ADB
Airfield Solutions

User Manual

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Rev. AA, 7/9/14

L-880 & L-881 PAPI, Style A

Precision Approach Path Indicator (Voltage Powered)

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A.1 Certification

CERTALERT

ADVISORY CAUTIONARY NON-DIRECTIVE

FOR INFORMATION, CONTACT AIRPORT SAFETY SPECIALIST, AAS-310 (202) 267.8729

DATE: **December 12, 2002** **No. 02-08**

TO: **Airport Operators, Airline Operators, FAA Airport Certification Safety Inspectors**

TOPIC: **PAPI OPERATION**

This is to advise airport operators of the possibility of light signal interruption from PAPI units not operated continuously, e.g., those units activated through the use of pilot-controlled-lighting (PCL) systems.

Because external PAPI lenses, used to improve light signals, are exposed to ambient weather conditions, the possibility of dew and/or frost forming on the outside of the glass becomes a concern when the units are not operated continuously. In particular, a PAPI unit operating in the "off" mode for an extended period of time during the evening hours could accumulate a level of environmental contaminants (e.g., dew or frost), which may not dissipate sufficiently to ensure correct light signals after pilot activation.

To preclude environmental contamination of PAPI lenses along with possible lighting signal interruption associated with limited dissipation of any dew/frost FAA recommends the following:

- At airports where PAPI units are activated when needed and thus are not operated continuously, change airport lighting circuitry to ensure PAPI's are preset to operate continuously on a low power setting, either 5 percent or 20 percent of full intensity as necessary for local site conditions.
- Airport operators must submit changes as per the front cover of the Airport/Facility Directory removing the PAPI reference.

OSB
Benedict D. Castellano
Airport Safety and Operations

12/12/2002
Date

A.0 Terms and Acronyms

General Aviation Terms and Acronyms that you may encounter using our manuals.

Table 1: Terms

Term	Definition
ALCMS	Acronym for Airfield Lighting Control Monitoring System. An ALCMS incorporates many components that are used to control and monitor an airport's entire airfield lighting system. The ALCMS may include Touch Screens for lighting control, Maintenance Center(s) for data viewing and archiving, Electrical Lighting equipment for CCR control and monitoring.
CCR	Abbreviation for Constant Current Regulator. The CCRs are located within the Airfield Lighting Vault (ALV). They produce a constant current output to the airfield series circuit that light the airfield lighting fixtures.
BRITE™	ADB Airfield Solutions' trademarked abbreviation for Bi-directional Series Transceiver which is a term that describes the technology used to transmit and receive data across airfield lighting series circuit cabling.
Remote	Unit installed in the airfield (normally in pull-pits or base cans) which provides control and monitoring of individual or blocks of light fixtures. Each Remote has its own unique address for control and monitoring data communication to the Master.
Master	Unit installed within the lighting vault that provides the means for data communication on the airfield series circuit cables. The Master is connected in parallel (across) to the output of the CCR. Each series circuit that contains Remotes must also have a Master installed at the CCR.
MWD	Abbreviation of Microwave Detector. Microwave detectors are installed in pre-designated locations on the airfield. The MWD also has its own unique address for control and monitoring purposes. A MWD is used to detect movement within an established detection zone and communicate the status back to the Master.
Control Panel	This term is used to reference the device used to control and monitor the controllable stopbars and the associated lighting equipment. The control panel could be either an L-821 style pushbutton panel or a Touchscreen style control panel. The control panel is located in the Air Traffic Control Tower cab.
SMGCS	Acronym which means Surface Movement Guidance and Control System. SMGCS is an organized system created to improve and enhance low visibility operations.
VSP	Acronym for Variable System Parameter. This term relates to a time value (in seconds) determined by the airport that is used in conjunction with the Stopbar control timing. In the event that the automatic Stopbar control or MWDs fail, the Stopbars are reset after the VSP value has expired.

Table 2: General List of Aviation Acronyms

Acronym	Definition
A2C	AGLS2 Configuration Tool, US Market: BRITE III Configuration Tool
AGL	Aviation Ground Lighting
ATC	Air Traffic Controller
BRITE™	Bi-directional Series Transceiver
CPU	Central Processing Unit
CRC	Cyclic Redundancy Code
EEPROM	Electrically Erasable Programmable Read Only Memory
EMI	Electromagnetic Interface
FAT	Factory Acceptance Test
FSK	Frequency Shift Keying
GUI	Graphical User Interface
HMI	Human-Machine Interface
ICW	Integrated Controller Workstation
ILS	Instrument Landing System

Acronym	Definition
IRMS	Insulation Resistance Monitoring System
PAPI	Precision Approach Path Indicator
RF	Radio Frequency
RWY	Runway
RVR	Runway Visual Range
SMSS	Surface Movement Surveillance System
TDZ	Touchdown Zone
TWY	Taxiway
UPS	Uninterrupted Power Supply

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Table of Contents

1.0 Safety

This section contains general safety instructions for installing and using ADB Airfield Solutions equipment. Some safety instructions may not apply to the equipment in this manual. Task- and equipment-specific warnings are included in other sections of this manual where appropriate.

1.1 To use this equipment safely:

WARNING

Read installation instructions in their entirety before starting installation.

- Refer to the FAA Advisory Circular AC 150/5340-26, Maintenance of Airport Visual Aids Facilities, for instructions on safety precautions.
- Observe all safety regulations. To avoid injuries, always disconnect power before making any wiring connections or touching any parts. Refer to FAA Advisory Circular AC 150/5340-26.
- Become familiar with the general safety instructions in this section of the manual before installing, operating, maintaining or repairing this equipment.
- Read and carefully follow the instructions throughout this manual for performing specific tasks and working with specific equipment.
- Make this manual available to personnel installing, operating, maintaining or repairing this equipment.
- Follow all applicable safety procedures required by your company, industry standards and government or other regulatory agencies.
- Install all electrical connections to local code.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility, and cover removal.
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility, and cover removal.
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning prior to returning power to the circuit.

1.1.1 Additional Reference Materials:

- NFPA 70B, Electrical Equipment Maintenance.
- NFPA 70E, Electrical Safety Requirements for Employee Workplaces.
- ANSI/NFPA 79, Electrical Standards for Metalworking Machine Tools.
- OSHA 29 CFR, Part 1910, Occupational Health and Safety Standards.
- National and local electrical codes and standards.

1.1.2 Qualified Personnel

The term **qualified personnel** is defined here as individuals who thoroughly understand the equipment and its safe operation, maintenance and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations and have been trained to safely install, operate, maintain and repair the equipment. It is the responsibility of the company operating this equipment to ensure that its personnel meet these requirements.

Always use required personal protective equipment (PPE) and follow safe electrical work practices.

1.1.3 Intended Use

WARNING

Using this equipment in ways other than described in this manual may result in personal injury, death or property and equipment damage. Use this equipment only as described in this manual.

ADB Airfield Solutions cannot be responsible for injuries or damages resulting from nonstandard, unintended applications of its equipment. This equipment is designed and intended only for the purpose described in this manual. Uses not described in this manual are considered unintended uses and may result in serious personal injury, death or property and equipment damage. Unintended uses may result from taking the following actions:

- Making changes to equipment that are not recommended or described in this manual or using parts that are not genuine ADB Airfield Solutions replacement parts.
- Failing to make sure that auxiliary equipment complies with approval-agency requirements, local codes and all applicable safety standards.
- Using materials or auxiliary equipment that are inappropriate or incompatible with ADB Airfield Solutions equipment.
- Allowing unqualified personnel to perform any task.

1.1.4 Storage

CAUTION

If equipment is to be stored prior to installation, it must be protected from the weather and kept free of condensation and dust.

Failure to follow this instruction can result in injury or equipment damage.

1.1.4.1 Operation

WARNING

- Only qualified personnel, physically capable of operating the equipment and with no impairments in their judgment or reaction times, should operate this equipment.
- Read all system component manuals before operating this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.
- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON.

1.1.4.2 Material Handling Precautions

CAUTION

This equipment may contain electrostatic sensitive devices.

- Protect from electrostatic discharge.
- Electronic modules and components should be touched only when this is unavoidable e.g. soldering, replacement.
- Before touching any component of the cabinet you should bring your body to the same potential as the cabinet by touching a conductive earthed part of the cabinet.
- Electronic modules or components must not be brought in contact with highly insulating materials such as plastic sheets, synthetic fiber clothing. They must be laid down on conductive surfaces.
- The tip of the soldering iron must be grounded.
- Electronic modules and components must be stored and transported in conductive packing.

1.1.4.3 Action in the Event of a System or Component Malfunction

WARNING

- Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.
- Disconnect and lock out electrical power.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual.

1.1.4.4 Maintenance and Repair

WARNING

Allow only qualified personnel to perform maintenance, troubleshooting, and repair tasks.

- Only persons who are properly trained and familiar with ADB Airfield Solutions equipment are permitted to service this equipment.
- Disconnect and lock out electrical power.
- Always use safety devices when working on this equipment.
- Follow the recommended maintenance procedures in the product manuals.
- Do not service or adjust any equipment unless another person trained in first aid and CPR is present.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved ADB Airfield Solutions replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.
- Check interlock systems periodically to ensure their effectiveness.
- Do not attempt to service electrical equipment if standing water is present. Use caution when servicing electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.

2.0 L-880 & L-881 PAPI, Style A

L-880 & L-881 PAPI, Style A, Voltage Powered PAPI manual.

2.1 About this manual

The manual shows the information necessary to:

- Install
- Carry Out Maintenance
- Carry Out Troubleshooting on the L-880 & L-881 PAPI, Style A.

2.1.1 How to work with the manual

1. Become familiar with the structure and content.
2. Carry out the actions completely and in the given sequence.

2.1.2 Record of changes

Page	Rev	Description	EC No.	Checked	Approved	Date
	A	Released manual.		TN	WT	1996
2-11, 7-3 and schematics	V	Updated Diagrams/Schematics	2633	GM	ER	05/05/10
3-13	W	Correction for Runway Longitudinal Gradient	2682	GM	ER	06/16/10
	X	Parts update				
Alll	Y	Entire Manual, parts and diagrams	3337	ER	DR	08/19/11
All	Z	updated formats		RW	JC	7/25/13
All	AA	Updated introduction, drawings and parts		RW	JC	7/8/14

2.1.3 Icons used in the manual

For all WARNING symbols see the Safety section.

Carefully read and observe all safety instructions in this manual, which alert you to safety hazards and conditions that may result in personal injury, death or property and equipment damage and are accompanied by the symbol shown below.

WARNING

- Failure to observe a warning may result in personal injury, death or equipment damage.

CAUTION

- Failure to observe a caution may result in equipment damage.

2.2 Introduction

See Figure 1 and Figure 2. This section describes the Style A, L-880 and L-881 Precision Approach Path Indicator (PAPI) systems used to provide visual approach path guidance to pilots of landing aircraft. The PAPI system is designed to operate from 220/240 Vac 50/60 Hz power.

Figure 1: L-880 Four-Box System

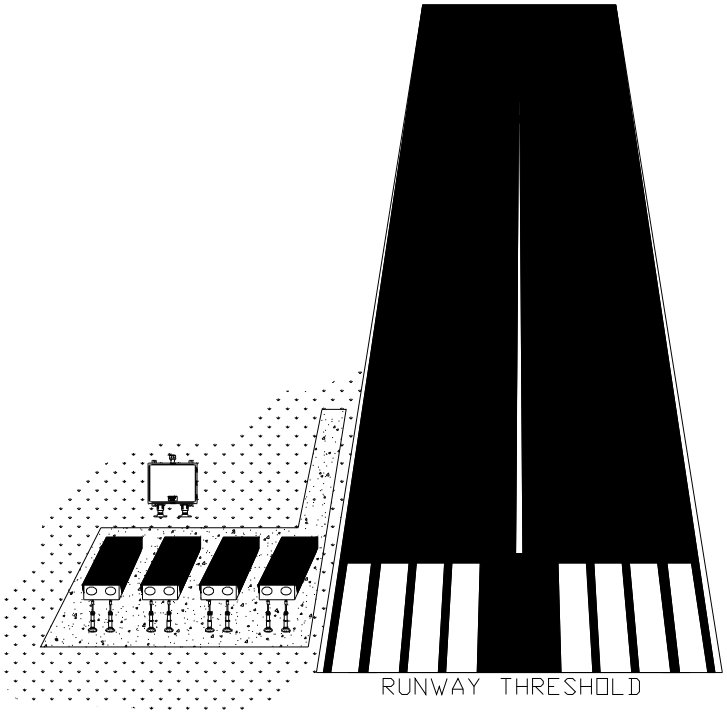
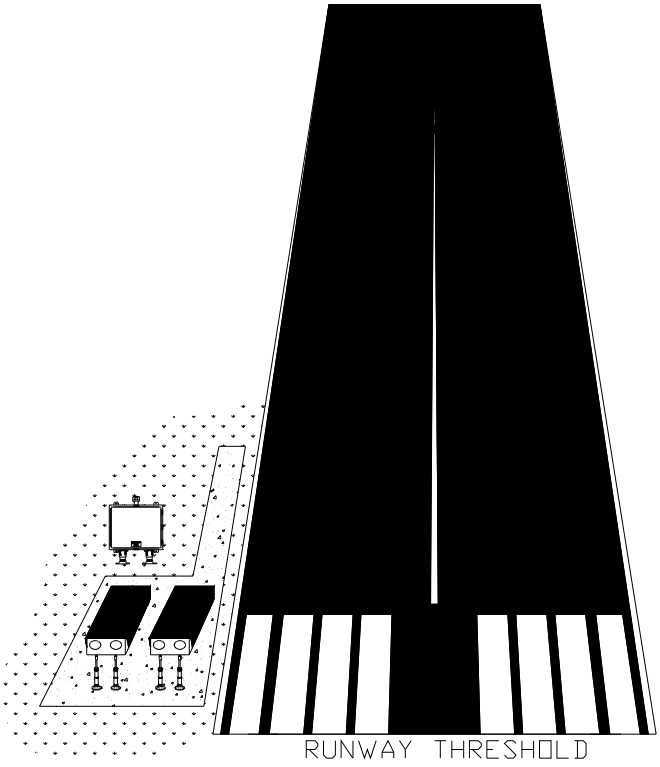


Figure 2: L-881 Two-Box System



2.2.1 Type L-880 PAPI System

See Figure 1, Figure 3, and Figure 4. The L-880 PAPI system consists of four identical light units that are normally installed on the left side of the runway (viewed from the approach end) in a line perpendicular to the runway centerline.

Figure 3: PAPI Obstacle Clearance Surface

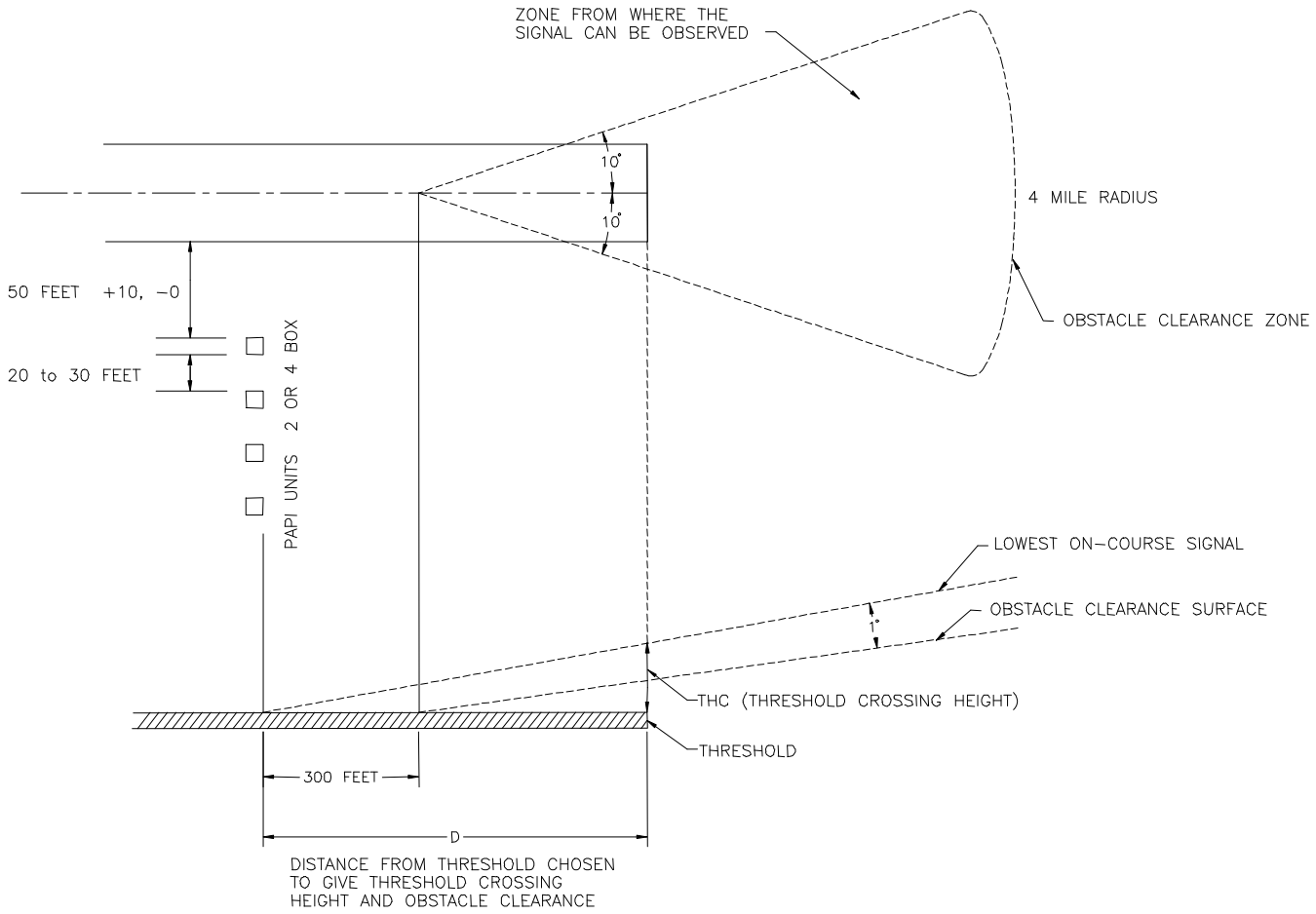
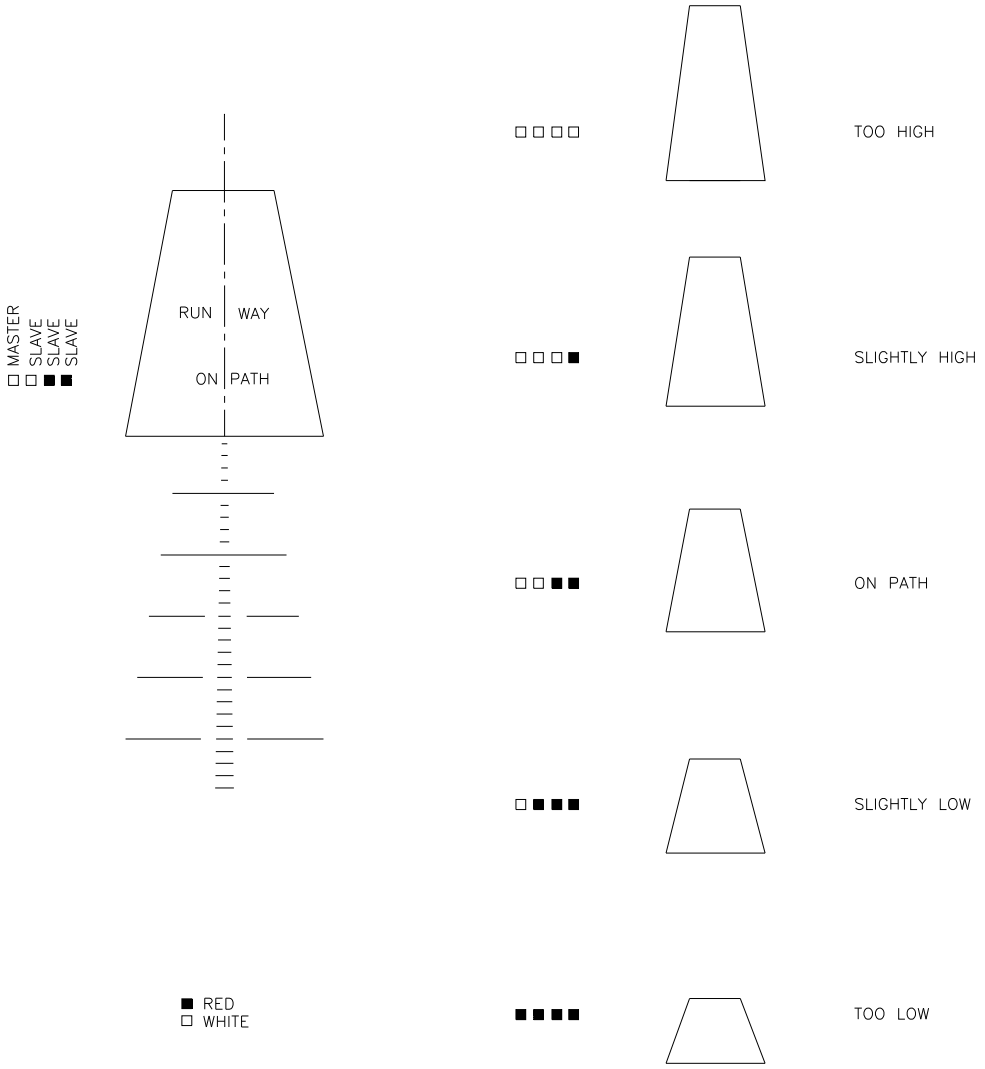


Figure 4: L-880 Signal Display



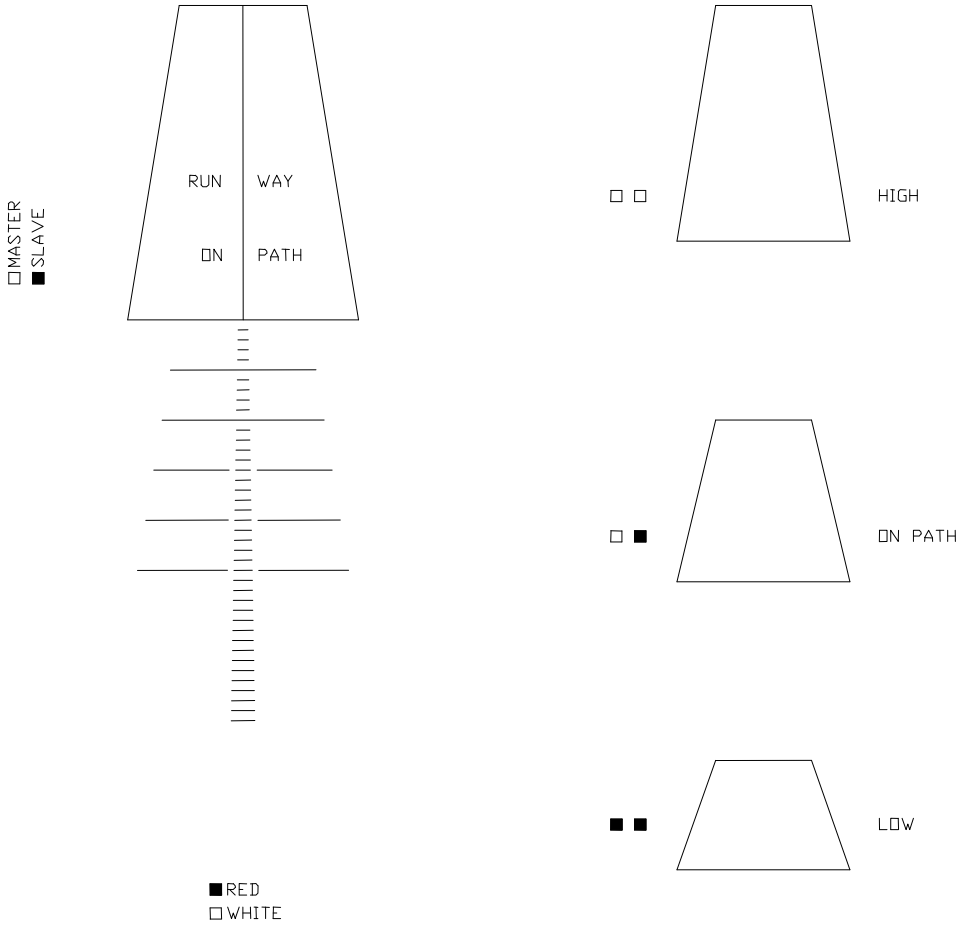
The units are aimed so that during a landing approach the pilot will see the following signal format:

- The inner two units as red and the outer two units as white when the aircraft is close to or on the approach slope.
- The unit nearest the runway as red and the three units farthest from the runway as white when above the approach slope; all four units appear white if the aircraft is excessively above the approach slope;
- The three units closest to the runway are seen as red and the unit farthest from the runway as white if the aircraft is slightly below the approach slope; and still further below, all the units will appear red.

2.2.2 Type L-881 PAPI System

See Figure 2, Figure 3, and Figure 5. The L-881 PAPI system consists of two identical light units that are normally installed on the left side of the runway (viewed from the approach end) in a line perpendicular to the runway centerline.

Figure 5: L-881 Signal Display



2.2.3 Type L-881 PAPI

The units are aimed so that during a landing approach the pilot will see the following signal format:

Both units as red when the aircraft is below the approach slope

The unit nearest the runway as red and the other unit as white when on or close to the approach slope

Both units as white when the aircraft is above the approach slope

2.2.4 PAPI Light Unit

See Figure 6 for a 3-lamp PAPI and Figure 2-7 for a 2-lamp PAPI. A single PAPI light unit contains two or three 6.6 A, 200 W lamps, two or three reflectors and red filters, four or six lenses, a lens shield, an electronic shorting device PCB, and a tilt switch assembly. The PAPI unit is mounted on three or four adjustable legs. Each of these parts is discussed below.

Figure 6: PAPI Light Unit (3-Lamp)

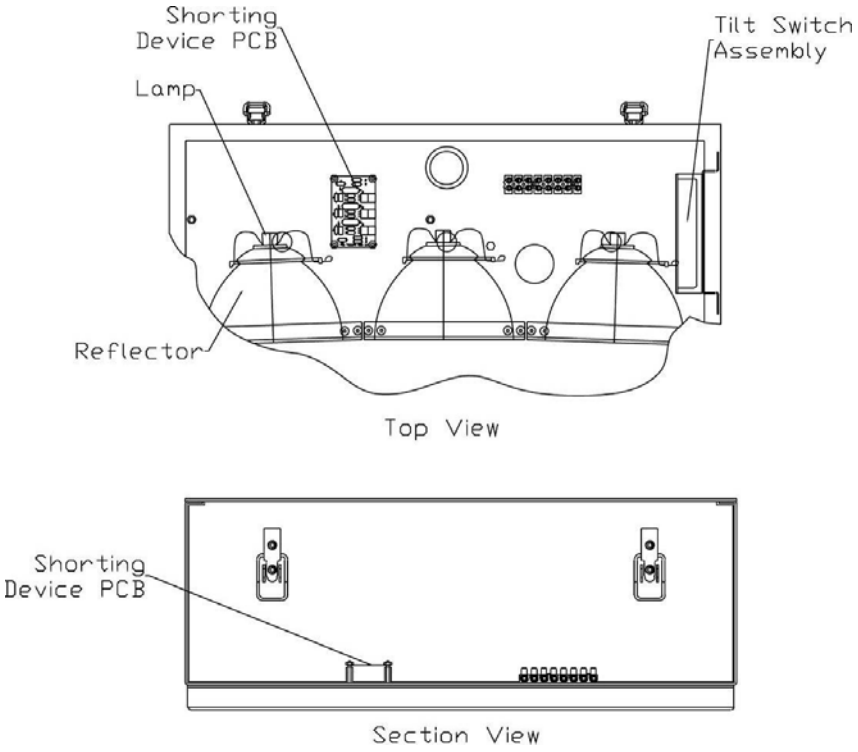
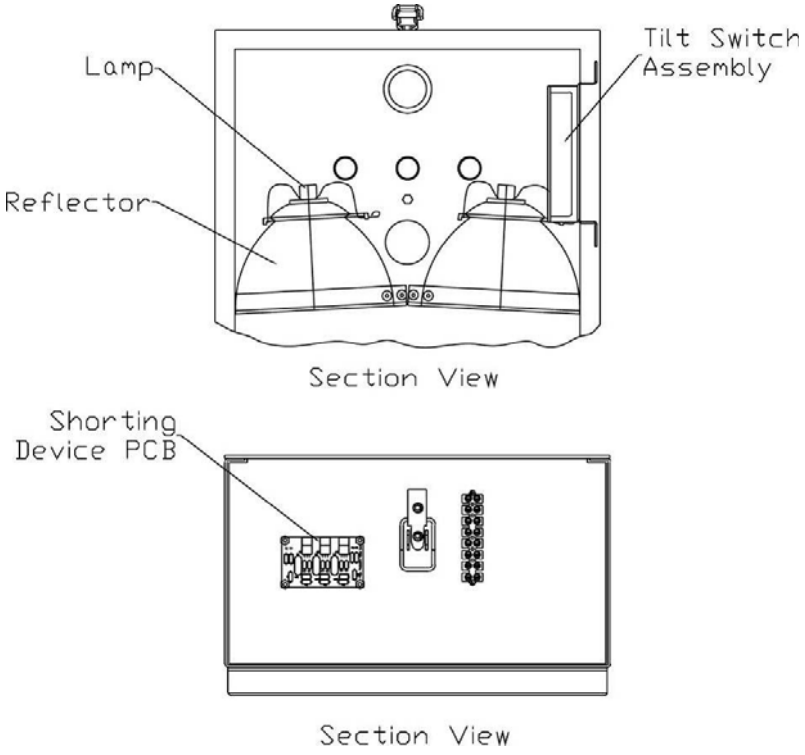


Figure 7: PAPI Light Unit (2-Lamp)



2.2.4.1 Lamps

Two or three 200-watt prefocused halogen lamps are located in the rear of the unit, each in an indexed lampholder in a reflector and held in place with a forked spring clip. Slip-on type electrical connections permit easy replacement of failed lamps.

2.2.4.2 Reflector Panel

The reflector panel is fitted with two apertures in which the elliptical reflectors are housed. The reflectors are made of aluminum that is mechanically polished for brilliance and anodized for protection.

2.2.4.3 Filter Panel

The filter panel houses the two or three red filters. It also has two reference slots, C and D, used to locate the aiming device for making field adjustments of the light unit. These reference slots are precision machined in the factory. Be careful not to damage these machined slots.

2.2.4.4 Lens Panels

Four or six high optical quality objective lenses are housed in two or three lens panels. The upper rim of the front lens panel is equipped with two reference blocks, A and B, for field adjustment of the light unit. These blocks are precision-adjusted in the factory to be parallel with the optical centerline of the objective lenses.

2.2.4.5 Lens Shield

The flat glass shield (protective glass) serves to protect the lenses against materials such as sand and stone, and is designed to avoid reflections.

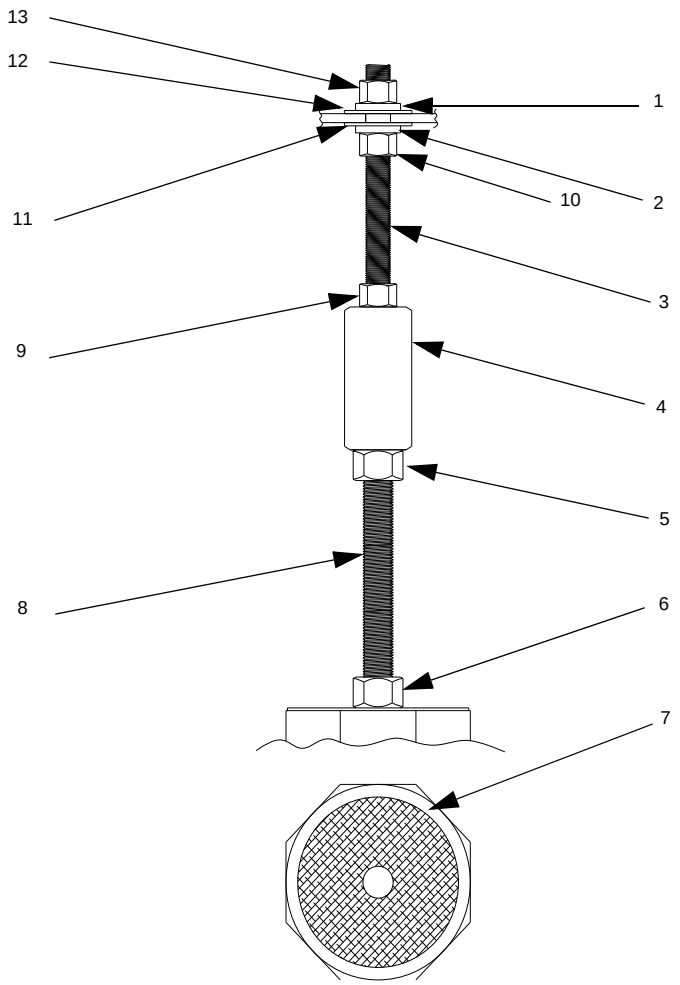
2.2.4.6 Adjustable Mounting Legs

See Figure 8. The three or four adjustable mounting legs are each made up of two screw rods (3, 8) connected by a differential sleeve (4). The upper (smaller diameter) rod is fitted with nuts and locking nuts designed for coarse height setting of the unit. The differential sleeve is used for the fine adjustment setting of the unit. The lower (larger diameter) rod is inserted into a conduit column with frangible coupling held in place by a flange bolted on a concrete pad.

When installing the upper and lower rods in the differential make sure there is room for movement of the rods.

2.2.4.7 Adjustable Mounting Legs

Figure 8: Adjustable Mounting Legs



1. Upper 3/8 Split Lock Washer	5. Locking Hex Nut 1/2-13	9. 3/8–16 Hex Nut 3/8-16
2. Lower 3/8 Split Lock Washer	6. 1/2–13 Hex Nut	10.Lower Hex Nut 3/8-16
3. 3/8–16 x 6 All Thread	7. Leg Cap	11.Lower 3/8 Flat Washer
4. Differential	8. 1/2–13 x 5 All Thread	12.Upper 3/8 Flat Washer
		13.Upper Hex Nut 3/8-16

2.2.4.8 Tilt Switch

The tilt switch assembly is designed to de-energize the lamps if the optical pattern is raised more than 1/2 degree or lowered more than 1/4 degree with respect to the present setting angle of the light unit. A time delay of 10-30 seconds is incorporated to prevent intermittent tilt switch activation due to vibration. The tilt switch assembly has a fail-safe operation so that any malfunction of the switch including loss of power de-energizes the lamp circuits controlled by the tilt switch.

2.2.5 Theory of Operation

This section describes the L-880/L-881 PAPI system theory of operation. It includes operations of the master, slave, optional heater, and tilt switch.

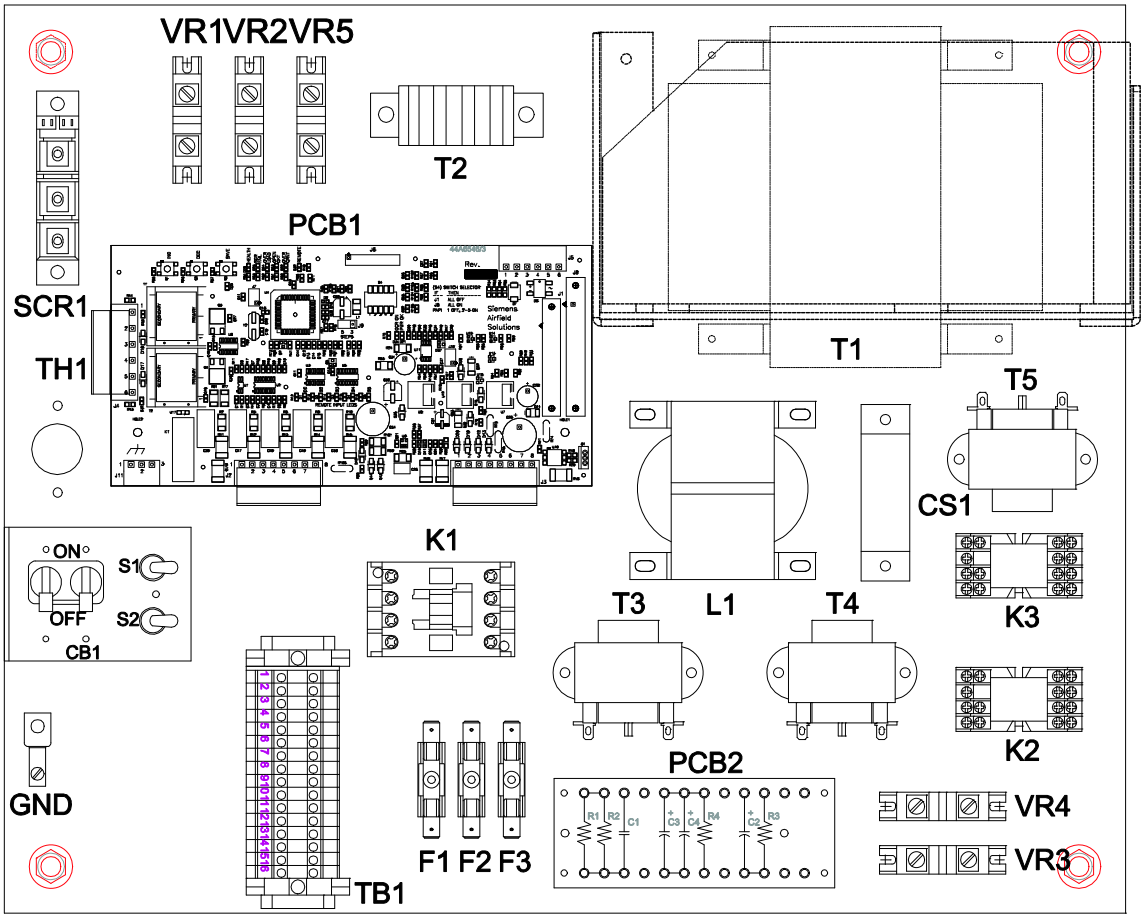
2.2.5.1 Master

See Figure 9. See the *Wiring Schematics* section. 220/240 Vac is supplied to the Master box at TB1-1 and TB1-3. TB-2 is the neutral line. TB1-1 and TB1-3 is fed through VR1 and VR2 to provide lightning protection. 220/240 Vac is fed through circuit breaker CB1 and contactor K1. CB1 provides overcurrent protection. When CB1 is turned on, 220/240 Vac is fed to transformer T4. This steps the voltage down to 18 Vac. When the tilt switches are closed, this 18 Vac is fed to the LC-control PCB1, which provides power for the PCB.

When S1 is set to LOCAL or to REM and remote wires are connected, contactor K1 is energized. When contactor K1 is energized, 220/240 Vac is fed to the inductor L1, SCRs, and step-up transformer T1 (on the L-880 system only). The LC-control PCB1 turns the SCRs on and provides 6.6 A to the lamps at TB1-13 and TB1-14. VR3 and VR4 provide lightning protection at the output.

NOTE: T1-35A0494 is for 4-Box, 3-LT. Units or T1-35A0689 for 4-Box, 2-LT. Units

Figure 9: Master Component Panel



2.2.5.2 Daytime Operation

When the illumination on the photocell rises to 50 to 60 foot-candles, the photocell PC1 is de-energized. This de-energizes relay K2 and provides 120 Vac to J2-7 on LC-control PCB1 and turns on the PAPI system to full intensity.

2.2.5.3 Nighttime Operation

When the illumination drops to 25 to 35 foot-candles, photocell PC1 energizes. This energizes relay K2 and removes 120 Vac from J2-7 on LC-control PCB1. This causes the PAPI system to operate at low intensity (if the interlock relay is used, the PAPI system will not energize until the interlock relay CS1 detects the current flow). A time delay of 45-75 seconds is incorporated in the photocell circuit to prevent switching because of stray light or temporary shadows. In case of failure of the photocell control circuitry, the system reverts to high intensity. Two night intensity settings, approximately 5% and 20% of full intensity, can be set by using toggle switch S2. This allows the user to select either of the two settings to accommodate local site conditions.

NOTE: Refer to “Optional Interlock Relay” on page 12.

2.2.5.4 Remote/Local Operation

Toggle switch S1 allows the unit to operate either in REM or LOCAL. When the switch is set to LOCAL, the unit can be operated locally. When the switch is set to REM and the remote wires are connected to TB1-7 and TB1-8, the unit can be operated from a remote location by a switch closure across TB1-7 and TB1-8.

2.2.5.5 Light Unit

See Figure 6 and Figure 7. Power is provided to the lamps in the light boxes via TB1-13 and TB1-14 in the master and are connected in series. The normally closed tilt switch in each unit is connected to TB1-5 and TB1-6 and are connected in series. These wires connect to TB1-9 and TB1-10 in the master unit. If the optional heater is used in the tilt switch, two wires must be connected from TB1-11 and TB1-12 on the master unit to TB1-7 and TB1-8 on all the light units to provide power to the heater when required.

2.2.5.6 Optional Heater

See Figure 9. Thermostat TH1 in the master is used to supply 240 Vac to the heater. When the outside air temperature drops below 0 °F, the thermostat turns on. This provides 240 Vac to the heater resistors R1 in the tilt switch boxes. This prevents the mercury in the tilt switches from freezing.

2.2.5.7 Optional Interlock Relay

This option provides ON/OFF control through current sensing of the runway series circuit during nighttime operations.

2.2.5.8 Tilt Switch

The tilt switch assembly is designed to de-energize the lamps if the optical pattern is raised more than 1/2 degree or lowered more than 1/4 degree with respect to the present setting angle of the light unit. If a tilt switch is moved from proper alignment, the time delay relay in the master will de-energize after a nominal 15-second time delay, which de-energizes the system and removes the 6.6 A power supply to all the lamps in the PAPI system.

2.2.6 Style A L-880/L-881 PAPI: Required Equipment

Refer to Table 1 and Table 2 for required equipment that is supplied. Refer to Table 3 for required equipment that is not supplied. Refer to the *Parts* section for ordering information.

Table 1: L-880 PAPI Required Equipment Supplied

Description	Quantity
Master PAPI assembly	1
Light box assembly	4
Field splice kit	4
Instruction manual	1 per order

Table 2: L-881 PAPI Required Equipment Supplied

Description	Quantity
Master PAPI assembly	1
Light Box assembly	2
Field splice kit	2
Instruction manual	1 per order

Table 3: Required Equipment Not Supplied

Description	Quantity	Note
Aiming device kit (optional)	1	One required per airport.
Positioning plate	1	See Table 24 through Table 27 in the *Installation* section.
Survey instrument	1	
L-867 light base for L-880 and L-881 (optional)	As required	One L-867 light base is required per light box.
L-867 base plate, 1 hub (optional)	As required	One L-867 base plate (1 hub) is required for the L-867 base near each optical box.
1-1/4 inch (31.75 mm) flex conduit male connector	As required	Supplied by contractor. Refer to Table 4 for quantities.
1-1/2 inch x 1-1/4 inch (38.1 x 31.75 mm) hex reducer bushing	As required	Supplied by contractor. Refer to Table 4 for quantities.
1-1/4 inch (31.75 mm) flex conduit/fluid tight	As required	Supplied by contractor. Refer to Table 4 for quantities.
Interconnector cable (6-conductor)	As required	Supplied by contractor. Refer to Table 4 for quantities.
Concrete	As required	
L-830 30 W/45 W transformer	1	Required only with interlocking relay option.
Primary connector kit	1	Required only with interlocking relay option.

Table 4: Contractor-Supplied Connectors, Conduit, Cable, and Bushings

	L-880 PAPI				L-881 PAPI		L-880/881 PAPI
Description	**Light Box #1**	**Light Box #2**	**Light Box #3**	**Light Box #4**	**Light Box #1**	**Light Box #2**	**Master Box**
1 1/4 flex conduit male connector	2	2	2	2	2	2	
1 1/2 x 1 1/4 hex reducer bushing	1	1	1	1	1	1	
1 1/4 flex conduit/fluid tight	1	1	1	1	1	1	
Interconnector cable (6-conductor)	2	1	1	1	2	1	2

2.2.7 Specifications

This subsection describes the specifications for the L-880 (4 box) and L-881 (2 box) PAPI systems. Refer to the *Parts* section for part numbers.

2.2.7.1 Input Power	220/240 Vac, 50/60 Hz
2.2.7.2 Lamps	Two or three 200 W, 6.6 A quartz lamps per PAPI unit
2.2.7.3 Lamp Life	1000 hours
2.2.7.4 Transmission Factor of Red Sector	At least 15%
2.2.7.5 Transmission Sector	Three minutes of arc over full beam spread
2.2.7.6 Visual Acquisition Range	7.1 miles within an approach envelope of ±5 degrees from the approach axis
2.2.7.7 Transient Suppression	Solid state equipment is capable of withstanding lightning transient consisting of a 10 x 20 microsecond current surge of 15,000 amperes with the subsequent power-follow current and voltage surge of 10 kV/microsecond. System also will withstand without damage the repeated application of an overvoltage transient on the input power lines equal to 500 volts peak for a duration of 50 milliseconds.
2.2.7.8 Tilt Switch	De-energizes all lamps in the PAPI system if optical pattern of any light unit is raised more than 1/2 degree or lowered more than 1/4 degree.
2.2.7.9 Mean Time Between Failures	Six months (minimum) between failures for all components (excluding lamps)
2.2.7.10 Environmental Operating Conditions	The environmental operating conditions includes temperature range of operation, humidity, and wind.
2.2.7.11 Temperature Range of Operation	Refer to Table 5. The standard PAPI A unit meets both Class 1 and Class 2 specifications.

Table 5: Temperature Range of Operation

Class	Operating Temperature Range (Celsius)	Operating Temperature Range (Fahrenheit)
Class 1	-35 to +55 °C	-31 to +131 °F
Class 2	-55 to +55 °C	-67 to +131 °F

2.2.7.12 Humidity	0 to 100%
2.2.7.13 Wind	Velocities up to 100 mph (161 km/h)
2.2.7.14 Mounting Provisions	Three or four mounting legs
2.2.7.15 Weight	93 lb (42.6 kg) (approximate) per light unit; 145 lb (65.8 kg) (approximate) for master

2.2.7.16 Dimensions

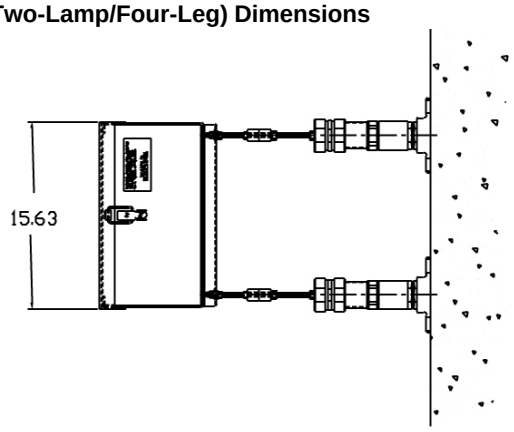
See Figure 10 and Figure 11. Refer to Table 6.

NOTE: Figure 10 shows the two-lamp/four-leg and Figure 11 shows the three-lamp/three-leg PAPI A. The four-leg PAPI A has the same dimensions as the three-leg PAPI A.

Table 6: Dimensions

PAPI Type	Width	Height	Length
L-880/L-881 two lamps	15.63 in. (397 mm)	40 in. (1016 mm)	35 in. (889 mm)
L-880/L-881 three lamps	25.74 in. (654 mm)	40 in. (1016 mm)	39.28 in. (998 mm)

Figure 10: PAPI A (Two-Lamp/Four-Leg) Dimensions



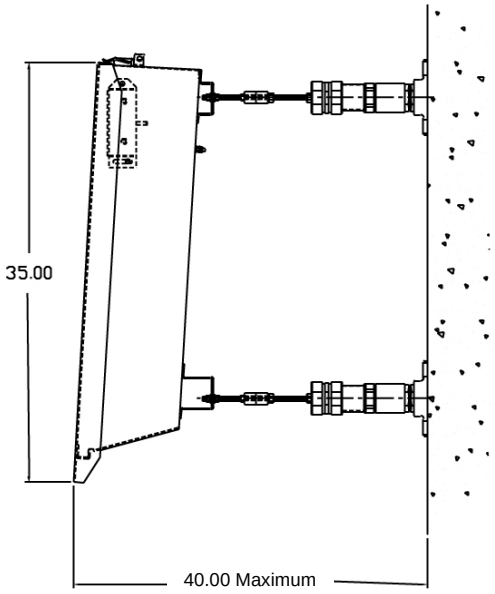
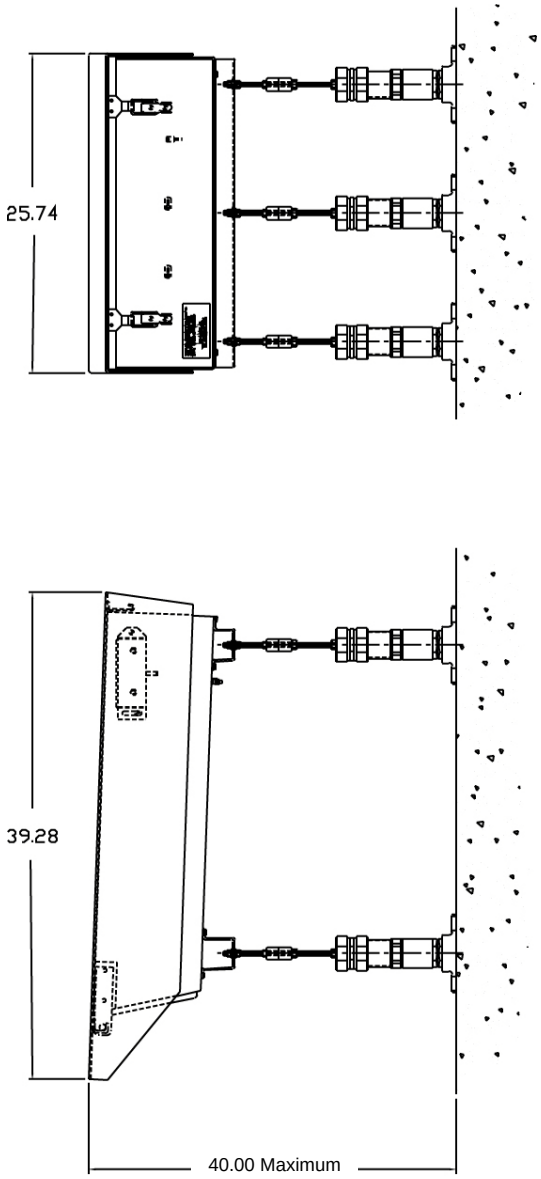


Figure 11: PAPI A (Three-Lamp/Three-Leg) Dimensions



2.2.7.17 Photometrics

Each light unit used in the L-880/L-881 PAPI systems has two/three lamps and provides a beam of light split horizontally to produce white light in the top sector and red light in the bottom sector. When viewed by an observer at a distance of 1000 feet (304.8 m), the transition from red light to white light occurs within an angle of three minutes of arc at the beam center and within an angle of five minutes of arc at the beam edges.

2.2.8 Digital Protractor Specifications

This subsection provides specifications for the optional digital protractor used to aim the PAPI.

2.2.8.1 Range	Range is 360 degrees (90 degrees x 4).
2.2.8.2 Resolution	Resolution is 0.01 degree (0 to 9.99 degrees). Resolution is 0.10 degree (10 to 90 degrees).
2.2.8.3 Accuracy	Refer below for digital protractor accuracy. ±0.05 degree (0 to 10 degrees). ±0.10 degree (80 to 90 degrees). ±0.20 degree (10 to 80 degrees).
2.2.8.4 Repeatability	Repeatability is ±0.05 degree.
2.2.8.5 Supply Voltage	9 volt alkaline battery.
2.2.8.6 Battery Life	500 hours typical.
2.2.8.7 Temperature	Operating temperature: -5 to 50 °C (23 to 122 °F). Storage temperature: -20 to 65 °C (-4 to 149 °F).
2.2.8.8 Weight	Weight is 295 g (10.4 oz).

2.3 Installation

WARNING

Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.
See FAA CERT Alert on page iii Concerning Light Signal Interruption Before Proceeding With Installation.

This section provides instructions for the installation of the PAPI system. Refer to the airport project plans and specifications for the specific installation instructions.

2.3.1 Unpacking

Handle equipment very carefully to prevent component damage. Note any exterior damage to the crate that might lead to detection of equipment damage. If you note any damage to any equipment, file a claim with the carrier immediately. The carrier may need to inspect the equipment.

2.3.2 Instruments for Installation and Verification

This subsection provides information about the instruments necessary to install the PAPI.

2.3.2.1 Installation Using Bubble-Level Style Aiming Device

The instruments below are required for installing, leveling, setting, and checking the elevation setting of the light units using the bubble-level style aiming device.

- One bubble-level style aiming device for azimuth and elevation setting.
- One precision bubble level for leveling the units.
- One checking stick for routine checks of the elevation setting.

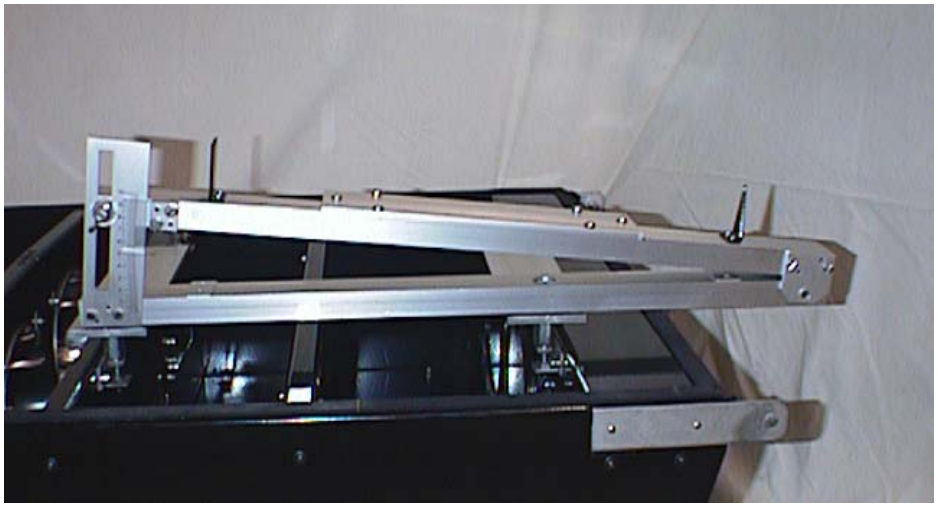
2.3.2.2 Bubble-Level Style Aiming Device

See Figure 12 and Figure 13. The bubble-level style aiming device consists of the following:

- One base to rest on reference block B and slot C, and two movable arms to rest on reference block A and slot D.
- Two graduated scales for elevation setting.
- One bar used for the longitudinal horizontal reference required to set both azimuth and elevation.

NOTE: Figure 12 and Figure 13 show the aiming device on the three-lamp PAPI. These figures also apply to the two-lamp PAPI.

Figure 12: Side View of Bubble-Level Aiming Device for Three-Lamp PAPI



The two movable arms increase the stability of the aiming device and are used to establish the transverse horizontal references. Screws are provided on the bar and on the movable arms to guarantee an exact positioning of the level during setting and adjustment. This exact

positioning is required to have a perfect match between the level and the longitudinal and transverse horizontal references. The two V-sites on the bar of the aiming device are for azimuth alignment.

Figure 13: Top View of Bubble-Level Aiming Device for Three-Lamp PAPI

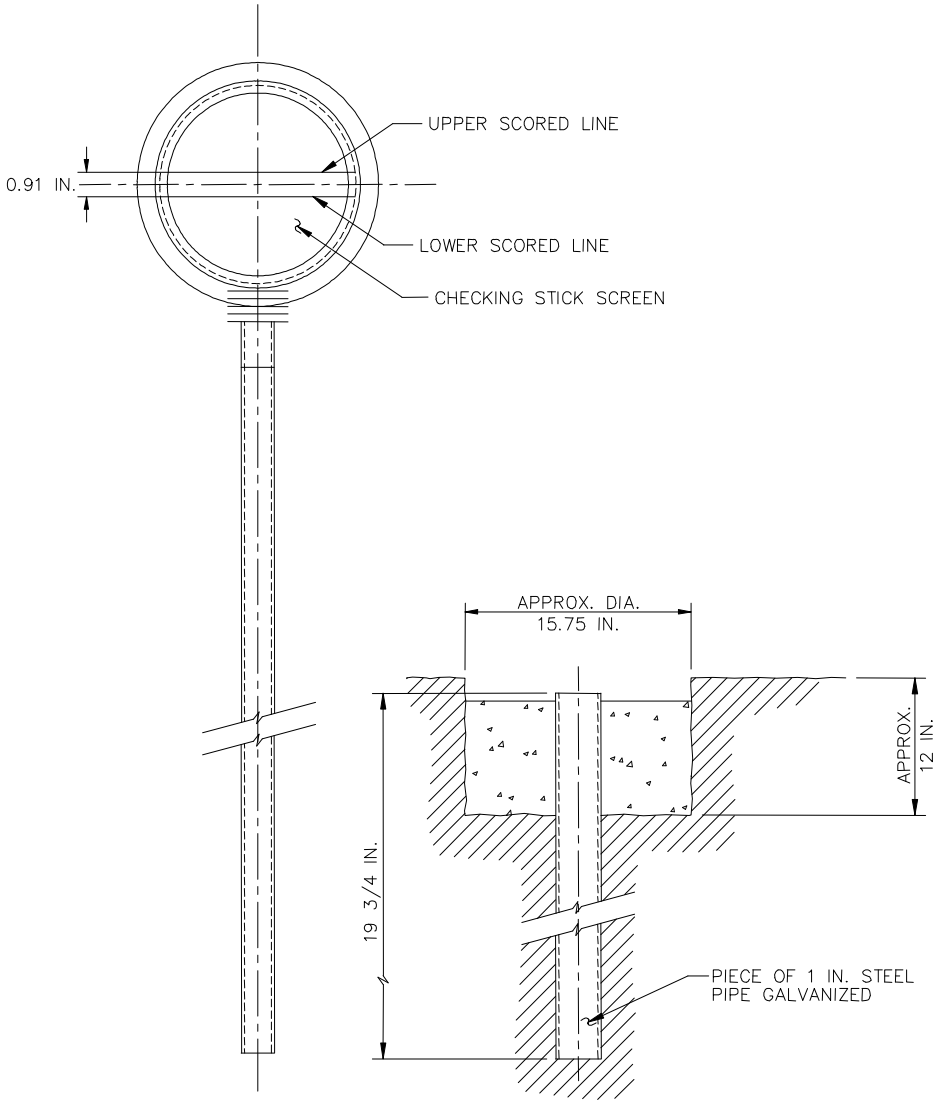
Bubble Level

This instrument has a 0.004 in/ft (0.3 mm/m) degree of precision which allows a very precise setting (within one minute of arc) compatible with the design precision of the PAPI light unit.

Checking Stick

See Figure 14. The checking stick is used to make routine checks of the elevation setting of the PAPI units. It consists of a small transparent screen attached to a lightweight rod. The screen has two horizontal lines 23 mm (0.90 in.) apart to correspond to approximately 3 minutes of arc at 25 m (82 ft). Refer to *Reference Bases for Checking Stick* in this section for instructions on using the checking stick.

Figure 14: Checking Stick



2.3.2.3 Installation Using Digital-Level Style Aiming Device

The instruments below are required for installing, leveling, setting, and checking the elevation setting of the light units using the digital-level style aiming device.

- one digital-level style aiming device for azimuth and elevation setting
- one precision digital protractor for leveling the units and setting the tilt switch

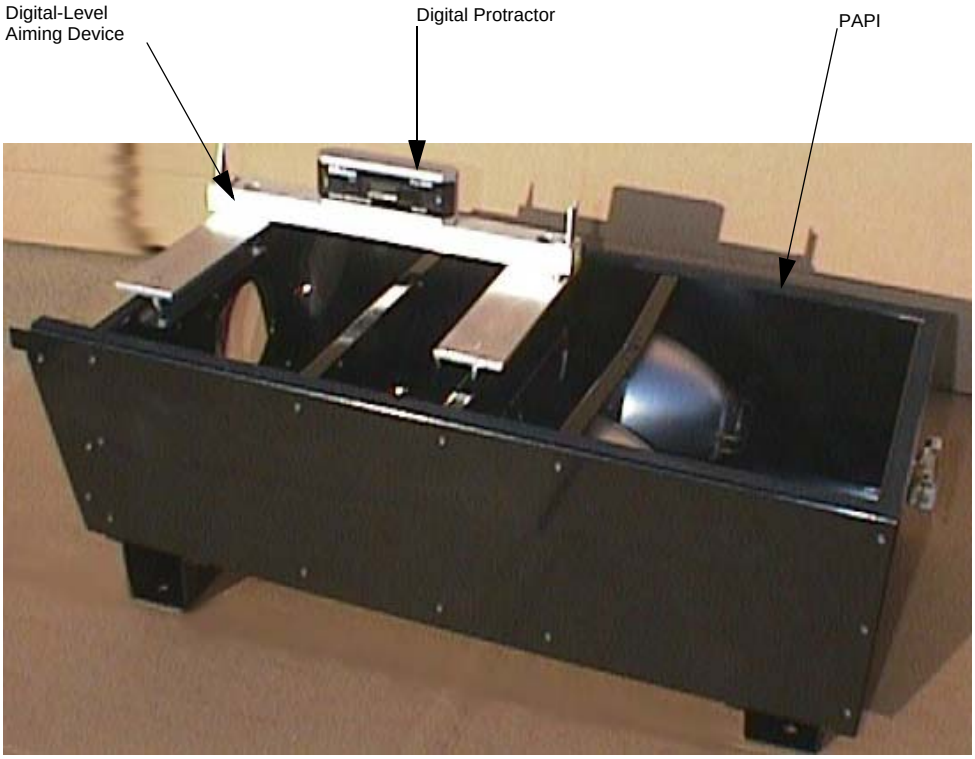
Digital-Level Style Aiming Device

See Figure 15 and Figure 16 for the digital-level aiming device. The digital-level style aiming device consists of the following:

- One base to rest on reference block B and slot C, and two movable arms to rest on reference block A and slot D.
- One bar used for the longitudinal horizontal reference required to set both azimuth and elevation.

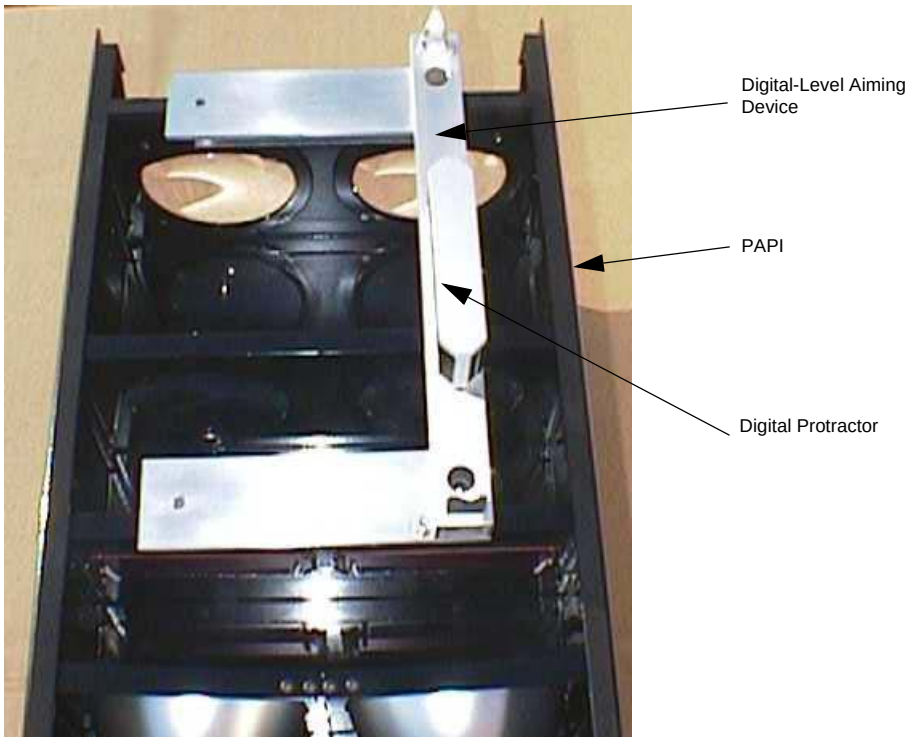
NOTE: Figure 15 and Figure 16 show the aiming device on the two-lamp PAPI. These figures also apply to the three-lamp PAPI.

Figure 15: Side View of Digital-Level Aiming Device for Two-Lamp PAPI



The two movable arms increase the stability of the aiming device and are used to establish the transverse horizontal references. Screws are provided on the bar and on the movable arms to guarantee an exact positioning of the level during setting and adjustment. This exact positioning is required to have a perfect match between the level and the longitudinal and transverse horizontal references. The two V-sights on the bar of the aiming device are for azimuth alignment.

Figure 16: Top View of Digital-Level Aiming Device for Two-Lamp PAPI



Digital Protractor

For information on the digital protractor, refer to *How Digital-Level Aiming Device Works* in this section and *Operating Digital Protractor* in the *Operation* section.

2.3.3 Siting Considerations

When viewed from the approach end, the PAPI system shall be located on the left-hand side of the runway as shown in Figure 3. The PAPI may be located on the right side of the runway if siting problems exist, such as conflicts with runways or taxiways. The PAPI must be sited and aimed so that it defines an approach path with adequate clearance over obstacles and a minimum threshold crossing height.

If the runway has an established ILS glideslope, refer to *Siting PAPI with ILS Glideslope* in this section. The PAPI must be installed so that the visual glideslope coincides (as much as possible) with the electronic glideslope. If there is no ILS on the runway, refer to *Siting PAPI on Runways Without an ILS* in this section. The PAPI's glideslope must be chosen to ensure the on-course signal of the PAPI provides adequate clearance over obstacles.

2.3.3.1 Distance of PAPI Units from Runway Edge

See Figure 3. The light unit nearest to the runway shall be no closer than 50 feet (15.24 m) (+10, -0 feet) (+3.048, -0 m) from the runway edge or to other runways or taxiways. This distance may be reduced to 30 feet (9.144 m) for small general aviation runways used by non-jet aircraft.

2.3.3.2 Lateral Spacing of PAPI Units

The PAPI units shall have a spacing between units of 20 to 30 feet (6.096 to 9.144 m). The distance between boxes shall not vary by more than 1 foot (304.8 mm).

2.3.4 Siting PAPI with ILS Glideslope

When a runway has an established ILS electronic glideslope, the PAPI on-slope signal should coincide, as much as possible, with that for the ILS. To accomplish this, place the PAPI at the same distance (tolerance of ±30 feet or ±9.144 m) from the threshold as the virtual source of the ILS glideslope and aim at the same angle as the ILS glideslope.

Refer to Table 7. This procedure must be modified for runways that serve aircraft in height group 4 because of the eye-to-antenna distance. For these runways, the distance of the PAPI from the threshold shall equal the distance to the virtual source of the ILS glideslope plus an additional

300 feet (91.44 m) (+50 ft, -0 ft) (+15.24 m, -0 m). Calculations should be performed to ensure that the site chosen provides adequate obstacle clearance and threshold crossing height.

Table 7: Threshold Crossing Height

Type of Aircraft	Cockpit-to-Wheel Height	Visual Threshold Crossing Height	Remarks
Height Group 1 (General aviation, small commuters, corporate turbojets)	10 feet (3.048 m) or less	40 feet (12.2 m) (+5 ft, -20 ft) (+1.524 m, -6.1 m)	Many runways less than 6,000 ft (1828.8 m) long with reduced widths and/or restricted weight bearing which would normally prohibit landings by larger aircraft
Height Group 2 (F-28, CV-340/440/580, B-737, DC-8/9)	15 feet (4.6 m)	45 feet (13.7 m) (+5 ft, -20 ft) (+1.524 m, -6.1 m)	Regional airport with limited air carrier service
Height Group 3 (B-707/720/727/757)	20 feet (6.1 m)	50 feet (15.24 m) (+5 ft, -15 ft) (+1.524 m, -4.6 m)	Primary runways not normally used by aircraft with ILS glideslope-to-wheel heights exceeding 20 ft (6.1 m)
Height Group 4 (B-747/767, L-1011, DC-10, A-300)	Over 25 feet (7.6 m)	75 feet (22.9 m) (+5 ft, -15 ft) (+1.524 m, -4.6 m)	Most primary runways at major airports.

2.3.5 Siting PAPI on Runways Without ILS

When the runway doesn't have an ILS glideslope, the PAPI must be sited and aimed so that it defines an approach path which will produce the required threshold crossing height and clearance over any obstacles in the approach area.

2.3.5.1 Threshold Crossing Height (TCH)

See Figure 3. The TCH is the height of the lowest on-course signal at a point directly above the threshold and the runway centerline. The minimum allowable TCH depends on the height group of the aircraft using the runway, and is shown in Table 7. The glideslope of the PAPI must provide the proper TCH for the most demanding aircraft height group using the runway.

2.3.5.2 Glideslope Angle

The standard visual glideslope angle for the PAPI is 3 degrees. For non-jet runways, this may be raised to 4 degrees if required to provide obstacle clearance.

2.3.5.3 Distance of PAPI from Threshold

The following method can be used to determine the PAPI installation distance from the runway threshold provided there are no obstacles in the area from which the PAPI signals can be observed, no differences in elevation between the threshold and the installation zone of the PAPI or between the units, or reduced length of runway. The distance of the PAPI units from the threshold (D1) can be calculated from the equation:

D1 = TCH x cotan (angle of lowest on-course signal) where the TCH is the threshold crossing height for the most demanding aircraft using the runway. Refer to Table 7. The angle of the lowest on-course signal is determined as follows:

For the L-880 PAPI system the angle of the lowest on-course signal will be the aiming angle of the third light unit from the runway minus 1.5 minutes or arc.

NOTE: The subtraction of 1.5 minutes of arc takes into account the width of the transition sector (3 minutes of arc) between the white and red part of the PAPI light beam. The lowest possible on-course signal is 3'/2 = 1.5' lower than the aiming angle.

For the L-881 PAPI system this angle will be the aiming angle of the outside light unit minus 1.5 minutes of arc.

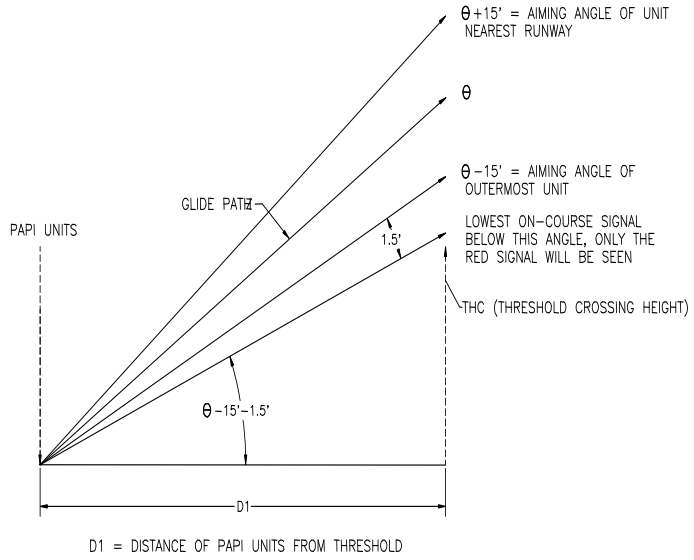
2.3.5.4 Obstacle Clearance Surface

Position and aim the PAPI so that no risk exists of an obstruction being located in an area where the PAPI signals can be observed. Make a survey of the site to determine if an obstacle is present in the area where you can observe the PAPI signals.

See Figure 3. This obstacle clearance surface begins 300 feet (91.44 m) in front of the PAPI units (closer to the threshold) and proceeds outward into the approach area at an angle of 1 degree less than the lowest on-course signal. This surface extends 10 degrees on either side of the runway centerline to a distance of 4 miles (6.44 km) from the point of origin.

If an obstruction penetrates the obstacle clearance surface and cannot be removed, then re-aim the glideslope angle or move the PAPI system further from the threshold. By moving or re-aiming the PAPI, re-position the obstacle clearance surface so that it will not be penetrated by an obstruction. See Figure 17.

Figure 17: Obstacle Clearance Surface



The 1.5' is one-half the width of the transition sector of the light beam. The transition between the white to red part of the beam is 3 minutes of arc (3'). Hence the additional 1.5' must be taken into account in calculating D1.

For L-881: D1 = TCH x cotan (Θ - 15' - 1.5')

NOTE: For the L-880 PAPI system, the lowest on-course signal will be the aiming angle of the third light unit from the runway minus 1.5'. For a standard L-880 installation the lowest on-course signal will be Θ -10' - 1.5'. For Height Group 4 aircraft this angle will be Θ - 15' - 1.5'.

For L-880 (Standard Installation): D1 = TCH x cotan (Θ - 10' - 1.5')

For L-880 (Ht. Group 4 aircraft): D1 = TCH x cotan (Θ - 15' - 1.5')

2.3.5.5 Reduction of Beam Coverage for Obstacle Avoidance

A PAPI system may require a reduction of the horizontal beam coverage because of an obstacle in the approach area. If this is the case, special consideration should be given to the following factors when determining the required system cutoff angle(s):

Type and location of the obstacle with respect to the area where the PAPI signals can be observed

- Wingspan of aircraft using the runway
- Vertical pitch of the glideslope
- Installation tolerances
- Position of the PAPI system
- Additional safety considerations
- Manufacturing tolerances are +0.0° to -0.4°
- Origin of the cutoff angle should be either the outermost or innermost unit (whichever is closest in azimuth to the obstacle)
- Cutoff angles should be FAA approved
- When ordering a PAPI system with a reduced horizontal beam coverage from ADB Airfield Solutions, the following information is required:
- Number of systems required
- Type of system -- L-880 or L-881; Style A or Style B
- Required cutoff angle (from pilot's viewpoint and tolerance)

NOTE: For example, if the nominal required cutoff is 7°, the cutoff angle which would be ordered is 7.2° (+0.0°, -0.4°). The additional 0.2° is added to the nominal value because it is the midpoint of the manufacturing tolerance (+0.0°, -0.4°). The sales order would say, for example, cutoff = 7° Right (from pilot's viewpoint).

Left/right cutoff (from pilot's viewpoint when landing)

2.3.6 Siting Tolerances

Siting tolerances involve azimuthal aiming, mounting height tolerance, PAPI tolerance along a line perpendicular to the runway, and correction for the runway longitudinal gradient.

2.3.6.1 Azimuthal Aiming

Each light unit shall be aimed outward into the approach zone on a line parallel to the runway centerline within a tolerance of ±1/2°.

2.3.6.2 Mounting Height Tolerance

The beam centers of all light units shall be within ±1 inch (25.4 mm) of a horizontal plane. This plane shall be within ±1 foot (304.8 mm) of the elevation of the runway centerline at the intercept point of the visual approach angle with the runway except for additional siting considerations. Refer to *Additonal Siting Considerations* in this section.

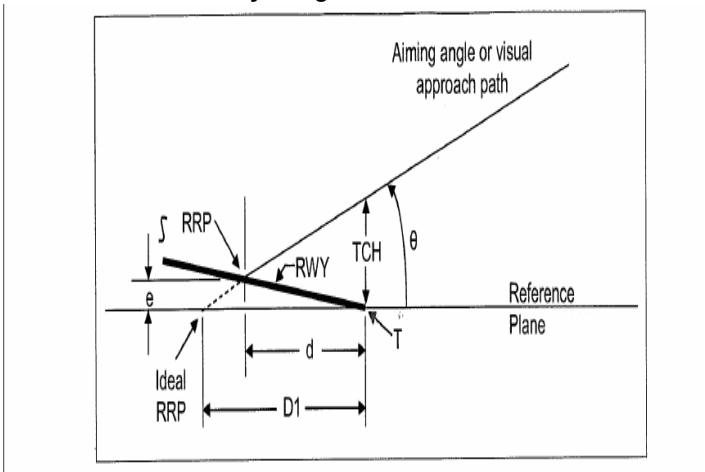
2.3.6.3 PAPI Tolerance Along Line Perpendicular to Runway

The front face of each light unit in a bar shall be located on a line perpendicular to the runway centerline within ±6 inches (152.4 mm).

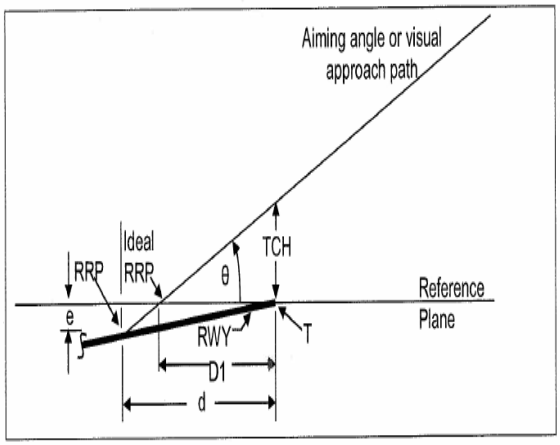
2.3.6.4 Correction for Runway Longitudinal Gradient

See Figure 18. Refer to AC 150/5435-28. On runways where a difference exists in elevation between the runway threshold and the elevation of the runway centerline adjacent to the PAPI, you may need to adjust the location of the light units with respect to the threshold to meet the required obstacle clearance and TCH.

Figure 18: Correction for Runway Longitudinal Gradient



Siting station displaced towards threshold



Siting station displaced from threshold

Symbols:

DI = ideal (zero gradient) distance from threshold
RWY = runway longitudinal gradient
TCH = threshold crossing height
T = threshold
e = elevation difference between threshold and RRP
RRP = runway reference point (where aiming angle or visual approach path intersects runway profile)
d = adjusted distance from threshold
Q = aiming angle

The RRP is at the front, center of the light emitting surface of the PAPI light unit.

If the condition exists, perform the following steps to compute the change in the distance from the threshold required to preserve the proper geometry:

a. Obtain the runway longitudinal gradient. This can be done by survey or obtained from airport obstruction charts or as-built drawings.
b. Determine the ideal (zero gradient) distance from the threshold in accordance with the preceding instructions.
c. Assume a level reference plane at the runway threshold elevation. Plot the location determined in Step 2 above.
d. Plot the runway longitudinal gradient.

e. Project the visual glideslope angle to its intersection with the runway longitudinal gradient. Then solve for the adjusted distance from the threshold either mathematically or graphically. Refer to *Mounting Height Tolerance* in this section.

f. Verify the calculated location gives the desired threshold crossing height.

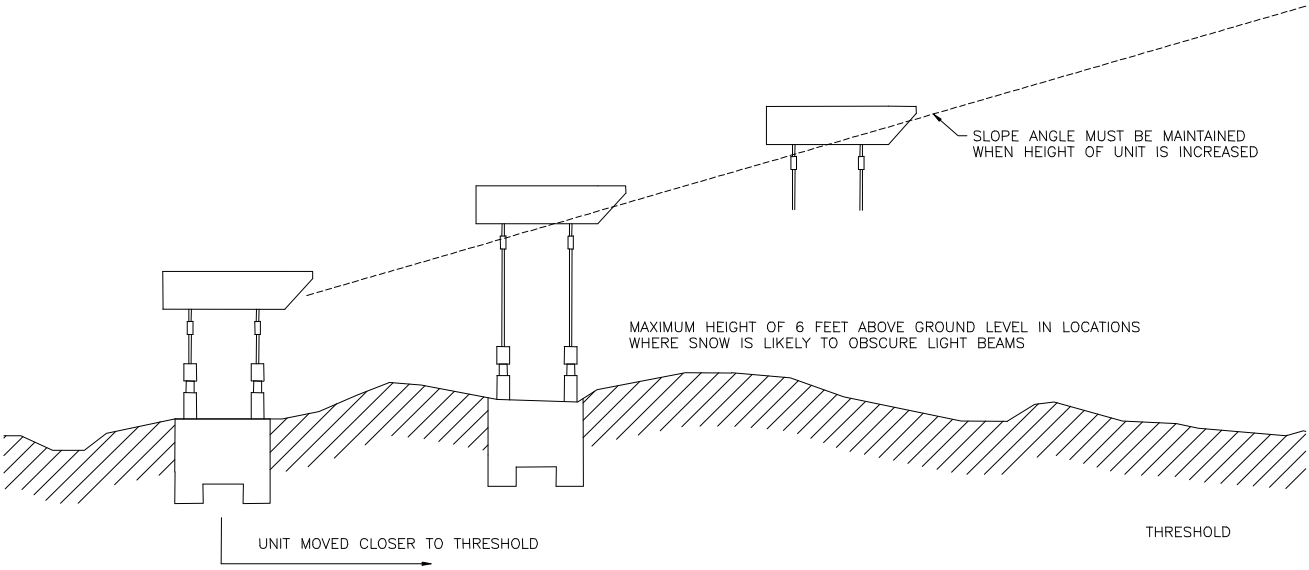
2.3.7 Additional Siting Considerations

Below are additional siting considerations.

- Where the terrain drops off rapidly near the approach threshold and severe turbulence is experienced, locate the PAPI farther from the threshold to keep the aircraft at the maximum possible threshold crossing height.
- On short runways, the PAPI should be as near the threshold as possible to provide the maximum amount of runway for braking after landing.
- See Figure 19. At locations where snow is likely to obscure the light beams, install the light units up to a maximum height of 6 feet (1.83 m) above ground level. This may require installing the light units farther from the runway edge to ensure adequate clearance for the most critical aircraft.

  Since increasing the height of the light units also increases the threshold crossing height of the visual glideslope, you may need to relocate the lights closer to the threshold to remain within the specified tolerance.
- Since the effectiveness of the PAPI system is dependent on the optical red and/or white signal pattern from the light units, make sure that no other lights are close enough to confuse the pilot.

Figure 19: Relocating PAPI Units



2.3.8 PAPI Foundations

The PAPI units shall be installed on concrete pads at ground level with frangible couplings. The foundation should extend at least 12 inches (304.8 mm) below the frost line and at least 1 foot (304.8 mm) beyond the light unit to minimize damage from mowers. Figure 20 through Figure 23 show dimensions that are generally acceptable for the concrete pad for the two-lamp and three-lamp PAPI respectively.

Figure 20: Installation on Concrete Pad (Two-Lamp, Three-Leg PAPI)

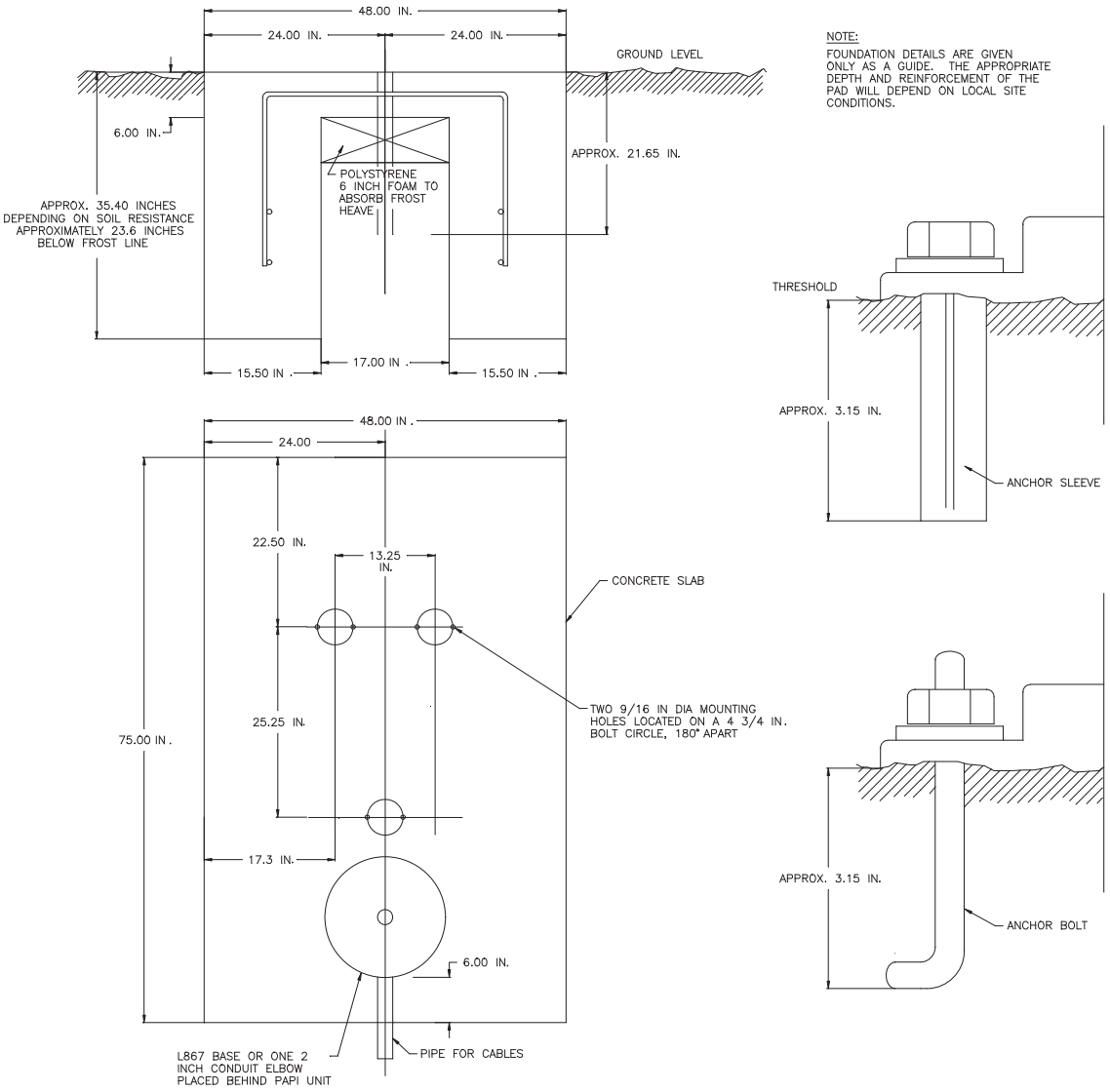


Figure 21: Installation on Concrete Pad (Two-Lamp, Four-Leg PAPI)

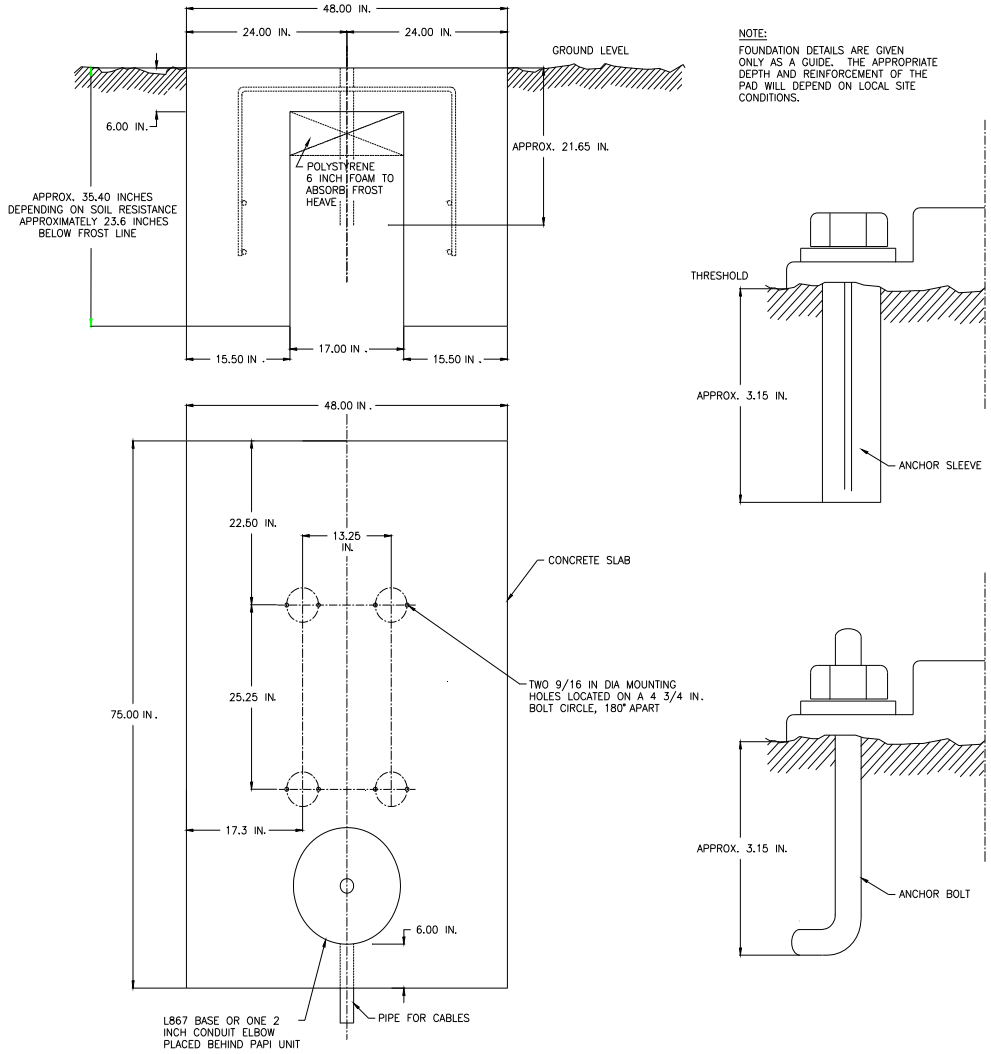


Figure 22: Installation on Concrete Pad (Three-Lamp, Three-Leg PAPI)

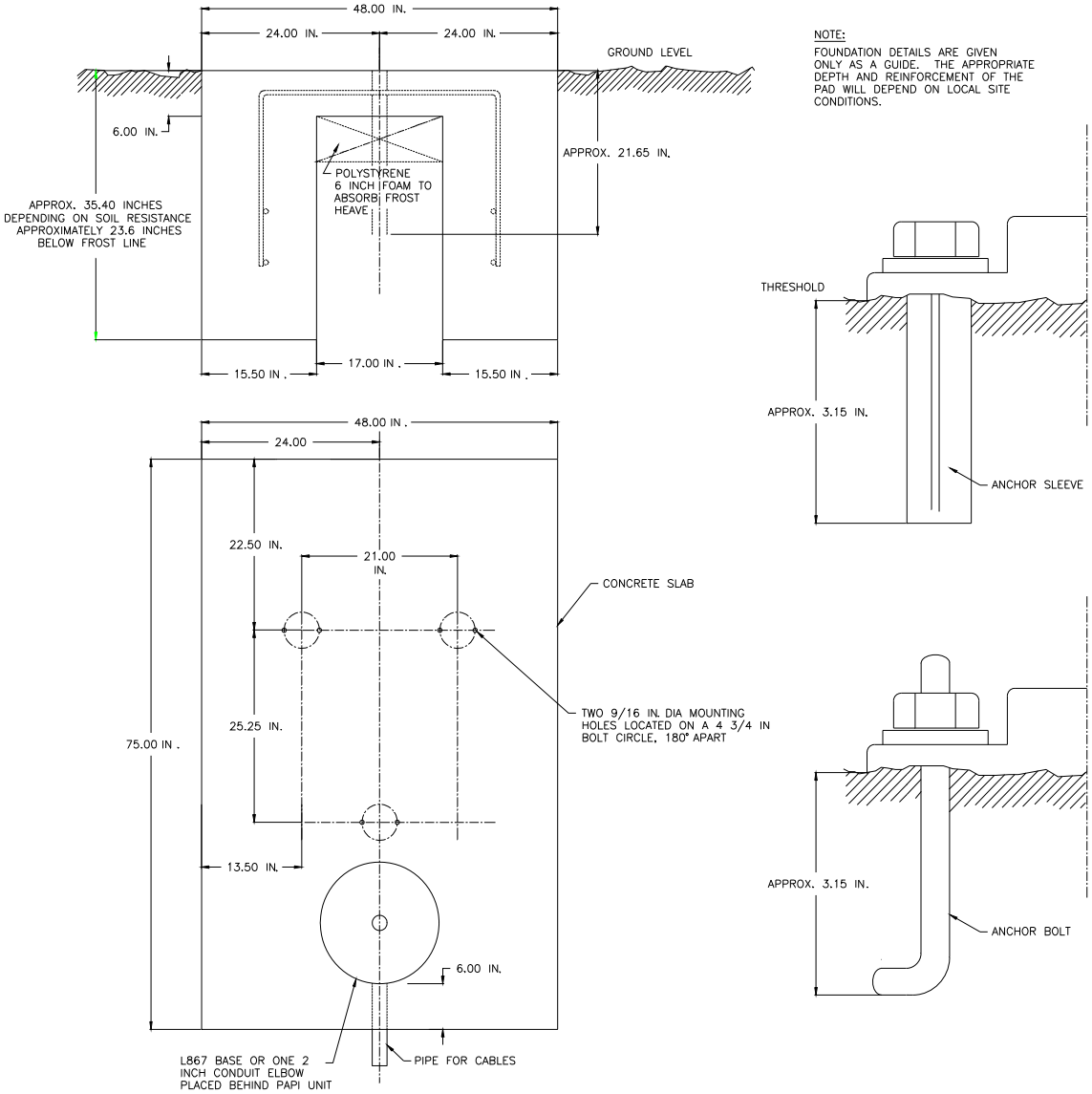
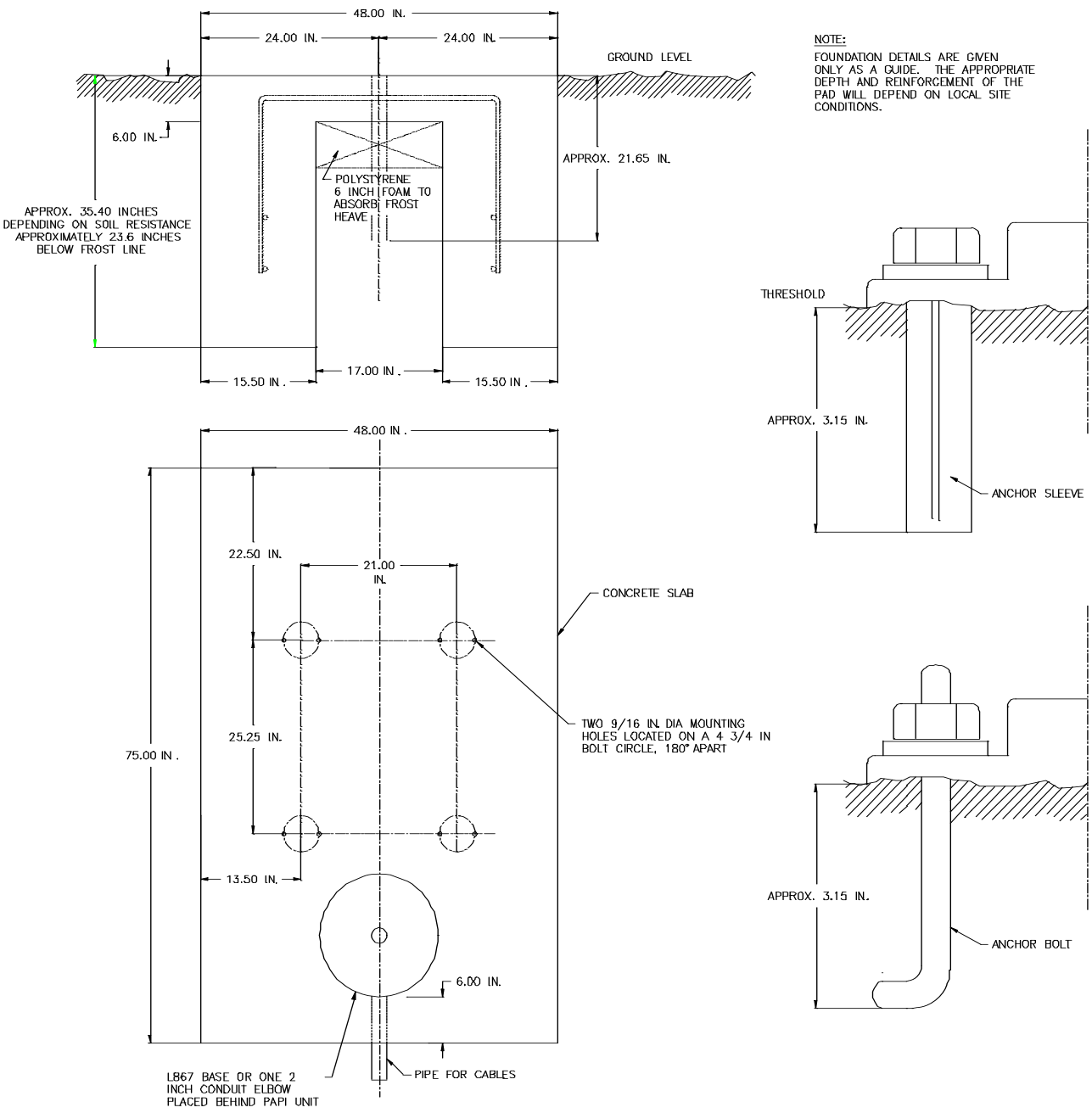


Figure 23: Installation on Concrete Pad (Three-Lamp, Four-Leg PAPI)



To cast the concrete pad and anchor the support fixtures, perform the following procedure:

1. Stake out the longitudinal axis of the light units parallel to the runway centerline.
2. Dig the foundation hole per Figure 20 and Figure 21 for the two-lamp and Figures Figure 22 and Figure 23 for the three-lamp.
3. Place foam in pit to absorb frost heave below the central part of the slab. Place L-867 light base/conduit elbows or pipes for cables. Place bars for reinforcement of concrete.
4. Pour in concrete and allow it to harden for at least one day.

5. After concrete sets up, using chalk draw a longitudinal axis (in accordance with the axis staked out on the ground) on the upper surface of the pad. Draw a transverse axis perpendicular to the other axis.
6. See Figure 24 and Figure 25 for the two-lamp/three- and four-leg and Figures 3-15 and 3-16 for the three-lamp/three- and four-leg PAPI. Lay a positioning plate on the pad; center it by positioning the central hole at the intersection of both axes; align the plate along the longitudinal axis using the V-notches in the plate.
7. Mark the eight locations of the screws on the slab; drill the eight holes to the diameter and depth required for the expansion sleeves and insert the sleeves.
8. See Figure 24 through Figure 27 to locate flanges using mounting templates. Place and fasten the flanges with two screws.

Figure 24: Positioning Plate (Two Lamps/Three Legs)

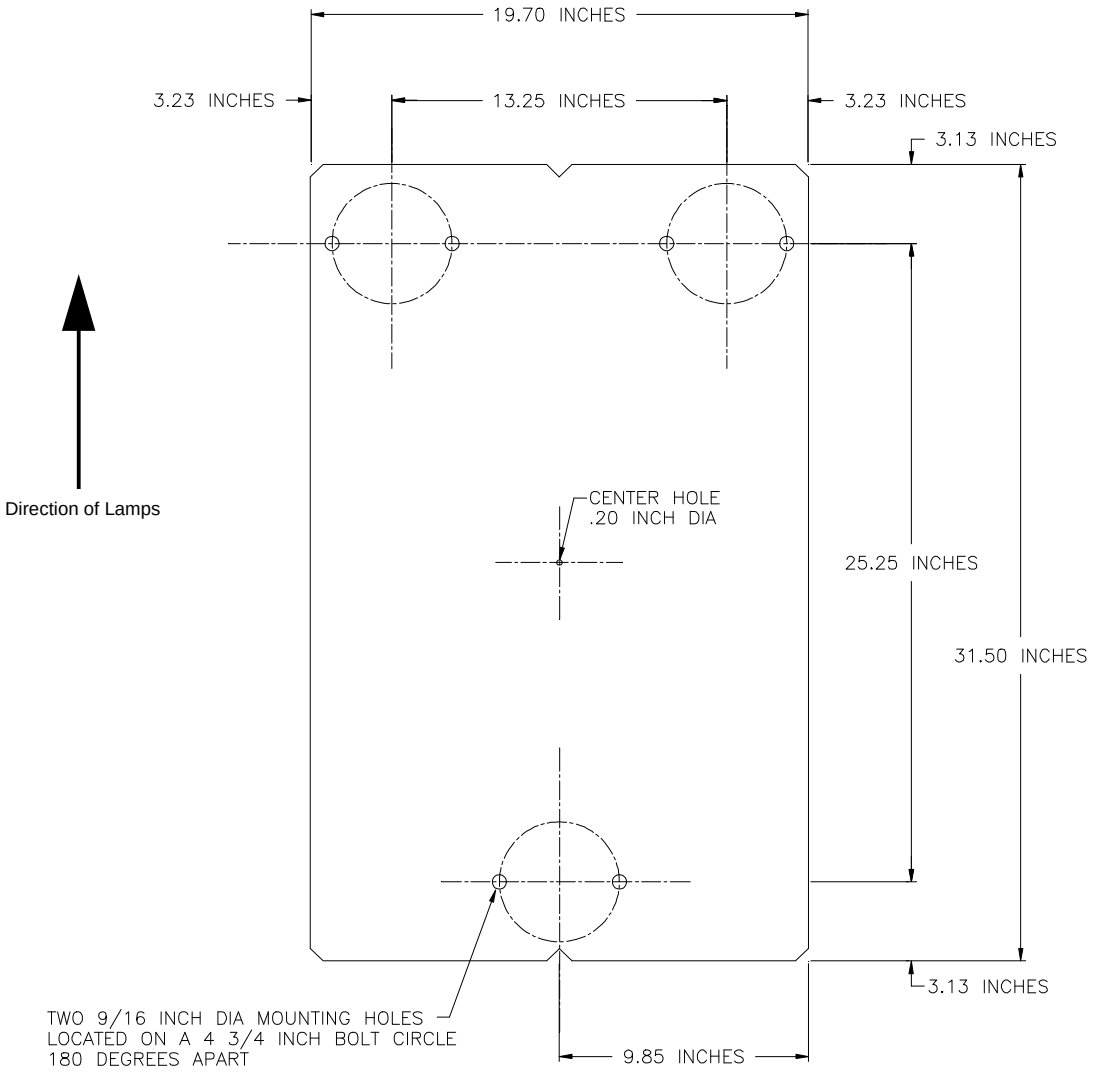


Figure 25: Positioning Plate (Two Lamps/Four Legs)

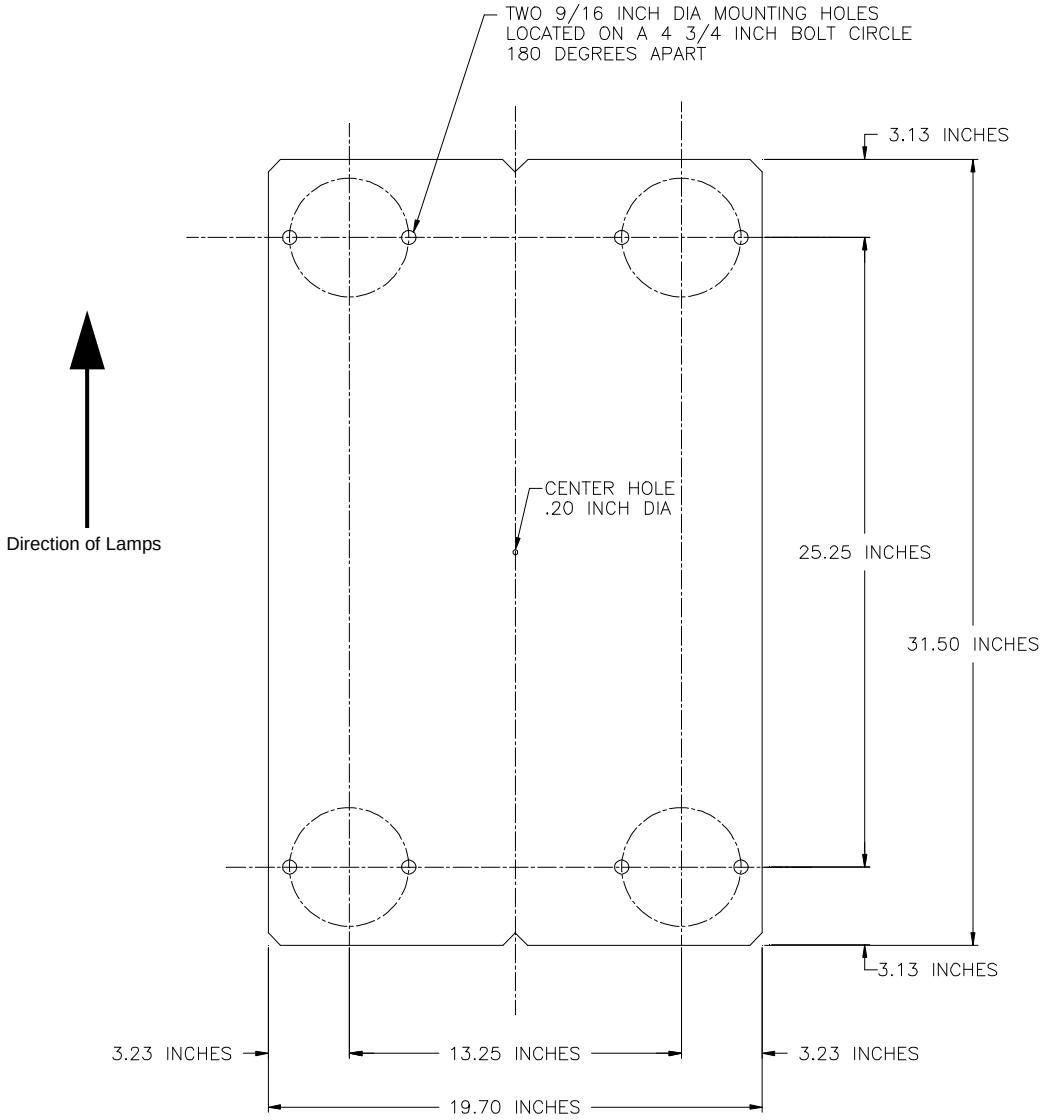


Figure 26: Positioning Plate (Three Lamps/Three Legs)

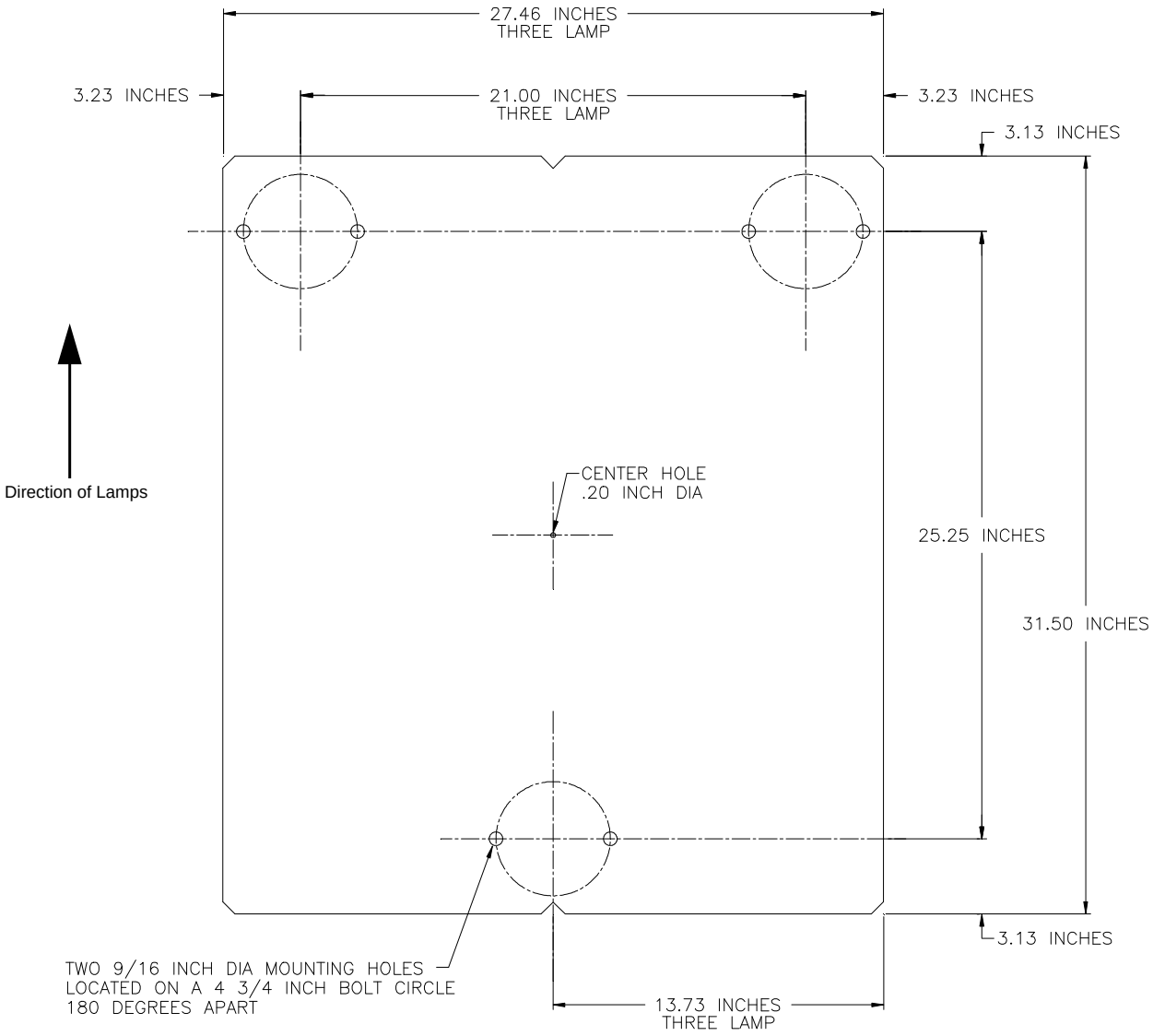
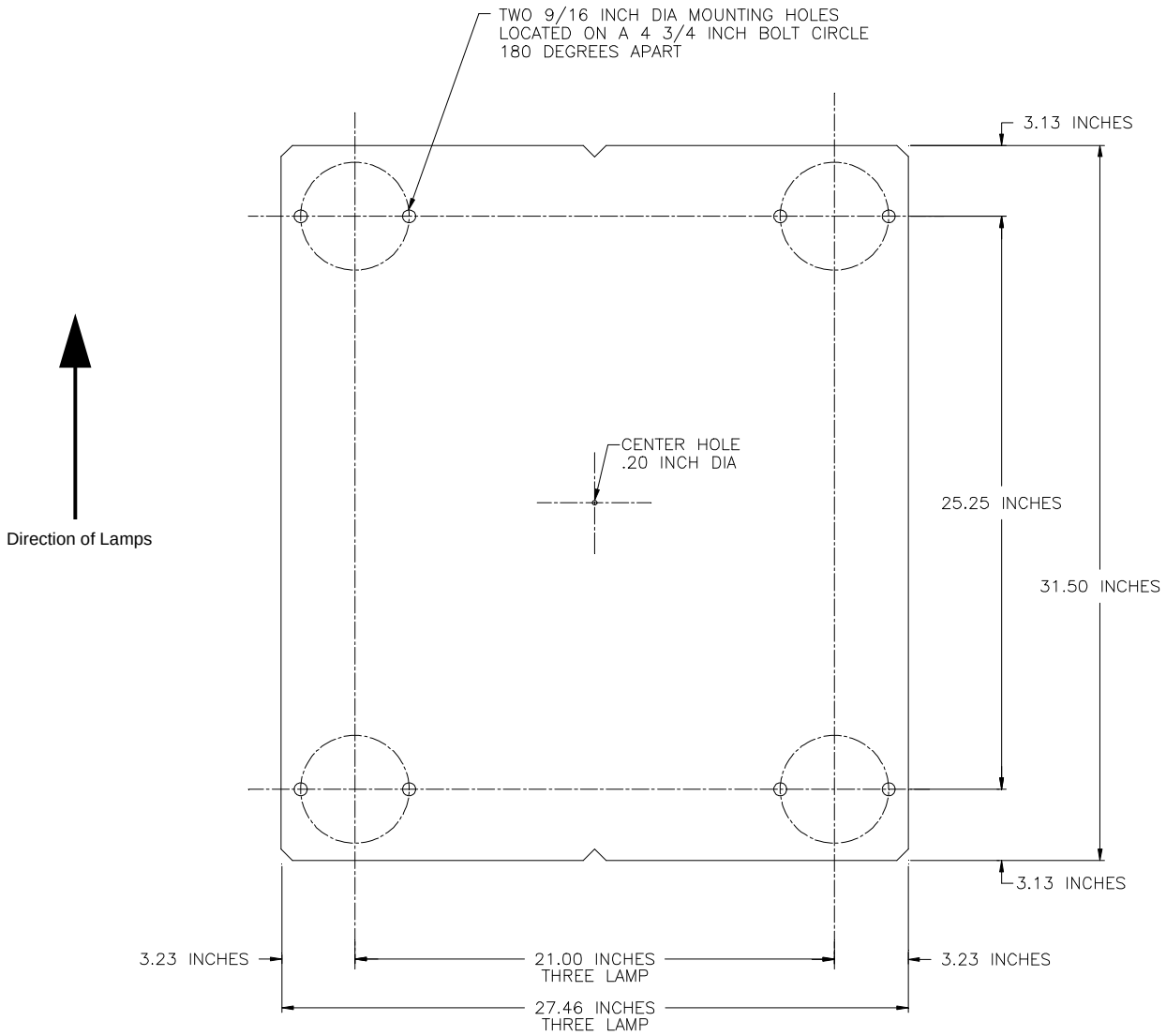


Figure 27: Positioning Plate (Three Lamps/Four Legs)

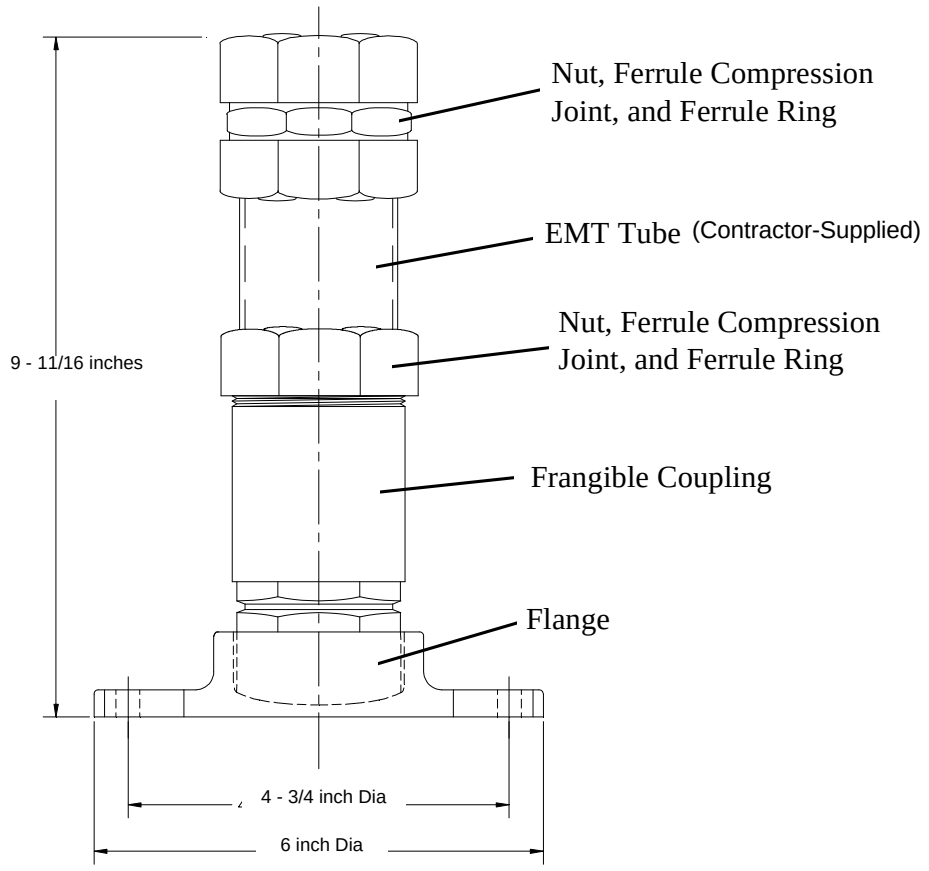


9. Install the frangible couplings. Make sure to place the second nut, ferrule compression joint, and ferrule ring on the bottom of the EMT tube first before screwing the tube with nuts, joints, and rings onto the frangible coupling. See Figure 28.

NOTE: The contractor supplies and installs the 2-inch (50.8 mm) diameter (2–3/16 OD) EMT tube. Determine length at installation to adjust for uneven elevation above the runway. The 2-inch EMT tube extends into the frangible coupling 3.25 inches (82.55 mm) and 1-1/2 inches (38.1 mm) into the nut and ferrule compression joint to ensure stable installation. Paint the tube according to Federal standard 595A, color #12197, international orange, to reduce corrosion.

Instead of expansion sleeves, cast 3/8–16 x 6-inch anchor j-bolts into the concrete at the proper locations on a 4 3/4 in. (120.65 mm) diameter bolt circle, in two places.

Figure 28: Frangible Coupling



2.3.9 PAPI Aiming Angles

Refer to Table 8 and Table 9 for the aiming angles for the L-880 and L-881 PAPI light units.

Table 8: Aiming Angles for L-880 PAPI Units

L-880 (4 box) PAPI	Aiming Angle (Minutes of Arc) (Standard Installation)	Aiming Angle (Minutes of Arc) (Height Group 4 Aircraft* on Runway with ILS)	Note
Unit nearest runway	30' above glide path	35' above glide path	A
Next adjacent unit	10' above glide path	15' above glide path	A
Next adjacent unit	10' below glide path	15' below glide path	A
Next adjacent unit	30' below glide path	35' below glide path	A

NOTE A: Refer to Table 7 in *Siting PAPI with ILS Glideslope* in this section.

Table 9: Aiming Angles for L-881 PAPI Units

L-881 (2 box) PAPI	Aiming Angle (Minutes of Arc) (Standard Installation)
Unit nearest runway	15' above glide path
Unit farthest from runway	15' below glide path

NOTE: 60 minutes of arc = one degree (60' = 1°).

2.3.10 Assembling Adjustable Legs

Assemble the legs for each PAPI unit as follows:

See Figure 8. Screw threaded rods (5, 11) into differentials (7) and assemble legs.

NOTE: Do not assemble upper hex nut (1), upper split lockwasher (2), and upper flatwasher (13). These items will be installed after the PAPI unit is mounted on the legs.

Screw front and rear leg assemblies into the frangible couplings installed on concrete pad.

2.3.11 Mounting Unit

To mount the unit, perform the following procedure:

See Figure 8. Gently mount PAPI unit on the three or four legs so that the unit rests on the top of the lower flatwasher (12), lockwasher (3), and hex nut (4).

NOTE: For the three-leg PAPI, assemble the upper end of the center rear leg as shown in Item 14 of Figure 8. Make further adjustment of the leg height by using the PAPI differential (7).

See also Figure 29 and Figure 30 while mounting unit. Figure 29 shows the two-lamp, four-leg PAPI. Figure 29 shows the two-lamp, three-leg PAPI. Figure 29 and Figure 30 also apply to the three-lamp PAPI.

Figure 29: Elevation Setting Sequence (Two-Lamp, Four-Leg PAPI Shown)

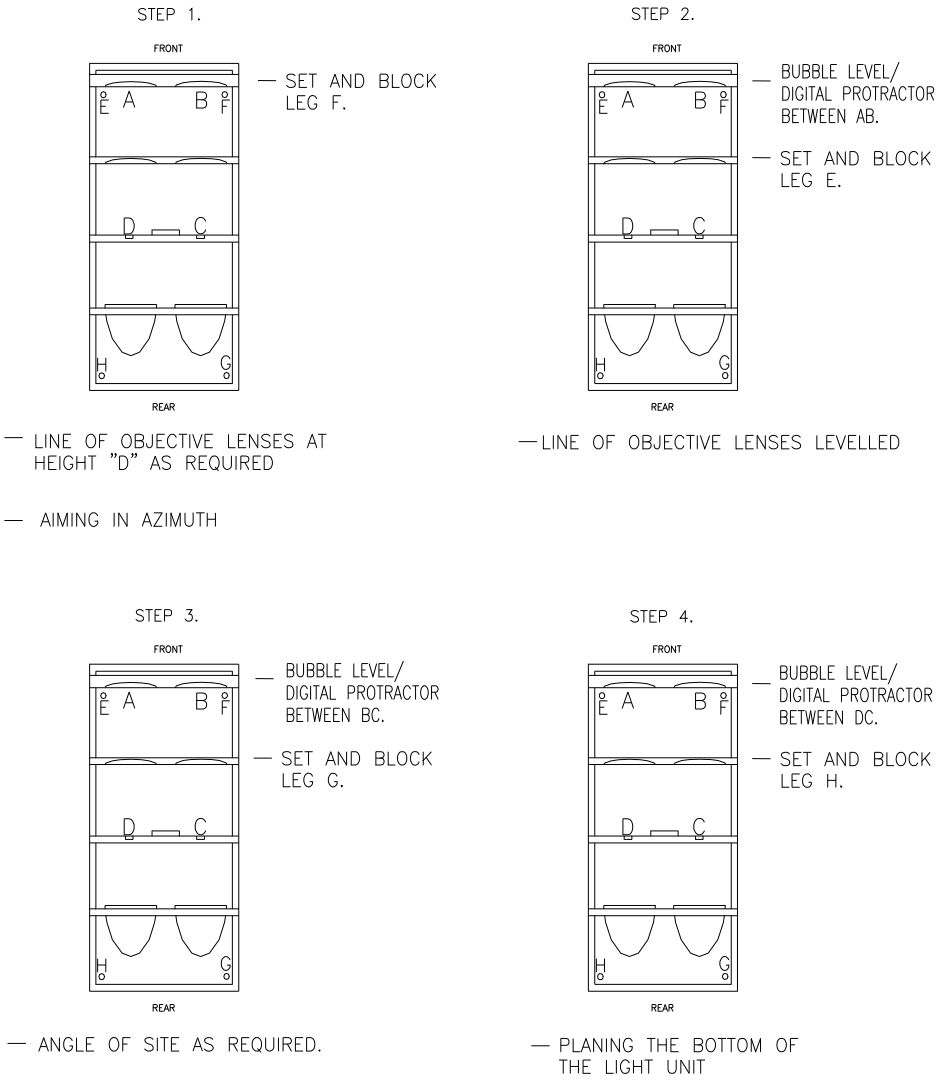
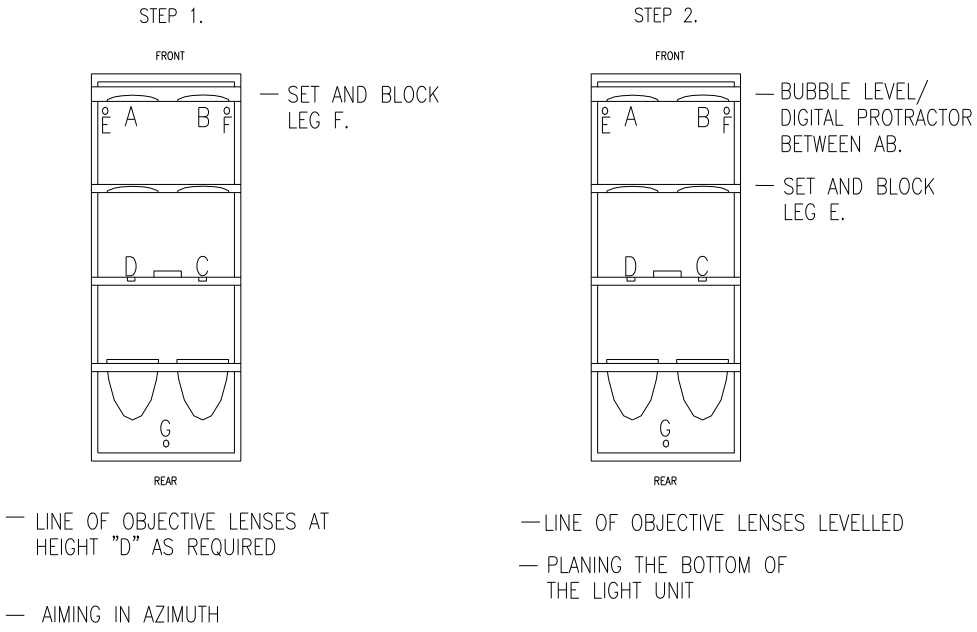


Figure 30: Elevation Setting Sequence (Two-Lamp, Three-Leg PAPI Shown)



See Figure 8, install the upper flat washer (8), lock washer (1), and hex nut (10) on the threaded rod (3). Do not tighten nuts.

Make sure the bottom of the unit is resting on the top of the lower flat washer (11) of the right front leg F.

Make sure all locking nuts on the frangible couplings are tightened.

2.3.12 Aligning Units

This subsection provides information for aligning the PAPI units using the two types of aiming devices: the bubble-level style and the digital-level style. Aligning the PAPI involves knowing how the two types of aiming devices work, using bubble-level or digital-level aiming device to align PAPI, and leveling the tilt switch.

NOTE: Alignment procedures are shown for the 2-lamp PAPI in Figure 29 and Figure 30, but the procedures apply to the 3-lamp PAPI as well.

2.3.12.1 How Bubble-Level Aiming Device Works

See Figure 12. The bubble-level aiming device has two graduated scales, a large metallic scale and a plastic scale (on the upper arm of the aiming device) which are used to set the aiming angle.

The ***metallic scale*** is calibrated in ***10 minutes of arc*** from 0° to 10°. Since there are 60 minutes of arc in one degree (60'= 1° or 30'= 1/2°), there are 6 divisions (0-10', 10-20', 20-30', 30-40', 40-50', 50-60') between each degree tic mark on the scale. Note the 30 minute or 1/2 degree tic mark between each degree tic mark (0 to 1°, 1 to 2°, 9 to 10°) on the metallic scale is slightly longer than the 10', 20' or 40' and 50' tic marks.

The ***plastic scale*** is calibrated in ***minutes of arc*** from 0 to 10 minutes. If an angular setting of, for example, 3° 30' is desired, the setting on the aiming device is obtained by moving the upper bar of the aiming device with the attached plastic graduate scale so that the *0 line on the plastic scale lines up exactly with the 3° 30' tic mark on the metallic scale* (the 30 minute (30') tic mark is midway between the 3 degree and 4 degree tic marks). After obtaining this setting, tighten the locking screw on the upper arm to secure the angular setting.

Suppose now that an angle of 3° 35' is desired. To obtain this setting, perform the following procedure:

Set the 0 line on the plastic scale at the 3° 30' tic mark as described above.

Locate the 5 minute line on the plastic scale. It will not be lined up with any of the tic marks on the metallic scale.

To obtain the desired setting of 3° 35', slowly move the 5 minute line upward until it lines up exactly with the **next tic mark** on the metallic scale. The 5 minute line on the plastic scale will be exactly lined up with the 4° 20' tic mark on the metallic scale when the aiming device is set for 3° 35'.

NOTE: The 0° line on the bottom of the plastic scale will be centered between 3° 30' tic mark and 3° 40' tic mark on the metallic scale. Tighten the locking screw on the upper arm to secure the arm's angular setting.

Practice using the aiming device to obtain the following angular settings: 3° 33' and 3° 38'.

NOTE: The 3° 33' angular setting is obtained when the 3 minute line on the plastic scale is lined up with the 4 degree tic mark on the metallic scale; the 3° 38' angular setting is obtained when the 8 minute line on the plastic scale is lined up with the 4° 50' tic mark on the metallic scale.

2.3.12.2 How Digital-Level Aiming Device Works

This subsection describes how the digital-level aiming device works. It provides information about the digital aiming device, how to calibrate the digital protractor, and how to install the digital protractor battery.

Digital Aiming Device

NOTE: Calibrate the digital-level before each use. See “Calibrating Digital Protractor” on page 43.

See Figure 15 and Figure 16. The digital-level aiming device has one survey device with two pivoting arms and a precision digital protractor that reads in 0.01 degree increments. Each 0.01 degree increment indicates a 0.6 minute movement.

The digital level reads directly in degrees with one hundreth (.XX) of a degree resolution. Table 10 is provided to convert minutes to decimal of degrees.

Example: 3° 35’ would read 3.58°.

3° 15’ would read 3.25°.

Suppose now that an angle of 3° 33' is desired. To obtain this setting, perform the following procedure:

Set the digital leveling device on mounting points A, B, C, and D per Figure 15 and Figure 16.

Aim the PAPI A box per the procedure on Figure 29 or Figure 30 as applicable.

NOTE: The digital level displays the precise angle at which the PAPI is aimed. In this case, 3° 33’ converts to 3.55°.

A laminated card with the conversion chart is provided with each alignment device.

Table 10: Conversion from Decimal Degrees to Minutes

Minutes	Decimal Degrees		Minutes	Decimal Degrees
1	0.02		31	0.52
2	0.03		32	0.53
3	0.05		33	0.55
4	0.07		34	0.57
5	0.08		35	0.58
6	0.10		36	0.60
7	0.12		37	0.62
8	0.13		38	0.63
9	0.15		39	0.65
10	0.17		40	0.67
11	0.18		41	0.68
12	0.20		42	0.70
13	0.22		43	0.72
14	0.23		44	0.73
15	0.25		45	0.75
16	0.27		46	0.77
17	0.28		47	0.78
18	0.30		48	0.80
19	0.32		49	0.82
20	0.33		50	0.83
21	0.35		51	0.85
22	0.37		52	0.87
23	0.38		53	0.88
24	0.40		54	0.90
25	0.42		55	0.92
26	0.43		56	0.93
27	0.45		57	0.95
28	0.47		58	0.97
29	0.48		59	0.98
30	0.50		60	1.00

2.3.13 Calibrating Digital Protractor

Calibrating the digital-level style aiming device involves performing an accuracy test and if necessary, a calibration test for the digital protractor.

NOTE: Refer to *Operating Digital Protractor* in the *Operation* section for digital protractor operating instructions.

CAUTION

To ensure accurate readings with the digital protractor, calibrate before use. It is also recommended to calibrate the digital protractor if it has been dropped or is being used in an environment that varies more than 5 °C (9 °F) from the environment in which it was last calibrated. Refer below for calibration instructions.

2.3.13.1 Performing Digital Protractor Accuracy Test

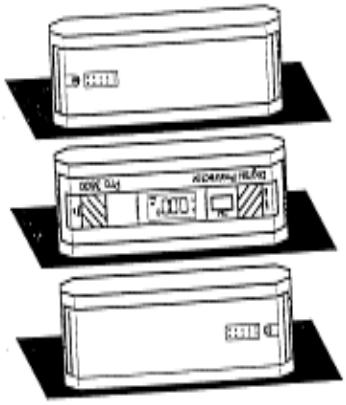
To perform the accuracy test for the digital protractor, perform the following procedure:

1. See Figure 31. Position the digital protractor with the display facing you on a clean, flat horizontal surface. It doesn't have to be exactly level. Wait ten seconds so the unit is completely settled and note the angle on the display.

Figure 31: Positioning Digital Protractor

2. See Figure 32. Rotate the unit end-for-end so that the display is facing away from you. Be sure to set the digital protractor in exactly the same spot, and wait 10 seconds before reading the angle that is displayed.

Figure 32: Rotating and Rolling Protractor



3. Now roll the unit forward so that that display is facing you, but the lettering on the face of the unit is upside down. Wait 10 seconds and note the angle on the display.
4. Rotate the unit end-for-end so that the display is facing away from you. The lettering should still be upside down. Wait 10 seconds and note the angle on the display.

CAUTION

If any of the four measurements in steps 1 through 4 varies from any other by more than 0.1 degrees, you must recalibrate the digital protractor. Refer below for calibration procedure.

2.3.13.2 Performing Digital Protractor Calibration Procedure

The calibration procedure below calibrates the digital protractor through its entire 360 degree range by electronically recording four horizontal and four vertical settings. It should be performed whenever the accuracy test shows a discrepancy of 0.1 degrees or more.

NOTE: You may cancel the calibration procedure at any time by turning off the digital protractor.

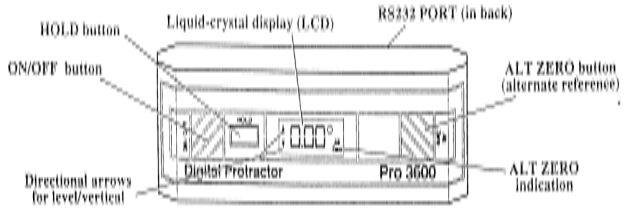
To calibrate the digital protractor, perform the following procedure:

1. Turn on the digital protractor and place it on a flat surface. You can use any horizontal surface within 10 degrees of level and any vertical surface within 10 degrees of plumb. You must use the same surfaces throughout the entire process.

NOTE: Each time you reposition the digital protractor, wait a minimum of 10 seconds before pressing the HOLD button to advance to the next step.

2. See Figure 33. Press and hold the HOLD and ALT ZERO buttons simultaneously. Keep them depressed for approximately three seconds.

Figure 33: Digital Protractor Displays and Buttons



3. See Figure 34. Release the buttons when the symbol “SUP” appears. A *0* within flashing brackets then appears. These brackets are composed of four horizontal and four vertical segments.

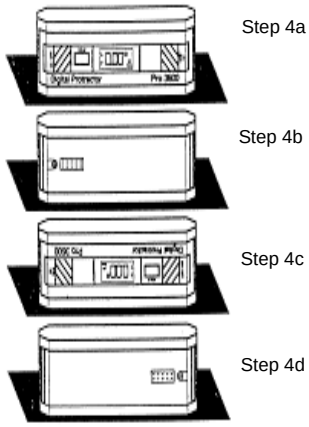
NOTE: As you proceed through this procedure, a new segment will hold steady after you complete each step.

Figure 34: *O* within Flashing Brackets

4. Calibrate horizontal settings by performing the following procedure:

   a. See Figure 35. Face the digital protractor toward you. The white lettering on the face should be right-side up. Align with an edge or line. Wait 10 seconds. Press the HOLD button until **[1]** appears.

Figure 35: Rotating and Rolling Digital Protractor for Horizontal Settings



   b. Rotate the digital protractor so that it faces away from you. The lettering should still be right-side up. Align with the same edge or line. Wait 10 seconds. Press the HOLD button until **[2]** appears.

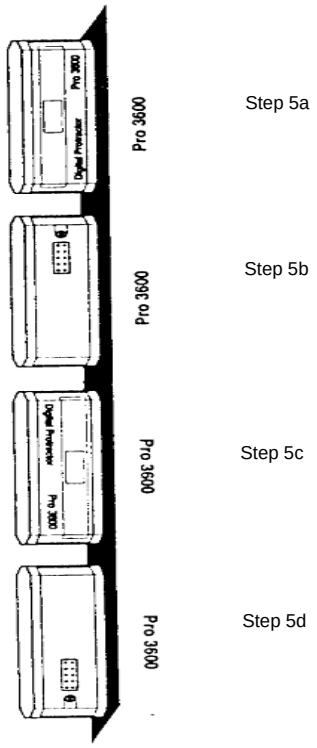
   c. Roll the protractor so that it faces you. The lettering should now be upside down. Align with the same edge or line. Wait 10 seconds. Press the HOLD button until **[3]** appears.

   d. Rotate the protractor so that it faces away from you. The lettering should still be upside down. Align with the same edge or line. Wait 10 seconds. Press the HOLD button until **[4]** appears.

5. Calibrate vertical settings by performing the following procedure:

   a. See Figure 36. Place the digital protractor against a vertical surface so that it faces you. The lettering on the face should read from bottom to top. Align with an edge or line. Wait 10 seconds. Press the HOLD button until **[5]** appears.

Figure 36: Rotating and Rolling Digital Protractor for Vertical Settings



   b. Roll the digital protractor so that it faces away from you. The lettering should still read from bottom to top. Align with the same edge or line. Wait 10 seconds. Press the HOLD button until **[6]** appears.

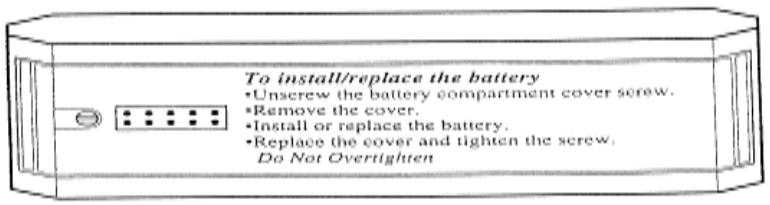
   c. Rotate the digital protractor end-for-end so that it faces you. The lettering should now read top to bottom. Align with the same edge or line. Wait 10 seconds. Press the HOLD button until **[7]** appears.

   d. Roll the digital protractor so that it faces away from you. The lettering should still read top to bottom. Align with the same edge or line. Wait 10 seconds. Press the HOLD button until **[8]** briefly appears, followed immediately by regular angle measuring.

Installing Digital Protractor Batteries

See Figure 37 for installing batteries.

Figure 37: Digital Protractor Installation



The digital protractor is powered by a 9-volt battery. A new alkaline battery provides 500 hours of use. A 9-volt lithium battery can be used for even longer life.

To extend battery life, the digital protractor shuts off automatically when left undisturbed for five minutes, unless activity exists on the serial port. To reactivate the digital protractor, push the ON/OFF button.

NOTE: Hooking serial port pin 5 (REQ) to pin 9 (BATT+) disables the auto-power shutoff. The digital protractor also indicates when the battery is low. Change the battery when the display alternately flashes “LobAt” with angle measurements.

The digital protractor does not display inaccurate angles due to a weak battery.

2.3.13.3 Aligning PAPI Using Bubble-Level/Digital-Level Aiming Devices

Using the bubble-level or digital-level aiming devices to align the PAPI units involves performing horizontal aiming, performing rough elevation setting, checking the horizontal aiming, and performing fine elevation setting.

Preliminary Remarks

The remarks below should be kept in mind in all the following operations: aligning horizontal cutoffs to aiming device, adjusting rough elevation setting, and checking horizontal aiming.

- When handling the unit and, in particular, during installation and aiming, avoid movement of the reference adjusting screws in blocks A and B.

NOTE: Any accidental movement of these screws will require resetting in the factory by specialized personnel.

- When placing the aiming device on the PAPI unit, make sure the holes and slots in the movable arms of the aiming device are properly inserted over the screw heads in the reference blocks (A and B) and into reference slots (C and D).
- The bubble level/digital protractor should be carefully positioned between the locator screws on the bar of the aiming device or against the locator screws on the movable arms.
- When working with the fastening nuts and locknuts on the legs, make sure that the threaded rod does not rotate.

Aligning Horizontal Cut-Offs to Aiming Device

See Figure 29, Step 1 for the 4-leg PAPI and Figure 30, Step 1 for the 3-leg PAPI. Horizontal cut-offs are aligned to the aiming device, not the PAPI box.

NOTE: The bubble-level style aiming device is set to the desired elevation setting (3 degrees, 15 minutes), then the PAPI unit is adjusted until the aiming device is level. For the digital-level style aiming device, the digital protractor reads the angular setting of the PAPI box directly. For more detail on the differences between the bubble-style and digital-style aiming devices, refer to *Installation Using Bubble-Level Style Aiming Device* and *Installation Using Digital-Level Style Aiming Device* in this section.

To align the horizontal cut-offs, perform the following procedure:

1. For the bubble-level style aiming device only, first set the aiming device at the required aiming angle for the unit.
2. Open up the two movable arms and place the instrument on the reference blocks A, B, and slots C and D as shown in Figure 29 and Figure 30. Carry out the following aiming procedure:
    a. Place rod at 164 feet (50 m) in front of the PAPI unit at the same distance from the runway centerline as reference block B and slot C.
    b. Check the alignment through the V-sites on bar of aiming device. Use the sighting pictures given in Figure 12 and Figure 13 for the bubble-level aiming device and

Figure 14 and Figure 15 for the digital-level aiming device. See Figure 8. If necessary, adjust alignment of unit by a small movement of the lower hex nut (4).

c. Tighten upper hex nut (13) on the right front leg F.

d. Do not tighten lower hex nut (10). Leg F will be the pivot during the following operations.

2.3.14 Adjusting Rough Elevation Setting

This subsection describes how to adjust the rough elevation for the 4-leg and 3-leg PAPI.

2.3.14.1 Adjusting Rough Elevation Setting for Four-Leg PAPI System

NOTE: If the legs of the unit are installed at the same height and are level, the unit will be aimed at approximately 3 degrees.

To adjust the coarse setting of the 4-leg PAPI unit, perform the following procedure:

1. See Step 2, Figure 29. Place the bubble level/digital protractor between locater screws on the movable arm resting on reference blocks A and B.
2. See Figure 8 and Figure 29. Level by adjusting the hex nuts (13, 10) on the left front leg E.
3. Tighten hex nuts (13, 10) simultaneously.
4. See Step 3, Figure 29. Place bubble level/digital protractor between locater screws on the bar of the aiming device resting on reference block B and slot C.
5. See Figure 8 and Figure 29. Level by adjusting hex nut (6) of the right rear leg G. During this operation, the rigid bottom of the unit must be free from hex nut (13) on the left rear leg H.
6. Position upper hex nut (13) on leg G against upper flat washer (12). Simultaneously tighten hex nuts and on leg G.
7. See Step 4, Figure 29. Place bubble level/digital protractor between locater screws on the movable arm resting on reference slots C and D.
8. See Figure 8 and Figure 29. Level by adjusting hex nut (10) on the left rear leg H. Some adjustment of the upper hex nut (13) may also be required.
9. Position hex nut on leg H against upper flat washer (12). Simultaneously tighten hex nuts (13, 10).
10. Tighten lower hex nut (10) on leg F.

NOTE: No further adjustment is required on the hex nuts.

2.3.14.2 Adjusting Rough Elevation Setting for Three-Leg PAPI System

NOTE: If the legs of the unit are installed at the same height and are level, the unit will be aimed at approximately 3 degrees.

To adjust the coarse setting of the 3-leg PAPI unit, perform the following procedure:

1. See Step 2, Figure 30. Place the bubble level/digital protractor between locater screws on the movable arm resting on reference blocks A and B.
2. See Figure 8 and Figure 30. Level by adjusting the hex nuts (13, 10) on the left front leg E.
3. Tighten hex nuts (13, 10) simultaneously.
4. See Step 3, Figure 30. Place bubble level/digital protractor between locater screws on the bar of the aiming device resting on reference block B and slot C.

2.3.14.3 Adjusting Rough Elevation Setting for Three-Leg PAPI System

5. See Figure 8 and Figure 30. Level by adjusting hex nut (6) of the right rear leg G.
6. Position upper hex nut (13) on leg G against upper flat washer (12). Simultaneously tighten hex nuts on leg G.
7. Tighten lower hex nut (10) on leg F.

Checking Horizontal Aiming

See Figure 8. Make sure rod at 164 feet (50 m) from the unit is still properly aligned with the V-sites on aiming bar. If not, loosen upper hex nut (13). Align the unit. Refer to “Aligning Horizontal Cut-Offs to Aiming Device” on page 47. Repeat the operations in the preceding section.

NOTE: It is not necessary for the alignment to be absolutely perfect. An error of 20 inches (508 mm) at 164 feet (50 m) yields an error of 0.5°, which is within tolerance. Refer to *Azimuthal Aiming* in *Siting Tolerances* in this section.

2.3.15 Adjusting Fine Elevation Setting

This subsection describes how to adjust the fine elevation setting for the 3-leg and 4-leg PAPI systems.

2.3.15.1 Adjusting Fine Elevation Setting for Four-Leg PAPI System

To adjust the fine elevation settings using the differential for the 4-leg PAPI, perform the following procedure:

1. Place aiming device on unit so that it rests on the screws of reference blocks A and B, and slots C and D.
2. See Figure 29, Step 1 and Figure 8. Make sure the locking hex nuts (5, 9) for the differential (4) on right front leg F are tightened. The locking hex nuts (5, 9) for the differentials on the other legs have to remain loose.
3. See Figure 29, Step 2 and Figure 8. Place bubble level/digital protractor on the arm of the aiming device resting on reference blocks A and B. Level by turning the differential on left front leg E in the proper direction. Tighten locking hex nuts (5, 9) on the differential on leg E when leveled.
4. See Figure 29, Step 3 and Figure 8. Place bubble level/digital protractor on the bar of the aiming device resting on reference block B and slot C. Proceed with the leveling procedure by adjusting the differential on rear legs G and H, turning both differentials in the same direction with equal amplitude. Tighten locking hex nuts (6, 8) on differential on leg G when leveling is completed.
5. See Figure 29, Step 4 and Figure 8. Place bubble level/digital protractor on the movable arm resting on slots C and D. Level by turning differential of left rear leg H in the appropriate direction. Tighten locking hex nuts on differential on leg H when leveling is completed.
6. Repeat the above fine elevation adjustment steps 2 through 5. If the setting is still not correct, go back and repeat the rough elevation adjustment steps and then the fine adjustment steps until the correct setting is obtained.

2.3.15.2 Adjusting Fine Elevation Setting for Three-Leg PAPI System

To adjust the fine elevation settings using the differential for the 3-leg PAPI, perform the following procedure:

Place aiming device on unit so that it rests on the screws of reference blocks A and B, and slots C and D.

See Figure 30, Step 1 and Figure 8. Make sure the locking hex nuts (5, 9) for the differential (4) on right front leg F are tightened. The locking hex nuts (5, 9) for the differentials on the other legs have to remain loose.

2.3.15.3 Adjusting Fine Elevation Setting for Three-Leg PAPI System (cont’d.)

See Figure 30, Step 2 and Figure 8. Place bubble level/digital protractor on the arm of the aiming device resting on reference blocks A and B. Level by turning the differential on left front leg E in the proper direction. Tighten locking hex nuts (5, 9) on the differential on leg E when leveled.

See Figure 30, Step 3 and Figure 8. Place bubble level/digital protractor on the bar of the aiming device resting on reference block B and slot C. Proceed with the leveling procedure by adjusting the differential on rear leg G, turning both differentials in the same direction with equal amplitude. Tighten locking hex nuts (5, 9) on differential on leg G when leveling is completed.

Repeat the above fine elevation adjustment steps 2 through 4. If the setting is still not correct, go back and repeat the rough elevation adjustment steps and then the fine adjustment steps until the correct setting is obtained.

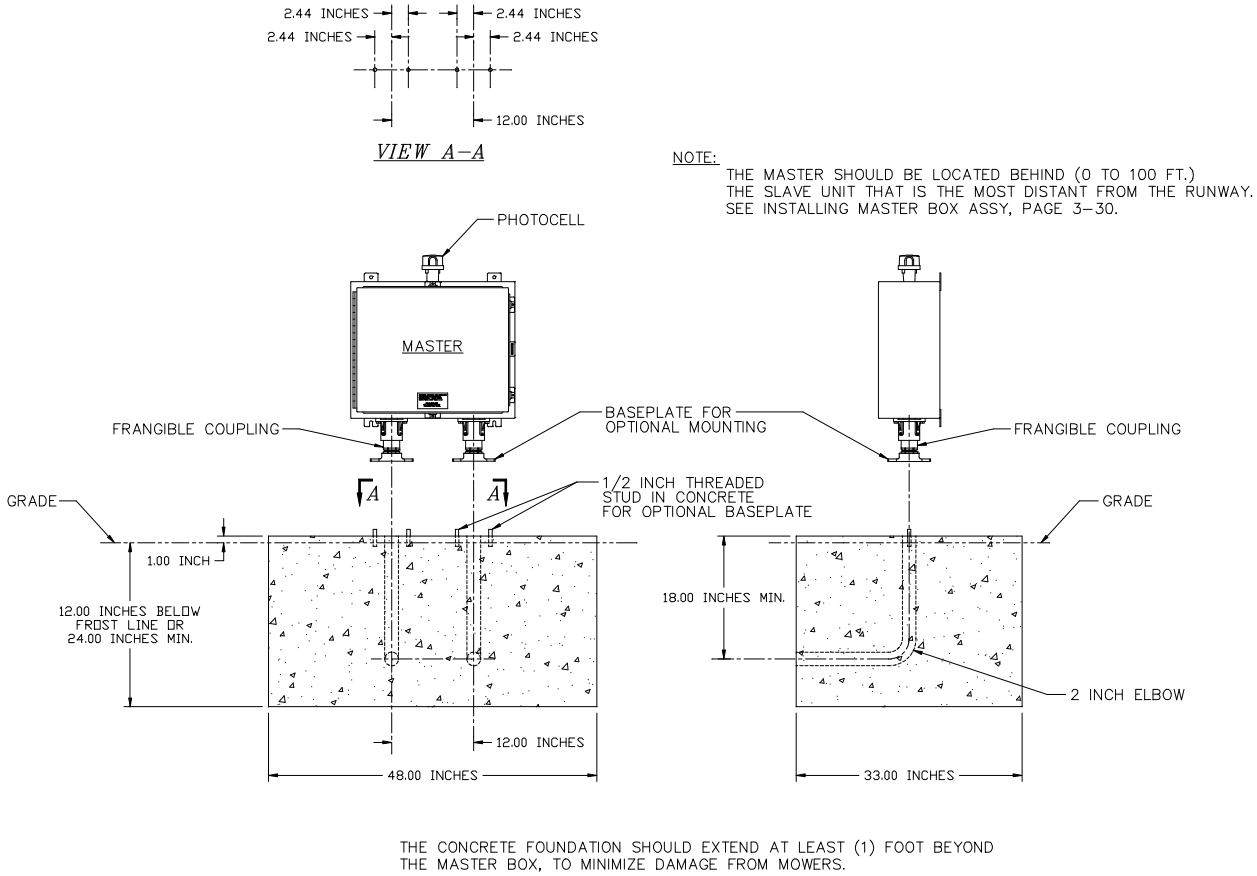
2.3.16 Installing Master Box Assembly

This subsection provides information for installing the master box assembly.

Locating Master Box

See Figure 38. The master should be located behind the optical box #1 (the unit most distant from the runway) from 0 to 100 feet from the light unit. It should be located so that stray light from taxiing aircraft, rotating beacons, and automobiles does not energize the photocell on the unit.

Figure 38: Master Box Assembly



Preparing Master Foundation

To prepare the master foundation, perform the following procedure:

1. Dig, frame, and pour the foundation for the master per Figure 38.
2. Install two-inch, 90 degree conduit elbows with couplings in the trench prior to pouring the concrete.
3. After the concrete has hardened, install frangible couplings in the two couplings on the concrete pad (optional baseplate with mounting studs can be used as shown).
4. Set the master unit on the frangible couplings and secure in place using the locking screws on the slipfitters on the bottom of the master unit.
5. Ground the master unit using AWG #12 ground wire.
6. See Figure 47 and Figure 48. Use external wiring diagrams to attach the appropriate field wiring to the labeled terminals of the master. See Figure 51 and Figure 52 for master internal wiring schematics.

2.3.16.1 Leveling Tilt Switches

To level the tilt switch, place a precision bubble level/digital protractor on top of the tilt switch (with metal plate attached to hold level). Loosen bolts and adjust the up/down position of the tilt switch until level reads true. Tighten the locking bolts.

NOTE: The bubble-level and digital protractor are located respectively in the Bubble-Type Level Aiming Device and Digital Protractor-Type Level Aiming Device Kit.

NOTE: Use a precision level such as the ±0.004 in/ft degree of precision level used for leveling the PAPI units.

2.3.17 Wiring between Masters and Light Units

WARNING

Before making any wire connections, make sure that you turn off the constant current regulator. Failure to observe this warning may result in personal injury, death, or equipment damage.

This subsection describes series circuit wiring requirements.

2.3.17.1 Grounding Units

Each PAPI unit must be grounded. To ground each unit: Attach a ground wire AWG #12 (minimum) to the ground lug located on the floor flange on the rear PAPI unit leg.

2.3.17.2 Connecting External Wiring

All installation wiring should conform to the applicable sections of the National Electric Code and Local Codes. Make wire connections as shown in Figure 47 for the L-880 PAPI system or in Figure 48 for the L-881 PAPI system. Route cable through the flexible conduit assemblies.

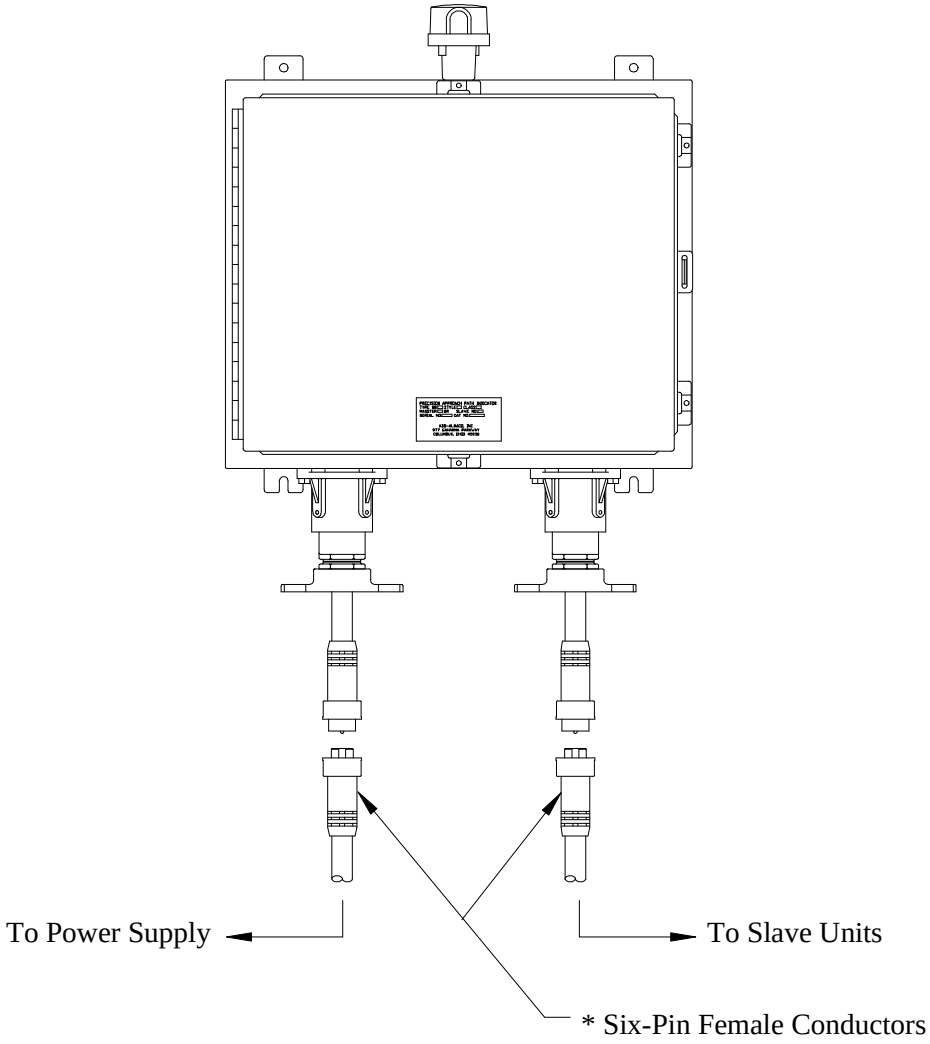
NOTE: All external wiring must be a minimum of 16 AWG/600 V.

See Figure 39 and Figure 40 for suggested method of connecting the wires between the master unit and the light box and the equipment that the contractor supplies. A field splice kit is available for L-880 installation and for L-881 PAPI installation. Each field splice kit provides enough items for entire installation. Refer to the *Parts* section for ordering information.

NOTE: It is important that the tilt switch wires be free from nicks and routed in such a manner as to minimize conducted interference between adjacent wires.

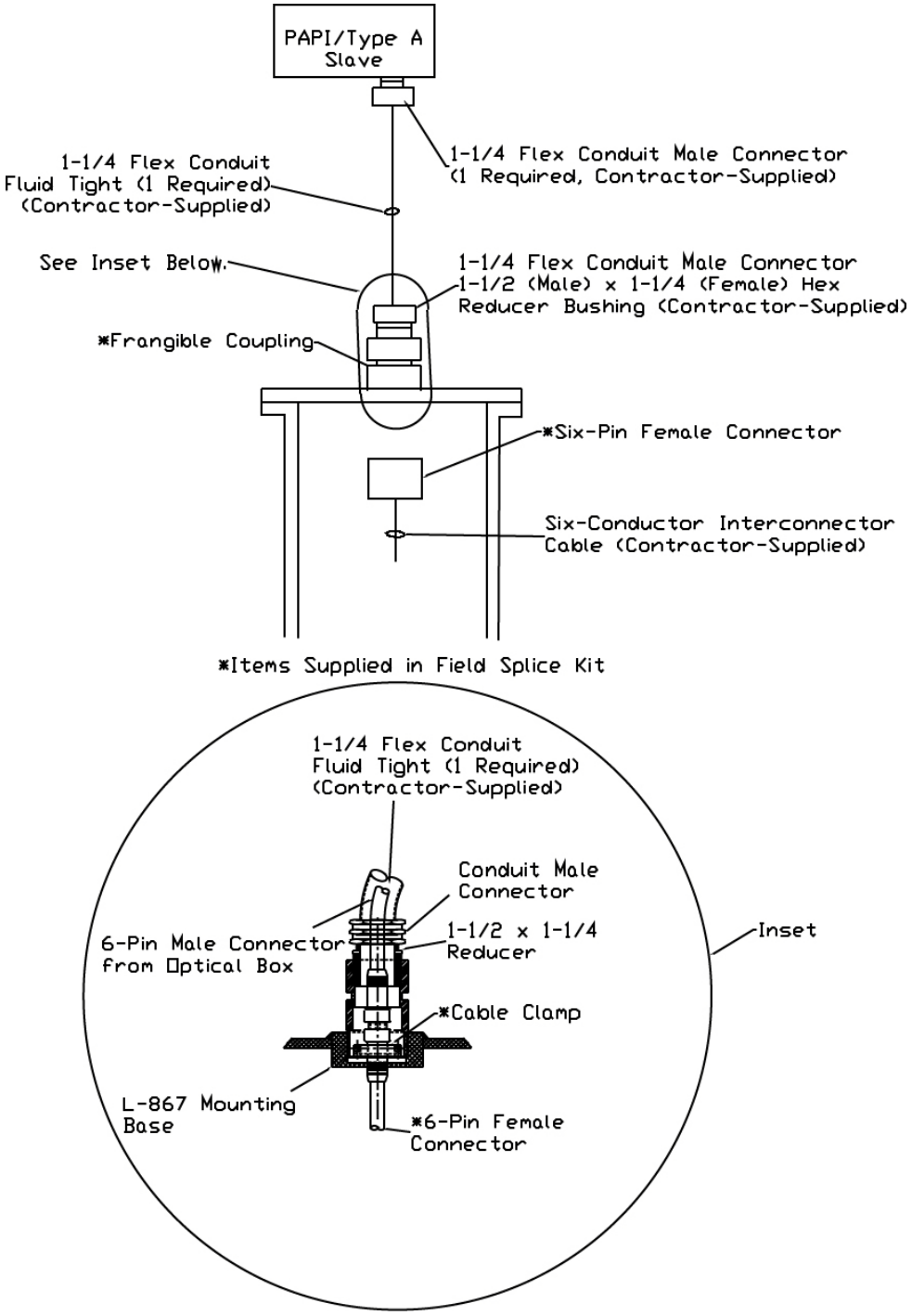
NOTE: After making all wiring connections and checking the operation of the units, install duct seal or RTV in all conduit entrances.

Figure 39: L-880/L-881 Master External Connections



* Part of ADB Field Splice Kit

Figure 40: L-880/L-881 Light Box External Connections



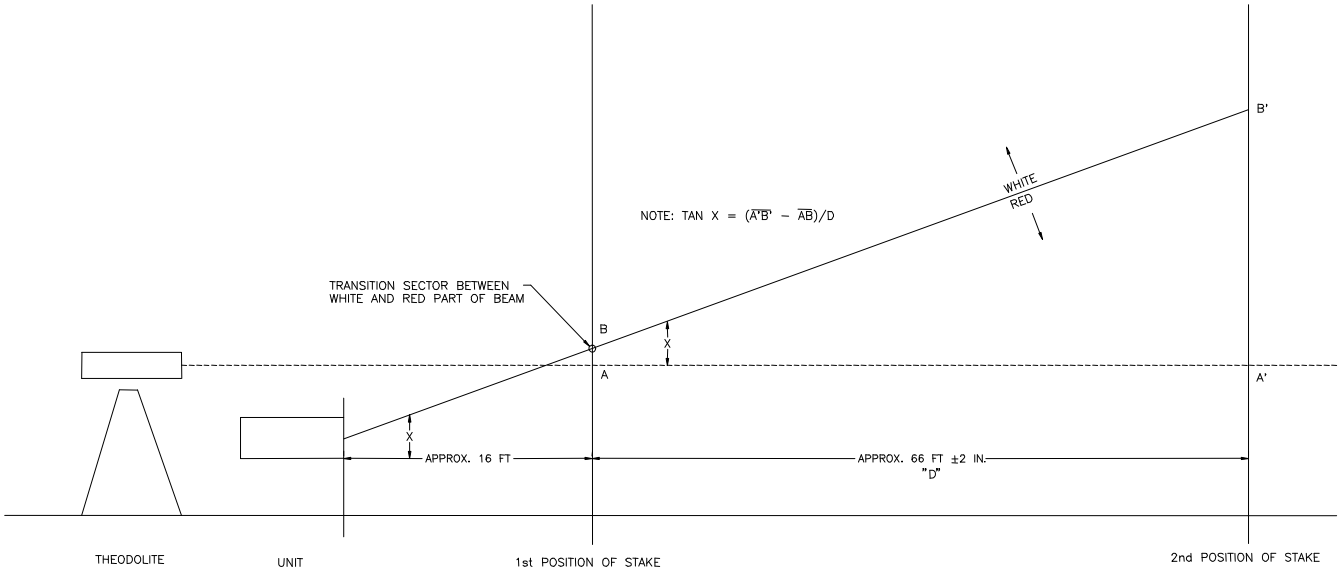
2.3.18 Checking Slope Angles of PAPI Units

It may be requested that when the equipment is put initially into operation and at regular intervals thereafter, the cut-off angle of the units be checked. To make this measurement, it will be necessary to use a surveying instrument or a bubble level with telescope and a surveyor's stake.

To check the slope angles of the PAPI units, perform the following procedure:

1. See Figure 41. Place the surveying instrument 6 to 10 feet (1.83 to 3.05 m) behind the unit pointing down beam.

Figure 41: Checking Slope Angles



2. A surveyor's stake is held by an assistant approximately 16 feet (4.88 m) in front of the unit.
3. Take reading *A* for the intersection of the horizontal of the telescope with the stake.
4. Take reading *B* for the intersection of the cut-off plane of the light beam with the surveyor's stake.
5. The assistant should now move a precisely measured distance of about 50 to 66 feet (15 to 20 m) (±0.25%) down beam and take the same measurements A' and B', as in steps 3 and 4 above.
6. The angle *x* of the beam cut-off to the horizontal is found from the following formula:

$$\tan x = \overline{(A'B'} - \overline{AB)} / D$$

NOTE: The overline (¯) denotes length where D is the horizontal distance between the two stake positions. If similar checks are to be scheduled in the future, a small concrete pad holding a galvanized pipe may be installed in front of each unit at the distances used above.

2.3.19 Using Reference Bases for Checking Stick

See Figure 14. As soon as the system is found to be operationally acceptable in all respects, install permanent sighting bases in front of each light unit to allow for routine checks of the elevation setting using the checking stick.

2.3.19.1 Locating Reference Bases

To locate a reference bases, perform the following procedure:

1. Locate a concrete sighting base on the extended centerline of each unit.
2. When the PAPI is switched on, walk along the centerline of the unit observing it from time to time through the screen on the checking stick until the lower limit of the white sector is about to disappear under the lower scored line.
3. At this point, dig a hole approximately 16 inches (406.4 mm) square and 12 inches (304.8 mm) deep.
4. See Figure 24 and Figure 25 for the two-lamp/three- and four- leg positioning plate and Figure 26 and Figure 27 for the three-lamp/three- and four-leg positioning plate. Drive a steel pipe vertically in the center of the hole until its top is at ground level.
5. Place the bottom end of the checking stick on top of the pipe and observe the light unit through the screen.
6. Gradually drive the pipe into the hole, while frequently observing the light unit through the screen, until the light beam no longer appears completely white just below the upper line of the screen.
7. Repeat this procedure for the other units, using the same observer.

2.3.19.2 Making Observations with Checking Stick

See Figure 14. *Refer to Reference Bases for Checking Stick* in this section. Place the checking stick on concrete sighting base in front of the light unit and switch the PAPI system on. Observe the light unit through the screen. Just below the upper line of the screen, the light beam should no longer appear completely white. If this is not the case, the unit is out of alignment and requires resetting. Refer to *Aligning Units* in this section.

2.3.19.3 Making Flight Checks for Reduced Horizontal Coverage

A flight check is required for the PAPI system when there is reduced horizontal coverage to determine if all horizontal cutoffs of the PAPI beams are properly located relative to any obstacles. If horizontal realignment is required, the upper an lower locknuts on all PAPI legs must be loosened and the unit realigned. Refer to *Aligning Horizontal Cut-Offs to Aiming Device* in this section.

2.4 Operation

This section provides operating information for the PAPI system and the aiming device digital protractor.

2.4.1 Operating PAPI System

This subsection provides information concerning PAPI normal operation, regions with heavy snowfall, criteria for system deactivation, initial startup using local control, REM control operation, and optional interlock relay.

2.4.1.1 Normal Operation

The PAPI system must operate continuously as long as the runway is in service. At night the system may operate continuously at either 5% or 20%. The nighttime intensity is set with a switch in the Master box.

2.4.1.2 Regions with Heavy Snowfall

Units should operate continuously at normal standby brightness even when the runway is not in use. Any snow will thus melt and drain off. When snowfall is expected to bury the units, the location of the units should be marked with sticks or flags (approximately 7 feet high) (2.13 m) to prevent damage to the units by snow removal equipment.

2.4.1.3 Criteria for System Deactivation

Pending repair and provided it is continually monitored, a unit in which one of the lamps has failed can still be regarded as operational. Should the system show more serious defects, it must be put out of operation.

2.4.1.4 Initial Startup Using Local Control

To turn on PAPI A using local control, perform the following procedure:

Verify that the PAPI Control Board jumper J9 is set to the 3-step setting. Short TB1-13 and TB-14 with 10 AWG wire, minimum. Connect a true RMS ammeter to this wire.

Place S1 to REM and turn circuit breaker CB1 to on.

Turn toggle switch S1 to LOCAL. The unit should turn on and the ammeter should read 6.6 A.

If the ammeter does not read 6.6 A, adjust the output current with buttons INC and DEC on the PAPI Control Board until the correct current is obtained. Press and hold the SAVE button for two seconds to save the setting.

Turn S1 to REM and CB1 to off.

Disconnect photocell by removing relay K2.

Turn CB1 to on and S1 to LOCAL. Unit should turn on.

Refer to Table 11. Turn toggle switch S2 to 20%. The ammeter should read 5.08A.

Table 11: Output Current

Intensity	Output Current
5%	4.09 A
20%	5.08 A
100%	6.6 A

If the ammeter does not read 5.08A, adjust the output current with buttons INC and DEC on the PAPI Control Board until the correct current is obtained. Press and hold the SAVE button for two seconds to save the setting.

Turn toggle switch S2 to 5%. The ammeter should read 4.09A.

If the ammeter does not read 4.09A, adjust the output current with buttons INC and DEC on the PAPI Control Board until the correct current is obtained. Press and hold the SAVE button for two seconds to save the setting.

Turn S1 to REM and CB1 to off. Install relay K2, and place S2 to 5% or 20% intensity for nighttime operation.

Remove wire between TB1-13 and TB1-14 and re-apply field load.

Turn CB1 to on and S1 to LOCAL. The system should energize and all lamps should come on.

With the load applied, verify all current steps are correct. Re-adjust if necessary.

2.4.1.5 Remote Control Operation

To set Remote control, perform the following procedure:

When the toggle switch S1 is set to REM and remote control wiring is connected to TB1-7 and TB1-8. The system should energize and the ammeter should read 6.6 A. All lamps should come on.

Turn CB1 to off and disconnect photocell by removing relay K2.

Turn CB1 to on. The system should energize, all lamps should come on, and the ammeter should read corresponding to setting of S2.

Turn CB1 to off and install relay K2.

Turn CB1 to on.

2.4.1.6 Optional Interlock Relay

To test interlock relay operation, perform the following procedure:

1. Turn S1 to REM and CB1 to off.
2. Remove relay K2.
3. Turn CB1 to on.
4. Unit should remain off.
5. Turn on CCR that control the interlock relay.
6. Unit should turn on and all lamps should come on, and current to lamp should read corresponding to setting of switch S2.
7. Turn CCR off, unit should turn off.
8. Turn CB1 to off and install relay K2. Turn CB1 to on.

2.4.2 Operating Digital Protractor

This subsection provides information for operating the digital protractor. The digital protractor is a part of the digital-level style aiming device. For more information on calibrating, maintaining, installing, and using the digital protractor, refer to “Calibrating Digital Protractor” on page 43 and “Installing Digital Protractor Batteries ” on page 46, and “Maintenance Procedures” on page 61.

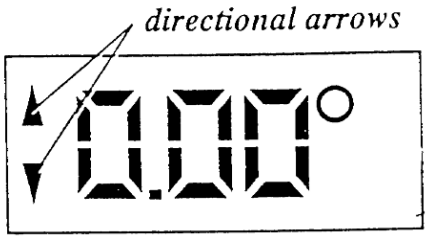
NOTE: Calibrate the digital-level before each use.
See “Calibrating Digital Protractor” on page 43.

To operate the digital protractor, perform the following procedure:

See Figure 33. Push the ON/OFF button. The digital protractor displays angle readings immediately.

NOTE: See Figure 42. When the unit is first turned on, the displayed angles are in standard reference mode. The true horizontal level is displayed as *0.00°*. An arrow on the left side of the display indicates which way to move the digital protractor to achieve level or plumb.

Figure 42: Digital Protractor Initial Angle Displayed



Set the digital protractor on the surface to be measured and read the angle.

NOTE: To get the most accurate reading, allow the unit to settle for 5 seconds before noting the angle.

NOTE: Expect a resolution of one hundredths of a degree for ±10 degrees of level. The resolution automatically changes to tenths of a degree beyond these points.

2.5 Section 5 Maintenance

This section provides maintenance information for the L-880/L-881 PAPI systems.

2.5.1 Maintenance Schedule

Refer to Table 12 for L-880/L-881 maintenance schedule.

Table 12: PAPI Maintenance

Interval	Maintenance Task	Action
After initial installation (during first few weeks)	(1) Check elevation angle of units.	(1) For the bubble-level style aiming device only, use that checking stick that comes in the Bubble-Type Level Aiming Kit. Reset any units out of alignment.
		(2) For the digital-level style aiming device, check the digital protractor calibration and verify the unit elevation aiming with aiming device and digital protractor located in the Digital Protractor-Type Level Aiming Kit.
Daily	(1) Check for frost or dew on outer lens if units are not operated continuously.	Remove frost or dew and change airport lighting circuitry per Cert Alert 02-08. See NTSB Cert Alert FAA Cert Alert No. 02-08 in Section 1
	(2) Check to ensure all lamps are lighted and illuminated evenly.	(1) Replace burned-out lamps. Clean any dirty glassware.
	(3) Check for any apparent evidence of damage to unit.	(2) Repair or replace any damaged components.
	(4) Check all control equipment for proper operation.	(3) Repair or replace any damaged components.
	(5) If using the aiming device with digital protractor, check the accuracy of the digital protractor. Calibrate the digital-level before each use. See “Calibrating Digital Protractor” on page 43	(4) Perform the digital protractor end-for-end accuracy test to make sure the digital protractor is in calibration. If the digital protractor is not accurate, perform the digital protractor calibration test. Refer to *Performing Accuracy Test* and *Performing Calibration Procedure* in the *Installation* section.
Weekly (more frequently during rainy season)	(1) Clean outer surface of protective glass.	(1) Use a soft cotton cloth moistened with alcohol.
	(1) Check elevation angle of units.	(1) For the bubble-level style aiming device only, use that checking stick that comes in the Bubble-Type Level Aiming Kit. Reset any units out of alignment.
	Calibrate the digital-level before each use. See “Calibrating Digital Protractor” on page 43	For the digital-level style aiming device, check the digital protractor calibration and verify the unit elevation aiming with aiming device and digital protractor located in the Digital Protractor-Type Level Aiming Kit.
Monthly	(1) Inspect housing and closure system, lamps, electrical connections, filters, and protective glass for damage, breakage, or warpage.	(1) Repair or replace any damaged parts.
	(2) Clean interior.	(2) Remove any foreign matter. Clean both sides of the protective glass, color filters, lenses and reflectors. Use a soft cotton cloth moistened with alcohol.
	(3) Make sure mounting is rigid.	(3) Tighten any loose hardware, nuts, screws, etc. Realign unit if hardware has loosened.
	(4) Make sure no vegetation obscures the light beams.	(4) Remove vegetation. Use weed killer to prevent any additional growth.
	(5) Make flight check of system, if possible.	(5) Verify that units give proper approach path indication.

2.5.2 Maintenance Procedures

Refer to maintenance procedures below.

2.5.2.1 Replacing Lamp

To replace a lamp, perform the following procedure:

1. Turn off circuit breaker CB1.
2. De-energize main input breaker.
3. Disconnect the electrical slip-on fitting on burned-out lamp, swing back the spring-loaded fork and remove lamp from the reflector.

NOTE: Replacement lamps shipped after May 1, 2005 will include extra male disconnects. Replacement lamp(s) 48A0077-1 will have female disconnects. If the lamps being replaced have male disconnects, then the female disconnects on the power leads must be cut off and replaced with the male disconnects supplied in the Replacement Lamp Kit (94A0337). If the lamps being replaced have female disconnects, then disconnects on the power leads do not need to be replaced.

4. Reverse Step 1 to install a new lamp.
5. Orientate lamp to match index slots in lamp base with index tabs in lampholder (one tab/slot is square, the other tab/slot is circular). Hold lamp in place by placing the forked spring clip over lamp base and locking spring clip in place by latching forked spring clip behind the locking ears located on side of lampholder.

CAUTION

Wear cotton gloves when handling the lamps. Touching the quartz bulb with bare fingers may seriously shorten lamp life. If the quartz bulb has been touched, wipe it carefully with lens cleaning tissue or similar material moistened with isopropyl alcohol.

NOTE: It is recommended that a systematic replacement of all lamps be made after a service period of approximately 800 hours at the 100% brightness level. An elapsed-time recorder connected to the constant current regulator may be used to determine the time for replacement.

2.5.2.2 Replacing Objective Lens

The objective lenses are precisely positioned in the unit and are not field repairable since the optical center of the lens must be realigned after replacement. Whenever an objective lens is damaged, the PAPI light unit must be returned to the factory for repair and adjustment. Contact ADB Airfield Solutions, Inc. Sales Department for details.

2.5.2.3 Replacing Filters

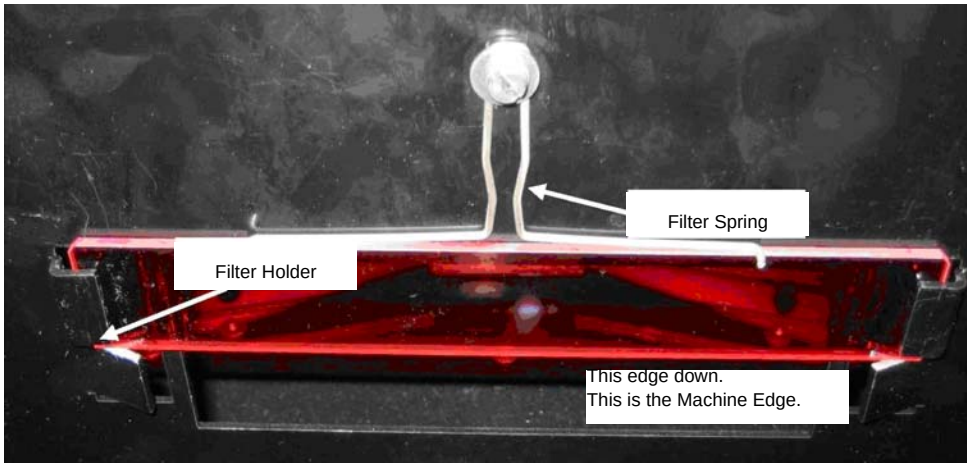
The filters must be perfectly clean. Use a soft cotton cloth moistened with alcohol to clean filters, and wear cotton gloves when handling filters.

Each filter is held in place in the filter holder by two springs.

To remove or replace a filter, perform the following procedure:

1. Remove the two springs using a small pliers.
2. Unclip the lower end of each spring from the hole in the panel and pull upward on the other end of the spring to remove.
3. Remove the filter by sliding it upward out of the holder.
4. To reinstall filter, reverse the removal steps. The filter must be installed in the holder so that the lower edge (dull edge or machine edge) of the filter is down.

NOTE: When cleaning filters, make sure each filter is returned to the same filter holder from which it was removed.



2.5.2.4 Cleaning and Storing Digital Protractor

Refer to the guidelines below for cleaning and storing the digital protractor used for aiming the PAPI.

- Clean the digital protractor with mild liquid soap applied to a damp cloth. Never immerse the protractor in water.
- Do not use solvents directly on any of the digital protractor plastic surfaces.
- Store the digital protractor away from extreme temperature.

CAUTION

Never store digital protractor below –20 °C (-4 °F) or above 65 °C (149 °F).

2.6 Troubleshooting

WARNING

Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all other related documentation.

De-energize the circuit and lock out the circuit or regulator so that the circuit cannot be energized by remote means before attempting to service the fixture.

This section provides troubleshooting procedures.

NOTE: As of 12/4/01, the tilt switch assembly for the PAPI A is internal only. Before 12/4/01, the tilt switch was external.

2.6.1 Troubleshooting

Refer to Table 13. This section describes preliminary troubleshooting and provides a basic troubleshooting table.

To do preliminary troubleshooting for the PAPI, perform the following procedure:

1. Check all fuses and circuit breaker.
2. Visually examine all areas of the PAPI. Check for burnt or loose connections and parts.
3. Check that input voltage is present and within +10% to -5% of nominal.
4. If the PAPI works in LOCAL but not in REMOTE, check voltage on the remote control lines. Check fuse F3. If voltage on remote control lines is correct and fuse F3 is normal, replace LC-control PCB1.
5. Turn toggle switch S1 from REM to LOCAL to check if the PAPI can be re-energized. If the PAPI re-energizes, the cause of the problem is an open circuit or overcurrent. Check the output wire for open circuit. If the output wire is closed, check overcurrent by calibrating LC-control PCB.
6. If open circuit exists, short the PAPI output with an AWG 8 (2000 volts, minimum) wire between TB1-13 and TB1-14 on the master, and turn on the PAPI. If the PAPI operates normally, the problem may be load related. Repair the PAPI output wire from the master to the individual light unit.
7. If the PAPI turns on for a few seconds and then shuts off and the the ammeter indicates 0 amps, the problem is either an open circuit, or current transformer T2 is open. Replace transformer T2.
8. If the PAPI turns on and then shuts off after a few seconds and a high current reading exists on the the ammeter, the problem is an overcurrent. Adjust the output current accordingly.
   If this does not work, replace LC-control PCB1 and then SCRs.
9. If the PAPI does not energize at all, check for undervoltage. If undervoltage exists, correct the undervoltage problem.

Table 13: L-880/L-881 PAPI Troubleshooting

Problem	Possible Cause	Solution
All lamps out	PAPI unit tilts	Realign PAPI unit.
	Tilt switch not level	Realign tilt switch.
	Power input	Repair or replace loose or broken wire.
	All lamps failed	Replace lamps. Check output current level. Calibrate, if necessary.
	LC-control PCB1 in master failed	Replace PCB1.
	SCRs failed	Replace SCRs.
	Fuses burned	Check all fuses. Replace blown fuses. If F4 is blown multiple times check that there are no ground faults in the output cables connected to the PAPI boxes. Ground faults must be repaired for proper PAPI operation.
	Shorting device PCB in light box bad	Replace shorting device PCB.
Lamp(s) dim	Dirty lens shield	Clean with soft cotton cloth moistened with alcohol.
	Lamp not properly seated in reflector	Re-seat lamp in reflector. Replace lamp socket, if necessary.
	Current level too low	Calibrate, if necessary.
	Lens is improperly aligned	Replace lens if loose in ring.
	Unit improperly aligned	Use check stick to check alignment.
Signal Interruption when PAPI unit is not operated continuously	Frost or Dew on outer lens	Change airport circuitry to ensure PAPI's are preset to operate on a low power setting of either 5 or 20 per cent. See FAA Cert Alert on page iii.
Short lamp life	Current level too high	Check output current level. Calibrate, if necessary.
Tilt switch circuitry tilted	Tilt switches incorrectly wired	Correct wiring.
Interlock relay not operating	CCR is off	Turn CCR on.
	Interlock relay not calibrated properly	Calibrate interlock relay by adjusting CS1 in master unit.
T1 Failure	Varying load on T1	Replace Power Core transformer (T1) and add 250V, 1A SLO-BLO fuse to protect (T1) if PCB does not have F4. See Parts List F4 and T1.

2.7 Parts

To order parts, call ADB Airfield Solutions Customer Service or your local representative. Use this five-column parts list, and the accompanying illustration, to describe and locate parts correctly.

2.7.1 Using the Illustrated Parts List

This subsection describes how to use the illustrated parts list covered later in this section. It does not provide the actual parts list.

The Item column numbers correspond to the numbers that identify parts in illustrations following each parts list. NS (not shown) indicates that a listed part is not illustrated.

The Description column gives the part name, as well as its dimensions and other characteristics when appropriate. Indentions show the relationships between assemblies, subassemblies, and parts.

The Part Number column gives the ADB Airfield Solutions part number.

Item	Description	Part Number	Quantity	Note
S1	Assembly	xxxxxxxx	1	A
NS	Part	xxxxxxxx	1	
H1	Part or Assembly			
	Part/Assembly for option 1	xxxxxxxx	2	
	Part/Assembly for option 2	xxxxxxxx	2	
T1	Assembly	xxxxxxxx	1	
	Part	xxxxxxxx	1	
	Part	xxxxxxxx	2	
NOTE A				

The Quantity column contains the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

The Note column contains letters that refer to notes at the end of each parts list. Notes contain special ordering or product/part version information.

2.7.2 L-880/L-881 Style A Part Numbering System

Refer to Table 14 and Table 15 for all replaceable parts for each replaceable component or assembly for the L-880 and L-881 Style A PAPI systems.

Figure 43 shows how to determine the part number for a particular L-880/L-881 PAPI system.

NOTE: Substitution of electrical components may be done only if substitution is the exact physical equivalent (body or case size) and equal, or better electrical characteristics with respect to tolerance, failure rate, and/or reliability.

Table 14: L-880 PAPI System

Component	Part Number
Master box assembly	44A4734-1XXX
Light box #1	44A4735-XXX
Light box #2	44A4735-XXX
Light box #3	44A4735-XXX
Light box #4	44A4735-XXX

Table 15: L-881 PAPI System

Component	Part Number
Master box assembly	44A4734-2XXX
Light box #1	44A4735-XXX
Light box #2	44A4735-XXX

Order Codes 44A4733 - X X X X

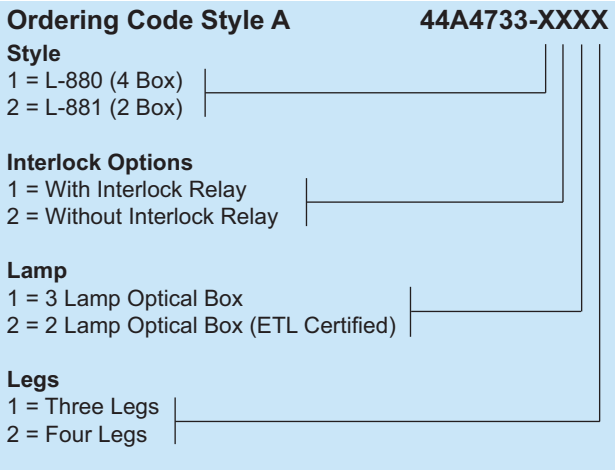


Figure 43: PAPI A L-880/L-881 Part Numbers

Spare Components

Description	Part No.
Filter, Red[2]	63A1019
Filter, Red[2]	1438.12.220
Frangible Coupling 2” EMT	44B0180
Frangible Coupling 2” Threaded One End	62A0711
Gasket, Optical Assembly (2-lamp unit)	63A0672
Gasket, Optical Assembly (3-lamp unit)	4071.41.550
Glass, Protective Shield (2-lamp unit)	63A0984
Glass, Protective Shield (3-lamp unit)	63A0671-1
Lamp, 200 W, 6.6 A, with female leads*	48A0077-1
Lamp driver/tilt sensing PCB (2-lamp and 3-lamp)	44A5857
LC Control Board, *PAPI A Only*	44A6546-3[3]
Leg Assembly	44C2362S
Master Box, 240 V, 4 Box, *PAPI A Only*	44A4734-1210
Master Box, 240 V, 2 Box, *PAPI A Only*	44A4734-2210
Optical Box, 2-Lamp (ETL Certified)	44A5861-1
Optical Box, 3-Lamp	44A5861-2
SCR Block, 95 A, *PAPI A Only*	28A0011
Shorting Device PCB, 6.6 A	44D4538
Spare Lamp Kit[1]	94A0337
Tilt Switch Assembly, *PAPI A Only (w/o heater)*	44A5863-2
Tilt Switch Assembly, *PAPI A Only (with heater)*	44A5863-1
Tilt Switch Assembly, *PAPI B Only*	44A5863

[1] For installations before May 2002. Spare Lamp Kit includes lamp and disconnects to convert power leads so lamp 48A0077-1 can be installed.

[2] Filter 63A1019 is 6.07” in length and is installed in PAPIs shipped from ADB after January 2005. Filter 1438.12.220 is 6.61” in length and is installed in earlier models. All other dimensions are equal.

[3] For PAPI As ordered before Fall 2007, the LC Control Board may have part no. 44D1475/3. This part is now obsolete. To order a retrofit kit, use part no. 94A0549 for both L-880 and L-881. An L-880 unit also requires part no. 94A0548 to replace the T1 transformer.

Precision Approach Path Indicators installed prior to June 1998 have some different spare parts and optional features. Please contact the ADB Sales Department for this information.

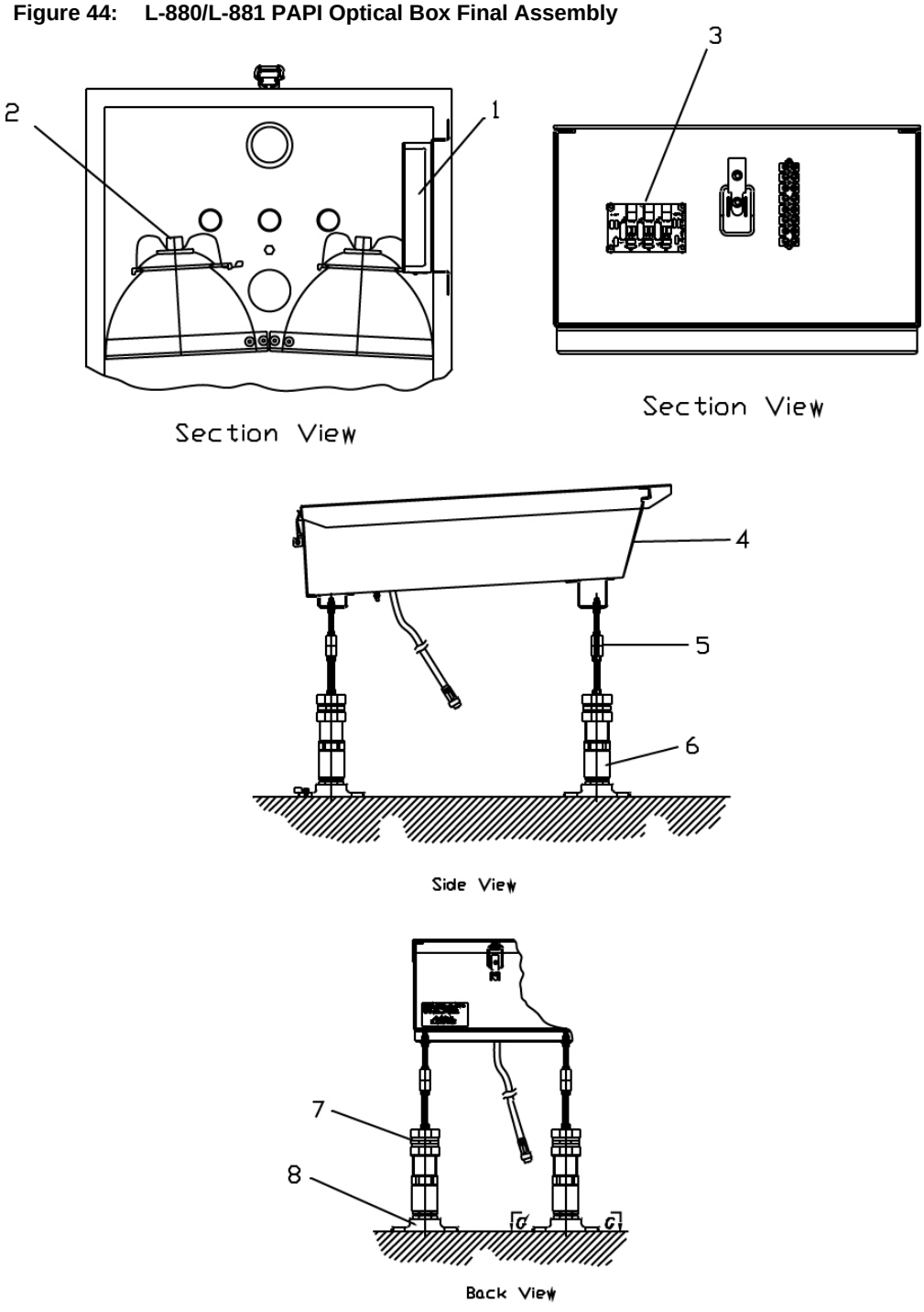
2.7.3 L-880/L-881 PAPI Style A Optical Box Final Assembly Parts List

See Figure 44.

Item	Description	Part Number	Quantity	Note
1	Tilt switch assembly		1	
	Tilt switch assembly, Class I, -35 °C, without Heater	44A5863-2		
	Tilt switch assembly, Class II, -55 °C, with heater	44A5863-1		
2	Lamp, 200 W, 6.6 A	48A0077-1	See note.	A
3	Shorting device PCB	44D4538	1	B
4	Light box assembly			
	Light box assembly, two lights	60A2356	1	
	Light box assembly, three lights	60A2357	1	
5	Adjustable leg assembly	44C2362	See note.	C
6	Frangible coupling assembly	44B0180	See note.	C
7	Coupling (Neer TC616)	77A0009	See note.	C
8	Base flange	62B0107-2	See note.	C
NS	Plug			
	Plug, two light	63B0371-21	2	
	Plug, three light	63B0371-23	2	

NOTE A: Two required for two-lamp assembly; three required for three-lamp assembly. Refer to *Replacing Lamp* in *Maintenance Procedures* in Section 5, *Maintenance*.
NOTE B: PCB is mounted vertically on inside back of light box for two-lamp box.
NOTE C: Three required for three-leg assembly; four required for four-leg assembly.
NS: Not Shown

Figure 44: L-880/L-881 PAPI Optical Box Final Assembly



2.7.4 PAPI Style A Master Box Assembly Parts List

Item	Description	Part Number	Quantity	Note
NS	Panel assembly	44D2656-XXX	1	
NS	Male plug	73A0130	2	

NS: Not Shown

2.7.5 PAPI Style A Master Panel Assembly Parts List

See Figure 45.

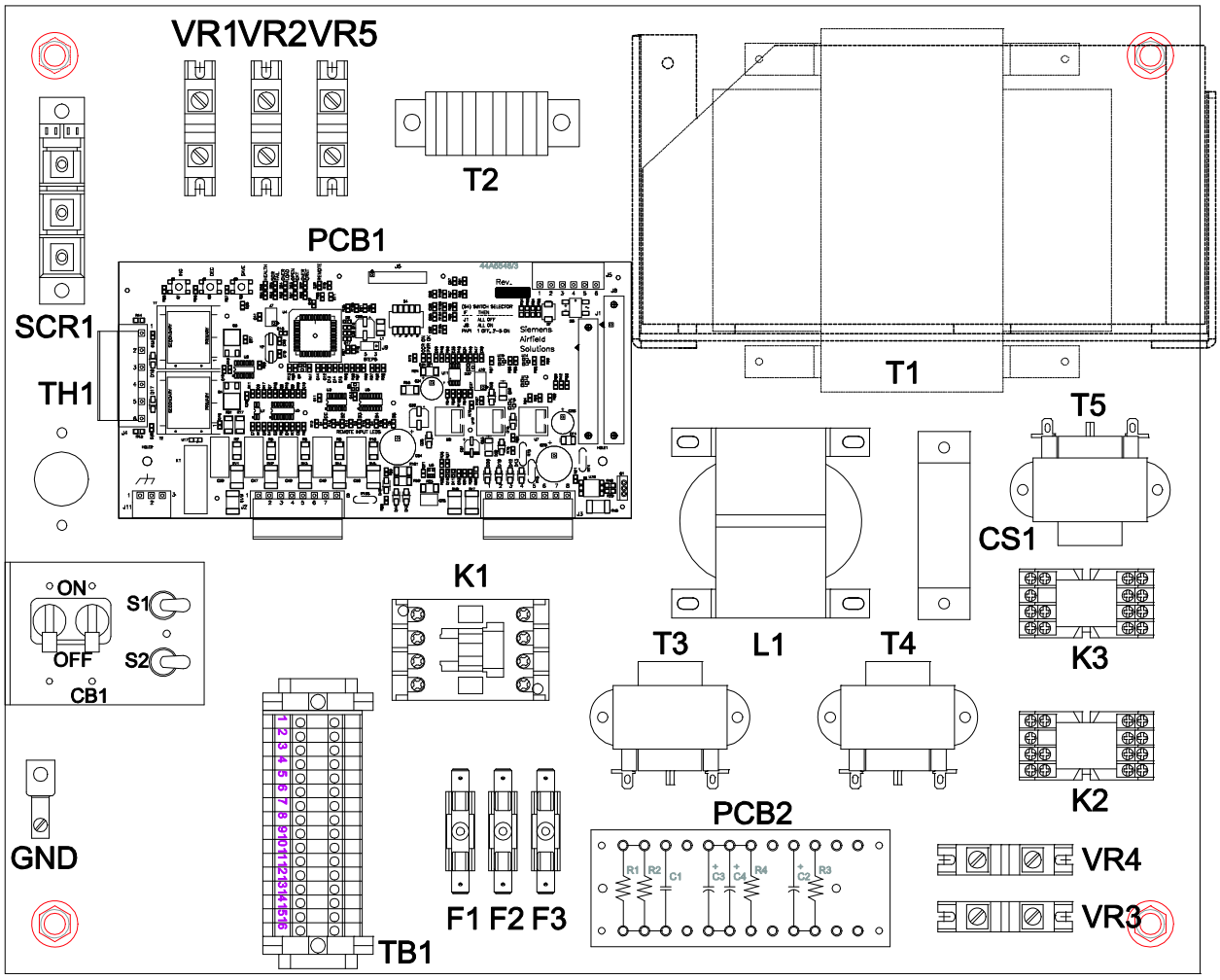
Item	Description	Part Number	Quantity	Note
TH1	Thermostat (Therm-O-Disc #37121)	54A0007	1	
PCB1	PAPI control PCB	44A6546-3	1	
SCR1	SCR	28A0011	1	
K3	Relay, 4PDT, 3 A, 24 Vdc coil	53A0310	1	
K2	Relay, 4PDT, 1A, 120 Vac coil	53A0284	1	
K2-3	Relay socket panel mounting	49A0155	2	
T2	Current XF, 6.6 A to .066 A	35A0548	1	
T3	Step down XF, 240 Vac to 120 Vac	35A0474	1	
T4	Step down XF, 240 to 18 Vac	35A0496	1	
K1	Contactor, 4P, 15 A, 120 Vac coil	53A0222	1	
CB1	Circuit breaker, 15 A, 2P	57A0039	1	

Continued on next page

Item	Description	Part Number	Quantity	Note
F1, F2	Fuse, 2 A, 250 V, Slo-Blo	47A0049	2	
F3	Fuse, 1/4 A, 250 V, Slo-Blo	47A0117	1	
F1-3	Fuse block	47A0061	3	
VR1, VR2	Lightning varistors, 571 Vac	32A0028	2	
VR3, VR4	Lightning varistors, 751 Vac	32A0025	2	
S1, S2	Toggle switch, SPST, 15 A, ON-OFF	45A0207	2	
PCB2	Snubber network PCB	44A4752	1	
CS1	Current sense switch	53A0283	1	
L1	Inductor	33A0013	1	
T1	Step-up transformer (used on L-880 only)			
	Two-lamp transformer	35A0457	1	
	Three-lamp transformer	35A0494	1	
F4	Fuse 1A	47A0017	1	
F4	Fuse Block	47A0061	1	

T1-35A0494 is for 4-Box, 3-LT. Units or 35A0689 for 4-Box, 2-LT. Units

Figure 45: Master Panel Assembly



2.7.6 PAPI Style A Optical Assembly Parts List

Item	Description	Part Number	Quantity	Note
NS	Protective glass	63A0671	1	A
NS	Gasket for outer protective glass	63A0672	1	A
NS	Lens in ring (factory installation only)	44B1039	See note.	B
NS	Filter, red	63A1019	See note.	B
NS	Reflector	61B0128	See note.	B
NS	Shorting device PCB	44D4538	1	

NOTE A: One required for 2-lamp only. For 3-lamp PAPI replacement for front glass or gasket, contact your ADB Airfield Solutions Sales representative.

NOTE B: Three required for three-lamp assembly; two required for two-lamp assembly.

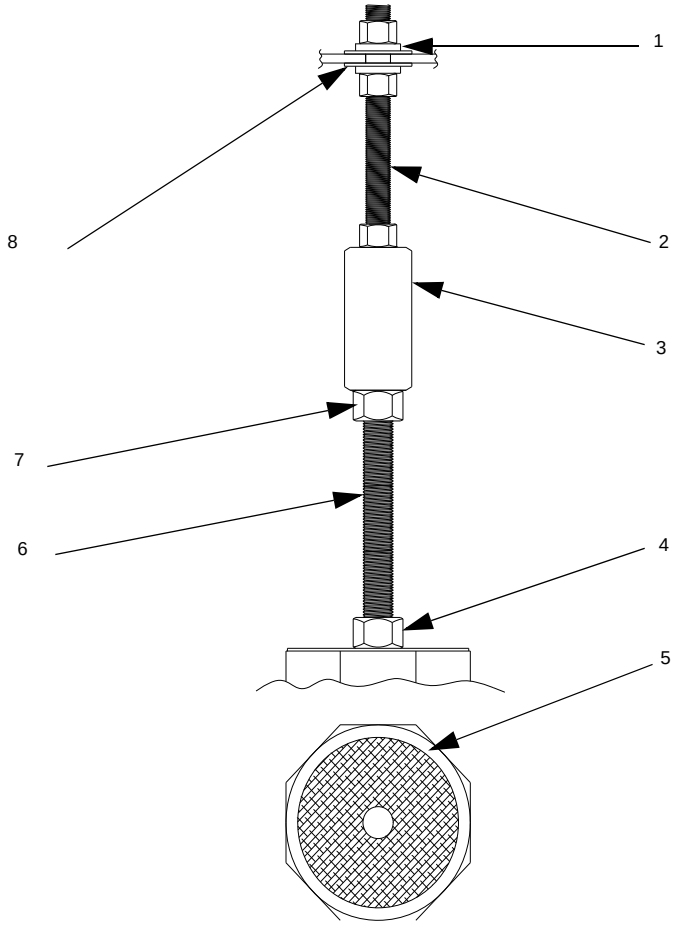
NS: Not Shown

2.7.7 PAPI Style A Adjustable Leg Parts List

See Figure 46.

Item	Description	Part Number	Quantity	Note
1	Split lockwasher, 3/8	66A0026-29	2	
2	Threaded rod, 3/8–16 x 6 in.	64A0210	1	
3	Differential	85B0057	1	
4	Hex nut, 1/2–13	65A0015-33	2	
5	Leg cap	62A0111	1	
6	Threaded rod, 1/2–13 x 5 in.	64A0211	1	
7	Hex nut, 3/8–16	65A0015-29	3	
8	Flatwasher, 3/8	66A0015-31	2	

Figure 46: Adjustable Mounting Legs



2.7.8 PAPI Style A L-880 (4-Box) Field Splice Kit Parts List

This subsection provides parts for the L-880 PAPI A field splice kit with and without interlock option.

2.7.8.1 PAPI Style A L-880 (4-Box) Field Splice Kit (With Interlock Option) Parts List

Item	Description	Part Number	Quantity	Note
NS	L-880 field splice kit (with interlock option)	94A0235-1	1	
NS	Frangible coupling	62A0711	4	
NS	6-pin female plug	73A0129	6	
NS	One-inch (25.4 mm) cable clamp	63A0563	4	
NS	Connector secondary kit plug	70A0050	1	
NS	Field splice heatshrink tube, 6 in. (152 mm) long	71A0053	15	
NS	Field butt splice for wire	71A0054	30	

NS: Not Shown

2.7.8.2 PAPI Style A L-880 (4-Box) Field Splice Kit (Without Interlock Option) Parts List

Item	Description	Part Number	Quantity	Note
NS	L-880 field splice kit (without interlock option)	94A0235-3	1	
NS	Frangible coupling	62A0711	4	
NS	6-pin female plug	73A0129	6	
NS	One-inch (25.4 mm) cable clamp	63A0563	4	
NS	Field splice heatshrink tube, 6 in. (152 mm) long	71A0053	15	
NS	Field butt splice for wire	71A0054	30	

NS: Not Shown

2.7.9 PAPI Style A L-881 (2-Box) Field Splice Kit Parts List

This subsection provides parts for the L-881 PAPI A field splice kit with and without interlock option.

2.7.9.1 PAPI Style A L-881 (2-Box) Field Splice Kit (With Interlock Option) Parts List

Item	Description	Part Number	Quantity	Note
NS	L-881 field splice kit (with interlock option)	94A0235-2	1	
NS	Frangible coupling	62A0711	4	
NS	6-pin female plug	73A0129	6	
NS	One-inch (25.4 mm) cable clamp	63A0563	4	
NS	Connector secondary kit plug	70A0050	1	
NS	Field splice heatshrink tube, 6 in. (152 mm) long	71A0053	15	
NS	Field butt splice for wire	71A0054	30	

NS: Not Shown

2.7.9.2 PAPI Style A L-881 (2-Box) Field Splice Kit (Without Interlock Option) Parts List

Item	Description	Part Number	Quantity	Note
NS	L-881 field splice kit (without interlock option)	94A0235-4		
NS	Frangible coupling	62A0711	4	
NS	6-pin female plug	73A0129	6	

Item	Description	Part Number	Quantity	Note
NS	One-inch (25.4 mm) cable clamp	63A0563	4	
NS	Field splice heatshrink tube, 6 in. (152 mm) long	71A0053	15	
NS	Field butt splice for wire	71A0054	30	

NS: Not Shown

2.7.10 PAPI Style A Aiming Device Kit Parts List

Item	Description	Part Number	Quantity	Note
NS	Aiming Device Kit	44A6031	See note.	A

NOTE A: One per airport.

NS: Not Shown

2.7.11 Recommended Spare Parts

Item	Description	Part Number	Quantity	Note
NS	Lamp, 200 W, 6.6 A	48A0077-1	See note.	A
NS	Tilt switch assembly		1 per optical box	
	Tilt switch assembly, Class I, -35 °C, without Heater	44A5863-2		
	Tilt switch assembly, Class II, -55 °C, with heater	44A5863-1		
NS	PAPI-control PCB	44A6546-3	1	
NS	Optical box		1	
	Optical box, 2-lamp	44A5861-1		
	Optical box, 3-lamp	44A5861-2		
NS	Master box		1	
	Master box, 240 V, 4 box	44D4734-1210		
	Master box, 240 V, 2 box	44D4734-2210		
NS	Frangible coupling	44B0180	See note.	B
NS	Leg assembly	44C2362	See note.	B
NS	Glass, protective (2 lamp PAPI) Glass, protective (3 lamp PAPI)	63A0984 63A0671-1	1 1	
NS	Gasket, optical assembly (2 lamp PAPI) Gasket, optical assembly (3 lamp PAPI)	63A0672 4071.41.550	1 1	
NS	SCR block	28A0011	1	
NS	Red filter 6.61 inch length Red filter 6.07 inch length (units sold after 2005)	1438.12.220 63A1019	See note.	A

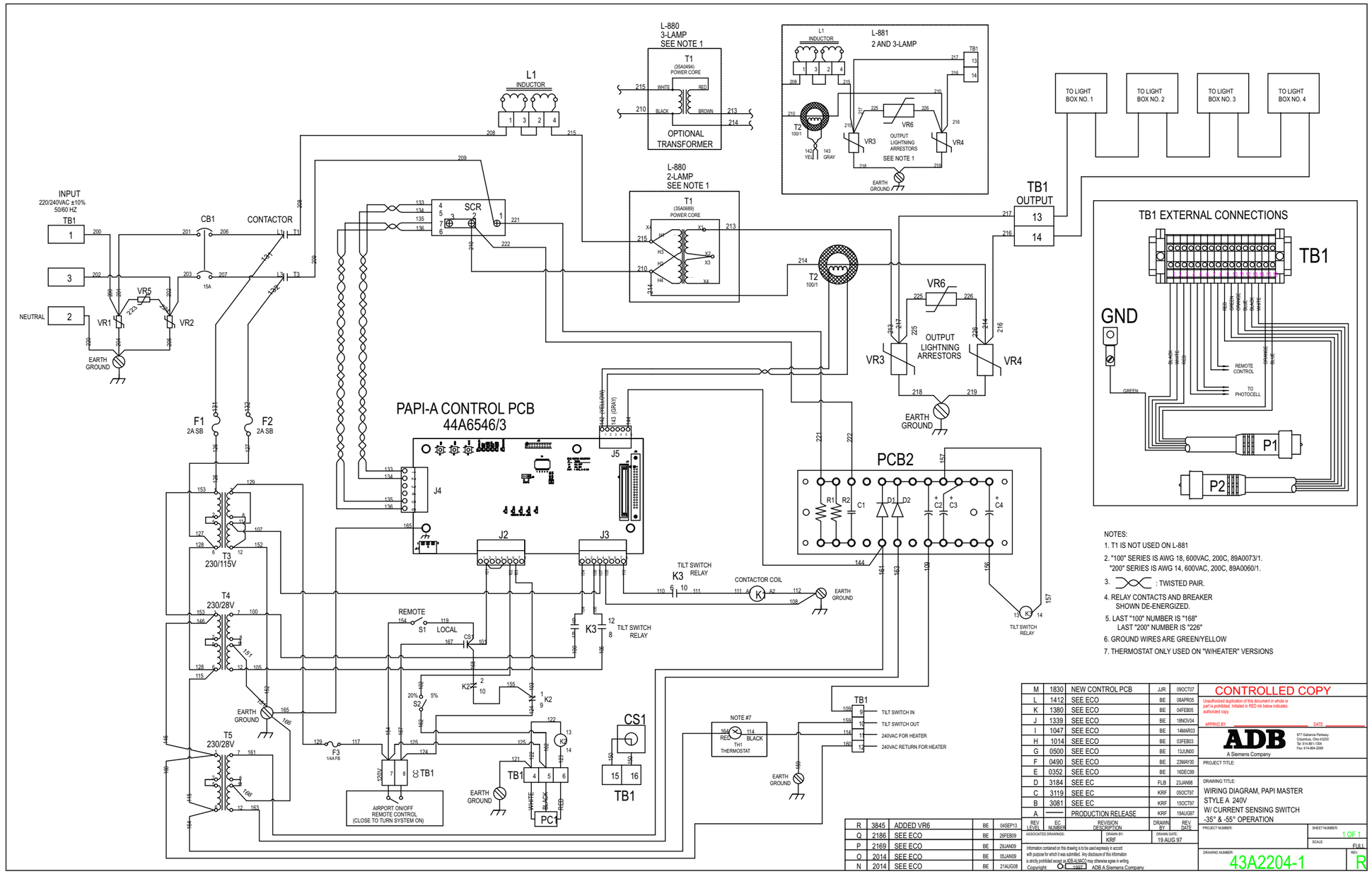
NOTE A: Three required for three-lamp assembly; two required for two-lamp assembly. Refer to “Replacing Lamp” on page 61.

NOTE B: Three required for three-leg assembly; four required for four-leg assembly.

NS: Not Shown

3.0 Wiring Schematics and Installation Drawings

Figure 47: 43A2204



SCHEMATICS

Figure 48: 43A2204

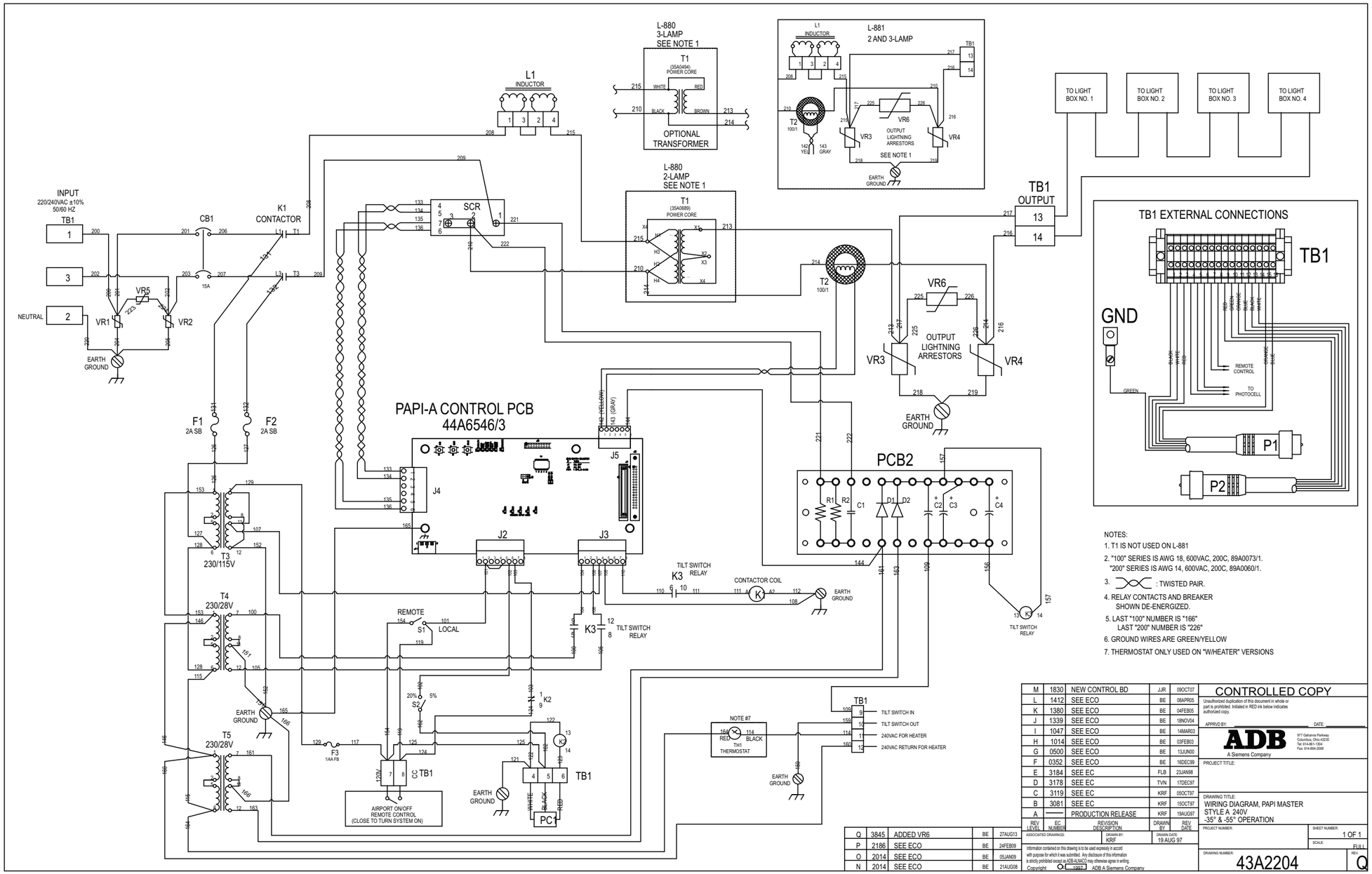
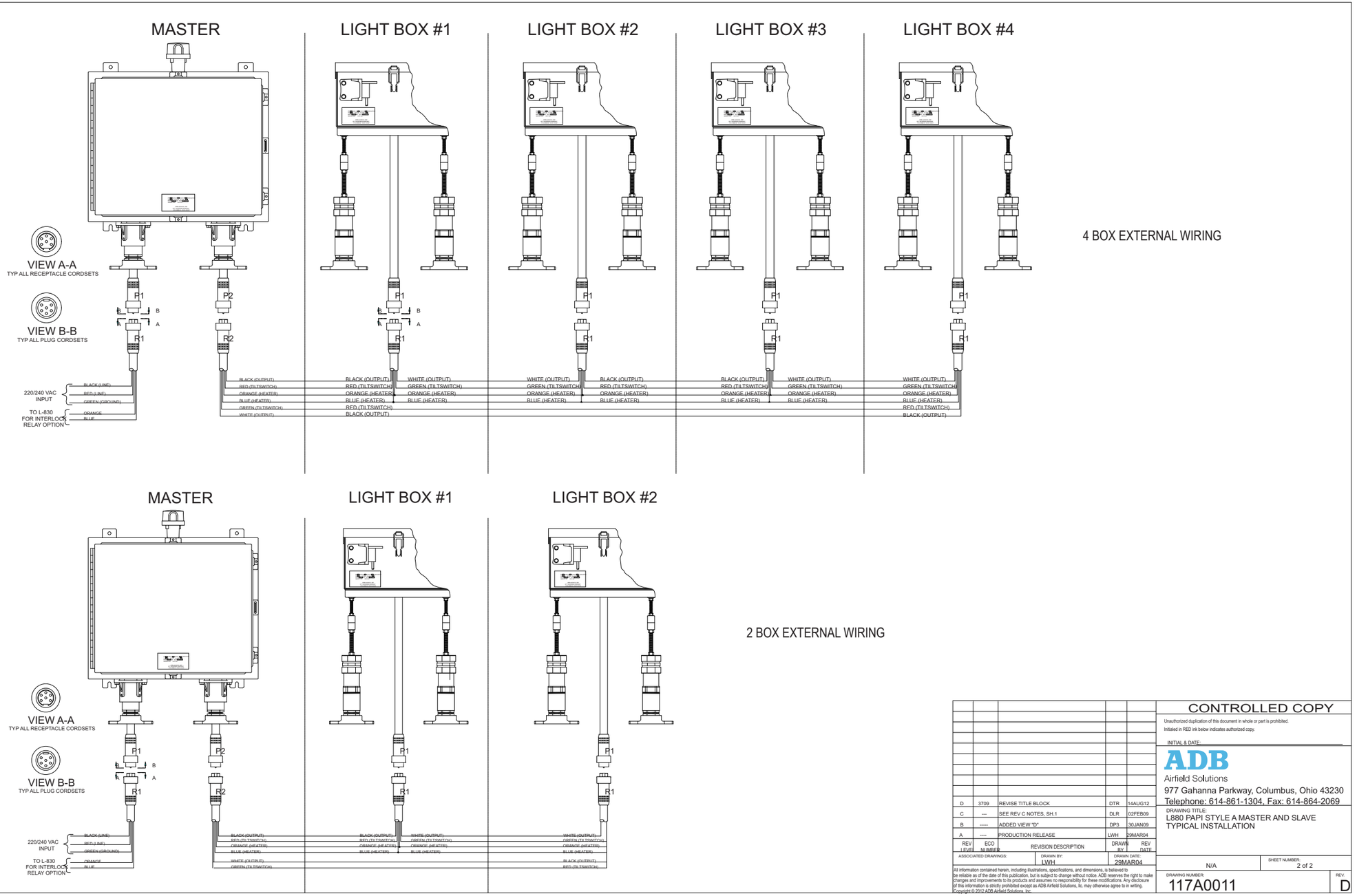
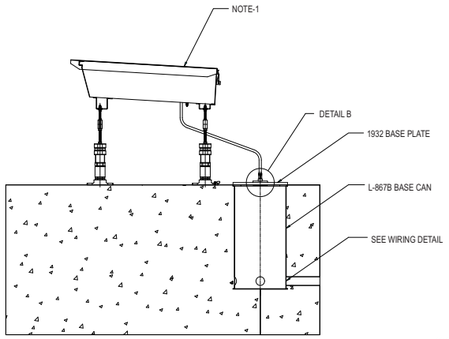


Figure 49: PAPI Installation Drawing A

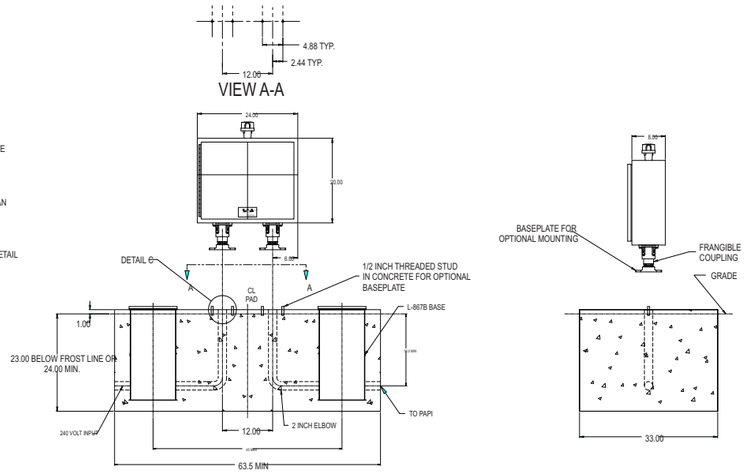


SCHEMATICS

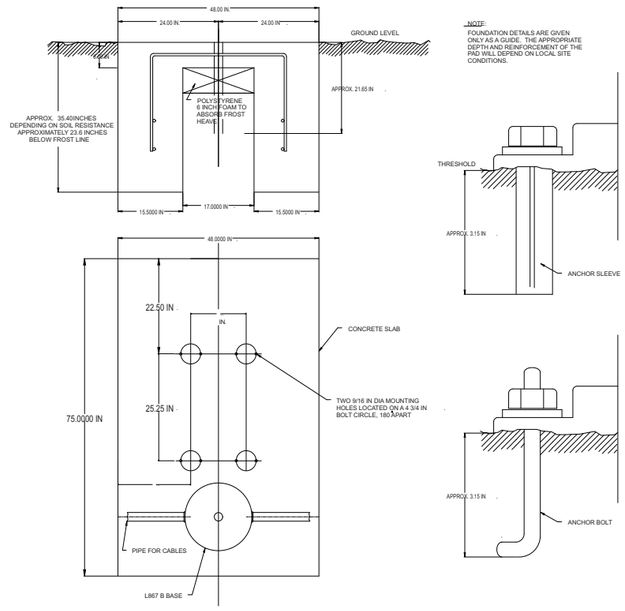
Figure 50: PAPI Installation Drawing B



PAPI TYPICAL INSTALLATION

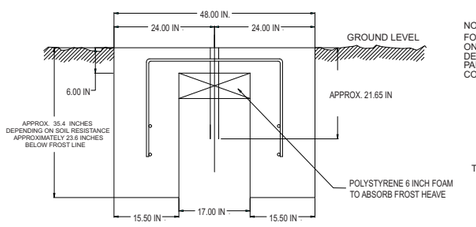


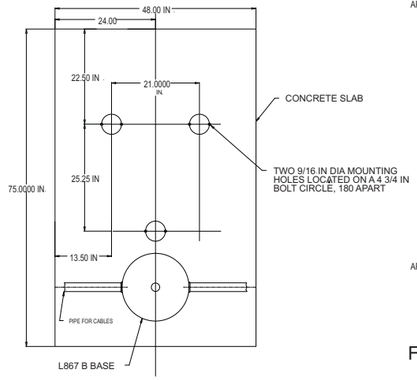
PAPI MASTER INSTALLATION (STYLE A ONLY)



PAPI 4 LEG FOUNDATION DETAIL

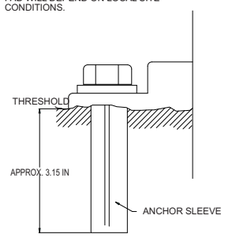
NOTE:
FOUNDATION DETAILS ARE GIVEN ONLY AS A GUIDE. THE APPROPRIATE DEPTH AND REINFORCEMENT OF THE PAD WILL DEPEND ON LOCAL SITE CONDITIONS.

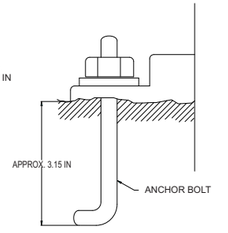




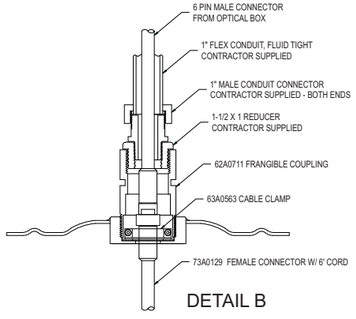
PAPI 3 LEG FOUNDATION DETAIL

NOTE:
FOUNDATION DETAILS ARE GIVEN ONLY AS A GUIDE. THE APPROPRIATE DEPTH AND REINFORCEMENT OF THE PAD WILL DEPEND ON LOCAL SITE CONDITIONS.

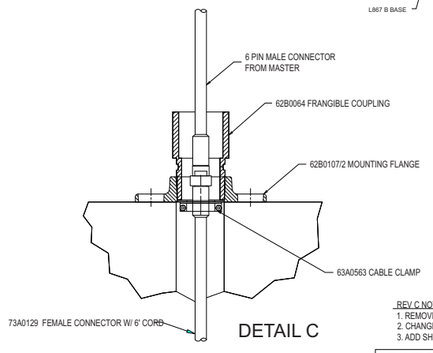




FOOT FLANGE DETAIL



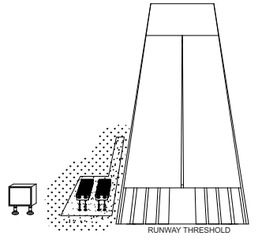
DETAIL B



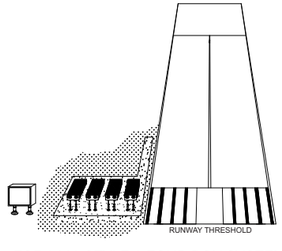
DETAIL C

NOTES:
1. ADB AIRFIELD SOLUTIONS PART 44A4733/XXXX OR EQUAL.

REV C NOTES:
1. REMOVE VIEW D
2. CHANGE MASTER INSTALLATION CONCRETE PAD TO SHOW TWO BASE CANS.
3. ADD SH 1 DETAIL B & DETAIL C.



FOR L880 STYLE A TWO BOX SYSTEM



FOR L880 STYLE A FOUR BOX SYSTEM

CAUTION:
THIS DRAWING IS ONLY INTENDED FOR USE AS GENERAL AIRFIELD SYSTEM DESIGN GUIDANCE. THE DESIGNER MUST VERIFY DESIGN WITH LOCAL CODES AND VARYING CHARACTERISTICS FOR EACH UNIQUE AIRFIELD APPLICATION.

REV LEVEL	ECO NUMBER	REVISION DESCRIPTION	DRAWN BY	REV DATE
D	3709	REVISE TITLE BLOCK	DTR	14AUG12
C	---	SEE REV C NOTES	DLR	02FEB09
B	-----	ADDED VIEW "D"	DP3	30JAN09
A	----	PRODUCTION RELEASE	LWH	29MAR04

ASSOCIATED DRAWINGS: | DRAWN BY: LWH | DRAWN DATE: 29MAR04

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ADB
Airfield Solutions
977 Gahanna Parkway, Columbus, Ohio 43230
Telephone: 614-861-1304, Fax: 614-864-2069

DRAWING TITLE:
L880 PAPI STYLE A MASTER AND SLAVE
TYPICAL INSTALLATION
L-880 / L-881

N/A | SHEET NUMBER: 1 of 2

DRAWING NUMBER: 117A0011 | REV: D

Figure 51: Two-Lamp PAPI Light Box Internal Wiring Schematic

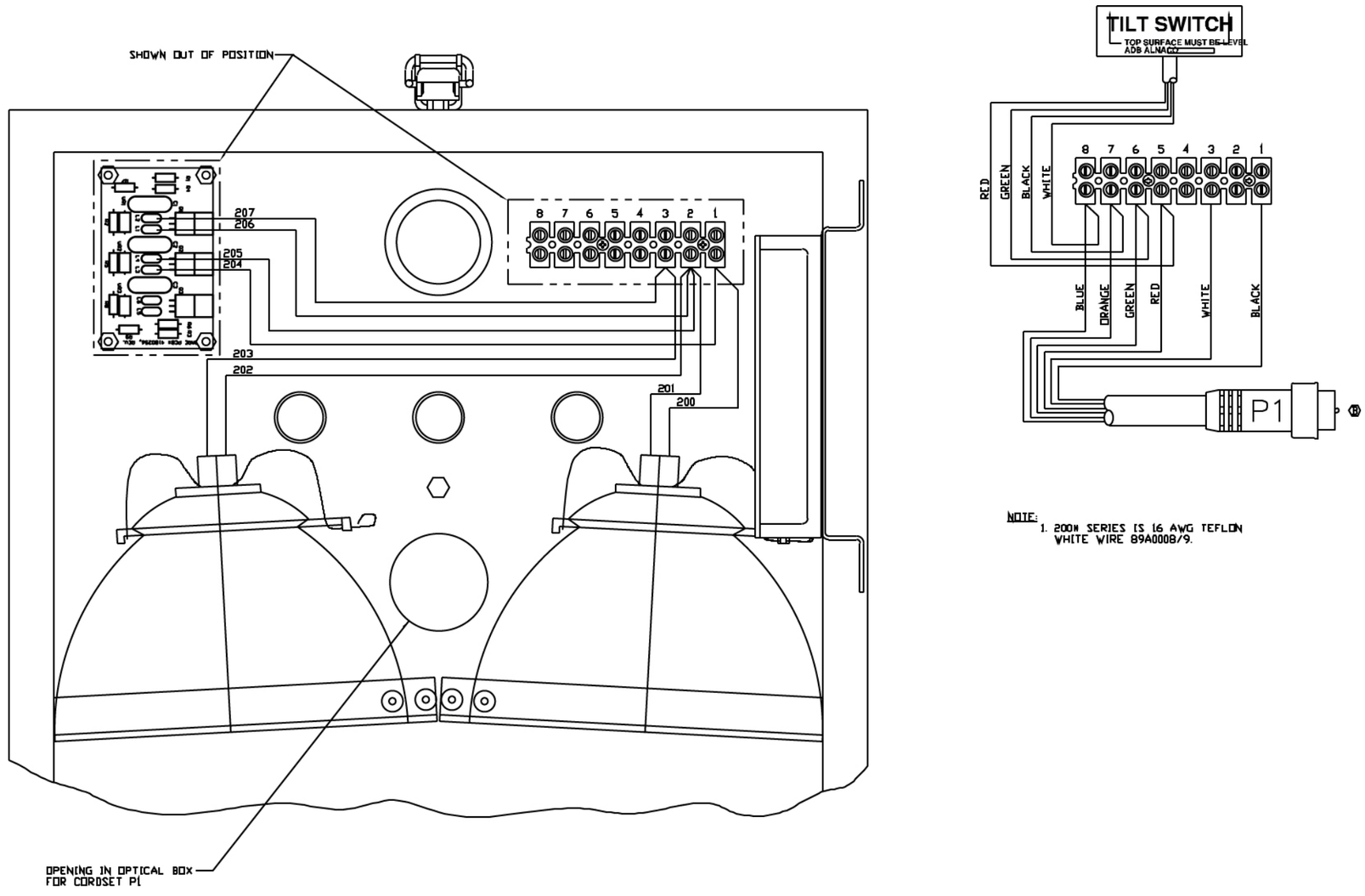
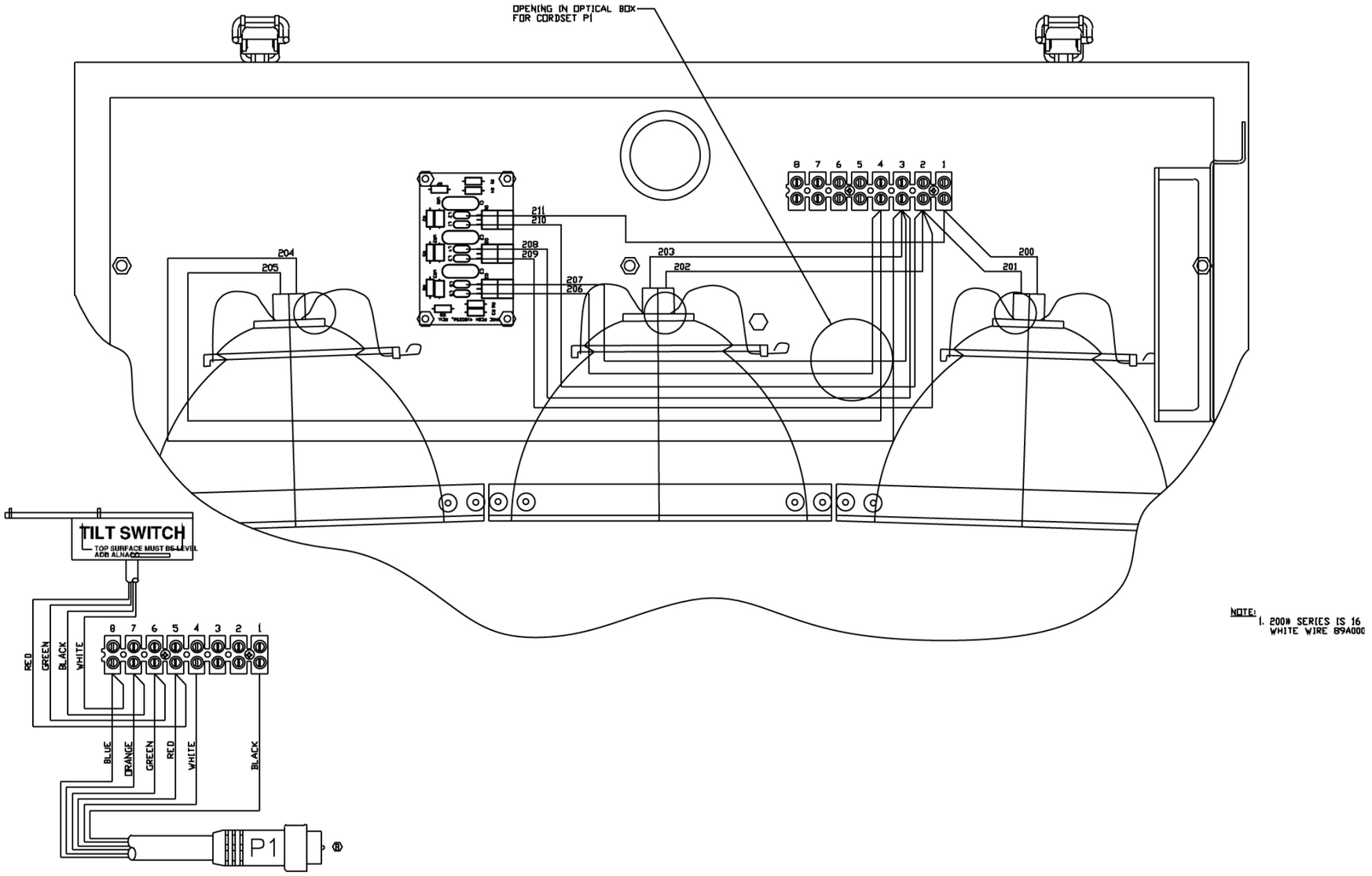


Figure 52: Three-Lamp Light Box Internal Wiring Schematic



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