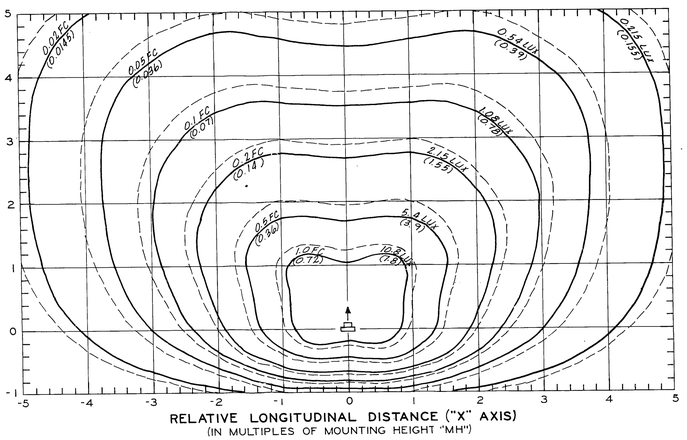
DATE: 347-78-48 (24)
SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET E-4

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

GPO 767-653

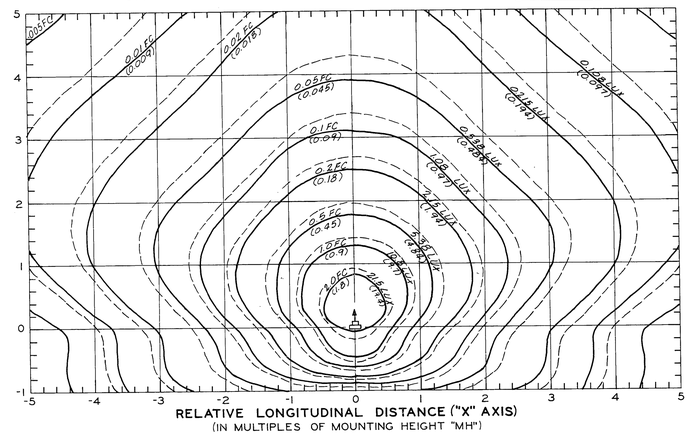
LUMINAIRE "E" - 70W HIGH PRESSURE SODIUM

STYLE "I" MAINTENANCE FACTOR 0.7225 = AVG. ILLUMINATION = (0.18) 0.25 FC



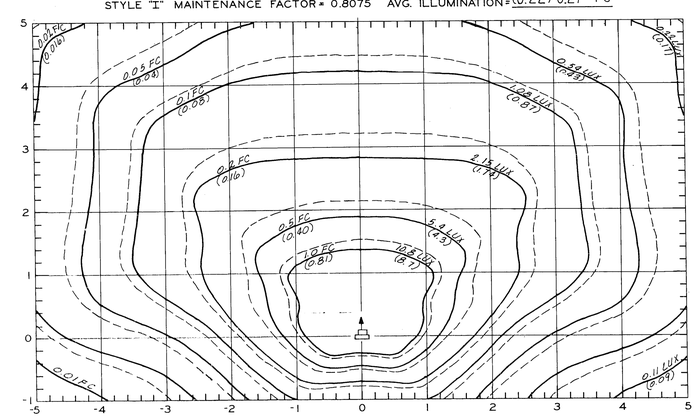
LUMINAIRE "F" - 35W LOW PRESSURE SODIUM

STYLE "II" MAINTENANCE FACTOR = 0.90 AVG. ILLUMINATION = (0.11) 0.12 FC



LUMINAIRE "G" - 250W QUARTZ IODINE

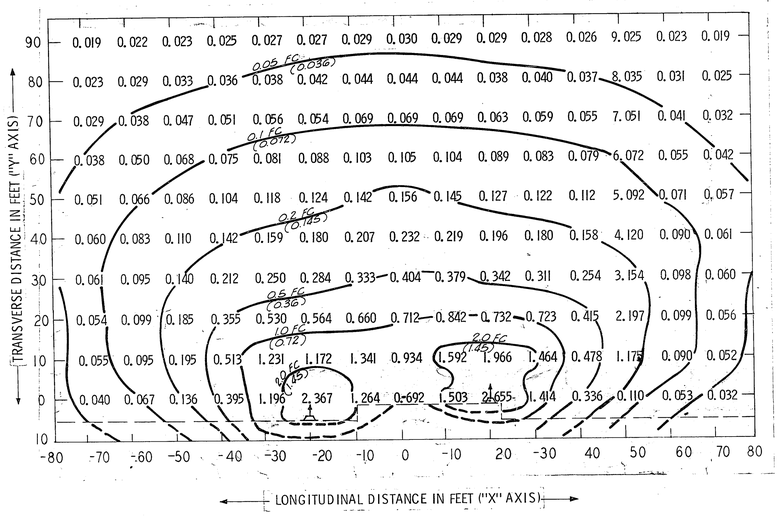
STYLE "I" MAINTENANCE FACTOR = 0.8075 AVG. ILLUMINATION = (0.22) 0.27 FC



MTG. HT.	MULT.	ACTUAL DISTANCE IN FEET									
MH 10	0.667	-50	-40	-30	-20	-10	0	10	20	30	40	50
MH 12	0.8	-60	-48	-36	-24	-12	0	12	24	36	48	60
MH 15	1.0	-75	-60	-45	-30	-15	0	15	30	45	60	75

ISOFOOTCANDLE (ISOLUX) CHARTS

(SEE NOTE 3; REFERENCE MH = 15 FT. SEE APPLICATION NOTES 1-4)



ILLUMINATION GRID - 70W H. P. S.

APPLICABLE COMPUTER RUN = TE024; M. H. = 13 ft.

Average Illumination = (0.12) 0.17 FC

DESIGN LUMINAIRES

(See Note 2)

a. Fixture "E"

Luminaire Type: 70W high pressure sodium wall mount unit, Model SWP 465
Manufacturer: Holophane — Catalog No: 419-20
Computer Code: V070SXXHO1 — Lamp No: LU70
Group Relamping: 8000 hrs. at 20% failure — Input Watts: 95
Initial lumens: 5800 — Rated Life in Hours: 12000
Dirt Factor: 0.85 — Lumen Depreciation Factor: 0.85
Eff. Projected Area (EPA): 1.1 sq. ft. — Weight: 18 lb.

Manufacturer's Photometric Data

Date: Approx. 1975 — Type: Candlepower Table (computer printout)
I. D. No: 27914 — Socket Position: NA — Multiplier: 1.0

b. Fixture "F"

Luminaire Type: 35W low pressure sodium wall mount unit
Manufacturer: Norelco — Catalog No: 33830
Computer Code: V35WL4MNO1 — Lamp No: SOX35
Group Relamping: 14000 hrs. at 20% failure — Input Watts: 60 - 67*
Initial Lumens: 4800 — Rated Life in Hours: 18000
Dirt Factor: 0.90 — Lumen Depreciation Factor: 1.00
Eff. Projected Area (EPA): 1.10 sq. ft. — Weight: 20 lb.

Manufacturer's Photometric Data

Date: January 18, 1977 — Type: Candlepower Table
I. D. No: ERL 2080 — Socket Position: NA — Multiplier: 1.0

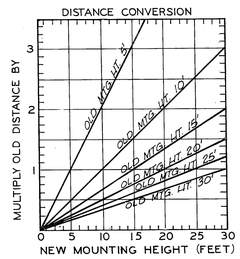
c. Fixture "G"

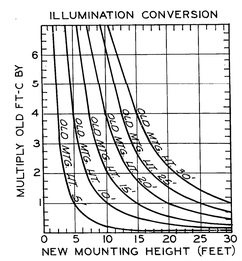
Luminaire Type: 250W tungsten-halide wall-mount; Wall packette
Manufacturer: Holophane — Catalog No: 414
Computer Code: V250QXXHO1 — Lamp No: 250Q/CL
Group Relamping: 1600 hrs. at 20% failure — Input Watts: 250
Initial Lumens: 5000 — Rated Life in Hours: 2000
Dirt Factor: 0.85 — Lumen Depreciation Factor: 0.95
Eff. Projected Area (EPA): 1.10 sq. ft. — Weight: 12 lb.

Manufacturer's Photometric Data

Date: March 18, 1966 — Type: Candlepower Table/Graph (45° plane - 77° cone)
I. D. No: 21495-L — Socket Position: NA — Multiplier: 1.0

* Wattage at 8000 Hours

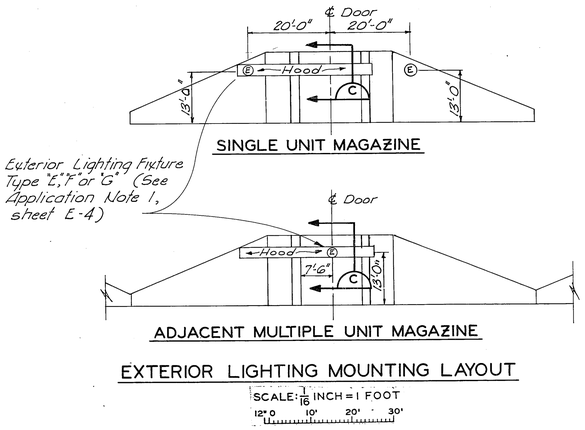




CONVERSION GRAPHS

FOOTCANDLE MULTIPLIER FOR ALTERNATE MTG. HTS.

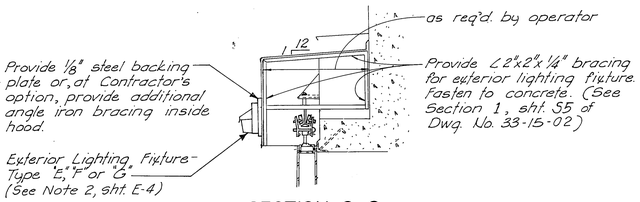
MOUNTING HEIGHT	MULTIPLIER
30	0.25
25	0.36
20	0.56
15	1.00
13	1.33
12	1.56
10	2.25
8	3.52
5	9.00



EXTERIOR LIGHTING MOUNTING LAYOUT

SCALE: 1/16 INCH = 1 FOOT

12" 0 10' 20' 30'



SECTION C-C

SCALE: 1 INCH = 2 FEET

2' 12" 0 2'

DATE	DESCRIPTION	MADE	APPR'D

REVISIONS

U. S. ARMY ENGINEER DISTRICT, OMAHA
CORPS OF ENGINEERS
OMAHA, NEBRASKA

DESIGNED BY: D. L. V.
DRAWN BY: T. S. A.
CHECKED BY:
SUBMITTED BY:
CHIEF ELEC. FAC. SECTION

RECOMMENDED:
CHIEF DESIGN BRANCH

APPROVED:
CHIEF ENGINEERING DIVISION

MUNITION STORAGE IGLOOS
MAGAZINE STEEL OVAL-ARCH. (25'-11" SPAN) EARTH COVERED
EXTERIOR ELECTRICAL
SHEET 2

DATE: 347-78-45 (25)

APPROVED:
COL. C. E., DISTRICT ENGINEER

SCALE: AS SHOWN
SPEC. NO. DACA45
DRAWING NUMBER 33-15-02
SHEET E-5

THIS PLAN ACCOMPANIES CONTRACT No. DACA45 MODIFICATION No.

GPO 767-653