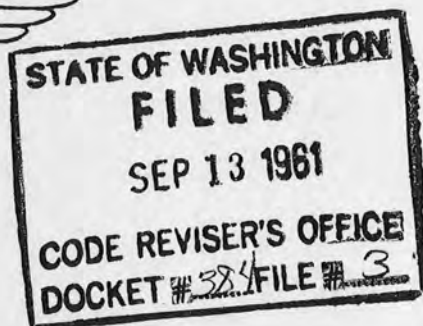


OBSTRUCTION MARKING & LIGHTING

STATE STANDARDS FOR MARKING AND LIGHTING
OBSTRUCTIONS TO AIR NAVIGATION



WASHINGTON STATE AERONAUTICS COMMISSION

BOEING FIELD

SEATTLE, WASHINGTON

WILLIAM A. CERENINI, Director

WASHINGTON STATE AERONAUTICS COMMISSION

OBSTRUCTION MARKING AND LIGHTING

State Standards for Marking and Lighting
Obstructions to Air Navigation

Albert D. Rosellini
Governor

Commissioners

J. Donald Sullivan
Seattle

Benjamin F. Smith
Kent

Arthur K. Avey
Kettle Falls

DeWitt Rowland
Tacoma

Robert L. Greenhalgh
Snohomish

W. O. Wikstrom
Yakima

Wm. A. Gebenini
Director of Aeronautics
7211 Perimeter Road
Boeing Field
Seattle 8, Washington

This book was assembled from data described in Federal Aviation Agency booklet "Obstruction Marking & Lighting" in cooperation with Federal Aviation Agency Airport Engineers.

FOREWORD

The purpose of this publication is to provide State, Municipal governments, private industry and interested persons with important information and guidance in connection with the marking and lighting of natural and man-made objects which are, or may become, hazards to the safe operation of aircraft.

Included in the text are the State standards prescribed for the marking and lighting of obstruction to air navigation.

In the Appendix will be found the texts of laws and regulations regarding existing or proposed objects which may present hazards to aircraft operations, and also important information to provide guidance in complying with these texts of laws and regulations.

TABLE OF CONTENTS

	Page
Introduction.....	1
State Obstacle Law.....	2
Marking.....	3
Vehicles.....	3
Natural and Man-made.....	3
General Application.....	3
Flags.....	4
Colors.....	4
Patterns.....	5
Paint Specifications.....	11
Overhead Lines.....	6
Lighting.....	7
Temporary Warning Lights.....	8
Day Lighting.....	6
Operation.....	8
Inspection.....	8
Notification of Failure.....	9
Distribution.....	9
Voltage Limitations.....	9
Intensity.....	9
Flashing.....	9
Interference to Railway Signals.....	10
Non-standard.....	10
Specifications.....	10
Recommended Equipment.....	11
Standards for Lighting.....	12
Towers, Poles, etc.....	12
Less than 150'..... (A-1).....	12
More than 150' Less than 300'..... (A-2).....	12
" " 300' " " 450'..... (A-3).....	13
" " 450' " " 600'..... (A-4).....	13
" " 600' " " 750'..... (A-5).....	14
" " 750' " " 900'..... (A-6).....	15
" " 900' " " 1050'..... (A-7).....	15
" " 1050' " " 1200'..... (A-8).....	16
" " 1200' " " 1350'..... (A-9).....	17
" " 1350' " " 1500'..... (A-10).....	17
" " 1500'..... (A-11).....	18
Trees (B-1).....	18
Power Lines (C-1).....	18

	Page
Smokestacks, etc.....	19
Less than 150'..... (D-1)	19
More than 150' Less than 300' (D-2)	19
" " 300' " " 450' (D-3)	20
" " 450' " " 600' (D-4)	20
" " 600' " " 750' (D-5)	21
" " 750' " " 900' (D-6)	21
" " 900'..... (D-7)	22
Prominent Buildings, etc.....	22
Less than 150'..... (E-1)	22
More than 150'..... (E-2)	23
Bridges, etc.....	24
Less than 150'..... (F-1)	24
More than 150'..... (F-2)	24
See Figure F.....	Fig. F
Water Towers, Grain Elevators, Tanks, etc.....	25
Less than 150'..... (G-1)	25
More than 150' Less than 300' (G-2)	25
" " 300' " " 450' (G-3)	26
Group of Towers, Poles, Tanks, Smokestacks, etc.....	26
Same over-all height and spaced less than 150'..... (H-1)	26
Same or not same over-all height and not equally spaced but less than 150'..... (H-2)	26
Hazard Areas.....	27
Visible or Invisible Hazard (I-1)	27
Large Visible or Invisible Hazard (I-2)	27
Appendix.....	28
Criteria for Determining Obstructions.....	30
Operation of Moored Balloons.....	31
Drawings, Examples, etc.	
Lighting of Towers, Poles, etc.....	Black Fig. A
" " Smokestacks, etc.....	" Fig. B
" " Water Towers, etc.....	" Fig. C & D
" " Bridges, etc.....	" Fig. F
Painting of Towers, Poles, etc.....	Red Fig. A
" " Water Towers, etc.....	" Fig. B
" " Gas Holders, etc.....	" Fig. C
" " Water Towers, etc.....	" Fig. D
Example of Obstacle Lights.....	Fig. G
" " Marked Lines.....	Fig. H

OBSTRUCTION MARKING AND LIGHTING

Introduction

The Washington State Aeronautics Commission has the Statutory responsibility of promoting safety in aeronautics and enforcing safety rules, regulations and standards. In the light of this responsibility, the Washington State Aeronautics Commission is vitally concerned with any object which may be a hazard to the safe operation of aircraft and the enforcement of State obstruction and marking law. Consequently, it has a primary responsibility in the determination of whether an existing or proposed object is, or will become, such a hazard.

In order to provide uniform criteria to determine whether an object is, or will be, an obstruction to air navigation, the Washington State Aeronautics Commission has issued State Standards for Determining Obstructions to Air Navigation. Natural or man-made objects or portions thereof, both temporary and permanent, which have been determined, through the application of these Standards, to be obstructions and all man-made objects, or portions thereof, greater than 150 feet in over-all height above ground, or water if so situated, should be marked and/or lighted in accordance with the applicable standards hereinafter described, unless aeronautical study indicates that the absence of such marking and/or lighting will not impair safety in air navigation. Existing non-standard obstruction marking and lighting installations should be replaced or modified so as to conform with these standards as soon as practicable.

The standards for marking and lighting obstructions prescribed in this publication are designed to provide the most effective means of indicating the presence of obstructions to pilots. In many instances the obstruction may be so located in reference to other objects or the contour of the ground, that the specific standard need be applied to its upper part only. Similarly, the obstruction may be so removed from the general flow of air traffic or may be so conspicuous by its shape, size or color that obstruction marking would serve no useful purpose and would be unnecessary. Furthermore, the obstruction may present such a hazard that lighting should be provided similar to that for an obstruction of a greater height. Portions of obstructions that are shielded by surrounding objects need not be marked or lighted, but the surrounding objects should be marked and lighted.

Because of the many influencing elements, the Washington State Aeronautics Commission may modify the obstruction marking and lighting standards hereinafter described when aeronautical study has indicated that a change or modification is necessary to provide adequate protection for Aeronautics.

Washington State Aeronautics Commission
7211 Perimeter Road-Boeing Field
Seattle 8, Washington

C O P Y O N L Y

AERONAUTICS--MARKING STRUCTURES AND OBSTACLES

SUBSTITUTE HOUSE BILL NO. 426

AN ACT relating to aeronautics; and adding two new sections to chapter 165, Laws of 1947 and to chapter 14.04 RCW.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

Section 1. There is added to chapter 165, Laws of 1947 and to chapter 14.04 RCW two new sections as set forth in sections 2 and 3 of this amendatory act.

NEW SECTION. Sec. 2. Any structure or obstacle which obstructs the air space above ground or water level, when determined by the commission after a hearing to be a hazard or potential hazard to the safe flight of aircraft, shall be plainly marked, illuminated, painted, lighted or designated in a manner to be approved in accordance with the general rules and regulations of the commission so that the same will be clearly visible to airman. In determining which structures or obstacles constitute or may become a hazard to air flight, the commission shall take into account only those obstacles located at river, lake and canyon crossings and in other low altitude flight paths usually traveled by aircraft.

NEW SECTION. Sec. 3. The director shall have the authority to require owners, operators, lessees or others having the control or management of structures or obstacles over one hundred fifty feet above ground or water level and which are or may become a hazard to air flight to report the location of such existing or proposed structures or obstacles to the commission. For that purpose the director may issue subpoenas and subpoenas duces tecum returnable within twenty days to the commission. In the event a person refuses to obey the director's subpoena, the commission may certify to the superior court all facts of any such refusal. The court shall summarily hear evidence on such refusal, and, if the evidence warrants, punish such person refusing in the same manner and to the same extent as for contempt committed before the court.

NEW SECTION. Sec. 4. This act shall not apply to structures required to be marked by federal regulations.

Passed the House March 9, 1961.

Speaker of the House.

Passed the Senate March 9, 1961.

President of the Senate.

Approved March 17, 1961

Governor of Washington

The purpose of marking an obstruction which presents a hazard to aeronautics is to warn airmen during the hours of daylight of the presence of such an obstruction. To accomplish this objective, it may be necessary to color such an obstruction so that it will be visible from aircraft at any normal angle of approach, or to indicate the general definition and location of the obstruction by use of suitable markers or flags.

When the upper part of only a portion of a structure or similar extensive obstruction projects above an obstruction determining surface, as described in State Standards, that portion only need be obstruction marked and the point or edge of it highest in relation to the obstruction determining surface should be regarded as the "top of the obstruction." In certain cases, however, such as when the obstruction determining surface concerned is an approach or transition surface (i.e., sloping) this point or edge highest in relation to the obstruction determining surface may not be the highest point or edge above a horizontal plane passing through the base of the object. In such cases, those portions of the object, the upper parts of which are higher above a horizontal plane passing through the base of the object than the upper part considered as the "top of the obstruction," should also be obstruction marked.

Marking of Vehicles

Vehicles customarily used on landing areas should be marked in accordance with the provisions of F.A.A. Technical Standard Order TSO-N4, Army-Navy-Civil Uniform Requirements for the Marking of Vehicles Used on Landing Areas.

Marking of Natural and Man-Made Obstructions

Markers

Markers should be used to mark obstructions when it has been determined that it is impracticable to mark such obstructions by use of surface colors, or it has been determined that markers should be used to provide protection for aeronautics in addition to that provided by the application of aviation surface orange and white colors.

General Application

Markers used to mark obstructions should be displayed on or adjacent to the obstruction in conspicuous positions so as to retain the general definition of the obstruction. The size of such marker shall be a visible surface from all directions not less than that of a 36 inch sphere the length of which shall not exceed twice its median width. Provided, however, that the Commission may approve a nonconforming marker.

The shape of such markers should be distinctive to the extent necessary to insure that they are not mistaken for markers employed to convey other information, and they should be such that the hazard presented by the obstruction they mark is not increased.

Flags

Flags may be used to mark obstructions when it has been determined that marking such obstructions by coloring or by markers is technically impracticable.

The flags should be displayed around or on top of the obstruction or around its highest edge and should not increase the hazard presented by the obstruction they mark. When flags are used to mark extensive obstructions or groups of closely spaced obstructions, they should be displayed at approximately 50 foot intervals.

The flags should be rectangular in shape and have stiffeners to keep them from drooping in calm or light wind. The flag stakes should be of such strength and height that they will support the flags free of the ground, vegetation, or nearby surfaces.

The flags should be in accordance with one of the following patterns:

(a) Solid color aviation surface orange not less than two feet on a side.

(b) Two triangular sections, one of aviation surface orange and the other of aviation surface white, combined to form a rectangle not less than two feet on a side.

(c) A checkerboard pattern of aviation surface orange and aviation surface white squares, each one foot plus or minus 10 percent on a side, combined to form a rectangle not less than three feet on a side.

Colors

Maximum visibility of obstructions by contrast in colors can best be obtained by the use of aviation surface orange and white. Paints and enamels of these colors have been developed for use by government agencies and private industry in marking obstructions to air navigation. In marking, either the aviation surface orange paint or enamel may be used as preferred.

The painted surfaces of obstructions should be cleaned or repainted as often as necessary to maintain good visibility.

If the smooth surface of the paint on the ladders, decks, and walkways of certain types of steel towers and similar structures presents a potential danger to maintenance personnel, such surfaces need not be painted. However, the omission of paint should be restricted to actual surfaces the painting of which will present a hazard to maintenance personnel, and care should be taken that the over-all marking effect of the painting is not reduced.

Solid. Obstructions the projection of which on any vertical plane has both dimensions less than 5 feet should be colored aviation surface orange.

Bands. Towers, poles, smokestacks and similar obstructions, as well as buildings of certain shape and dimensions, having essentially unbroken surfaces the projection of which on any vertical plane is 5 feet or more in one dimension and is less than 15 feet in the other dimension, and any skeleton or smoke-stack type obstruction having both dimensions 5 feet or more, should be colored to show alternate bands of aviation surface orange and white.

The bands should be perpendicular to the major axis of the obstruction with the band at each end colored aviation surface orange. The widths of the bands should be equal and the width of each band should be approximately one-seventh of the length of the major axis of the obstruction, provided that each band shall have a width of not more than 40 feet nor less than 1 1/2 feet. If it is technically impracticable to color the roof of a building to show alternate bands of aviation surface orange and white, such roof may be colored aviation surface orange.

Checkerboard Pattern. Water towers, grain elevators, gas holders, and similar obstructions, as well as buildings of certain shape and dimensions, having essentially unbroken surfaces the projection of which on any vertical plane is 15 feet or more in both dimensions, should have their top and vertical surfaces colored to show a checkerboard pattern of alternate rectangles of aviation surface orange and white. If it is technically impracticable to color the roof of a building to show alternate rectangles of aviation surface orange and white, such roof may be colored aviation surface orange.

The sides of the rectangles should measure not less than 5 feet nor more than 20 feet. The rectangles at the corners of surfaces should be colored aviation surface orange.

If a part of a water tower, gas holder, building, or similar obstruction consists of a skeleton type construction, that portion of the obstruction should be colored with alternate bands of aviation surface orange and white as specified for towers, poles, smokestacks and similar obstructions. In this case, if the portion of the obstruction, which is to be colored to show a checkerboard pattern of alternate rectangles of aviation surface orange and white, has any surfaces the projection of which on any vertical plane is less than 15 feet in either dimension, the alternate rectangles of aviation surface orange and white may have dimensions of less than 5 feet on a side, provided their dimensions remain as close as is practicable to the minimum 5 feet specified for coloring by the checkerboard pattern.

If the size and shape of water towers, grain elevators, gas holders and similar obstructions come within the dimensions set forth under the specification for coloring by bands; or if their type of construction does not permit coloring by the checkerboard pattern as hereinbefore described, then such obstructions should be colored by bands as specified for towers, poles, smokestacks and similar obstructions. Where this method of coloring is employed, the top aviation surface orange band should be continued from the vertical surface so as to cover the entire top of the obstruction.

If a part, or all, of certain obstructions such as water towers and gas holders of spherical shape does not permit the exact application of the checkerboard pattern of coloring, then the shape of the alternate rectangles of aviation surface orange and white covering the spherical shape may be modified to fit the particular shape of the structural surface, provided the dimensions of these modified rectangles remain to the extent practicable within the dimensional limits set forth in the specifications for coloring by the checkerboard pattern.

If certain obstructions such as gas holders and grain elevators are of such large size that the application of the checkerboard pattern of coloring to the complete outer surface of the structure would be impracticable, the application of the checkerboard pattern of coloring may be limited to the upper one-third of the structure, provided aeronautical study indicates that the modified marking will provide adequate protection for air navigation.

Special Day Lighting

The display of flashing or steady burning lights on an obstruction during daylight hours, for the purpose of warning airmen of the presence of such an obstruction, may be prescribed under certain conditions.

The foregoing day lighting is intended to provide protection in addition to that provided by the applicable marking standard hereinbefore described.

MARKING OVERHEAD LINES

Overhead lines and cables required to be marked under the provisions of Chapter 263, Laws of 1961, shall be marked by placing a marker as described in the last paragraph on page 3 at least every 150 feet on, or within 30 feet of such lines or cables. See Marking of Lines and Cables or Similar Obstructions Figure N.

Such markers shall be colored international orange equivalent to federal specifications TT-P-59 or TT-E-489.

The purpose of lighting an obstruction which presents a hazard to air commerce is to warn airmen during the hours of darkness and during periods of limited daytime light intensity of the presence of such an obstruction. To accomplish this objective, it is necessary to provide adequate lighting on the obstruction in a manner which assures visibility of such lighting from aircraft at any normal angle of approach. In determining the proper amount of obstruction lighting to adequately mark an obstruction, the mean elevation of the top of the building in closely built-up areas may be used as the equivalent of the ground level.

The top light, or lights, displayed on an obstruction should be installed so as to mark the points or edges of the obstruction highest in relation to an obstruction determining surface, except that when no obstruction determining surface is involved, such top light, or lights, should be installed on the points or edges of the obstruction highest in relation to the ground, or water if so situated. If two or more edges of an extended obstruction located near a landing area are of the same height, the edge nearest the landing area should be lighted.

When the upper part of only a portion of a building or similar extensive object projects above an obstruction determining surface, that portion only need be obstruction lighted and the point or edge of it highest in relation to the obstruction determining surface should be regarded as the "top of the obstruction." In certain cases, however, such as when the obstruction determining surface concerned is an approach or transition surface (i.e., sloping) this point or edge highest in relation to the obstruction determining surface may not be the highest above a horizontal plane passing through the base of the object. In such cases, additional obstruction lights should be placed on the highest part of the object as well as on the point or edge highest in relation to the obstruction determining surface.

If a light, or lights, which is installed on an obstruction is shielded in any direction by an adjacent object, additional lights should be mounted on that object in such a way as to retain the general definition of the obstruction, the shielded light, or lights, being omitted if it does not contribute to the definition of the obstruction.

Obstruction lights and hazard beacons should be operated at all times when the center of the sun's disc is 6° or more below the horizon and during periods of restricted visibility. They may also be operated at such other times as considered desirable. For the purpose of this standard, the term "sunset to sunrise" shall be generally regarded as that period when the center of the sun's disc is 6° or more below the horizon.

Temporary Warning Lights

When an obstruction to air navigation is presented during construction of a structure at least two lights, each light consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, should be installed at the uppermost point of the structure. In addition, as the height of the structure exceeds each level at which permanent obstruction lights will be required, two similar lights should be installed at each such level. These temporary warning lights should be displayed nightly from sunset to sunrise until the permanent obstruction lights have been installed and placed in operation, and should be positioned so as to insure unobstructed visibility of at least one of the lights at each level from aircraft at any normal angle of approach. It will be permissible, in the event it is more practicable, to install and operate the permanent obstruction lighting fixtures at each required level, in lieu of the above temporary warning lights, as each such level is exceeded in height during construction.

Operation of Obstruction Lighting

Light Sensitive Control Device

The operation of obstruction lighting installed on obstructions of an over-all height greater than 150 feet above ground, or water if so situated, should be controlled by a light sensitive control device adjusted so that the lights will be turned on at a north sky light intensity level of about 35 foot-candles and turned off at a north sky light intensity level of about 58 foot-candles, or should be continuous.

Under normal conditions, where no special means of controlling obstruction lighting has been recommended, either a light sensitive control device or an astronomic dial clock and time switch may be used to control the obstruction lighting in lieu of manual control.

Inspection of Obstruction Lighting

Obstruction lighting should be visually observed at least once each 24 hours, or checked by observing an automatic and properly maintained indicator designed to register any failure of such lights, to insure that all such lights are functioning properly as required. In the event the obstruction lighting is not readily accessible for the above observation at least once each 24 hours, an automatic alarm system designed to detect any failure of such lights may be installed to replace the normally required visual inspection. The Commission will not object to excluding the side or intermediate obstruction lights on an obstruction from the alarm circuit, provided the signaling device will indicate malfunctioning of all flashing and rotating beacons regardless of their position on the obstruction, and of all top lights; and that all obstruction lights mounted on the obstruction are visually inspected at least once every two weeks, with all lamps being replaced at regular intervals after being lighted the equivalent of not more than 75 percent of their normal life expectancy.

Any observed or otherwise known extinguishment of improper functioning of a marker light, regardless of its position on a man-made obstruction, which will last more than 30 minutes and any observed or otherwise known extinguishment or improper functioning of a steady burning obstruction light, installed at the top or near top of any natural or man-made obstruction, which will last more than 30 minutes should be immediately reported. Such reports should be made by telephone or telegraph to the nearest Airways Communications Station or office of Washington State Aeronautics Commission and should set forth the condition of the light, or lights, the circumstance which caused the failure and the probable date that normal operation will be resumed. Further notification by telephone or telegraph should be given immediately upon resumption of normal operation by the light, or lights.

Any extinguishment or improper functioning of a steady burning side or intermediate light, or lights, installed on a natural or man-made obstruction should be corrected as soon as possible, but notification of such extinguishment or improper functioning is not necessary.

Color of Lighting

The signal emitted by hazard beacons and obstruction lights shall be aviation red in color.

Light Distribution

The vertical and horizontal light distribution of the fixed obstruction lights should meet the requirements specified in the pertinent specifications listed in this publication. The vertical light distribution of the flashing and rotating hazard beacons should be such that the time-intensity integral of the flashes at angles between one degree and three degrees above the horizontal is not less than the candle-seconds values specified hereinbefore under "Intensity of Lighting," and the time-intensity integral at angles between three degrees and fifteen degrees above the horizontal is not less than the product of these candle-seconds values multiplied by nine over the square of the numerical value in degrees of the angle above the horizontal.

Rated Lamp Voltage

In order to provide satisfactory output by obstruction lights, the rated voltage of the lamp used should, in each case, correspond to or be within 3 percent higher than the average voltage across the lamp during the normal hours of operation.

Flashing of Lights

If the flashing mechanism in obstruction lighting circuits is installed so as to make it necessary for the lights to flash, the simultaneous flashing of all lights will be permissible.

Intensity of Lighting

The intensity of fixed obstruction lights should be not less than ten candles of aviation red light.

Where obstruction lighting is installed on obstructions which are located along or near railroad rights-of-way and thereby constitutes a potential hazard to the safe operation of railway trains, extreme care should be taken to prevent any possibility of these obstructions lights being mistaken by locomotive engineers for railway signal lights. Shielding of the obstruction lights from the view of the locomotive engineers, if practicable, should be considered; the fixed lights on the obstruction may be made to flash; or the lights at the lower levels of the obstruction may be extinguished if their extinguishment does not materially increase the hazard to air navigation caused by the presence of the obstruction.

Obstruction Lighting by Non-Standard Lights

Obstruction lighting installations may utilize incandescent lamps other than those specified under the recommended lamp equipment, gaseous tubes such as neon tubes, or any method other than the conventional incandescent lamps, provided such lighting installations offer equal or greater light intensity in all angles of azimuth and elevation than that specified for standard obstruction light assemblies, afford equal or greater dependability of operation, and possess the color characteristics prescribed in the following specifications.

Obstruction Lighting Equipment

Specifications and Drawings

The lighting equipment, paint and aviation colors referred to in the standards set forth in this publication should conform with the applicable provisions of the following specifications and their related drawings:

Double and Single Obstruction Lights

- (a) Military Specification MIL-L-7830
- (b) F.A.A. Specification L-810 Specification for Obstruction Light

Covers for Aeronautical Lights

- (a) Military Specification MIL-C-7989 Covers; Light-Transmitting (for Aeronautical Lights)

Aviation Colors

- (a) Air Force-Navy Aeronautical Specification AN-C-56 Colors; Aeronautical Lights and Lighting Equipment
- (b) Federal Specification TT-C-595 Color Guide; Ready Mixed Paint
 - (1) Orange No. 1205 (Aviation Surface Orange)

Aviation Surface Paint

- (a) Federal Specification TT-P-59
Aviation Surface Orange Paint (International Orange)
- (b) Federal Specification TT-E-489
Aviation Surface Orange Enamel (International Orange)
- (c) Federal Specification TT-P-102
Outside White Paint

Air Force-Navy Aeronautical Standard Drawings

- (a) AN2541
Globe--Marker Lamp
- (b) AN2547
Fitting Assembly--Marker Lamp

Disconnecting Obstruction Light

- (a) Air Force-Navy Aeronautical Specification AN-L-31
Lamp Assembly--Disconnecting Obstruction Marker

Recommended Lamp Equipment

Multiple circuits					
	Base	Lamp	Filament	L.C.L. inches	Type
100 watts	Med. screw	A-21 clear.....	C-9..	2 7/16.	Traffic signal.
100 watts	Med. pfc..	A-21 clear.....	CC-2V.	2 3/4..	Obstruction.
100 watts	Sc. term..	PAR-56, clear...	C-6..	Airway beacon.
*111 watts	Med. sc...	A-21 clear.....	C-9..	2 7/16.	Obstruction.
500 watts	Mog. pfc..	PS-40 clear.....	C-7A.	5 11/16	Code beacon.
500 watts	Med. bip..	T-20 clear.....	C-13B	3.....	Airway beacon.
**620 watts	Mog. pfc..	PS-40 clear.....	C-7A.	5 11/16	Code beacon.
1000 watts	Mog. bip..	T-20 clear.....	C-13.	4.....	Airway beacon.
1500 watts	Mog. bip..	T-24 clear (32v)	C-5..	4.....	Airway beacon.
Series circuit					
1020 Lumens	Med. pfc..	A-21 clear.....	C-8..	2 3/4..	Obstruction.

* Has same lumen output as 100-watt but designed for 3000 hours life.

** Has same lumen output as 500-watt but designed for 3000 hours life.

Copies of Military Specifications and Air Force-Navy Aeronautical Specifications or drawings can be obtained by contacting Commanding General, Air Material Command, Wright Field, Dayton, Ohio, or the Bureau of Aeronautics, Department of the Navy, Washington 25, D.C. Copies of F.A.A. specifications and information concerning Air Force-Navy Aeronautical Specifications and Federal Specifications can be obtained from the Office of Federal Airways, F.A.A. Washington 25, D.C.

Standards For Lighting Obstructions To Air Navigation

Towers, Poles and Similar Obstructions

Towers, poles and similar obstructions should be lighted in accordance with the following specifications:

Specification "A-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction at least two lights, each light consisting of a lamp of at least 100 watts enclosed in aviation red obstruction light globes. These lights should burn simultaneously and should be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

Specification "A-2." When the particular obstruction is more than 150 feet but not more than 300 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each lamp should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons at any normal angle of approach.

At the approximate mid point of the over-all height of the obstruction, there should be installed at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. Each light should be placed on diagonally or diametrically opposite positions of the obstruction and mounted so as to insure unobstructed visibility of at least one light from aircraft at any normal angle of approach.

In case of a triangular or rectangular shaped tower, the lights at the mid-level should be mounted so as to insure unobstructed visibility of at least one light from aircraft at any normal angle of approach, or a light should be installed on each corner of the tower at this level.

Specification "A-3." When the particular obstruction is more than 300 feet but not more than 450 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

On levels at approximately two-thirds and one-third or the over-all height of the obstruction, there should be installed at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. Each light should be placed on diagonally or diametrically opposite positions of the obstruction and mounted so as to insure unobstructed visibility of at least one light at each level from aircraft at any normal angle of approach.

In case of a triangular or rectangular shaped tower, the lights at the two-thirds and one-third levels should be mounted so as to insure unobstructed visibility of at least one light on each level from aircraft at any normal angle of approach, or a light should be installed on each corner of the obstruction at each level.

Specification "A-4." When the particular obstruction is more than 450 feet but not more than 600 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately one-half of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event this beacon cannot be installed in a manner to insure unobstructed visibility of it from aircraft at any normal angle of approach, there should be installed two such beacons. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed height.

On levels of approximately three-fourths and one-fourth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes, should be installed on each outside corner of the obstruction at each level.

Specification "A-5." When the particular obstruction is more than 600 feet but not more than 750 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately two-fifths of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event this code beacon cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at this level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed height.

On levels at approximately four-fifths, three-fifths and one-fifth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-6." When the particular obstruction is more than 750 feet but not more than 900 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts.

Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately two-thirds and at approximately one-third of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately five-sixths, one-half and one-sixth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-7." When the particular obstruction is more than 900 feet but not more than 1050 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately four-sevenths, and at approximately two-sevenths of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately six-sevenths, five-sevenths, three-sevenths and one-seventh of the over-all height of the obstruction one or more lights consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-8." When the particular obstruction is more than 1050 feet but not more than 1200 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately three-fourths, one-half and one-fourth of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately seven-eighths, five-eighths, three-eighths and one-eighth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-9." When the particular obstruction is more than 1200 feet but not more than 1350 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately two-thirds, four-ninths and two-ninths of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately eight-ninths, seven-ninths, five-ninths, one-third and one-ninth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-10." When the particular obstruction is more than 1350 feet but not more than 1500 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately four-fifths, three-fifths, two-fifths and one-fifth of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately nine-tenths, seven-tenths, one-half, three-tenths and one-tenth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-11." Towers and similar obstructions which are more than 1500 feet in over-all heights above ground, or water if so situated, will be given special aeronautical study to determine the proper manner in which to obstruction light them to provide adequate protection for air commerce.

Trees

A line of trees, with the individual trees located less than 150 feet apart, or a tree covered area should be lighted as an extensive obstruction in the manner set forth in the "E" Specifications for Prominent Buildings and Similar Extensive Obstructions, with the obstruction lights mounted on poles or towers, of a height slightly greater than the height of the outstanding trees. Individual trees and widely spaced trees should be lighted in accordance with the following specifications:

Specification "B-1." Poles of a height slightly greater than the height of the outstanding tree(s) should be installed adjacent to the tree(s) and lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles and similar obstructions of a corresponding over-all height above ground, or water if so situated.

Transmission Lines

The catenary of a transmission line or similar obstructions, should be lighted in accordance with the following specifications:

Specification "C-1." The towers, poles, or similar structures supporting such a line should be lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles, or similar obstructions of a corresponding over-all height above ground, or water if so situated.

In each case where a transmission line within 15,000 feet of a landing area is required to be lighted in accordance with the provisions of Chapter 263, Laws of 1961, one or more lights, each light consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, should be displayed for each 150 feet or fraction thereof, of the over-all length of the overhead line. These lights should be equally spaced along the entire length of the overhead transmission line at points not more than 150 feet apart and each light should be placed not below the level of the highest wire at the point marked.

When a transmission line more than 15,000 feet from a landing area is required to be lighted in accordance with the provisions of chapter 263, Laws of 1961, the distance between the obstruction lights displayed on such wires may be increased to not less than 600 feet.

Smokestacks and Similar Obstructions

Smokestacks and similar obstructions should be lighted in accordance with the following specifications:

In order to avoid the obscuring effect of the deposits generally in evidence from this type of structure, the top lights should be installed from 5 to 10 feet below the highest point of the structure. It is important that these lights be readily accessible to enable cleaning when necessary and to facilitate lamp replacements.

Smokestacks and similar obstructions may be floodlighted by fixed searchlight projectors installed at three or more equidistant points around the base of each such obstruction if the search light projectors will provide an average illumination of at least 15 candles at the top one-third of the obstruction.

Specification "D-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction three or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two of the lights from aircraft at any normal angle of approach.

Specification "D-2." When the particular obstruction is more than 150 feet but not more than 300 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately the midpoint of the over-all height of the obstruction, there should be installed at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one light from aircraft at any normal angle of approach.

Specification "D-3." When the particular obstruction is more than 300 feet but not more than 450 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels at approximately two-thirds and one-third of the over-all height of the obstruction, there should be installed on each level at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction lightglobes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one light from aircraft on any normal angle of approach.

Specification "D-4." When the particular obstruction is more than 450 feet but not more than 600 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately one-half of the over-all height of the structure, two or more similar flashing 300 mm electric code beacons should be installed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels of approximately three-fourths and on-fourth of the over-all height of the structure, there should be installed on each level at least three lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Specification "D-5." When the particular obstruction is more than 600 feet but not more than 750 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately two-fifths of the over-all height of the obstruction, two or more similar flashing 300 mm electric code beacons should be installed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels of approximately four-fifths, three-fifths and one-fifth of the over-all height of the obstruction, there should be installed on each level at least three lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Specification "D-6." When the particular obstruction is more than 750 feet but not more than 900 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately two-thirds and at approximately one-third of the over-all height of the obstruction two or more similar flashing 300 mm electric code beacons should be installed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels of at approximately five-sixths, one-half and one-sixth of the over-all height of the obstruction, there should be installed at least three lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes.

these lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Specification "D-7." Smokestacks and similar obstructions which are more than 900 feet in over-all height above ground, or water if so situated, will be given special aeronautical study to determine the proper manner in which to obstruct light them to provide adequate protection for air commerce.

Prominent Buildings and Similar Extensive Obstructions

Prominent buildings and similar extensive obstructions should be lighted in accordance with the following specifications. In the event the individual objects of a group of obstructions are approximately the same over-all height above ground, or water if so situated, and are located not more than 150 feet apart, the group of obstructions may be considered an extensive obstruction and so lighted.

Specification "E-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated,

If the obstruction is not more than 150 feet in either horizontal dimension, there should be installed at approximately the highest point or edge at each end of the major axis of the obstruction at least one light, consisting of a lamp of at least 100 watts, enclosed in an aviation red obstruction light globe. These lights should be positioned so as to insure unobstructed visibility of them from aircraft at any normal angle of approach, and to indicate the general extent of the obstruction; or, if the shape of the obstruction is such as to make this manner of lighting impracticable, there may be installed two such lights at the approximate center of the highest point or edge of the obstruction. Both lights should burn simultaneously and be so positioned as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

If the obstruction is more than 150 feet in one horizontal dimension, but not more than 150 feet in the other, there should be installed at least one light, consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, for each 150 feet, or fraction thereof, or the over-all length of the major axis of the obstruction. At least one of these top lights should be installed on the highest point or edge of each end of the obstruction, with the additional lights as required spaced at approximately equal intervals not exceeding 150 feet, on the highest points or edge between the end lights in a manner to indicate the extent of the obstruction and to insure unobstructed visibility of the lights from aircraft at any normal angle of approach. If there are two or more edges of the same height on such an obstruction located near a landing area, the edge nearest the landing area should be lighted.

If the obstruction is more than 150 feet in both horizontal dimensions, there should be installed at least one light, consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, on the highest point of each corner of the obstruction. In addition, there should be installed at least one similar light for each 150 feet, or fraction thereof, the distance between the corner lights exceeds 150 feet. These additional lights should be installed at approximately equal intervals, at the highest points along the outer edges of the obstruction, between the corner lights in a manner to indicate the general extent and definition of the obstruction and to insure unobstructed visibility of the lights from aircraft at any normal angle of approach.

In the event there are one or more points within the outer edges of the obstruction, the uppermost parts of which are higher than the highest level of the lights hereinbefore prescribed, at least one similar light should be displayed from the top of each such point.

Specification "E-2." When the particular obstruction is more than 150 feet in over-all height above ground, or water if so situated.

Top lights should be installed on the obstruction in the manner set forth in the applicable provisions of Specification "E-1."

In addition to the required top lights, intermediate lights, each consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, should be provided for each 150 feet, or fraction thereof, the obstruction exceeds 150 feet in over-all height above ground, or water if so situated. The position of these intermediate lights on the vertical plane should be at as close to equi-distant levels between the top lights and the ground level as the particular shape and type of obstruction will permit. One such light should be installed at each outside corner of the obstruction at each level and also one such light should be installed at equal intervals on the horizontal plane on each outer surface at each level between adjacent corner lights, for each 150 feet, or fraction thereof, the over-all horizontal distance between such adjacent corner lights exceeds 150 feet.

NOTE: In lieu of installing the obstruction lights on the obstructions, a pole or poles of a height slightly greater than the over-all height of the obstruction may be installed thereto and lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles, or similar obstructions of a corresponding over-all height. It is important that those towers, poles, or similar structures be installed in such a manner as to indicate the general definition and extent of the obstruction.

In the event early or special warning is considered necessary to provide adequate protection for aircraft, the top lights on each obstruction as required under Specifications "E-1" and "E-2" should be replaced with one or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts.

Where obstructions are extensive as in the case of a line of trees or hills, and the use of the fixed obstruction lights would be impracticable or inadequate, flashing or rotating hazard beacons may be used as an alternate to the fixed obstruction lights. Such beacons should be located on the highest points or edges of the extended obstruction at intervals not exceeding 3,000 feet, provided at least three beacons are placed on any one side or edge of the extensive obstruction to indicate a line of lights.

Bridges

The superstructure of a bridge should be lighted in accordance with the following specifications.

Where the bridge structure is over navigable water, approval of the lighting installation must be obtained from the Commandant of the United States Coast Guard to avoid interference with marine navigation.

Specification "F-1." When the bridge superstructure is not more than 150 feet in over-all length.

There should be installed at the approximate center of the highest point of the superstructure at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. The two lights should burn simultaneously and should be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

Specification "F-2." When the bridge superstructure is more than 150 feet in over-all length.

There should be installed for each 150 feet, or fraction thereof, of the over-all length of the bridge superstructure one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be installed on the highest points of the superstructure at approximately equal intervals not exceeding 150 feet in a manner to indicate the general definition and extent of the obstruction, and to insure unobstructed visibility of the lights from aircraft at any normal angle of approach. The distance between these top lights may be increased to a distance not exceeding 600 feet when the particular bridge is located more than 15,000 feet from the reference point of any landing area.

Where the bridge superstructure exceeds 150 feet in over-all length and the use of the above described obstruction lights would be impracticable or inadequate, flashing or rotating hazard beacons should be used as an alternate to the fixed obstruction lights. Such beacons should be located on the highest points or edge of the bridge superstructure at intervals not exceeding 3,000 feet, provided at least three beacons are installed to indicate the extent of the obstruction. The flashing or rotating beacons should conform to the provisions of the pertinent specifications as hereinbefore indicated under "Obstruction Lighting Equipment."

Water Towers, Grain Elevators, Gas Holders and Similar Obstructions

Water towers, grain elevators, gas holders and similar obstructions should be lighted in accordance with the following specifications:

Specification "G-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should burn simultaneously and should be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

Specification "G-2." When the particular obstruction is more than 150 feet but not more than 300 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. The beacon should be positioned so as to insure unobstructed visibility of it from aircraft at any normal angle of approach.

At the approximate midpoint of the over-all height of the obstruction, there should be installed three or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. The position of these intermediate lights on the vertical plane should be as close to an equidistant level between the top beacon and the ground level as the particular shape and type of construction of the obstruction will permit. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two of the lights from aircraft at any normal angle of approach.

Specification "G-3." When the particular obstruction is more than 300 feet but not more than 450 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. The beacon should be positioned so as to insure unobstructed visibility of it from aircraft at any normal angle of approach.

At approximately two-thirds and one-third of the over-all height of the obstruction there should be installed three or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. The position of these intermediate lights on the vertical plane should be as close to equidistant positions between the top beacon and the ground level as the particular shape and type of construction of the structure will permit. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Group of Structural Hazards

Towers, poles, tanks, smokestacks and similar obstructions which are so grouped as to present a common hazard to air navigation should be lighted in accordance with the following specifications.

Specification "H-1." This specification applies to a group of closely spaced towers, poles, tanks, smokestacks or similar obstructions of approximately the same over-all height above ground, or water if so situated, in which the spacing between the individual structures does not exceed 150 feet.

The group may be considered an extensive obstruction and lighted in accordance with the "E" Specifications for Prominent Buildings and Similar Extensive Obstructions.

Specification "H-2." This specification applies to a group of closely spaced towers, poles, tanks, smokestacks and similar obstructions, which may or may not be of the same over-all height, in which the spacing between the individual structures is not in all cases equal to or less than 150 feet.

Each prominent object within the group should be lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles, and similar obstructions or a corresponding over-all height above ground, or water if so situated

In addition, there should be installed at the top of a prominent center obstruction or on a special tower located near the center of the group of obstructions, at least one rotating beacon producing aviation red flashes. The frequency of its flashes should be such as hereinbefore specified for rotating beacons.

Hazard Areas

Areas in which a visible or invisible hazard, or hazards, exists should be lighted in accordance with the following specifications.

The obstruction lighting prescribed hereinafter is in addition to such lighting as may be necessary on any natural or man-made obstruction located within the hazard area.

Specification "I-1." An area in which a visible or invisible hazard, or hazards, to aircraft exists.

There should be mounted on top of a tower or other suitable structure, located near the center of the area, at least one rotating beacon producing aviation red flashes. The frequency of its flashes should be such as hereinbefore specified for rotating beacons.

Specification "I-2." A large area in which a visible or invisible hazard, or hazards, to aircraft exists.

There should be installed at two or more places around the perimeter of the area a rotating beacon, mounted on top of a tower or other suitable structure, producing aviation red flashes. The beacons should be located in a manner to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The frequency of its flashes should be such as hereinbefore specified for rotating beacons.

The main body of this publication presents standards for marking and lighting objects, which are potential hazards to the safe operation of aircraft, for the purpose of indicating their presence to pilots. The material in this Appendix includes texts of laws and regulations, together with information to provide guidance in complying with these texts of laws and regulations, pertaining to such objects.

Existing or contemplated structures which, by reason of their height and location relative to landing areas, constitute potential hazards to the safe operation of aircraft continually demand attention in the effort to provide and maintain maximum safety for air commerce.

It is vitally important that prompt notification of the construction or alteration of towers, electric transmission and telephone lines, smokestacks, water towers, buildings and similar structures, of certain heights and distances from landing areas and civil airways, be given to the aeronautical public through Notices to Airmen before any such structure is constructed or altered. Achievement of this result requires the cooperation of all Federal, State and Municipal agencies, private industry and individuals engaged in such construction or alteration.

For this purpose, Regulations of The Washington State Aeronautics Commission have been promulgated requiring the submission of Form 426 prior to the beginning of the construction or alteration of structures falling within the prescribed limits of air activity. The limits within which construction or alteration requires the submission of the form have been set after careful study of the problem and with due regard for the maximum protection of airmen.

In the case of an existing structure on which a proper notice has already been submitted, some latitude for repairs is permitted by an explanation of the term "alteration." Notice may be omitted if the alteration or alterations will not increase or decrease the height of the top or any part of the structure from that previously reported by more than 1 foot for each 500 feet, or fraction thereof, of the distance that the structure is situated from the nearest boundary of the landing area involved. However, notice must be given of any alteration or alterations increasing or decreasing the height of the top or any part of a structure by more than 10 feet from that previously reported.

The information required on proposed construction or alteration is clearly explained in the Form 426 prepared for that purpose and is essentially that material needed to warn airmen of a potential hazard to air navigation. It is necessary, therefore, that all applicable questions therein be answered without exception. Copies of these forms may be obtained from the Washington State Aeronautics Commission, Boeing Field Seattle, Washington.

The distance between the nearest boundary of a landing area and the site of the construction or alteration may be measured by the use of maps, or on the surface of the earth by an automobile mileage meter, or other convenient but reasonably accurate means.

The term "navigable water" as used in connection with obstructions to air navigation, denotes all water suitable for the take-off or landing of water aircraft. Other geographical features which combine hydrographic and topographic characteristics, such as marshes, swamps and bogs, come within the meaning of the term "ground" as described in the Act.

The State Aeronautics Commission desires to assist those contemplating construction which may present a potential hazard to air navigation in selecting locations for the structures which will create a minimum of interference with air operations; to recommend the proper obstruction marking and lighting to insure adequate protection to aircraft; and to minimize the possibility of damage to structures from collision by aircraft.

For this purpose the Commission has provided a special advisory service consisting of personnel who conduct the specific investigation of each case. This service is available upon request, which may be by letter or in person. The request should be accompanied by a complete description of the proposed construction, including the geographic coordinates and the distance and direction of the site from the nearest town; the distance from the nearest landing area; the height of the structure above the ground and the over-all height of the structure above mean sea level. A map or sketch showing the height and location of all tall structures in the vicinity should also be furnished. The investigation will ordinarily take approximately ten days because of the necessary contacts with aeronautical interests concerned. This period may be longer if the problem is a complex one, because every attempt is made by the investigators to resolve the problem with due regard to the safety factor.

Interested contractors, engineers and architects should avail themselves of this service so as to prevent delays in obtaining the necessary permits for the construction.

Criteria For Determining Obstructions to Air Navigation

Introduction

In order to provide uniform criteria for determining obstructions to air navigation, this standard has been adopted by the Washington State Aeronautics Commission.

Directive

In accordance with the procedure for establishing technical aeronautical standards specified in State Obstruction Marking and Lighting Law, "Criteria for Determining obstructions to Air Navigation" set forth below is established as a State Standard.

This standard is the official Washington State Aeronautics Commission guide for determining obstructions to air navigation and supersedes all existing obstruction criteria which do not conform to its requirements.

Specific Instructions

Procedure for Determining Obstructions.

Sec. 2. Any structure or obstacle which obstructs the air space above ground or water level, when determined by the commission after a hearing to be a hazard or potential hazard to the safe flight of aircraft, shall be plainly marked, illuminated, painted, lighted or designated in a manner to be approved in accordance with the general rules and regulations of the commission so that the same will be clearly visible to airman. In determining which structures or obstacles constitute or may become a hazard to air flight, the commission shall take into account only those obstacles located at river, lake and canyon crossings and in other low altitude flight paths usually traveled by aircraft.

Sec. 3. The director shall have the authority to require owners, operators, lessees or others having the control or management of structures or obstacles over one hundred fifty feet above ground or water level and which are or may become a hazard to air flight to report the location of such existing or proposed structures or obstacles to the commission. For that purpose the director may issue subpoenas and subpoenas duces tecum returnable within twenty days to the commission.

In the event a person refuses to obey the director's 31 subpoena, the commission may certify to the superior court all facts of any such refusal.

The court shall summarily hear evidence on such refusal, and, if the evidence warrants, punish such person refusing in the same manner and to the same extent as for contempt committed before the court.

Objects which are located or will be located with respect to other objects of a permanent character such that there results no material increase in the aeronautical hazard will not be considered obstructions.

Operation of Moored Balloons

Scope. The following rules shall apply to moored balloons when operated anywhere in the State of Washington at altitude controlled by State Law.

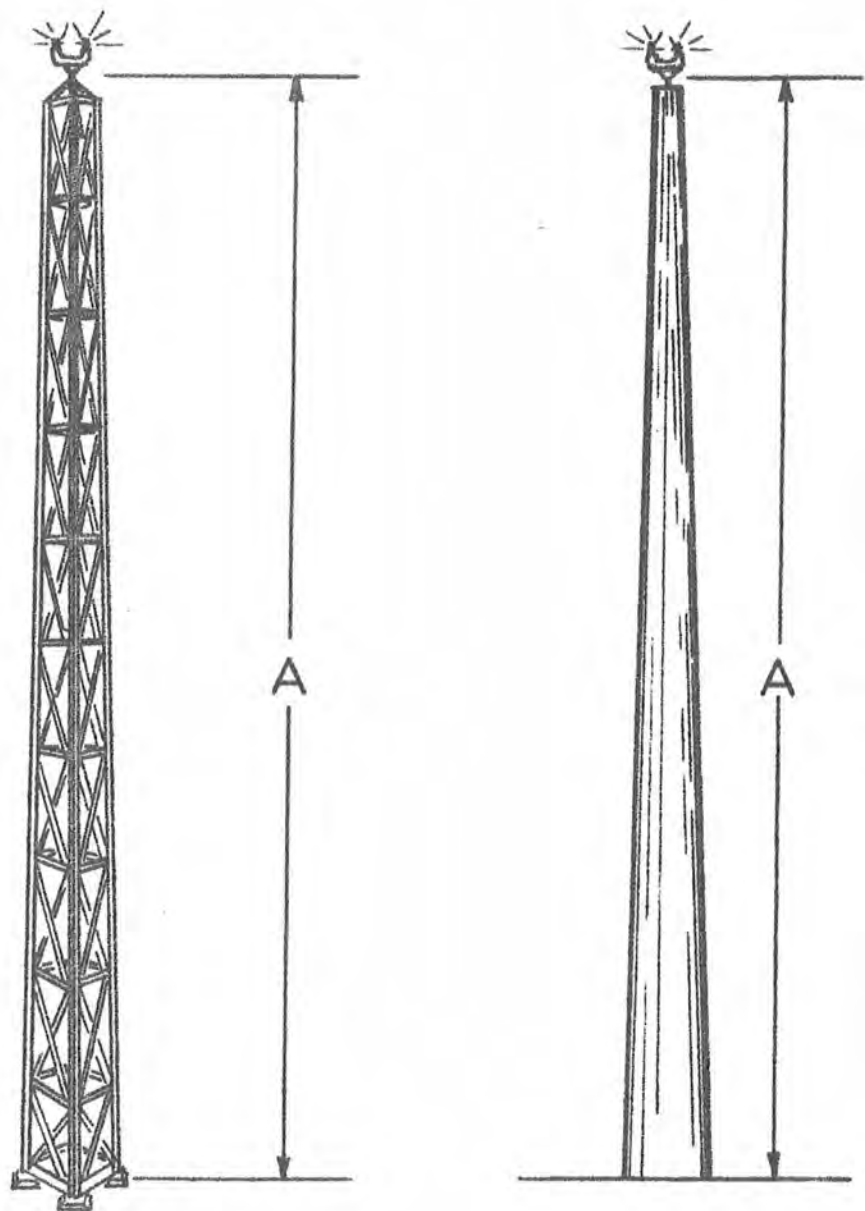
General. Moored balloons may be operated without permit from or notice to the State when operated less than 150 feet above the surface at a location not usually traveled by aircraft.

Operation requiring a permit. Unless operated under the conditions specified in "General" moored balloons subject to these regulations shall be operated under the authority of and in compliance with the terms and conditions of a permit issued by the State Aeronautics Commission when such moored balloons are operated:

- (a) closer than 500 feet to the base of any cloud, or
- (b) during the hours of darkness, or
- (c) when ground visibility is less than 3 miles, or
- (d) at altitudes more than 150 feet above the surface, or
- (e) in a location usually traveled by aircraft

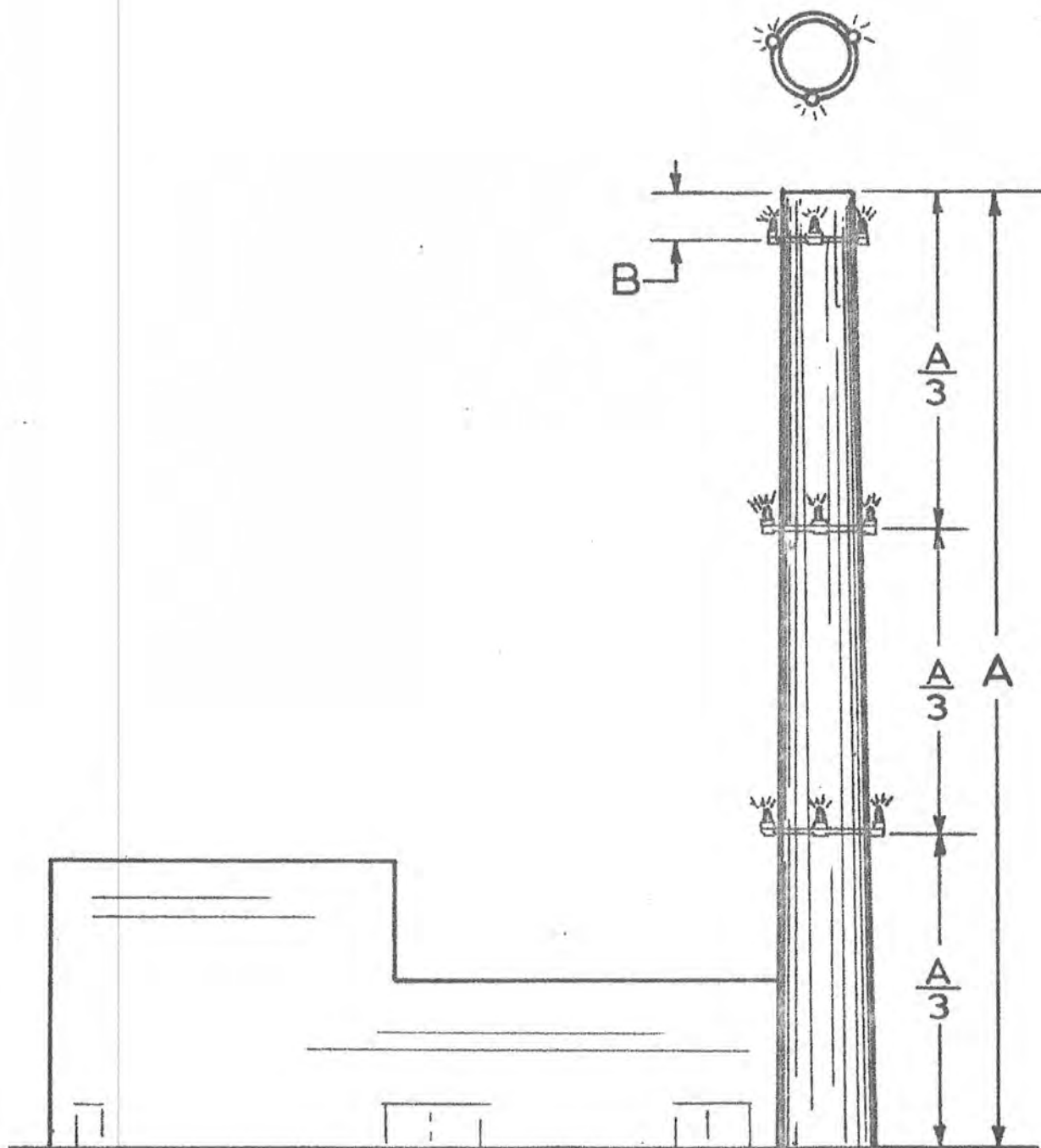
Written notice of intent must be submitted to the office of the Commission at least 30 days prior to the date of operation. Such notice shall contain the name and address of the owner and person operating the balloon, the date or dates of the proposed operation, and the location and altitude at which the proposed operation will be conducted. No moored balloons will be operated without written approval from the Washington State Aeronautics Commission.

Rapid deflation device. No moored balloon having a diameter of more than 6 feet or a gas capacity of more than 115 cubic feet shall be operated unless it is equipped with a device or means of automatic and rapid deflation in the event of an escape from its moorings.



A = NOT MORE THAN 150 FT.

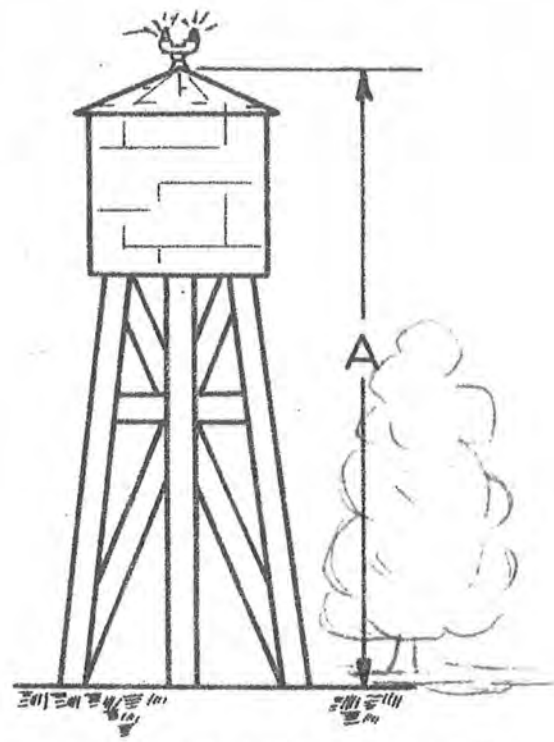
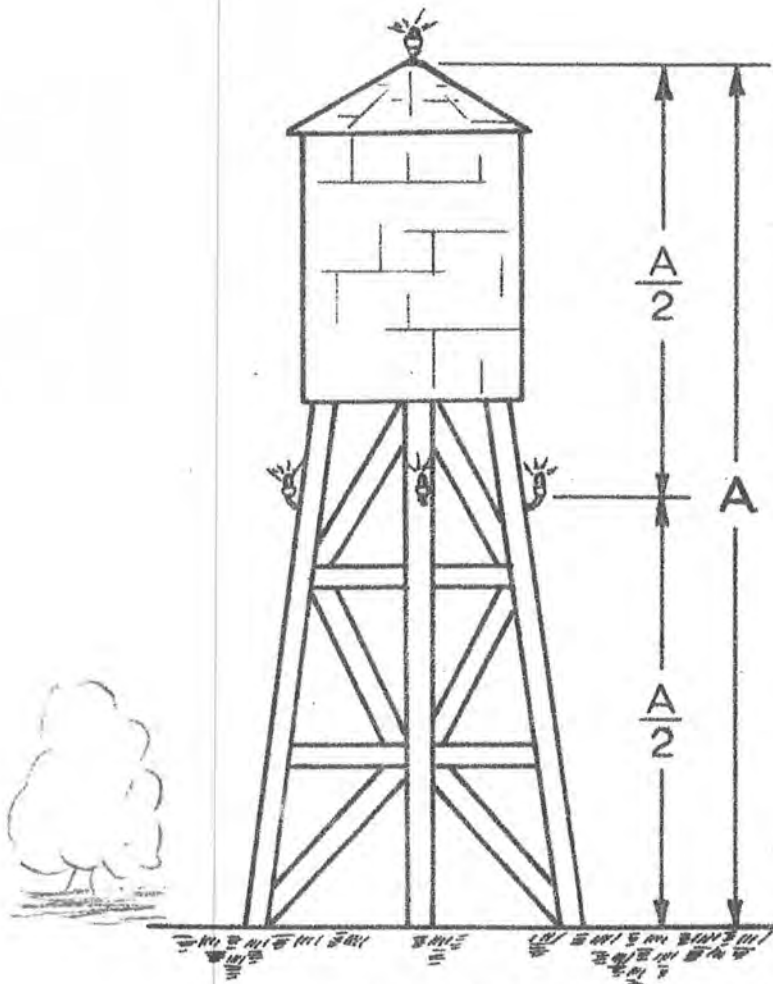
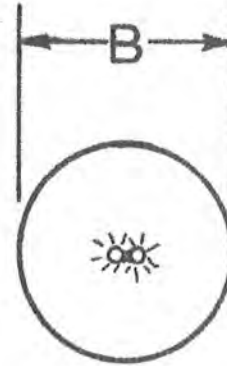
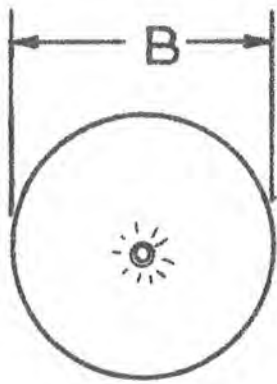
LIGHTING OF TOWERS, POLES AND SIMILAR OBSTRUCTIONS



A = 300 TO 450 FT.

B = 5 TO 10 FT.

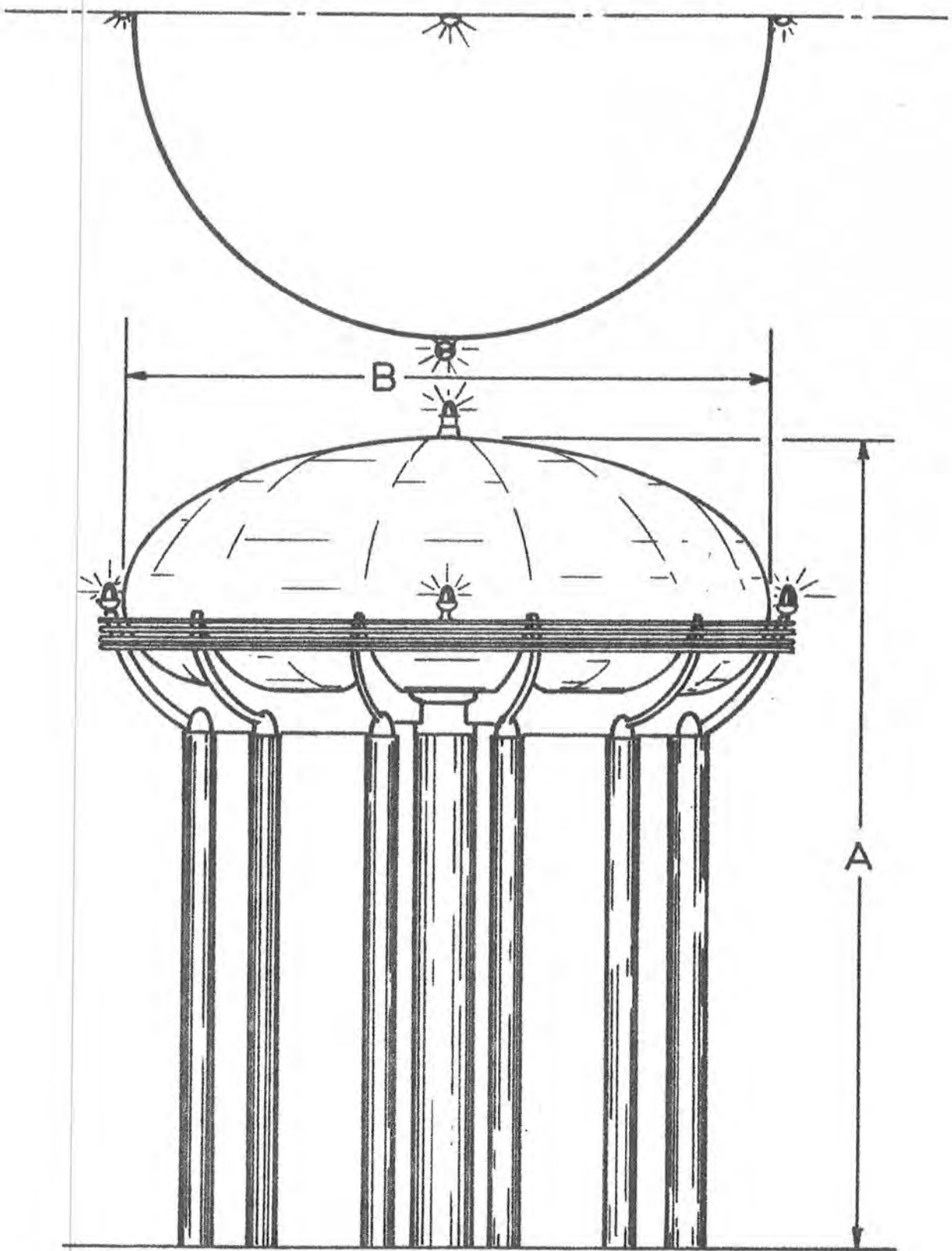
LIGHTING OF SMOKESTACKS AND SIMILAR OBSTRUCTIONS



A = 150 TO 300 FT.
B = 150 FT OR LESS

A & B = 150 FT OR LESS

LIGHTING OF WATER TOWERS AND SIMILAR OBSTRUCTIONS



A = 150 TO 300 FT

B = 150 FT OR LESS

LIGHTING OF WATER TOWERS
AND SIMILAR OBSTRUCTIONS

WASHINGTON STATE AERONAUTICS COMMISSION

FIGURE E

LIGHTING OF BRIDGES
WASHINGTON STATE AERONAUTICS COMMISSION

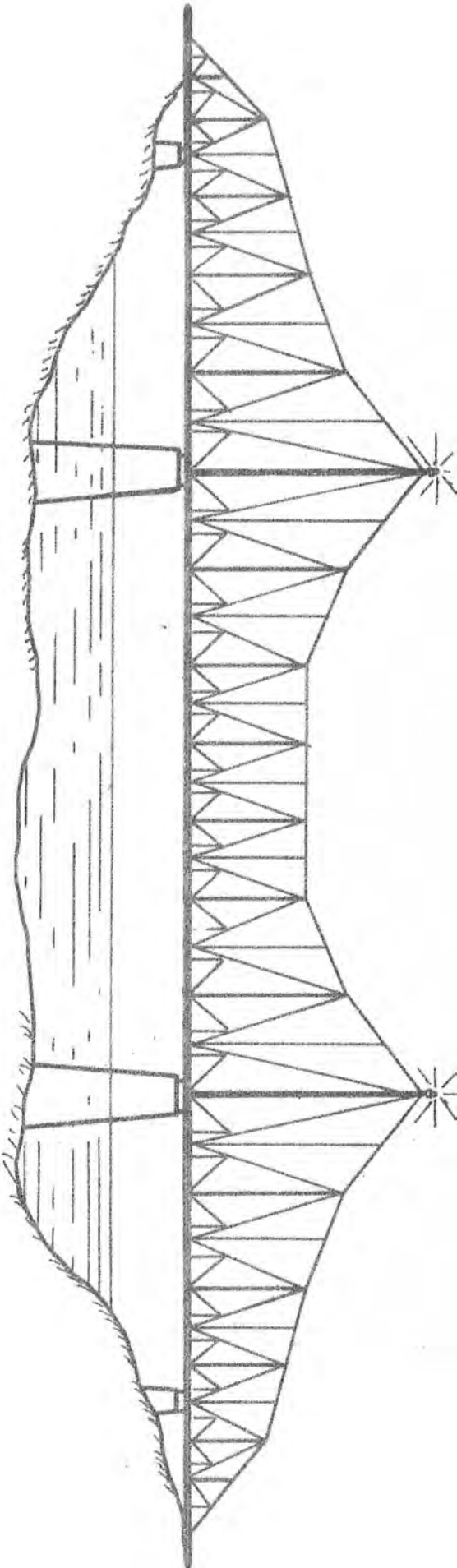
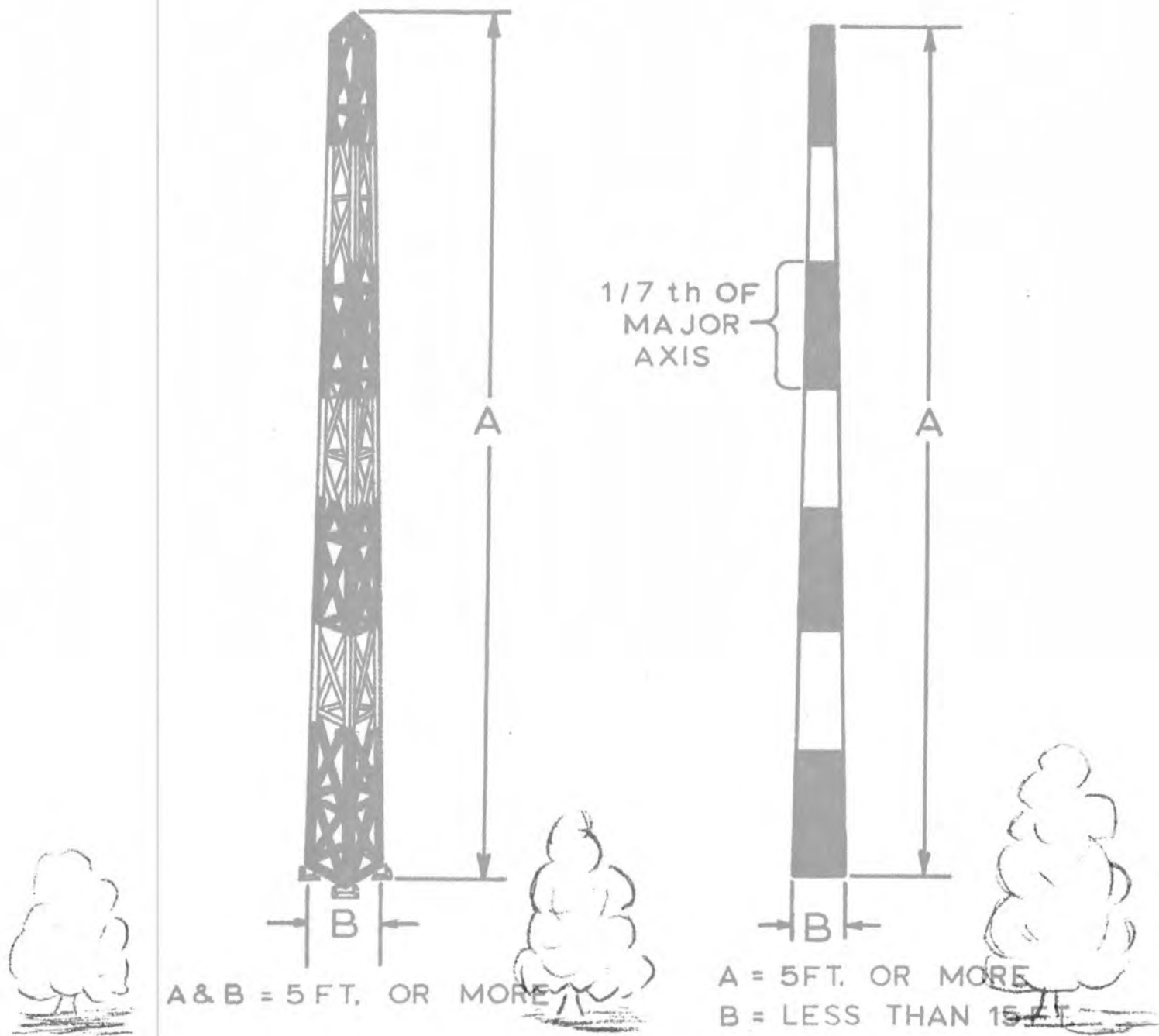
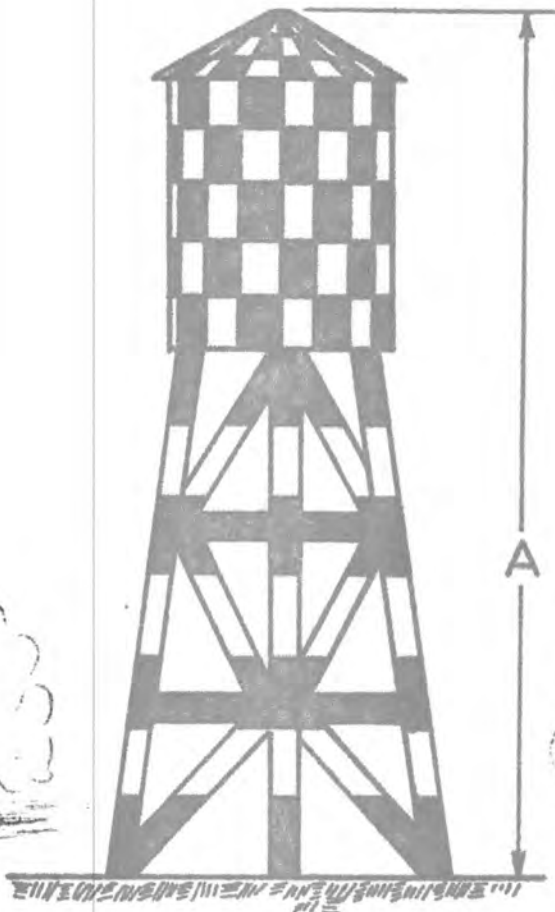


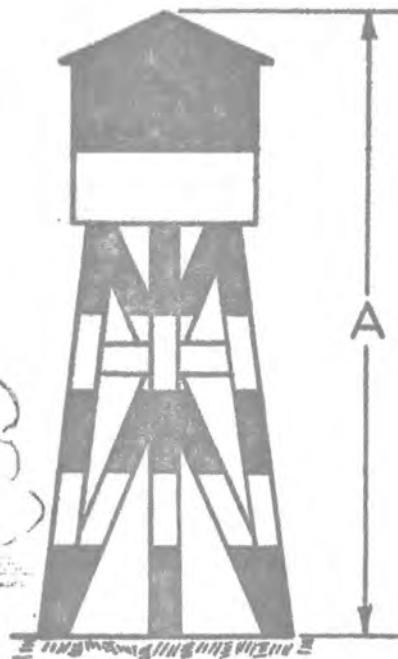
FIGURE F



PAINING OF TOWERS
POLES AND SIMILAR OBSTRUCTIONS

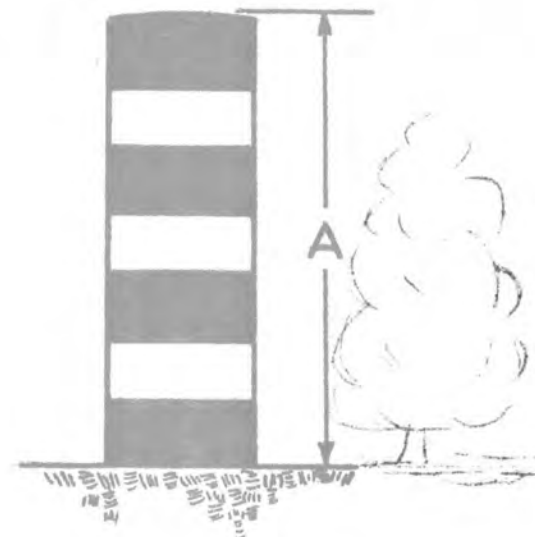
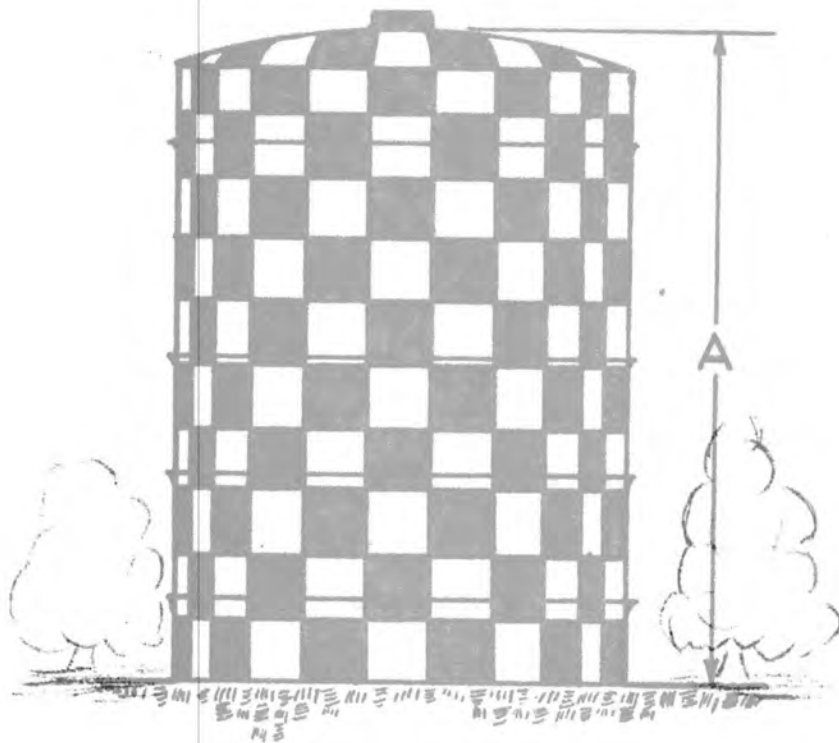
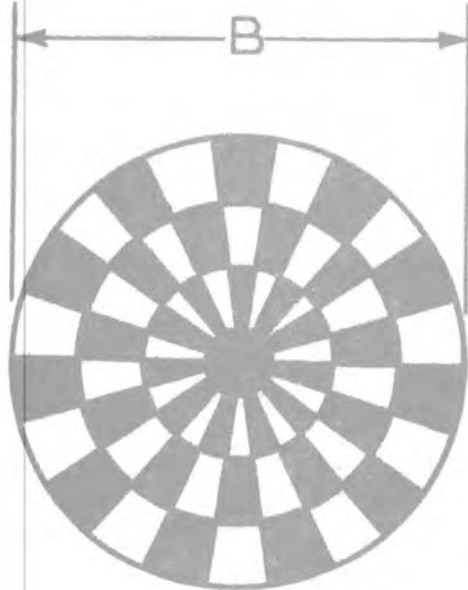


A & B = 15 FT. OR MORE



A = 5 FT. OR MORE
B = LESS THAN 15 FT.

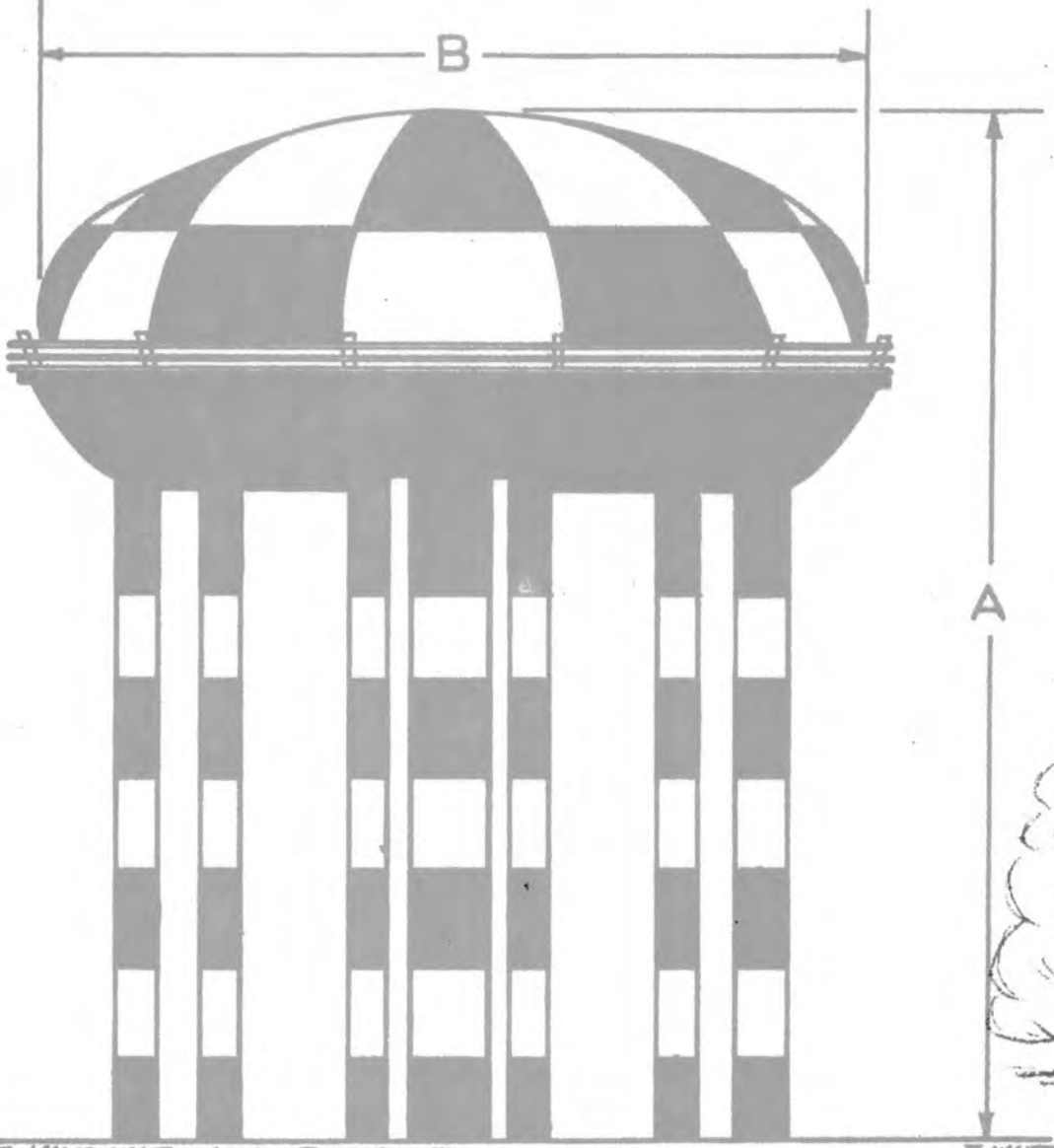
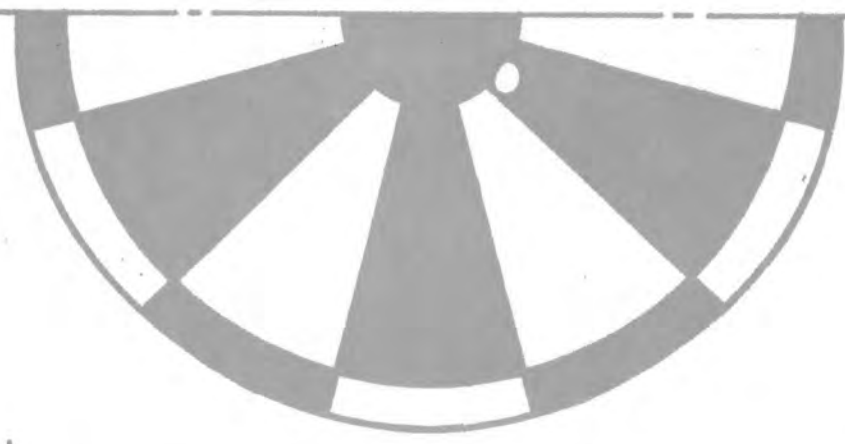
PAINING OF WATER TOWERS AND SIMILAR OBSTRUCTIONS



A & B = 15 FT. OR MORE

A = 5 FT. OR MORE
B = LESS THAN 15 FT.

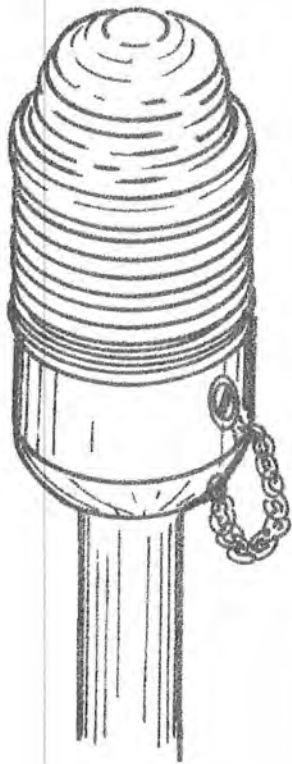
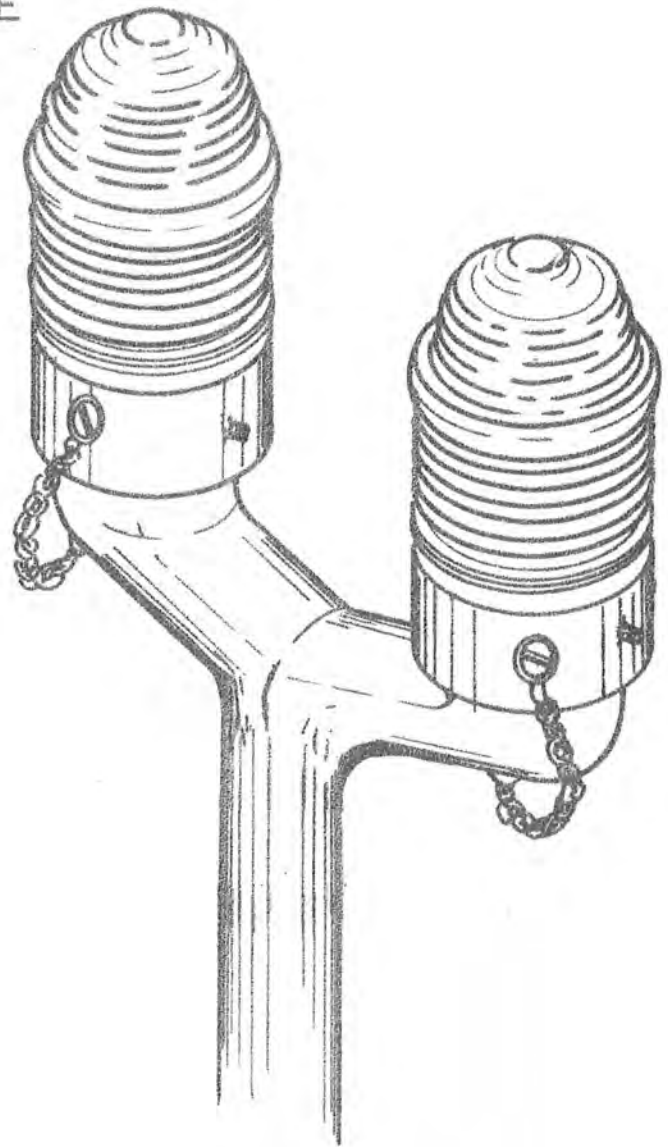
PAINING OF GAS HOLDERS AND SIMILAR OBSTRUCTIONS



A & B = 15 FT. OR MORE.

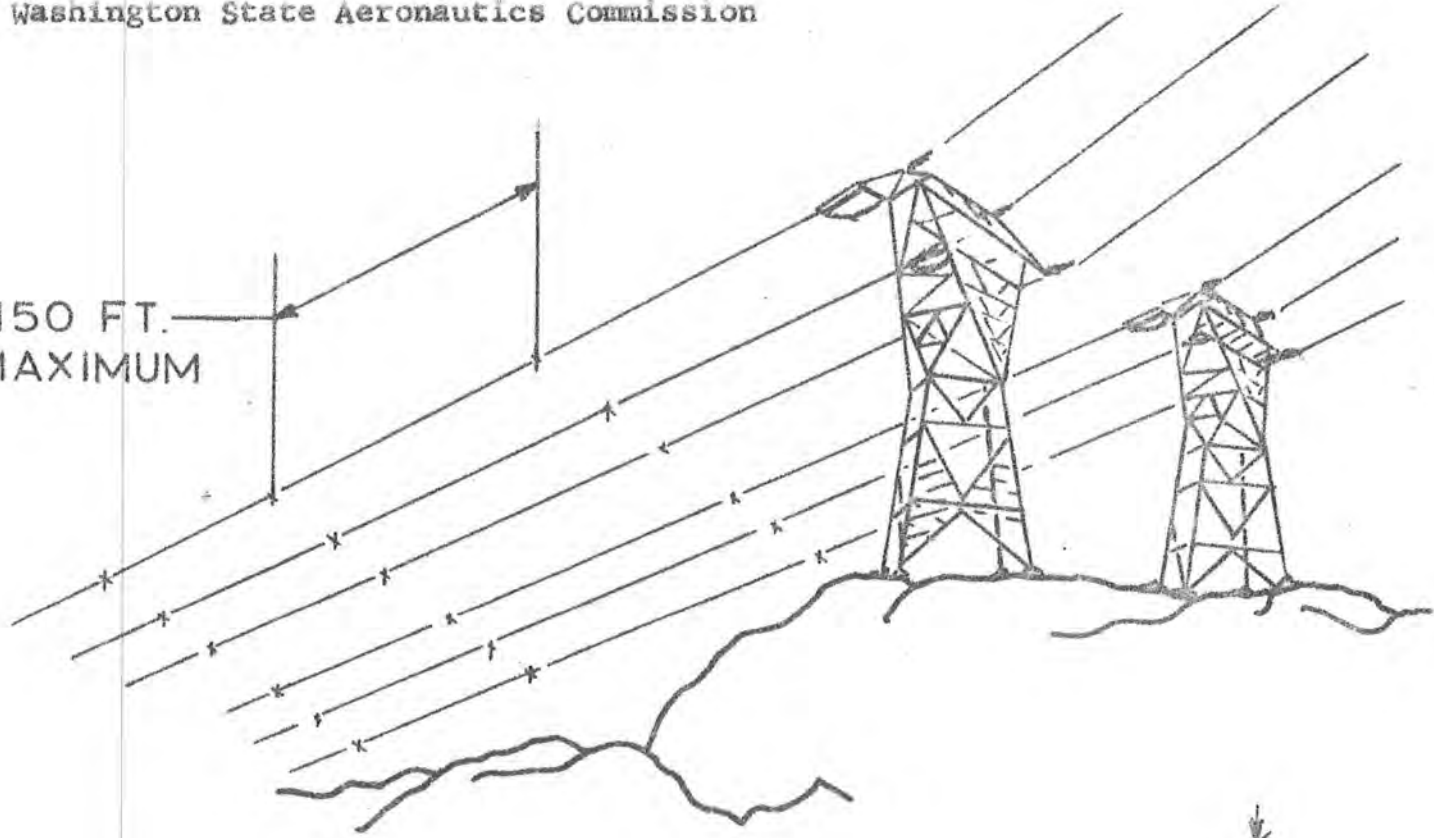
PAINING OF WATER TOWERS AND SIMILAR OBSTRUCTIONS FIGURE D

TYPICAL DOUBLE
OBSTRUCTION
LIGHT FITTING



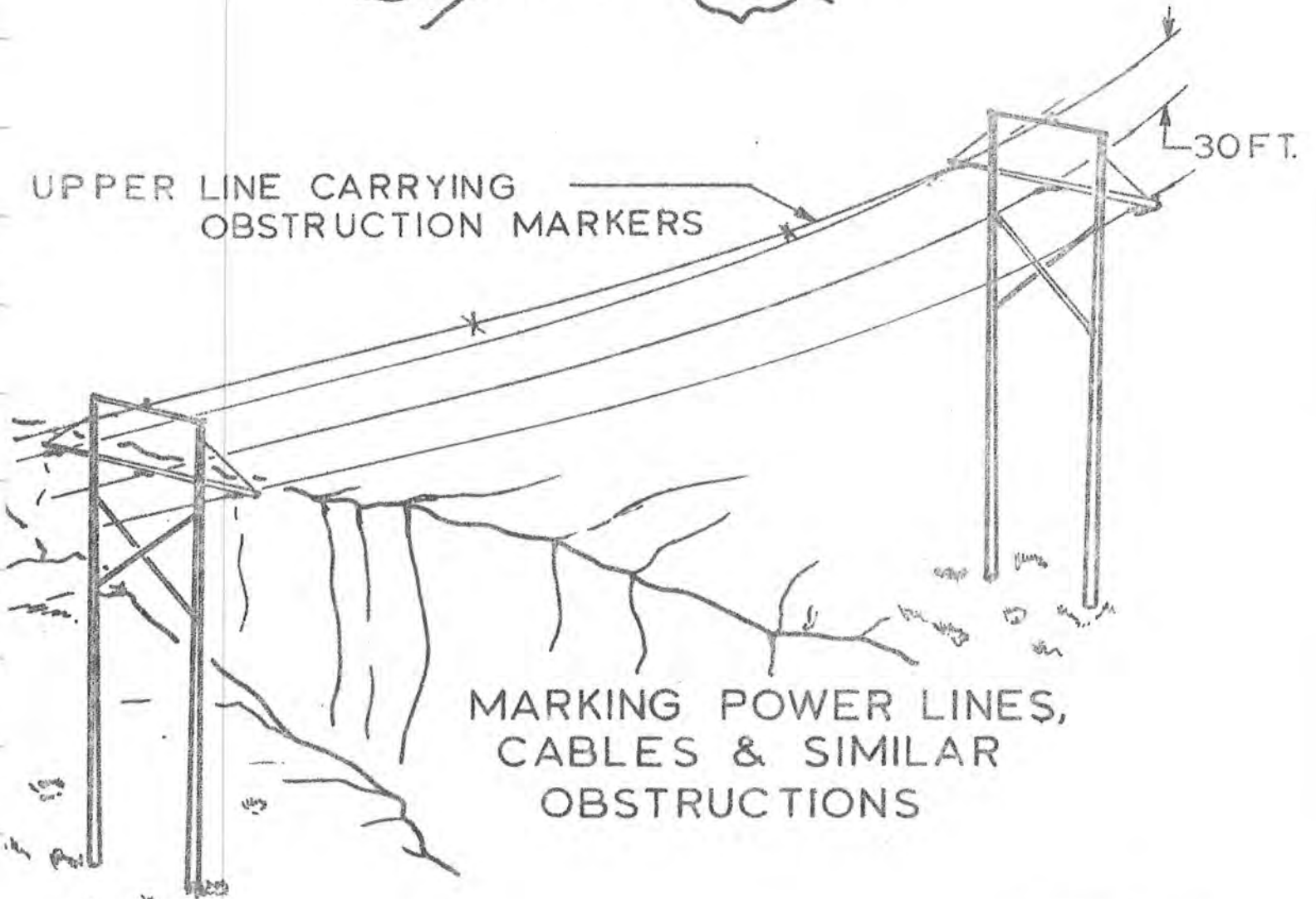
TYPICAL SINGLE
OBSTRUCTION
LIGHT FITTING

150 FT.
MAXIMUM



UPPER LINE CARRYING
OBSTRUCTION MARKERS

30 FT.



MARKING POWER LINES,
CABLES & SIMILAR
OBSTRUCTIONS

FIGURE H

Exhibit A
Feltz

WASHINGTON STATE AERONAUTICS COMMISSION

OBSTRUCTION MARKING AND LIGHTING

State Standards for Marking and Lighting
Obstructions to Air Navigation

Albert D. Rosellini
Governor

Commissioners

J. Donald Sullivan
Seattle

Benjamin F. Smith
Kent

Arthur K. Avey
Kettle Falls

DeWitt Rowland
Tacoma

Robert L. Greenhalgh
Snohomish

W. O. Wikstrom
Yakima

Wm. A. Gebenini
Director of Aeronautics
7211 Perimeter Road
Boeing Field
Seattle 8, Washington

This book was assembled from data described in Federal Aviation Agency booklet "Obstruction Marking & Lighting" in cooperation with Federal Aviation Agency Airport Engineers.

FOREWORD

The purpose of this publication is to provide State, Municipal governments, private industry and interested persons with important information and guidance in connection with the marking and lighting of natural and man-made objects which are, or may become, hazards to the safe operation of aircraft.

Included in the text are the State standards prescribed for the marking and lighting of obstruction to air navigation.

In the Appendix will be found the texts of laws and regulations regarding existing or proposed objects which may present hazards to aircraft operations, and also important information to provide guidance in complying with these texts of laws and regulations.

TABLE OF CONTENTS

	Page
Introduction.....	1
State Obstacle Law.....	2
Marking.....	3
Vehicles.....	3
Natural and Man-made.....	3
General Application.....	3
Flags.....	4
Colors.....	4
Patterns.....	5
Paint Specifications.....	11
Lighting.....	7
Temporary Warning Lights.....	8
Day Lighting.....	6
Operation.....	8
Inspection.....	8
Notification of Failure.....	9
Distribution.....	9
Voltage Limitations.....	9
Intensity.....	9
Flashing.....	9
Interference to Railway Signals.....	10
Non-standard.....	10
Specifications.....	10
Recommended Equipment.....	11
Standards for Lighting.....	12
Towers, Poles, etc.....	12
Less than 150' (A-1).....	12
More than 150' Less than 300' (A-2).....	12
" " 300' " " 450' (A-3).....	13
" " 450' " " 600' (A-4).....	13
" " 600' " " 750' (A-5).....	14
" " 750' " " 900' (A-6).....	15
" " 900' " " 1050' (A-7).....	15
" " 1050' " " 1200' (A-8).....	16
" " 1200' " " 1350' (A-9).....	17
" " 1350' " " 1500' (A-10).....	17
" " 1500' (A-11).....	18
Trees (B-1).....	18
Power Lines (C-1).....	18

	Page
Smokestacks, etc.....	19
Less than 150'..... (D-1).....	19
More than 150' Less than 300' (D-2).....	19
" " 300' " " 450' (D-3).....	20
" " 450' " " 600' (D-4).....	20
" " 600' " " 750' (D-5).....	21
" " 750' " " 900' (D-6).....	21
" " 900'..... (D-7).....	22
Prominent Buildings, etc.....	22
Less than 150'..... (E-1).....	22
More than 150'..... (E-2).....	23
Bridges, etc.....	24
Less than 150'..... (F-1).....	24
More than 150'..... (F-2).....	24
See Figure F.....	Fig. F
Water Towers, Grain Elevators, Tanks, etc.....	25
Less than 150'..... (G-1).....	25
More than 150' Less than 300' (G-2).....	25
" " 300' " " 450' (G-3).....	26
Group of Towers, Poles, Tanks, Smokestacks, etc.....	26
Same over-all height and spaced less than 150'..... (H-1).....	26
Same or not same over-all height and not equally spaced but less than 150'..... (H-2).....	26
Hazard Areas.....	27
Visible or Invisible Hazard (I-1).....	27
Large Visible or Invisible Hazard (I-2).....	27
Appendix.....	28
Criteria for Determining Obstructions.....	30
Operation of Moored Balloons.....	31
Drawings, Examples, etc.	
Lighting of Towers, Poles, etc.....	Black Fig. A
" " Smokestacks, etc.....	" Fig. B
" " Water Towers, etc.....	" Fig. C & D
" " Bridges, etc.....	" Fig. F
Painting of Towers, Poles, etc.....	Red Fig. A
" " Water Towers, etc.....	" Fig. B
" " Gas Holders, etc.....	" Fig. C
" " Water Towers, etc.....	" Fig. D
Example of Obstacle Lights.....	Fig. G

OBSTRUCTION MARKING AND LIGHTING

Introduction

The Washington State Aeronautics Commission has the Statutory responsibility of promoting safety in aeronautics and enforcing safety rules, regulations and standards. In the light of this responsibility, the Washington State Aeronautics Commission is vitally concerned with any object which may be a hazard to the safe operation of aircraft and the enforcement of State obstruction and marking law. Consequently, it has a primary responsibility in the determination of whether an existing or proposed object is, or will become, such a hazard.

In order to provide uniform criteria to determine whether an object is, or will be, an obstruction to air navigation, the Washington State Aeronautics Commission has issued State Standards for Determining Obstructions to Air Navigation. Natural or man-made objects or portions thereof, both temporary and permanent, which have been determined, through the application of these Standards, to be obstructions and all man-made objects, or portions thereof, greater than 150 feet in over-all height above ground, or water if so situated, should be marked and/or lighted in accordance with the applicable standards hereinafter described, unless aeronautical study indicates that the absence of such marking and/or lighting will not impair safety in air navigation. Existing non-standard obstruction marking and lighting installations should be replaced or modified so as to conform with these standards as soon as practicable.

The standards for marking and lighting obstructions prescribed in this publication are designed to provide the most effective means of indicating the presence of obstructions to pilots. In many instances the obstruction may be so located in reference to other objects or the contour of the ground, that the specific standard need be applied to its upper part only. Similarly, the obstruction may be so removed from the general flow of air traffic or may be so conspicuous by its shape, size or color that obstruction marking would serve no useful purpose and would be unnecessary. Furthermore, the obstruction may present such a hazard that lighting should be provided similar to that for an obstruction of a greater height. Portions of obstructions that are shielded by surrounding objects need not be marked or lighted, but the surrounding objects should be marked and lighted.

Because of the many influencing elements, the Washington State Aeronautics Commission may modify the obstruction marking and lighting standards hereinafter described when aeronautical study has indicated that a change or modification is necessary to provide adequate protection for Aeronautics.

C O P Y O N L Y

AERONAUTICS--MARKING STRUCTURES AND OBSTACLES

SUBSTITUTE HOUSE BILL NO. 426

AN ACT relating to aeronautics; and adding two new sections to chapter 165, Laws of 1947 and to chapter 14.04 RCW.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF WASHINGTON:

Section 1. There is added to chapter 165, Laws of 1947 and to chapter 14.04 RCW two new sections as set forth in sections 2 and 3 of this amendatory act.

NEW SECTION. Sec. 2. Any structure or obstacle which obstructs the air space above ground or water level, when determined by the commission after a hearing to be a hazard or potential hazard to the safe flight of aircraft, shall be plainly marked, illuminated, painted, lighted or designated in a manner to be approved in accordance with the general rules and regulations of the commission so that the same will be clearly visible to airman. In determining which structures or obstacles constitute or may become a hazard to air flight, the commission shall take into account only those obstacles located at river, lake and canyon crossings and in other low altitude flight paths usually traveled by aircraft.

NEW SECTION. Sec. 3. The director shall have the authority to require owners, operators, lessees or others having the control or management of structures or obstacles over one hundred fifty feet above ground or water level and which are or may become a hazard to air flight to report the location of such existing or proposed structures or obstacles to the commission. For that purpose the director may issue subpoenas and subpoenas duces tecum returnable within twenty days to the commission. In the event a person refuses to obey the director's subpoena, the commission may certify to the superior court all facts of any such refusal. The court shall summarily hear evidence on such refusal, and, if the evidence warrants, punish such person refusing in the same manner and to the same extent as for contempt committed before the court.

NEW SECTION. Sec. 4. This act shall not apply to structures required to be marked by federal regulations.

Passed the House March 9, 1961.

Speaker of the House.

Passed the Senate March 9, 1961.

President of the Senate.

Approved March 17, 1961

Governor of Washington

The purpose of marking an obstruction which presents a hazard to aeronautics is to warn airmen during the hours of daylight of the presence of such an obstruction. To accomplish this objective, it may be necessary to color such an obstruction so that it will be visible from aircraft at any normal angle of approach, or to indicate the general definition and location of the obstruction by use of suitable markers or flags.

When the upper part of only a portion of a structure or similar extensive obstruction projects above an obstruction determining surface, as described in State Standards, that portion only need be obstruction marked and the point or edge of it highest in relation to the obstruction determining surface should be regarded as the "top of the obstruction." In certain cases, however, such as when the obstruction determining surface concerned is an approach or transition surface (i.e., sloping) this point or edge highest in relation to the obstruction determining surface may not be the highest point or edge above a horizontal plane passing through the base of the object. In such cases, those portions of the object, the upper parts of which are higher above a horizontal plane passing through the base of the object than the upper part considered as the "top of the obstruction," should also be obstruction marked.

Marking of Vehicles

Vehicles customarily used on landing areas should be marked in accordance with the provisions of F.A.A. Technical Standard Order TSO-N4, Army-Navy-Civil Uniform Requirements for the Marking of Vehicles Used on Landing Areas.

Marking of Natural and Man-Made Obstructions

Markers

Markers should be used to mark obstructions when it has been determined that it is impracticable to mark such obstructions by use of surface colors, or it has been determined that markers should be used to provide protection for aeronautics in addition to that provided by the application of aviation surface orange and white colors.

General Application.

Markers used to mark obstructions should be displayed on or adjacent to the obstruction in conspicuous positions so as to retain the general definition of the obstruction. The size of such marker shall be a visible surface from all directions not less than that of a 36 inch sphere the length of which shall not exceed twice its median width. Provided, however, that the commission may approve a nonconforming marker.

The shape of such markers should be distinctive to the extent necessary to insure that they are not mistaken for markers employed to convey other information, and they should be such that the hazard presented by the obstruction they mark is not increased.

Flags

Flags may be used to mark obstructions when it has been determined that marking such obstructions by coloring or by markers is technically impracticable.

The flags should be displayed around or on top of the obstruction or around its highest edge and should not increase the hazard presented by the obstruction they mark. When flags are used to mark extensive obstructions or groups of closely spaced obstructions, they should be displayed at approximately 50 foot intervals.

The flags should be rectangular in shape and have stiffeners to keep them from drooping in calm or light wind. The flag stakes should be of such strength and height that they will support the flags free of the ground, vegetation, or nearby surfaces.

The flags should be in accordance with one of the following patterns:

(a) Solid color aviation surface orange not less than two feet on a side.

(b) Two triangular sections, one of aviation surface orange and the other of aviation surface white, combined to form a rectangle not less than two feet on a side.

(c) A checkerboard pattern of aviation surface orange and aviation surface white squares, each one foot plus or minus 10 percent on a side, combined to form a rectangle not less than three feet on a side.

Colors

Maximum visibility of obstructions by contrast in colors can best be obtained by the use of aviation surface orange and white. Paints and enamels of these colors have been developed for use by government agencies and private industry in marking obstructions to air navigation. In marking, either the aviation surface orange paint or enamel may be used as preferred.

The painted surfaces of obstructions should be cleaned or repainted as often as necessary to maintain good visibility.

If the smooth surface of the paint on the ladders, decks, and walkways of certain types of steel towers and similar structures presents a potential danger to maintenance personnel, such surfaces need not be painted. However, the omission of paint should be restricted to actual surfaces the painting of which will present a hazard to maintenance personnel, and care should be taken that the over-all marking effect of the painting is not reduced.

Solid. Obstructions the projection of which on any vertical plane has both dimensions less than 5 feet should be colored aviation surface orange.

Bands. Towers, poles, smokestacks and similar obstructions, as well as buildings of certain shape and dimensions, having essentially unbroken surfaces the projection of which on any vertical plane is 5 feet or more in one dimension and is less than 15 feet in the other dimension, and any skeleton or smoke-stack type obstruction having both dimensions 5 feet or more, should be colored to show alternate bands of aviation surface orange and white.

The bands should be perpendicular to the major axis of the obstruction with the band at each end colored aviation surface orange. The widths of the bands should be equal and the width of each band should be approximately one-seventh of the length of the major axis of the obstruction, provided that each band shall have a width of not more than 40 feet nor less than 1 1/2 feet. If it is technically impracticable to color the roof of a building to show alternate bands of aviation surface orange and white, such roof may be colored aviation surface orange.

Checkerboard Pattern. Water towers, grain elevators, gas holders, and similar obstructions, as well as buildings of certain shape and dimensions, having essentially unbroken surfaces the projection of which on any vertical plane is 15 feet or more in both dimensions, should have their top and vertical surfaces colored to show a checkerboard pattern of alternate rectangles of aviation surface orange and white. If it is technically impracticable to color the roof of a building to show alternate rectangles of aviation surface orange and white, such roof may be colored aviation surface orange.

The sides of the rectangles should measure not less than 5 feet nor more than 20 feet. The rectangles at the corners of surfaces should be colored aviation surface orange.

If a part of a water tower, gas holder, building, or similar obstruction consists of a skeleton type construction, that portion of the obstruction should be colored with alternate bands of aviation surface orange and white as specified for towers, poles, smokestacks and similar obstructions. In this case, if the portion of the obstruction, which is to be colored to show a checkerboard pattern of alternate rectangles of aviation surface orange and white, has any surfaces the projection of which on any vertical plane is less than 15 feet in either dimension, the alternate rectangles of aviation surface orange and white may have dimensions of less than 5 feet on a side, provided their dimensions remain as close as is practicable to the minimum 5 feet specified for coloring by the checkerboard pattern.

If the size and shape of water towers, grain elevators, gas holders and similar obstructions come within the dimensions set forth under the specification for coloring by bands; or if their type of construction does not permit coloring by the checkerboard pattern as hereinbefore described, then such obstructions should be colored by bands as specified for towers, poles, smokestacks and similar obstructions. Where this method of coloring is employed, the top aviation surface orange band should be continued from the vertical surface so as to cover the entire top of the obstruction.

If a part, or all, of certain obstructions such as water towers and gas holders of spherical shape does not permit the exact application of the checkerboard pattern of coloring, then the shape of the alternate rectangles of aviation surface orange and white covering the spherical shape may be modified to fit the particular shape of the structural surface, provided the dimensions of these modified rectangles remain to the extent practicable within the dimensional limits set forth in the specifications for coloring by the checkerboard pattern.

If certain obstructions such as gas holders and grain elevators are of such large size that the application of the checkerboard pattern of coloring to the complete outer surface of the structure would be impracticable, the application of the checkerboard pattern of coloring may be limited to the upper one-third of the structure, provided aeronautical study indicates that the modified marking will provide adequate protection for air navigation.

Special Day Lighting

The display of flashing or steady burning lights on an obstruction during daylight hours, for the purpose of warning airmen of the presence of such an obstruction, may be prescribed under certain conditions.

The foregoing day lighting is intended to provide protection in addition to that provided by the applicable marking standard hereinbefore described.

The purpose of lighting an obstruction which presents a hazard to air commerce is to warn airmen during the hours of darkness and during periods of limited daytime light intensity of the presence of such an obstruction. To accomplish this objective, it is necessary to provide adequate lighting on the obstruction in a manner which assures visibility of such lighting from aircraft at any normal angle of approach. In determining the proper amount of obstruction lighting to adequately mark an obstruction the mean elevation of the top of the building in closely built-up areas may be used as the equivalent of the ground level.

The top light, or lights, displayed on an obstruction should be installed so as to mark the points or edges of the obstruction highest in relation to an obstruction determining surface, except that when no obstruction determining surface is involved, such top light, or lights, should be installed on the points or edges of the obstruction highest in relation to the ground, or water if so situated. If two or more edges of an extended obstruction located near a landing area are of the same height, the edge nearest the landing area should be lighted.

When the upper part of only a portion of a building or similar extensive object projects above an obstruction determining surface, that portion only need be obstruction lighted and the point or edge of it highest in relation to the obstruction determining surface should be regarded as the "top of the obstruction." In certain cases, however, such as when the obstruction determining surface concerned is an approach or transition surface (i.e., sloping) this point or edge highest in relation to the obstruction determining surface may not be the highest above a horizontal plane passing through the base of the object. In such cases, additional obstruction lights should be placed on the highest part of the object as well as on the point or edge highest in relation to the obstruction determining surface.

If a light, or lights, which is installed on an obstruction is shielded in any direction by an adjacent object, additional lights should be mounted on that object in such a way as to retain the general definition of the obstruction, the shielded light, or lights, being omitted if it does not contribute to the definition of the obstruction.

Obstruction lights and hazard beacons should be operated at all times when the center of the sun's disc is 6° or more below the horizon and during periods of restricted visibility. They may also be operated at such other times as considered desirable. For the purpose of this standard, the term "sunset to sunrise" shall be generally regarded as that period when the center of the sun's disc is 6° or more below the horizon.

Temporary Warning Lights

When an obstruction to air navigation is presented during construction of a structure at least two lights, each light consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, should be installed at the uppermost point of the structure. In addition, as the height of the structure exceeds each level at which permanent obstruction lights will be required, two similar lights should be installed at each such level. These temporary warning lights should be displayed nightly from sunset to sunrise until the permanent obstruction lights have been installed and placed in operation, and should be positioned so as to insure unobstructed visibility of at least one of the lights at each level from aircraft at any normal angle of approach. It will be permissible, in the event it is more practicable, to install and operate the permanent obstruction lighting fixtures at each required level, in lieu of the above temporary warning lights, as each such level is exceeded in height during construction.

Operation of Obstruction Lighting

Light Sensitive Control Device

The operation of obstruction lighting installed on obstructions of an over-all height greater than 150 feet above ground, or water if so situated, should be controlled by a light sensitive control device adjusted so that the lights will be turned on at a north sky light intensity level of about 35 foot-candles and turned off at a north sky light intensity level of about 58 foot-candles, or should be continuous.

Under normal conditions, where no special means of controlling obstruction lighting has been recommended, either a light sensitive control device or an astronomic dial clock and time switch may be used to control the obstruction lighting in lieu of manual control.

Inspection of Obstruction Lighting

Obstruction lighting should be visually observed at least once each 24 hours, or checked by observing an automatic and properly maintained indicator designed to register any failure of such lights, to insure that all such lights are functioning properly as required. In the event the obstruction lighting is not readily accessible for the above observation at least once each 24 hours, an automatic alarm system designed to detect any failure of such lights may be installed to replace the normally required visual inspection. The Commission will not object to excluding the side or intermediate obstruction lights on an obstruction from the alarm circuit, provided the signaling device will indicate malfunctioning of all flashing and rotating beacons regardless of their position on the obstruction, and of all top lights; and that all obstruction lights mounted on the obstruction are visually inspected at least once every two weeks, with all lamps being replaced at regular intervals after being lighted the equivalent of not more than 75 percent of their normal life expectancy.

Notification of Light Failure

Any observed or otherwise known extinguishment of improper functioning of a marker light, regardless of its position on a man-made obstruction, which will last more than 30 minutes and any observed or otherwise known extinguishment or improper functioning of a steady burning obstruction light, installed at the top or near top of any natural or man-made obstruction, which will last more than 30 minutes should be immediately reported. Such reports should be made by telephone or telegraph to the nearest Airways Communications Station or office of Washington State Aeronautics Commission and should set forth the condition of the light, or lights, the circumstance which caused the failure and the probable date that normal operation will be resumed. Further notification by telephone or telegraph should be given immediately upon resumption of normal operation by the light, or lights.

Any extinguishment or improper functioning of a steady burning side or intermediate light, or lights, installed on a natural or man-made obstruction should be corrected as soon as possible, but notification of such extinguishment or improper functioning is not necessary.

Color of Lighting

The signal emitted by hazard beacons and obstruction lights shall be aviation red in color.

Light Distribution

The vertical and horizontal light distribution of the fixed obstruction lights should meet the requirements specified in the pertinent specifications listed in this publication. The vertical light distribution of the flashing and rotating hazard beacons should be such that the time-intensity integral of the flashes at angles between one degree and three degrees above the horizontal is not less than the candle-seconds values specified hereinbefore under "Intensity of Lighting," and the time-intensity integral at angles between three degrees and fifteen degrees above the horizontal is not less than the product of these candle-seconds values multiplied by nine over the square of the numerical value in degrees of the angle above the horizontal.

Rated Lamp Voltage

In order to provide satisfactory output by obstruction lights, the rated voltage of the lamp used should, in each case, correspond to or be within 3 percent higher than the average voltage across the lamp during the normal hours of operation.

Flashing of Lights

If the flashing mechanism in obstruction lighting circuits is installed so as to make it necessary for the lights to flash, the simultaneous flashing of all lights will be permissible.

Intensity of Lighting

The intensity of fixed obstruction lights should be not less than ten candles of aviation red light.

Interference with Railway Signals

Where obstruction lighting is installed on obstructions which are located along or near railroad rights-of-way and thereby constitutes a potential hazard to the safe operation of railway trains, extreme care should be taken to prevent any possibility of these obstruction lights being mistaken by locomotive engineers for railway signal lights. Shielding of the obstruction lights from the view of the locomotive engineers, if practicable, should be considered; the fixed lights on the obstruction may be made to flash; or the lights at the lower levels of the obstruction may be extinguished if their extinguishment does not materially increase the hazard to air navigation caused by the presence of the obstruction.

Obstruction Lighting by Non-Standard Lights

Obstruction lighting installations may utilize incandescent lamps other than those specified under the recommended lamp equipment, gaseous tubes such as neon tubes, or any method other than the conventional incandescent lamps, provided such lighting installations offer equal or greater light intensity in all angles of azimuth and elevation than that specified for standard obstruction light assemblies, afford equal or greater dependability of operation, and possess the color characteristics prescribed in the following specifications.

Obstruction Lighting Equipment

Specifications and Drawings

The lighting equipment, paint and aviation colors referred to in the standards set forth in this publication should conform with the applicable provisions of the following specifications and their related drawings:

Double and Single Obstruction Lights

- (a) Military Specification MIL-L-7830
- (b) F.A.A. Specification L-810 Specification for Obstruction Light

Covers for Aeronautical Lights

- (a) Military Specification MIL-C-7989 Covers; Light-Transmitting (for Aeronautical Lights)

Aviation Colors

- (a) Air Force-Navy Aeronautical Specification AN-C-56 Colors; Aeronautical Lights and Lighting Equipment
- (b) Federal Specification TT-C-595 Color Guide; Ready Mixed Paint
 - (1) Orange No. 1205 (Aviation Surface Orange)

Aviation Surface Paint

- (a) Federal Specification TT-P-59
Aviation Surface Orange Paint (International Orange)
- (b) Federal Specification TT-E-489
Aviation Surface Orange Enamel (International Orange)
- (c) Federal Specification TT-P-102
Outside White Paint

Air Force-Navy Aeronautical Standard Drawings

- (a) AN2541
Globe--Marker Lamp
- (b) AN2547
Fitting Assembly--Marker Lamp

Disconnecting Obstruction Light

- (a) Air Force-Navy Aeronautical Specification AN-L-31
Lamp Assembly--Disconnecting Obstruction Marker

Recommended Lamp Equipment

Multiple circuits

	Base	Lamp	Filament	L.C.L. inches	Type
100 watts	Med. screw	A-21 clear.....	C-9..	2 7/16.	Traffic signal
100 watts	Med. pfc..	A-21 clear.....	CC-2V.	2 3/4..	Obstruction.
100 watts	Sc. term..	PAR-56, clear...	C-6..	Airway beacon.
*111 watts	Med. sc...	A-21 clear.....	C-9..	2 7/16.	Obstruction.
500 watts	Mog. pfc..	PS-40 clear.....	C-7A.	5 11/16	Code beacon.
500 watts	Med. bip..	T-20 clear.....	C-13B	3.....	Airway beacon.
**620 watts	Mog. pfc..	PS-40 clear.....	C-7A.	5 11/16	Code beacon.
1000 watts	Mog. bip..	T-20 clear.....	C-13.	4.....	Airway beacon.
1500 watts	Mog. bip..	T-24 clear (32v)	C-5..	4.....	Airway beacon.

Series circuit

1020 Lumens	Med. pfc..	A-21 clear.....	C-8..	2 3/4..	Obstruction.
-------------	------------	-----------------	-------	---------	--------------

* Has same lumen output as 100-watt but designed for 3000 hours life.

** Has same lumen output as 500-watt but designed for 3000 hours life.

Copies of Military Specifications and Air Force-Navy Aeronautical Specifications or drawings can be obtained by contacting Commanding General, Air Material Command, Wright Field, Dayton, Ohio, or the Bureau of Aeronautics, Department of the Navy, Washington 25, D.C. Copies of F.A.A. specifications and information concerning Air Force-Navy Aeronautical Specifications and Federal Specifications can be obtained from the Office of Federal Airways, F.A.A. Washington 25, D.C.

Standards For Lighting Obstructions To Air Navigation

Towers, Poles and Similar Obstructions

Towers, poles and similar obstructions should be lighted in accordance with the following specifications:

Specification "A-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated:

There should be installed at the top of the obstruction at least two lights, each light consisting of a lamp of at least 100 watts enclosed in aviation red obstruction light globes. These lights should burn simultaneously and should be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

Specification "A-2." When the particular obstruction is more than 150 feet but not more than 300 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each lamp should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons at any normal angle of approach.

At the approximate mid point of the over-all height of the obstruction, there should be installed at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. Each light should be placed on diagonally or diametrically opposite positions of the obstruction and mounted so as to insure unobstructed visibility of at least one light from aircraft at any normal angle of approach.

In case of a triangular or rectangular shaped tower, the lights at the mid-level should be mounted so as to insure unobstructed visibility of at least one light from aircraft at any normal angle of approach, or a light should be installed on each corner of the tower at this level.

Specification "A-3." When the particular obstruction is more than 300 feet but not more than 450 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

On levels at approximately two-thirds and one-third or the over-all height of the obstruction, there should be installed at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. Each light should be placed on diagonally or diametrically opposite positions of the obstruction and mounted so as to insure unobstructed visibility of at least one light at each level from aircraft at any normal angle of approach.

In case of a triangular or rectangular shaped tower, the lights at the two-thirds and one-third levels should be mounted so as to insure unobstructed visibility of at least one light on each level from aircraft at any normal angle of approach, or a light should be installed on each corner of the obstruction at each level.

Specification "A-4." When the particular obstruction is more than 450 feet but not more than 600 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately one-half of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event this beacon cannot be installed in a manner to insure unobstructed visibility of it from aircraft at any normal angle of approach, there should be installed two such beacons. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed height.

On levels of approximately three-fourths and one-fourth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes, should be installed on each outside corner of the obstruction at each level.

Specification "A-5." When the particular obstruction is more than 600 feet but not more than 750 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately two-fifths of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event this code beacon cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at this level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed height.

On levels at approximately four-fifths, three-fifths and one-fifth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-6." When the particular obstruction is more than 750 feet but not more than 900 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts.

Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately two-thirds and at approximately one-third of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately five-sixths, one-half and one-sixth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-7." When the particular obstruction is more than 900 feet but not more than 1050 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately four-sevenths, and at approximately two-sevenths of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately six-sevenths, five-sevenths, three-sevenths and one-seventh of the over-all height of the obstruction one or more lights consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-8." When the particular obstruction is more than 1050 feet but not more than 1200 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately three-fourths, one-half and one-fourth of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately seven-eighths, five-eighths, three-eighths and one-eighth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-9." When the particular obstruction is more than 1200 feet but not more than 1350 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any normal angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately two-thirds, four-ninths and two-ninths of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately eight-ninths, seven-ninths, five-ninths, one-third and one-ninth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-10." When the particular obstruction is more than 1350 feet but not more than 1500 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. Where a rod or other construction of not more than 20 feet in height and incapable of supporting this beacon is mounted on top of the obstruction and it is determined that this additional construction does not permit unobstructed visibility of the code beacon from aircraft at any angle of approach, there should be installed two such beacons positioned so as to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach.

At approximately four-fifths, three-fifths, two-fifths and one-fifth of the over-all height of the obstruction, a similar flashing 300 mm electric code beacon should be installed in such a position within the obstruction proper that the structural members will not impair visibility of this beacon from aircraft at any normal angle of approach. In the event these electric code beacons cannot be installed in a manner to insure unobstructed visibility from aircraft at any normal angle of approach, there should be installed two such beacons at each level. Each beacon should be mounted on the outside of diagonally opposite corners or opposite sides of the obstruction at the prescribed heights.

On levels at approximately nine-tenths, seven-tenths, one-half, three-tenths and one-tenth of the over-all height of the obstruction one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes should be installed on each outside corner of the obstruction at each level.

Specification "A-11." Towers and similar obstructions which are more than 1500 feet in over-all heights above ground, or water if so situated, will be given special aeronautical study to determine the proper manner in which to obstruction light them to provide adequate protection for air commerce.

Trees

A line of trees, with the individual trees located less than 150 feet apart, or a tree covered area should be lighted as an extensive obstruction in the manner set forth in the "E" Specifications for Prominent Buildings and Similar Extensive Obstructions, with the obstruction lights mounted on poles or towers, of a height slightly greater than the height of the outstanding trees. Individual trees and widely spaced trees should be lighted in accordance with the following specifications:

Specification "B-1." Poles of a height slightly greater than the height of the outstanding tree(s) should be installed adjacent to the tree(s) and lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles and similar obstructions of a corresponding over-all height above ground, or water if so situated.

Transmission Lines

The catenary of a transmission line or similar obstructions, should be lighted in accordance with the following specifications:

Specification "C-1." The towers, poles, or similar structures supporting such a line should be lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles, or similar obstructions of a corresponding over-all height above ground, or water if so situated.

In each case where a transmission line within 15,000 feet of a landing area is required to be lighted in accordance with the provisions of chapter 263, Laws of 1961, one or more lights, each light consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, should be displayed for each 150 feet or fraction thereof, of the over-all length of the overhead line. These lights should be equally spaced along the entire length of the overhead transmission line at points not more than 150 feet apart and each light should be placed not below the level of the highest wire at the point marked.

When a transmission line more than 15,000 feet from a landing area is required to be lighted in accordance with the provisions of chapter 263, Laws of 1961, the distance between the obstruction lights displayed on such wires may be increased to not less than 600 feet.

Smokestacks and Similar Obstructions

Smokestacks and similar obstructions should be lighted in accordance with the following specifications:

In order to avoid the obscurant effect of the deposits generally in evidence from this type of structure, the top lights should be installed from 5 to 10 feet below the highest point of the structure. It is important that these lights be readily accessible to enable cleaning when necessary and to facilitate lamp replacements.

Smokestacks and similar obstructions may be floodlighted by fixed searchlight projectors installed at three or more equidistant points around the base of each such obstruction if the search light projectors will provide an average illumination of at least 15 candles at the top one-third of the obstruction.

Specification "D-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction three or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two of the lights from aircraft at any normal angle of approach.

Specification "D-2." When the particular obstruction is more than 150 feet but not more than 300 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately the midpoint of the over-all height of the obstruction, there should be installed at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one light from aircraft at any normal angle of approach.

Specification "D-3." When the particular obstruction is more than 300 feet but not more than 450 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels at approximately two-thirds and one-third of the over-all height of the obstruction, there should be installed on each level at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction lightglobes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one light from aircraft on any normal angle of approach.

Specification "D-4." When the particular obstruction is more than 450 feet but not more than 600 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately one-half of the over-all height of the structure, two or more similar flashing 300 mm electric code beacons should be installed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels of approximately three-fourths and one-fourth of the over-all height of the structure, there should be installed on each level at least three lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Specification "D-5." When the particular obstruction is more than 600 feet but not more than 750 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately two-fifths of the over-all height of the obstruction, two or more similar flashing 300 mm electric code beacons should be installed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels of approximately four-fifths, three-fifths and one-fifth of the over-all height of the obstruction, there should be installed on each level at least three lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Specification "D-6." When the particular obstruction is more than 750 feet but not more than 900 feet in over-all height above ground, or water if so situated.

There should be installed at a near top level of the obstruction two or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts. The beacons should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

At approximately two-thirds and at approximately one-third of the over-all height of the obstruction two or more similar flashing 300 mm electric code beacons should be installed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least one beacon from aircraft at any normal angle of approach.

On levels of at approximately five-sixths, one-half and one-sixth of the over-all height of the obstruction, there should be installed at least three lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes.

these lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Specification "D-7." Smokestacks and similar obstructions which are more than 900 feet in over-all height above ground, or water if so situated, will be given special aeronautical study to determine the proper manner in which to obstruction light them to provide adequate protection for air commerce.

Prominent Buildings and Similar Extensive Obstructions

Prominent buildings and similar extensive obstructions should be lighted in accordance with the following specifications. In the event the individual objects of a group of obstructions are approximately the same over-all height above ground, or water if so situated, and are located not more than 150 feet apart, the group of obstructions may be considered an extensive obstruction and so lighted.

Specification "E-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated.

If the obstruction is not more than 150 feet in either horizontal dimension, there should be installed at approximately the highest point or edge at each end of the major axis of the obstruction at least one light, consisting of a lamp of at least 100 watts, enclosed in an aviation red obstruction light globe. These lights should be positioned so as to insure unobstructed visibility of them from aircraft at any normal angle of approach, and to indicate the general extent of the obstruction; or, if the shape of the obstruction is such as to make this manner of lighting impracticable, there may be installed two such lights at the approximate center of the highest point or edge of the obstruction. Both lights should burn simultaneously and be so positioned as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

If the obstruction is more than 150 feet in one horizontal dimension, but not more than 150 feet in the other, there should be installed at least one light, consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, for each 150 feet, or fraction thereof, or the over-all length of the major axis of the obstruction. At least one of these top lights should be installed on the highest point or edge of each end of the obstruction, with the additional lights as required spaced at approximately equal intervals not exceeding 150 feet, on the highest points or edge between the end lights in a manner to indicate the extent of the obstruction and to insure unobstructed visibility of the lights from aircraft at any normal angle of approach. If there are two or more edges of the same height on such an obstruction located near a landing area, the edge nearest the landing area should be lighted.

If the obstruction is more than 150 feet in both horizontal dimensions, there should be installed at least one light, consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, on the highest point of each corner of the obstruction. In addition, there should be installed at least one similar light for each 150 feet, or fraction thereof, the distance between the corner lights exceeds 150 feet. These additional lights should be installed at approximately equal intervals, at the highest points along the outer edges of the obstruction, between the corner lights in a manner to indicate the general extent and definition of the obstruction and to insure unobstructed visibility of the lights from aircraft at any normal angle of approach.

In the event there are one or more points within the outer edges of the obstruction, the uppermost parts of which are higher than the highest level of the lights hereinbefore prescribed, at least one similar light should be displayed from the top of each such point.

Specification "E-2." When the particular obstruction is more than 150 feet in over-all height above ground, or water if so situated.

Top lights should be installed on the obstruction in the manner set forth in the applicable provisions of Specification "E-1."

In addition to the required top lights, intermediate lights, each consisting of a lamp of at least 100 watts enclosed in an aviation red obstruction light globe, should be provided for each 150 feet, or fraction thereof, the obstruction exceeds 150 feet in over-all height above ground, or water if so situated. The position of these intermediate lights on the vertical plane should be at as close to equi-distant levels between the top lights and the ground level as the particular shape and type of obstruction will permit. One such light should be installed at each outside corner of the obstruction at each level and also one such light should be installed at equal intervals on the horizontal plane on each outer surface at each level between adjacent corner lights, for each 150 feet, or fraction thereof, the over-all horizontal distance between such adjacent corner lights exceeds 150 feet.

NOTE: In lieu of installing the obstruction lights on the obstructions, a pole or poles of a height slightly greater than the over-all height of the obstruction may be installed thereto and lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles, or similar obstructions of a corresponding over-all height. It is important that those towers, poles, or similar structures be installed in such a manner as to indicate the general definition and extent of the obstruction.

In the event early or special warning is considered necessary to provide adequate protection for aircraft, the top lights on each obstruction as required under Specifications "E-1" and "E-2" should be replaced with one or more flashing 300 mm electric code beacons, each beacon equipped with two lamps and aviation red color filters. The two lamps of each beacon should burn simultaneously and each should be at least 500 watts.

Where obstructions are extensive as in the case of a line of trees or hills, and the use of the fixed obstruction lights would be impracticable or inadequate, flashing or rotating hazard beacons may be used as an alternate to the fixed obstruction lights. Such beacons should be located on the highest points or edges of the extended obstruction at intervals not exceeding 3,000 feet, provided at least three beacons are placed on any one side or edge of the extensive obstruction to indicate a line of lights.

Bridges

The superstructure of a bridge should be lighted in accordance with the following specifications.

Where the bridge structure is over navigable water, approval of the lighting installation must be obtained from the Commandant of the United States Coast Guard to avoid interference with marine navigation.

Specification "F-1." When the bridge superstructure is not more than 150 feet in over-all length.

There should be installed at the approximate center of the highest point of the superstructure at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. The two lights should burn simultaneously and should be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

Specification "F-2." When the bridge superstructure is more than 150 feet in over-all length.

There should be installed for each 150 feet, or fraction thereof, of the over-all length of the bridge superstructure one or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should be installed on the highest points of the superstructure at approximately equal intervals not exceeding 150 feet in a manner to indicate the general definition and extent of the obstruction, and to insure unobstructed visibility of the lights from aircraft at any normal angle of approach. The distance between these top lights may be increased to a distance not exceeding 600 feet when the particular bridge is located more than 15,000 feet from the reference point of any landing area.

Where the bridge superstructure exceeds 150 feet in over-all length and the use of the above described obstruction lights would be impracticable or inadequate, flashing or rotating hazard beacons should be used as an alternate to the fixed obstruction lights. Such beacons should be located on the highest points or edge of the bridge superstructure at intervals not exceeding 3,000 feet, provided at least three beacons are installed to indicate the extent of the obstruction. The flashing or rotating beacons should conform to the provisions of the pertinent specifications as hereinbefore indicated under "Obstruction Lighting Equipment."

Water Towers, Grain Elevators, Gas Holders and Similar Obstructions

Water towers, grain elevators, gas holders and similar obstructions should be lighted in accordance with the following specifications:

Specification "G-1." When the particular obstruction is not more than 150 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction at least two lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. These lights should burn simultaneously and should be positioned so as to insure unobstructed visibility of at least one of the lights from aircraft at any normal angle of approach.

Specification "G-2." When the particular obstruction is more than 150 feet but not more than 300 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. The beacon should be positioned so as to insure unobstructed visibility of it from aircraft at any normal angle of approach.

At the approximate midpoint of the over-all height of the obstruction, there should be installed three or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. The position of these intermediate lights on the vertical plane should be as close to an equidistant level between the top beacon and the ground level as the particular shape and type of construction of the obstruction will permit. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two of the lights from aircraft at any normal angle of approach.

Specification "G-3." When the particular obstruction is more than 300 feet but not more than 450 feet in over-all height above ground, or water if so situated.

There should be installed at the top of the obstruction a flashing 300 mm electric code beacon equipped with two lamps and aviation red color filters. The two lamps of the beacon should burn simultaneously and each should be at least 500 watts. The beacon should be positioned so as to insure unobstructed visibility of it from aircraft at any normal angle of approach.

At approximately two-thirds and one-third of the over-all height of the obstruction there should be installed three or more lights, each light consisting of a lamp of at least 100 watts, enclosed in aviation red obstruction light globes. The position of these intermediate lights on the vertical plane should be as close to equidistant positions between the top beacon and the ground level as the particular shape and type of construction of the structure will permit. These lights should be placed at regular intervals on the horizontal plane in a manner to insure unobstructed visibility of at least two lights on each level from aircraft at any normal angle of approach.

Group of Structural Hazards

Towers, poles, tanks, smokestacks and similar obstructions which are so grouped as to present a common hazard to air navigation should be lighted in accordance with the following specifications.

Specification "H-1." This specification applies to a group of closely spaced towers, poles, tanks, smokestacks or similar obstructions of approximately the same over-all height above ground, or water if so situated, in which the spacing between the individual structures does not exceed 150 feet.

The group may be considered an extensive obstruction and lighted in accordance with the "E" Specifications for Prominent Buildings and Similar Extensive Obstructions.

Specification "H-2." This specification applies to a group of closely spaced towers, poles, tanks, smokestacks and similar obstructions, which may or may not be of the same over-all height, in which the spacing between the individual structures is not in all cases equal to or less than 150 feet.

Each prominent object within the group should be lighted in accordance with the specifications hereinbefore prescribed for individual towers, poles, and similar obstructions or a corresponding over-all height above ground, or water if so situated.

In addition, there should be installed at the top of a prominent center obstruction or on a special tower located near the center of the group of obstructions, at least one rotating beacon producing aviation red flashes. The frequency of its flashes should be such as hereinbefore specified for rotating beacons.

Hazard Areas

Areas in which a visible or invisible hazard, or hazards, exists should be lighted in accordance with the following specifications.

The obstruction lighting prescribed hereinafter is in addition to such lighting as may be necessary on any natural or man-made obstruction located within the hazard area.

Specification "I-1." An area in which a visible or invisible hazard, or hazards, to aircraft exists.

There should be mounted on top of a tower or other suitable structure, located near the center of the area, at least one rotating beacon producing aviation red flashes. The frequency of its flashes should be such as hereinbefore specified for rotating beacons.

Specification "I-2." A large area in which a visible or invisible hazard, or hazards, to aircraft exists.

There should be installed at two or more places around the perimeter of the area a rotating beacon, mounted on top of a tower or other suitable structure, producing aviation red flashes. The beacons should be located in a manner to insure unobstructed visibility of at least one of the beacons from aircraft at any normal angle of approach. The frequency of its flashes should be such as hereinbefore specified for rotating beacons.

The main body of this publication presents standards for marking and lighting objects, which are potential hazards to the safe operation of aircraft, for the purpose of indicating their presence to pilots. The material in this Appendix includes texts of laws and regulations, together with information to provide guidance in complying with these texts of laws and regulations, pertaining to such objects.

Existing or contemplated structures which, by reason of their height and location relative to landing areas, constitute potential hazards to the safe operation of aircraft continually demand attention in the effort to provide and maintain maximum safety for air commerce.

It is vitally important that prompt notification of the construction or alteration of towers, electric transmission and telephone lines, smokestacks, water towers, buildings and similar structures, of certain heights and distances from landing areas and civil airways, be given to the aeronautical public through Notices to Airmen before any such structure is constructed or altered. Achievement of this result requires the cooperation of all Federal, State and Municipal agencies, private industry and individuals engaged in such construction or alteration.

For this purpose, Regulations of The Washington State Aeronautics Commission have been promulgated requiring the submission of Form 426 prior to the beginning of the construction or alteration of structures falling within the prescribed limits of air activity. The limits within which construction or alteration requires the submission of the form have been set after careful study of the problem and with due regard for the maximum protection of airmen.

In the case of an existing structure on which a proper notice has already been submitted, some latitude for repairs is permitted by an explanation of the term "alteration." Notice may be omitted if the alteration or alterations will not increase or decrease the height of the top or any part of the structure from that previously reported by more than 1 foot for each 500 feet, or fraction thereof, of the distance that the structure is situated from the nearest boundary of the landing area involved. However, notice must be given of any alteration or alterations increasing or decreasing the height of the top or any part of a structure by more than 10 feet from that previously reported.

The information required on proposed construction or alteration is clearly explained in the Form 426 prepared for that purpose and is essentially that material needed to warn airmen of a potential hazard to air navigation. It is necessary, therefore, that all applicable questions therein be answered without exception. Copies of these forms may be obtained from the Washington State Aeronautics Commission, Boeing Field Seattle, Washington.

The distance between the nearest boundary of a landing area and the site of the construction or alteration may be measured by the use of maps, or on the surface of the earth by an automobile mileage meter, or other convenient but reasonably accurate means.

The term "navigable water" as used in connection with obstructions to air navigation, denotes all water suitable for the take-off or landing of water aircraft. Other geographical features which combine hydrographic and topographic characteristics, such as marshes, swamps and bogs, come within the meaning of the term "ground" as described in the Act.

The State Aeronautics Commission desires to assist those contemplating construction which may present a potential hazard to air navigation in selecting locations for the structures which will create a minimum of interference with air operations; to recommend the proper obstruction marking and lighting to insure adequate protection to aircraft; and to minimize the possibility of damage to structures from collision by aircraft.

For this purpose the Commission has provided a special advisory service consisting of personnel who conduct the specific investigation of each case. This service is available upon request, which may be by letter or in person. The request should be accompanied by a complete description of the proposed construction, including the geographic coordinates and the distance and direction of the site from the nearest town; the distance from the nearest landing area; the height of the structure above the ground and the over-all height of the structure above mean sea level. A map or sketch showing the height and location of all tall structures in the vicinity should also be furnished. The investigation will ordinarily take approximately ten days because of the necessary contacts with aeronautical interests concerned. This period may be longer if the problem is a complex one, because every attempt is made by the investigators to resolve the problem with due regard to the safety factor.

Interested contractors, engineers and architects should avail themselves of this service so as to prevent delays in obtaining the necessary permits for the construction.

Criteria For Determining Obstructions to Air Navigation

Introduction

In order to provide uniform criteria for determining obstructions to air navigation, this standard has been adopted by the Washington State Aeronautics Commission.

Directive

In accordance with the procedure for establishing technical aeronautical standards specified in State Obstruction Marking and Lighting Law, "Criteria for Determining obstructions to Air Navigation" set forth below is established as a State Standard.

This standard is the official Washington State Aeronautics Commission guide for determining obstructions to air navigation and supersedes all existing obstruction criteria which do not conform to its requirements.

Specific Instructions

Procedure for Determining Obstructions.

Sec. 2. Any structure or obstacle which obstructs the air space above ground or water level, when determined by the commission after a hearing to be a hazard or potential hazard to the safe flight of aircraft, shall be plainly marked, illuminated, painted, lighted or designated in a manner to be approved in accordance with the general rules and regulations of the commission so that the same will be clearly visible to airman. In determining which structures or obstacles constitute or may become a hazard to air flight, the commission shall take into account only those obstacles located at river, lake and canyon crossings and in other low altitude flight paths usually traveled by aircraft.

Sub 1
~~Objects exceeding the limiting heights above ground described in Section 3 shall be considered obstructions to air navigation unless found not to be objectionable after special aeronautical study.~~
Ed Tracy

Sec. 3. The director shall have the authority to require owners, operators, lessees or others having the control or management of structures or obstacles over one hundred fifty feet above ground or water level and which are or may become a hazard to air flight to report the location of such existing or proposed structures or obstacles to the commission. For that purpose the director may issue subpoenas and subpoenas duces tecum returnable within twenty days to the commission.

In the event a person refuses to obey the director's subpoena, the commission may certify to the superior court all facts of any such refusal. The court shall summarily hear evidence on such refusal, and, if the evidence warrants, punish such person refusing in the same manner and to the same extent as for contempt committed before the court.

Objects which are located or will be located with respect to other objects of a permanent character such that there results no material increase in the aeronautical hazard will not be considered obstructions.

Operation of Moored Balloons

Scope. The following rules shall apply to moored balloons when operated anywhere in the State of Washington at altitude controlled by State Law.

General. Moored balloons may be operated without permit from or notice to the State when operated less than 150 feet above the surface at a location not usually traveled by aircraft.

Operation requiring a permit. Unless operated under the conditions specified in "General" moored balloons subject to these regulations shall be operated under the authority of and in compliance with the terms and conditions of a permit issued by the State Aeronautics Commission when such moored balloons are operated:

- (a) closer than 500 feet to the base of any cloud, or
- (b) during the hours of darkness, or
- (c) when ground visibility is less than 3 miles, or
- (d) at altitudes more than 150 feet above the surface, or
- (e) in a location usually traveled by aircraft

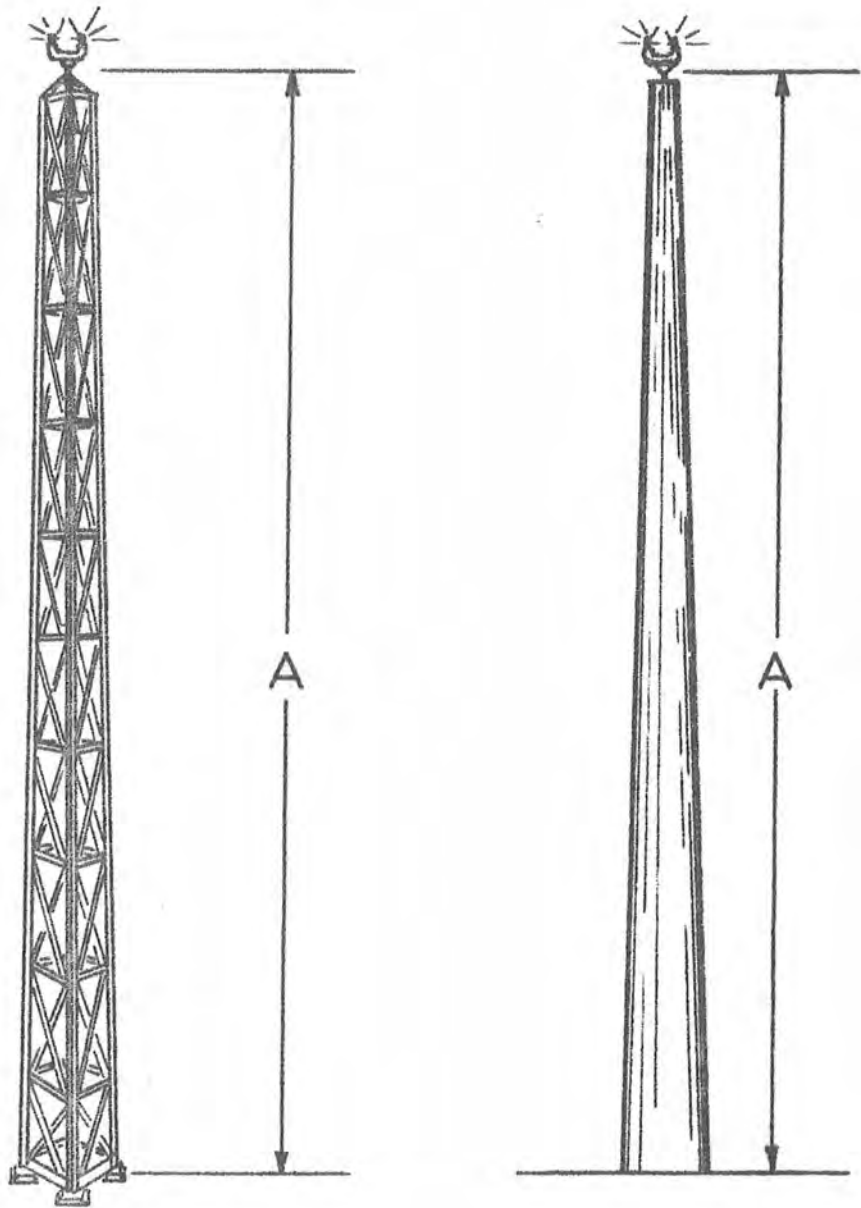
Written notice of intent must be submitted to the office of the Commission at least 30 days prior to the date of operation. Such notice shall contain the name and address of the owner and person operating the balloon, the date or dates of the proposed operation, and the location and altitude at which the proposed operation will be conducted. No moored balloons will be operated without written approval from the Washington State Aeronautics Commission.

Rapid deflation device. No moored balloon having a diameter of more than 6 feet or a gas capacity of more than 115 cubic feet shall be operated unless it is equipped with a device or means of automatic and rapid deflation in the event of an escape from its moorings.

NEW SECTION

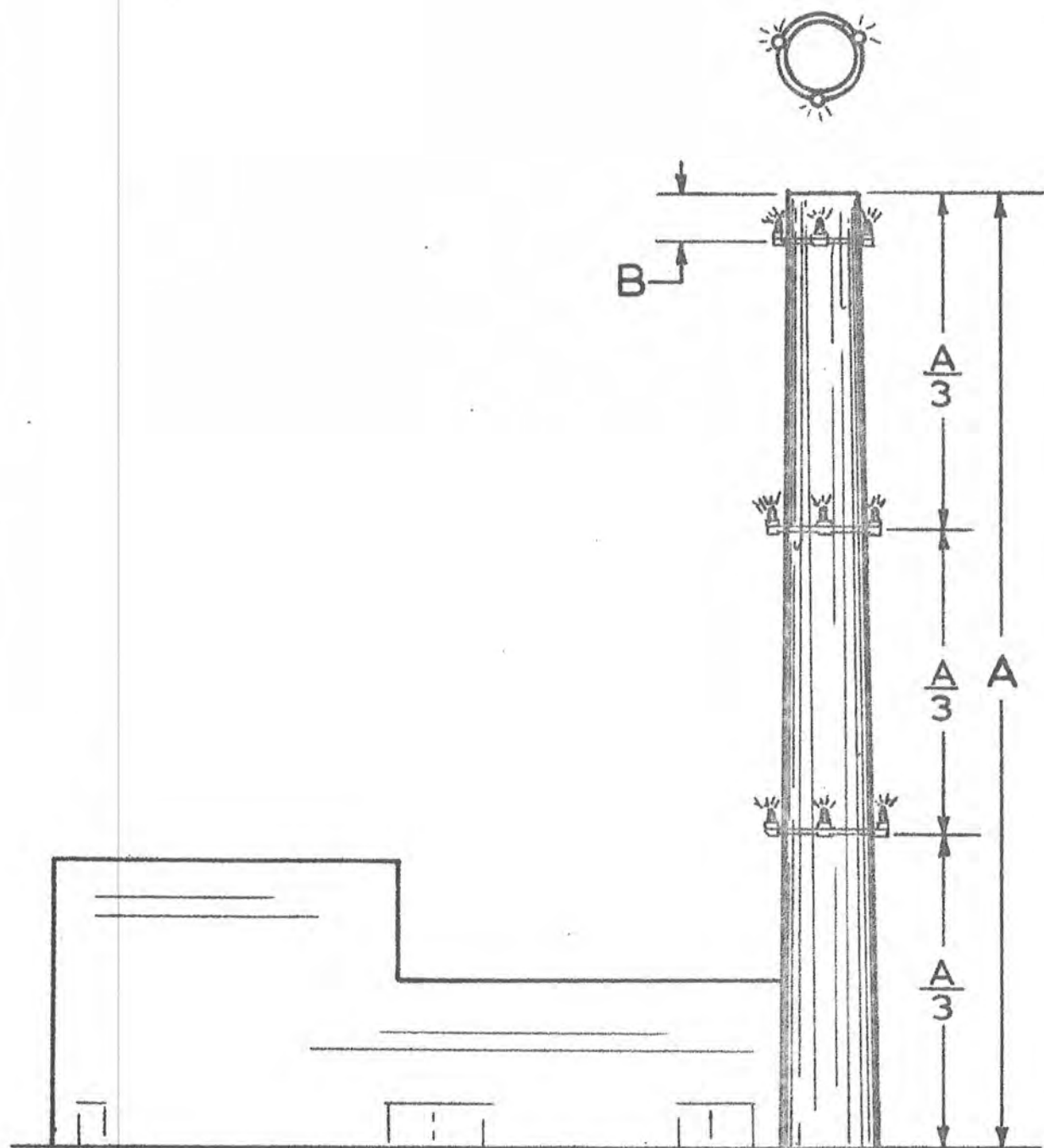
Overhead lines and cables required to be marked under the provisions of chapter 263, Laws of 1961, shall be marked by placing a marker as described in the last paragraph on page 3 at least every 150 feet on, or within 30 feet of such lines or cables. See Marking of Lines and Cables or Similar Obstructions Figure A.

Such markers shall be colored international orange equivalent to federal specifications TT-P-59 or TT-E-489.



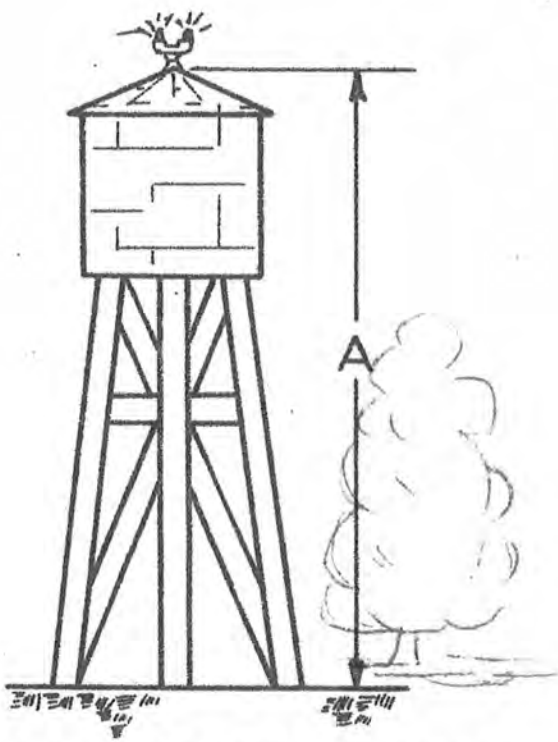
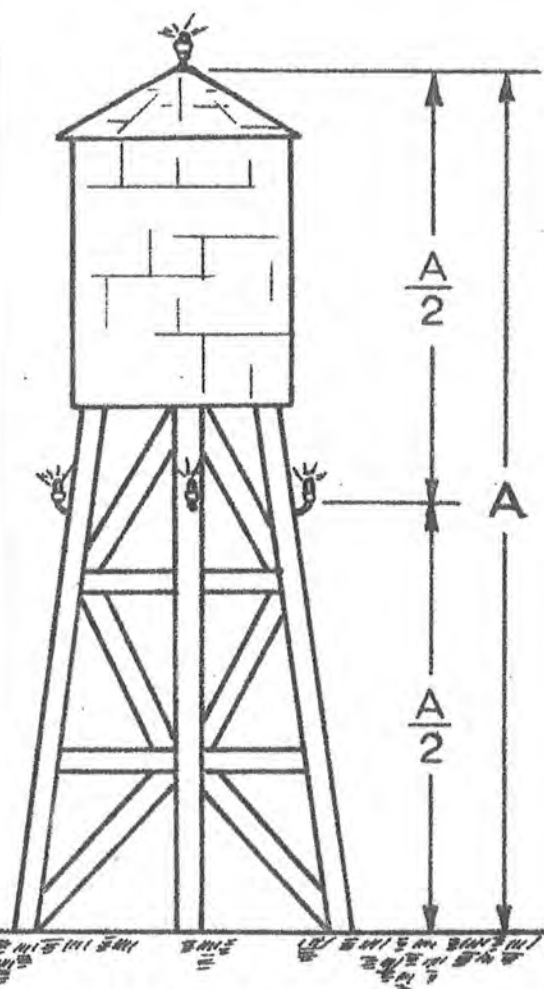
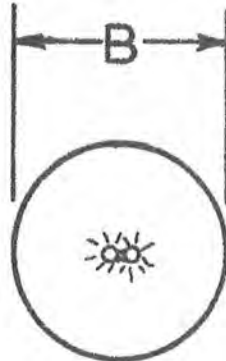
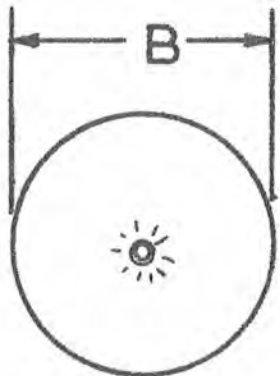
A = NOT MORE THAN 150 FT.

LIGHTING OF TOWERS, POLES AND SIMILAR OBSTRUCTIONS



A = 300 TO 450 FT.
 B = 5 TO 10 FT.

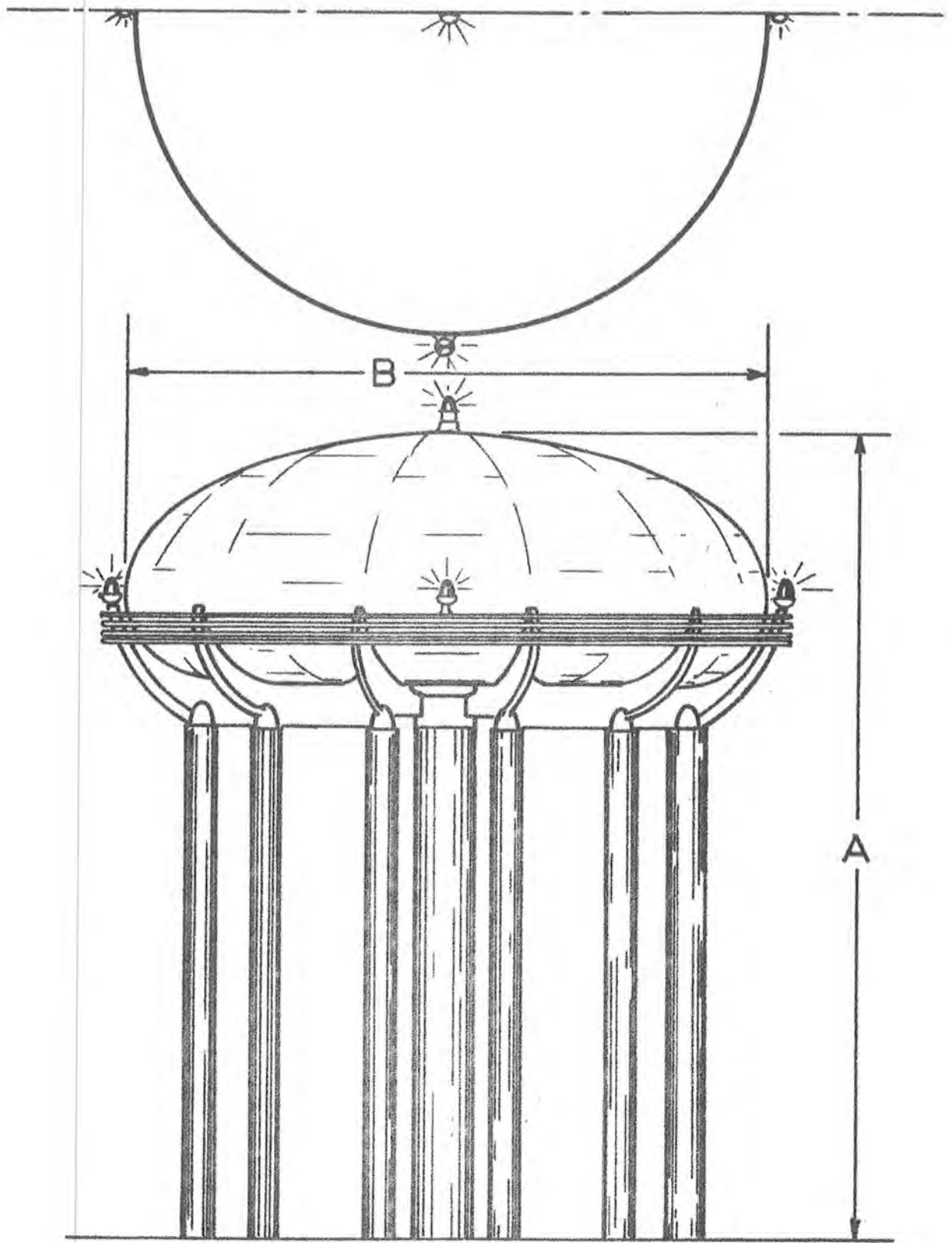
LIGHTING OF SMOKESTACKS AND SIMILAR OBSTRUCTIONS



A = 150 TO 300 FT.
B = 150 FT OR LESS

A & B = 150 FT OR LESS

LIGHTING OF WATER TOWERS AND SIMILAR OBSTRUCTIONS

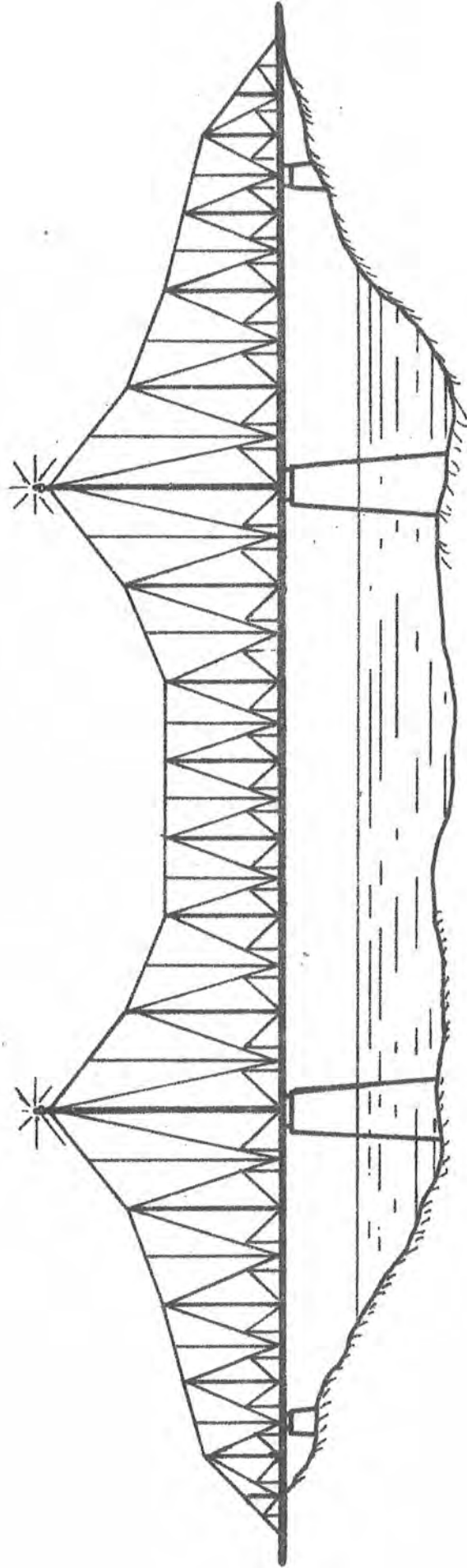


A = 150 TO 300 FT

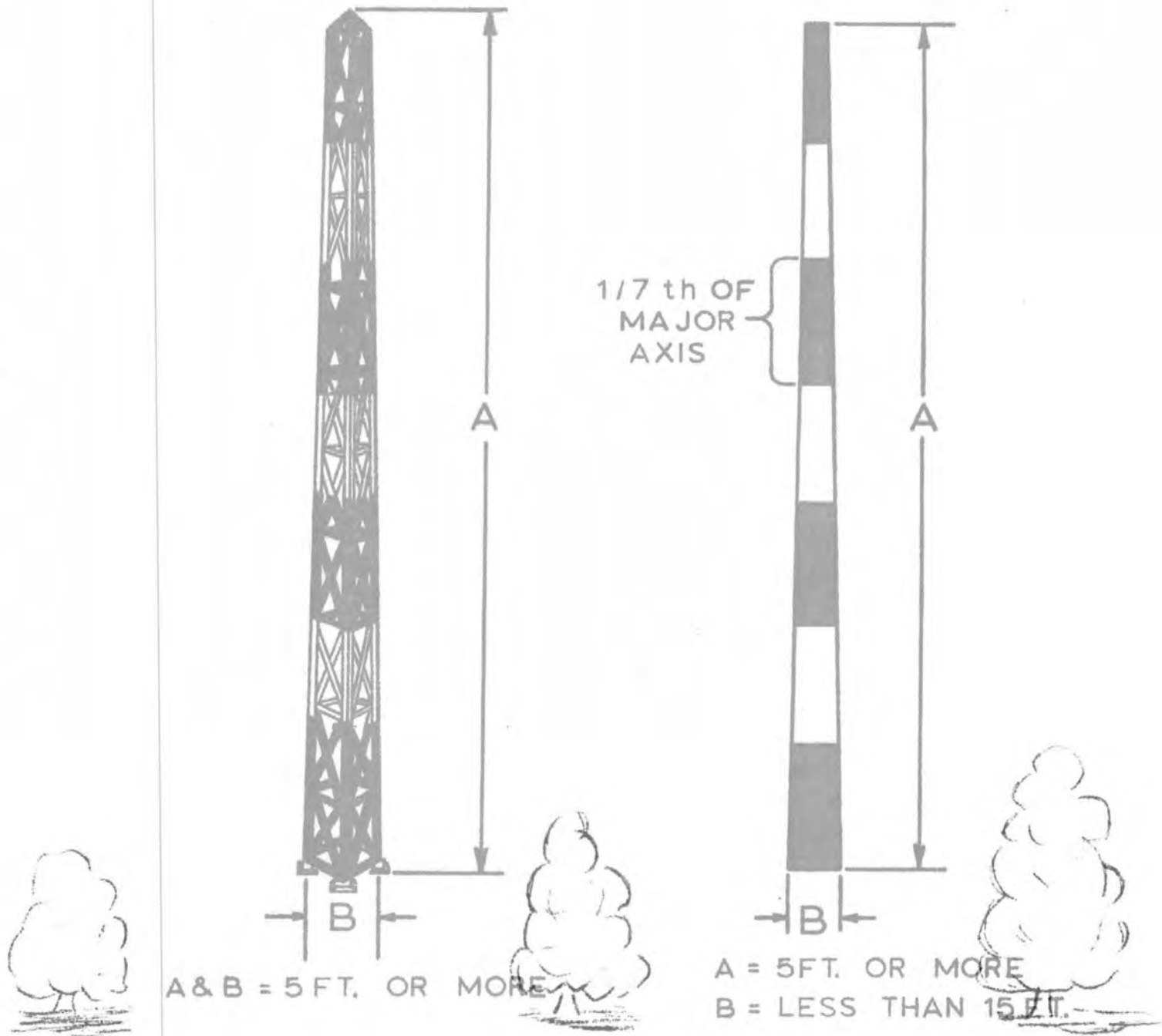
B = 150 FT OR LESS

LIGHTING OF WATER TOWERS
AND SIMILAR OBSTRUCTIONS

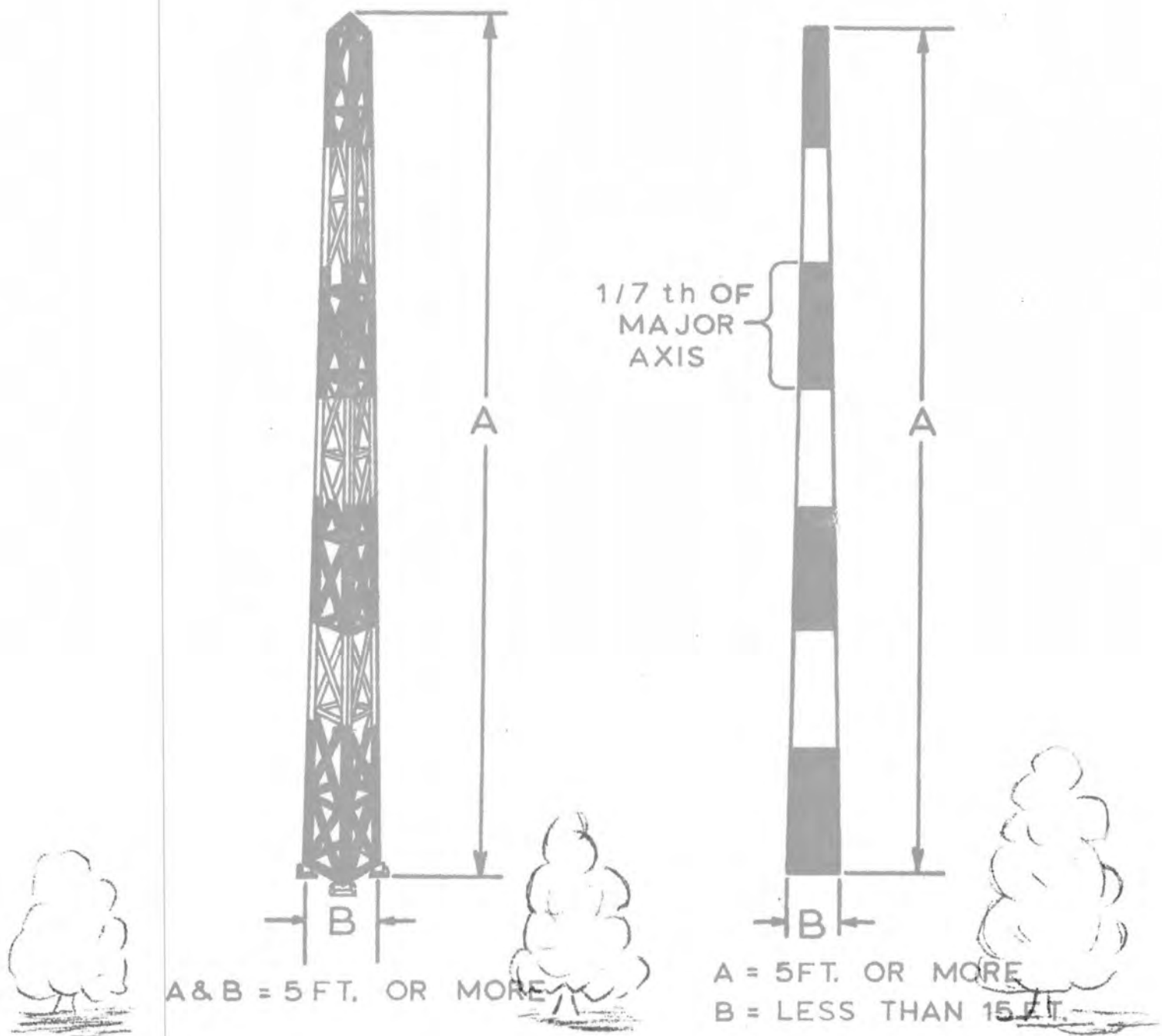
WASHINGTON STATE AERONAUTICS COMMISSION



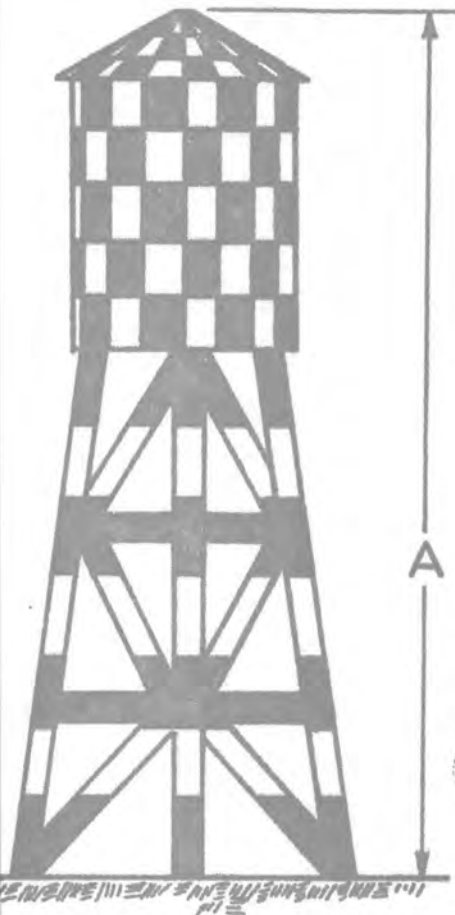
LIGHTING OF BRIDGES
WASHINGTON STATE AERONAUTICS COMMISSION



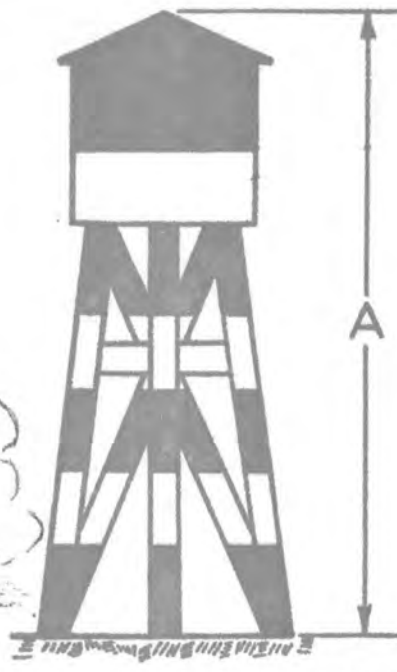
PAINING OF TOWERS
POLES AND SIMILAR OBSTRUCTIONS



PAINING OF TOWERS
POLES AND SIMILAR OBSTRUCTIONS

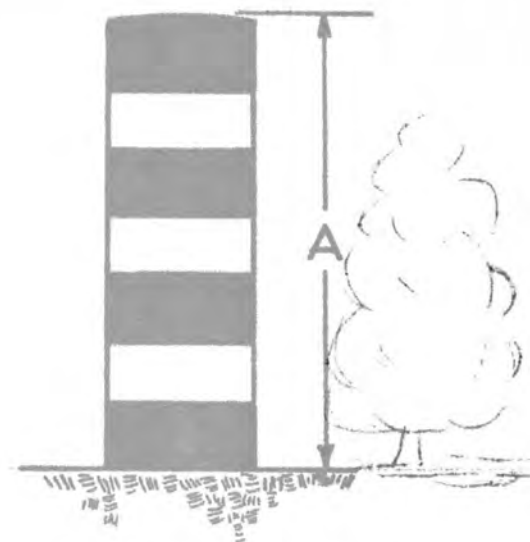
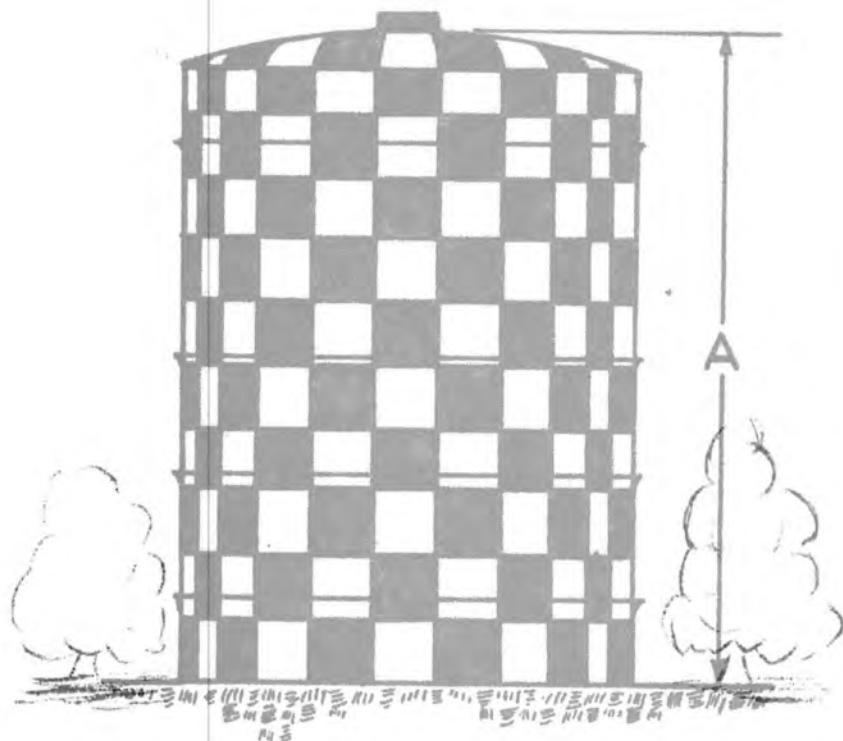
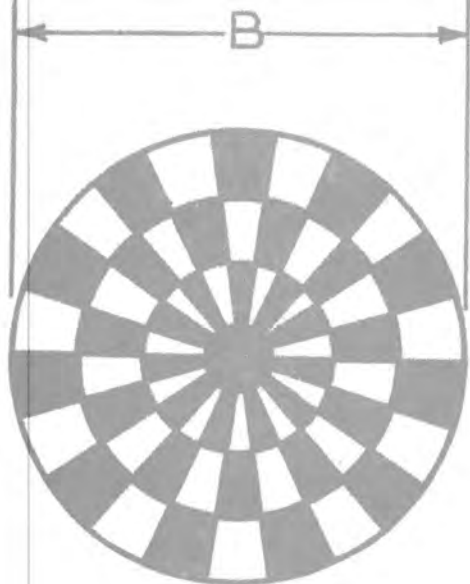


A & B = 15 FT. OR MORE



A = 5 FT. OR MORE
B = LESS THAN 15 FT.

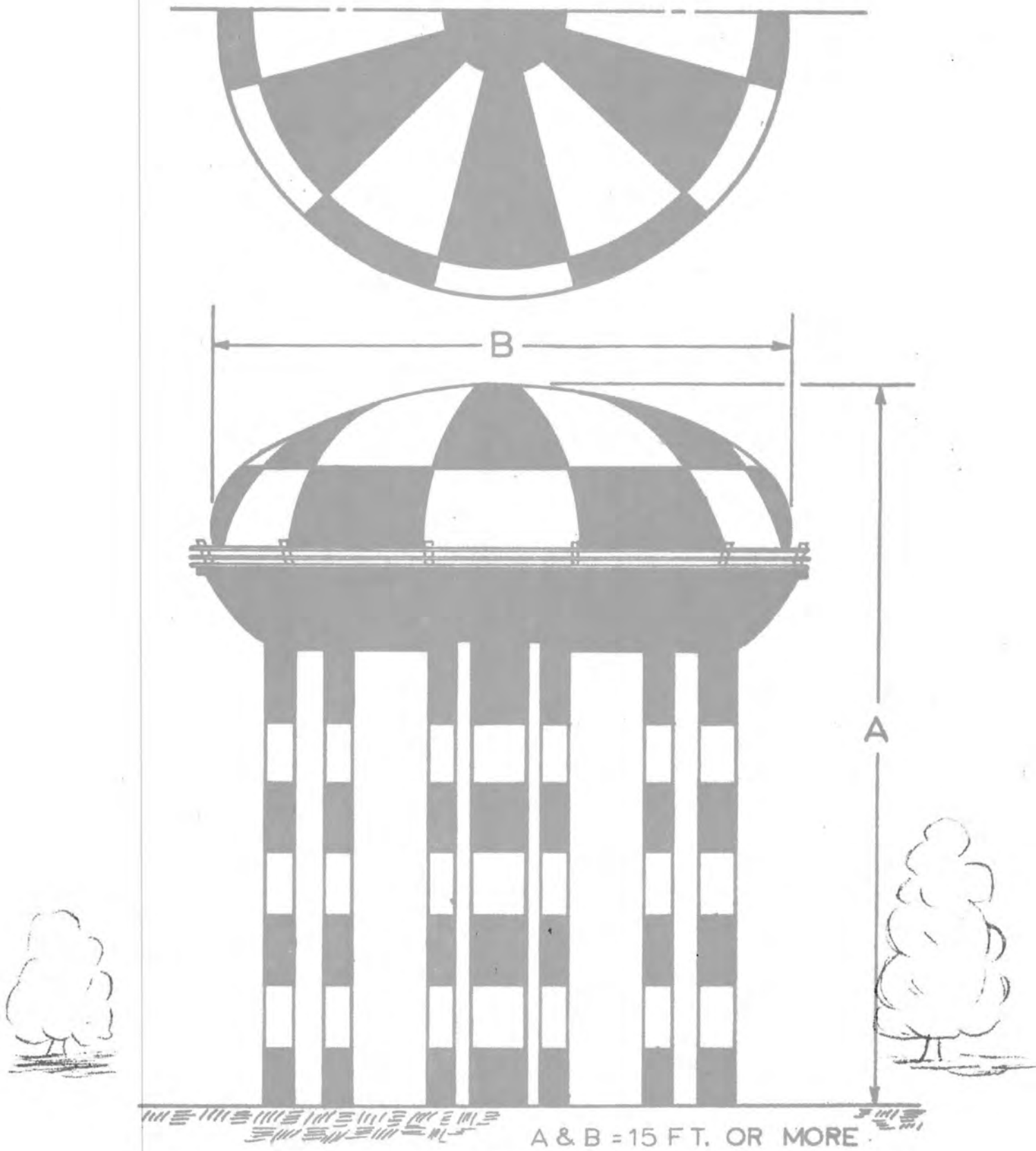
PAINING OF WATER TOWERS AND SIMILAR OBSTRUCTIONS



A & B = 15 FT. OR MORE

A = 5 FT. OR MORE
B = LESS THAN 15 FT.

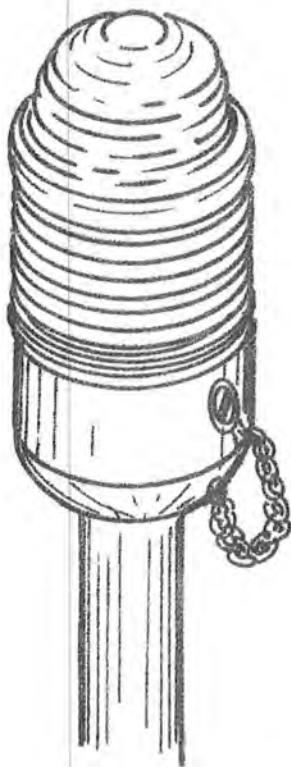
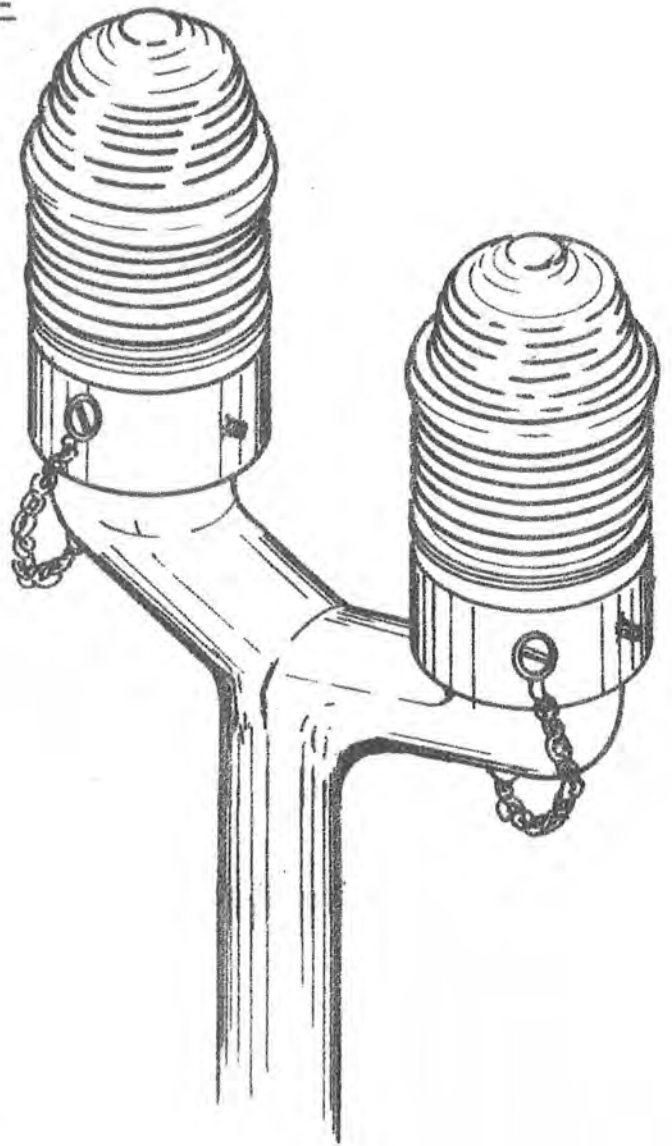
PAINING OF GAS HOLDERS AND SIMILAR OBSTRUCTIONS



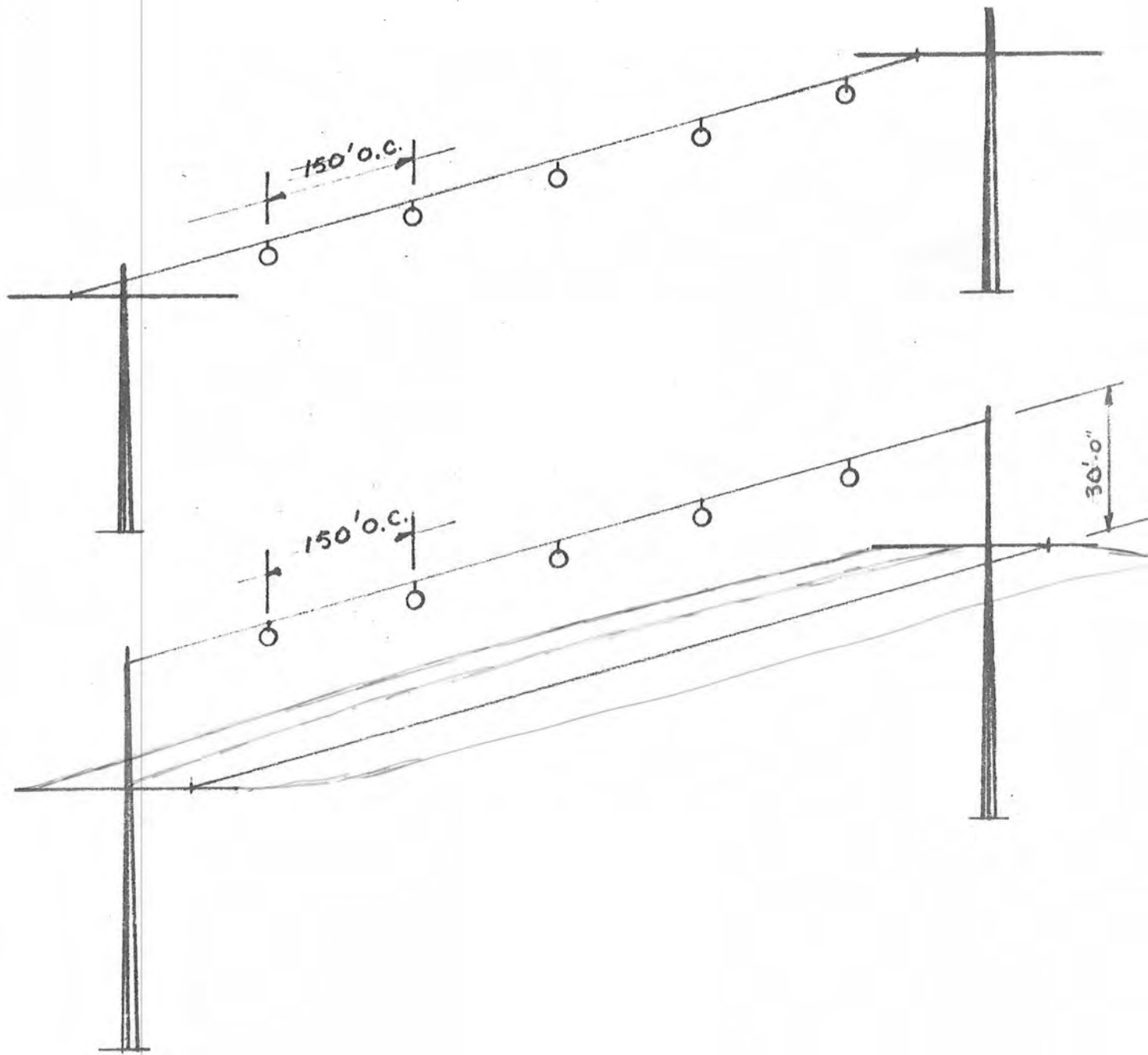
PAINING OF WATER TOWERS AND
SIMILAR OBSTRUCTIONS

FIGURE D

TYPICAL DOUBLE
OBSTRUCTION
LIGHT FITTING



TYPICAL SINGLE
OBSTRUCTION
LIGHT FITTING



MARKING LINES AND CABLES IN SIMILAR OBSTRUCTIONS

FIGURE A