



DESIGNING FOR USCG & NAVY SHORE POWER APPLICATIONS



AGENDA

USCG

- Specs
- Types of connections
- ESL Solutions

NAVFAC

- Specs
- Types of connections
- ESL Solutions

COAST GUARD



COAST GUARD STANDARDS

- **Configuration Standard Technical Order (CSTO) Electrical Shore Ties**
 - Last update: 11/4/2011
 - (73) pages
- **U.S. Coast Guard C4&IT Shore Tie Cable Standards**
 - “C4” = Command, Control, Communication, Computers
 - “IT” = Information Technology
 - Last update: 6/19/2013
 - (7) pages

Configuration Standard Technical Order (CSTO) Electrical Shore Ties

Classification (Types) of Vessels

- Standard Small Boats, (e.g. 41' UTB, 45' RBM, 47' MLB, and 49' BUSL)
- Non Standard Small Boats
- Low Power Cutters (LPC), (e.g. tugboats (WTGB, WYTL), patrol boats (WPB), craft (WPC) and fast response cutter (FRC)
- High Power Cutters (HPC), (icebreakers (WAGB, WLBB), National Security Cutters (WMSL), Offshore Patrol Cutters (OPC), high and medium endurance cutters (WHEC, WMEC), training ships (WIX), as well as coastal and sea going buoy tenders (WLM, WLB)

Configuration Standard Technical Order (CSTO)

Electrical Shore Ties

Main points of the requirements

- Outdoor enclosures adjacent to bodies of salt water shall be of NEMA 4X construction with Type 316 stainless steel exterior hardware.
- 450V ungrounded delta power requirements for most Coast Guard vessels.
- Phase loss relays to shut off power until corrected.
- Surge Protection
- Coast Guard White color (only “white” or “light grey” is mentioned in the standard)
- Paint coating system must meet the minimum requirements of IEEE C57.12.29 unless noted otherwise.
- Line Insulation Monitor (LIM) when required:
 - Shore side LIM to be automatically disconnected whenever a vessel is connected and powered from the shore side.
 - Bypass switch to engage shore side LIM if the connected vessel does not have an operational LIM.

Configuration Standard Technical Order (CSTO) Electrical Shore Ties

Standard currently references Bender IRDH375 – now obsolete and has been replaced by Bender ISOHV425+AGH



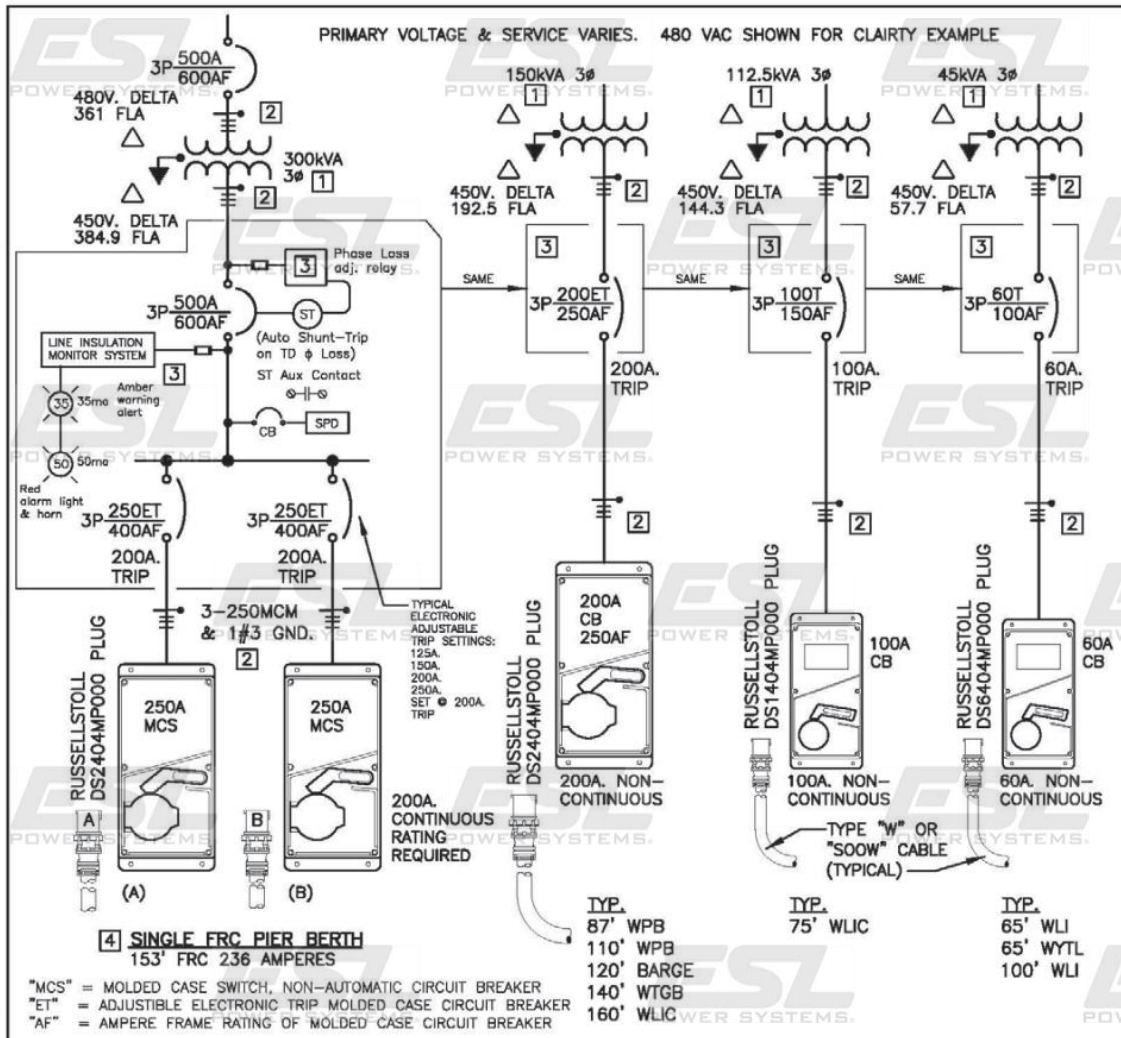
LOW POWER CUTTER (LPC)											
VESSEL			SHIP SHORE POWER						DOCKSIDE SHORE POWER		
L	TYPE	DESCRIPTION	HULL NUMBER	VAC NOM.	PH	WIRE QTY	CIRCUIT		RECEPT. AMP	REF. DWG.	NOTES
							AMPS	QTY			
65	WLI	INLAND BUOY TENDER	65400, 65401	450	3	3	60	1	60	A3	1, 2, 4
65	WYTL	SMALL HARBOR TUG	65604 65607 - 65612 65614, 65615	450	3	3	60	1	60	A3	1, 2
75	WLR	RIVER BUOY TENDER	75307	450	3	3	100	1	100	A3	1, 2
75	WLIC	INLAND CONSTRUCTION TENDER	75301 - 75306 75309, 75310	450	3	3	200	1	200	A3	1, 2
87	WPB	MARINE PROTECTOR CLASS COASTAL PATROL BOAT	87313 - 87374	450	3	3	100	1	100	A3	1, 2
87	WPB	MARINE PROTECTOR CLASS COASTAL PATROL BOAT	87301 - 87312	450	3	3	100	2	100	A3	1, 2
100	WLIC	INLAND CONSTRUCTION TENDER	315	450	3	3	150	1	150	A3	1, 2
100	WLI	INLAND BUOY TENDERS	313	480	3	3	60	1	60	A3	1, 2
100	WLI	INLAND BUOY TENDERS	642	450	3	3	100	1	200	A3	1, 2
110	WPB	PATROL BOAT	1301, 1302, 1304 1307, 1309 - 1314 1316, 1318 - 1324 1326, 1327, 1329 - 1349	450	3	3	200	1	200	A3	1, 2
120	BARGE	BARGE	12001, 12002	450	3	3	200	1	200	A3	1, 2
140	WTGB	ICE BREAKING TUG	101-109	450	3	3	200	1	200	A3	1, 2
153	WPB	FAST RESPONSE CUTTER	FRC-01,02,03	450	3	3	200	2	200	A3	1, 2, 3
160	WLIC	INLAND CONSTRUCTION TENDER	800 - 803	450	3	3	200	1	200	A3	1, 2

LOW POWER CUTTER (LPC)											
VESSEL			SHIP SHORE POWER						DOCKSIDE SHORE POWER		
L	TYPE	DESCRIPTION	HULL NUMBER	VAC NOM.	PH	WIRE QTY	CIRCUIT		RECEPT. AMP	REF. DWG.	NOTES
							AMPS	QTY			
65	WLR	RIVER BUOY TENDER	65501- 65506	230	3	3	150	1	200	A5	1
75	WLR	RIVER BUOY TENDER	75401 - 75405, 75407, 75408	230	3	3	100	1	100	A5	1
75	WLR	RIVER BUOY TENDER	75409, 75406	230	3	3	175	1	200	A5	1
75	WLR	RIVER BUOY TENDER	75407, 75500, 75501	230	3	3	200	1	200	A5	1, 2

High Power Cutters

HIGH POWER CUTTER (HPC)												
VESSEL			SHIP SHORE POWER						DOCKSIDE SHORE POWER			
L	TYPE	DESCRIPTION	HULL NUMBERS	VAC NOM.	PH	WIRE QTY	CIRCUIT		RECEPTACLE		REF. DWG	NOTES
							AMPS	QTY	AMP	QTY		
175	WLM	BUOY TENDERS - COASTAL	551 - 564	450	3	3	400	1	400	1	A6	1,2
210	WMBC	MEDIUM ENDURANCE CUTTERS	615 - 630	450	3	3	400	1	400	1	A6	1
225	WLB	BUOY TENDERS - SEAGOING	201 - 216	450	3	3	400	2	400	2	A7	1,2
240	WLBB	SEAGOING TENDER/ICE BREAKER	30	450	3	3	400	3	400	3	A8	1
270	WMBC	MEDIUM ENDURANCE CUTTERS	901 -913	450	3	3	400	2	400	2	A7	1
295	WIX	TRAINING SHIP	327	450	3	3	300	1	400	1	A6	1
378	WHEC	HIGH ENDURANCE CUTTERS	715 - 726	450	3	3	400	2	400	2	A7	1
399	WAGB	ICE BREAKERS - POLAR CLASS	10 -11	450	3	3	290	4	400	4	A8	1
418	WMSL	NATIONAL SECURITY CUTTER	750 - 753	450	3	3	400	7	400	7	A8	1
420	WAGB	ICE BREAKERS	20	450	3	3	400	8	400	8	A8	1

Low Power Cutters





ESL
POWER SYSTEMS.

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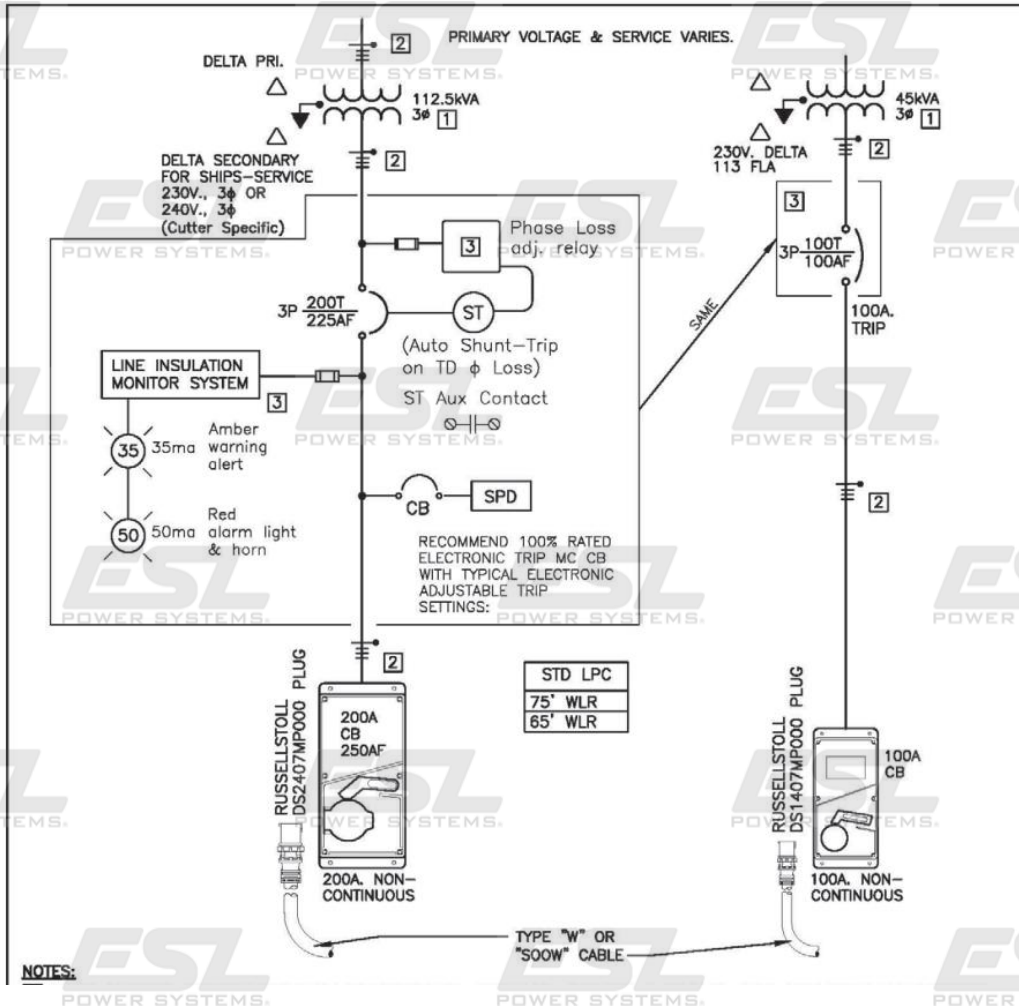
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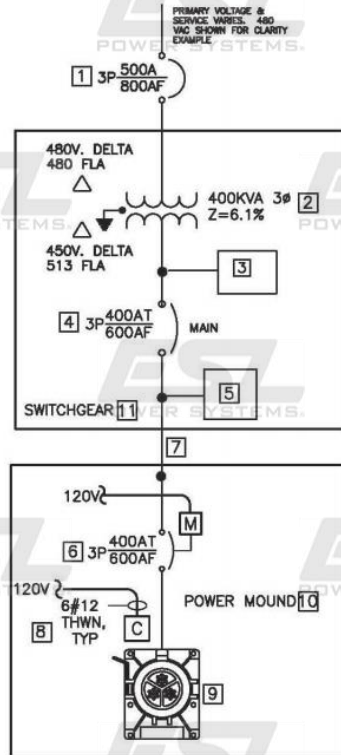
ESL
POWER SYSTEMS.

ESL
POWER SYSTEMS.

Low Power Cutters



High Power Cutters



ONE LINE DIAGRAM

HPC
175' WLM
210' WMEC
295' WIX

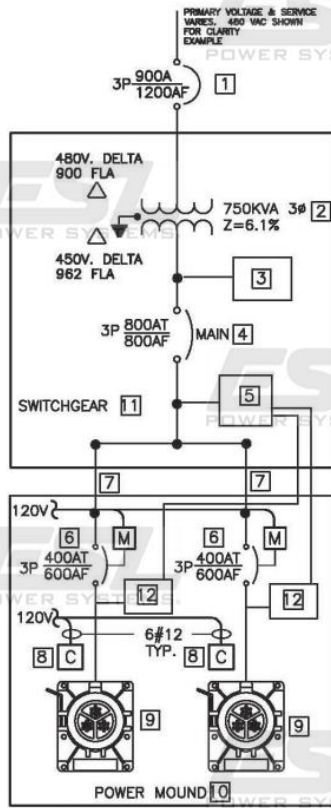
ONE LINE NOTES

- SIZES OF COMPONENTS BASED UPON 400A SERVICE.
- REFER TO SECTION FOUR OF THIS CSTO FOR THE TECHNICAL INFORMATION ON THE REQUIRED EQUIPMENT IDENTIFIED.
- RECEPTACLE DISCONNECT CAN BE ELECTRICALLY OR MANUALLY OPERATED. DESIGNER TO DETERMINE METHOD. IF MECHANICAL RECOMMEND UTILIZING ES; MODULE TYPE INTERLOCK CONFIGURATION FOR MIL-C.
- REFER TO DRAWING AB.2 FOR TYPICAL PUSHBUTTON CONTROLS TO BE PROVIDED FOR EACH MIL-C-24368/2 RECEPTACLE IN A POWER MOUNT ENCLOSURE. REFER TO DWG A9 FOR STANDARD MIL-C MICROSWITCH ASSEMBLY.

EQUIPMENT ITEMS:

- MOLDED CASE CIRCUIT BREAKER [REQUIRED]
- ISOLATION TRANSFORMER -SHIELDED PRIMARY, SECONDARY AND CORE [REQUIRED]
- ELECTRONIC INSULATION RESISTANCE MONITOR [REQUIRED]
- INSULATED CASE CIRCUIT BREAKER: WITH ELECTRONIC TRIP. [REQUIRED]
- SOLID STATE MULTIFUNCTION METER AND CIRCUIT MONITOR. (SQUARD D CM-4000T OR APPROVED EQUAL.) [REQUIRED]
- MOLDED CASE CIRCUIT BREAKER: [REQUIRED] SEE NOTE 3 ABOVE
- FEEDER CONDUCTORS: DLO TYPE CABLE RECOMMENDED. REFER TO DWG D1.
- POWER MOUNT CONTROLS. MINIMUM WIRING PER MIL-C USE SHIELDED CABLE IF LED INDICATOR LIGHTING SPECIFIED. [REQUIRED] REFER TO DWG. AB.3.
- MIL-C-24368/2 RECEPTACLE. [REQUIRED]
- POWER MOUNT ENCLOSURE: CONSOLIDATE TELCOM IN ENCLOSURE. REFER TO C4&IT CSTO. [REQUIRED]
- SWITCHGEAR

High Power Cutters



ONE LINE DIAGRAM

HPC
378" WHEC
270" WMEC
225" WLB

ONE LINE NOTES

1. SIZES OF COMPONENTS BASED UPON 800A SERVICE.

2. REFER TO SECTION FOUR OF THIS CSTO FOR THE TECHNICAL INFORMATION ON THE REQUIRED EQUIPMENT IDENTIFIED.

3. RECEPTACLE DISCONNECT CAN BE ELECTRICALLY OR MANUALLY OPERATED. DESIGNER TO DETERMINE METHOD. IF MECHANICAL RECOMMEND UTILIZING ES; MODULE TYPE INTERLOCK CONFIGURATION FOR MIL-C.

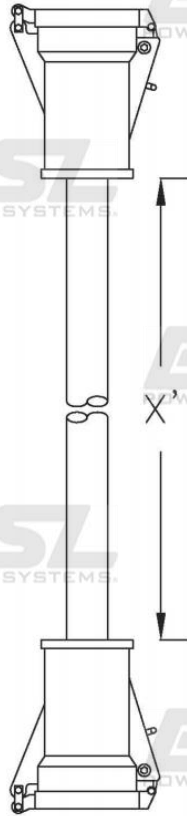
4. REFER TO DRAWING AB.2 FOR TYPICAL PUSHBUTTON CONTROLS TO BE PROVIDED FOR EACH MIL-C-24368/2 RECEPTACLE IN A POWER MOUND ENCLOSURE. REFER TO DWG A9 FOR STANDARD MIL-C MICROSWITCH ASSEMBLY.

EQUIPMENT ITEMS:

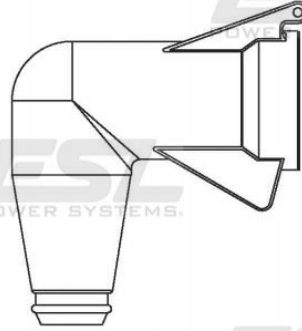
- 1 MOLDED CASE CIRCUIT BREAKER [REQUIRED]
- 2 ISOLATION TRANSFORMER—SHIELD PRIMARY, SECONDARY AND CORE. [REQUIRED]
- 3 ELECTRONIC INSULATION RESISTANCE MONITOR. [REQUIRED]
- 4 INSULATED CASE CIRCUIT BREAKER: WITH ELECTRONIC TRIP. [REQUIRED]
- 5 SOLID STATE MULTIFUNCTION METER AND CIRCUIT MONITOR (SQUARE D CM-4000T OR APPROVED EQUAL.) [REQUIRED]
- 6 MOLDED CASE SWITCH: WITH MOTOR OPERATOR.
- 7 FEEDER CONDUCTORS: DLO TYPE CABLE RECOMMENDED. REFER TO DWG A11 FOR CABLE INFORMATION AND REQUIRED CONNECTORS.
- 8 POWER MOUND CONTROLS. MINIMUM WIRING PER MIL-C. per Mil-C. USE SHIELDED CABLE IF LED INDICATOR LIGHTS SPECIFIED. [REQUIRED] REFER TO DWG. AB.3.
- 9 MIL-C-24368/2 RECEPTACLE. [REQUIRED]
- 10 POWER MOUND ENCLOSURE. CONSOLIDATE TELCOM IN ENCLOSURE. REFER TO C4&IT CSTO. [REQUIRED]
- 11 SWITCHGEAR
- 12 SOLID STATE POWER METER: ONE PER MIL-C RECEPTACLE. (SQUARE D PM820 OR EQUAL)



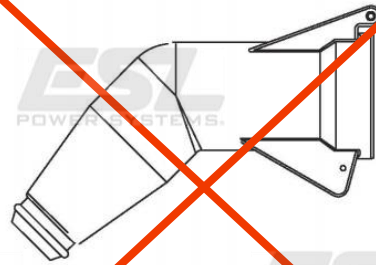
MIL-C- 24368/1 Plug



TYP. CABLE ASSEMBLY
W/MIL-C PLUG
SCALE: NTS"





























90 MIL-C PLUG (OPTIONAL)
SCALE: NTS"



45 MIL-C PLUG (OPTIONAL)
SCALE: NTS"

EQUIPMENT NOTE
REFER TO SECTION FOUR OF THIS CSTO
FOR THE TECHNICAL REQUIREMENTS OF
THE EQUIPMENT SHOWN.





U.S. Coast Guard C4&IT Shore Tie Cable Standards

U.S. Coast Guard C4&IT Shore Tie Cable Standards

1.1. **Cable:** Shore Tie cable is **Belden's 9389**, 18 gauge, stranded 6 pair cable.



1.2.2 **Shore-side and Shipboard Connector:** Shore-side and shipboard receptacles will be the **RussellStoll SKWR12XG**



U.S. Coast Guard C4&IT Shore Tie Cable Standards

1.4.1 **NSC:** Due to the unique requirements of the NSC, each cutter will utilize **3** shore tie receptacles.

1.4.2 **FRC, 175', 210', 225', 240', 270', 378', 399', 420'** and **EAGLE:** Each cutter will utilize **2** shore tie receptacles.

1.4.3 **140' and below:** Each cutter will utilize **1** shore tie receptacle

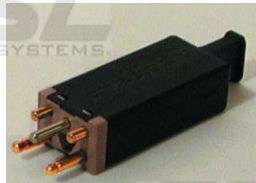


U.S. Coast Guard C4&IT Shore Tie Cable Standards

1.5 Shore-side Configuration: Shoreside pier mound will provide 4 dedicated copper C4&IT shoretie receptacles (RussellStoll SKWR12XG) and 2 future fiber optic receptacles (**Delphi Hermaphroditic 12-CH receptacles**). Copper receptacles will be fed with 2 each 25 pair Category 5-E rated cables via dedicated 4 inch conduits and shall be terminated using standard 5-pin Gas Tube protection devices



Fiber Optic Connector



5-pin Gas Tube



Telecom Termination Panel



NAVY



NAVY

UFC 4-150-02

UNIFIED FACILITIES CRITERIA (UFC) DOCKSIDE UTILITIES FOR SHIP SERVICE

- Link: https://www.wbdg.org/FFC/DOD/UFC/ufc_4_150_02_2020.pdf
- Last update: 11/12/2020
- (216) Pages

Key sections:

3-8.3.1 Ships Power.

- Historically, the electrical system providing power for most ships has been a dedicated 480 V (nominal), three-phase, 60 Hz, **ungrounded** system.
- Currently, 4160 V (nominal), three-phase, three-wire, 60 Hz power is required for nuclear aircraft carriers (CVN 68 class and higher).
- Future classes of ships (surface combatants and amphibious assault) will require 4160 V (nominal), three-phase, three-wire, 60 Hz power.
- CVN 78 class ships will require 13.8kV (nominal), three phase, three wire, 60 Hz power.
- The pier electrical distribution system must be designed to limit the fault current contribution from the shore power, at the ship's bus, to:
 - 100,000 A (rms) for 480 V distribution
 - 35,000 A for 4160 V distribution
 - 15,000 A (rms) for 13.8kV distribution.

Key sections:

3-8.3.3 Permanent Pier Loads and Industrial Power.

Industrial power must be supplied from dedicated 480Y/277 V transformers. A delta primary winding for transformers prevents 3rd harmonics from being transmitted to the primary line and limits voltage distortion impacts to the electrical distribution system whereas a wye-wye wound transformer does not. Industrial power is defined as power specifically for equipment utilized for the repair and overhaul of ships at berth and is normally only required in naval shipyards. Do not provide permanent pier load power or industrial power from the same transformers providing shore to ship hotel power.

NAVFAC

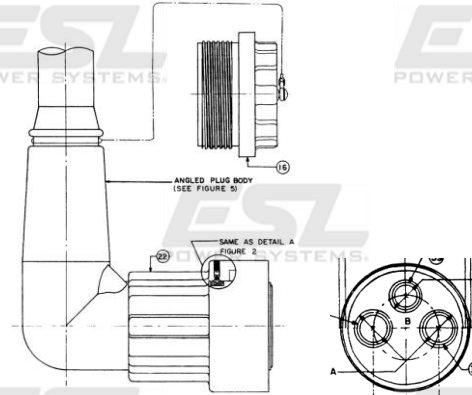
Naval Facilities Engineering Systems Command

Standard connectors usually referenced for shore power applications:

MIL-C-24368/2C
(500A, 500VAC)

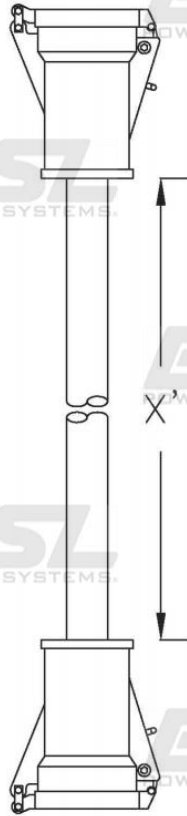


MIL-C-24368/1C
(500A, 500VAC)

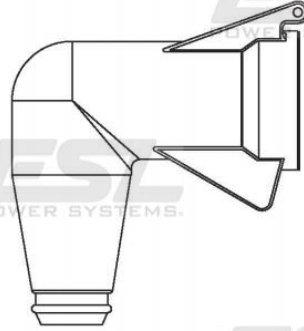


MIL-C-24368/5
"Submarine Plug"
(400A, 500VAC)

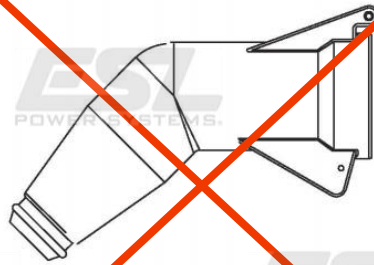
MIL-C-24368/1 Plug



**TYP. CABLE ASSEMBLY
W/MIL-C PLUG
SCALE: NTS"**



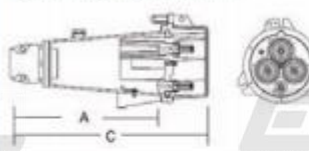
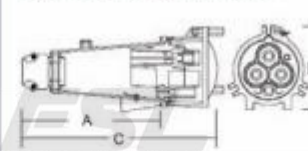
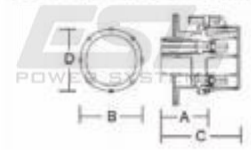
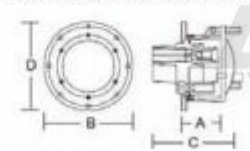
**90 MIL-C PLUG (OPTIONAL)
SCALE: NTS"**



**45 MIL-C PLUG (OPTIONAL)
SCALE: NTS"**

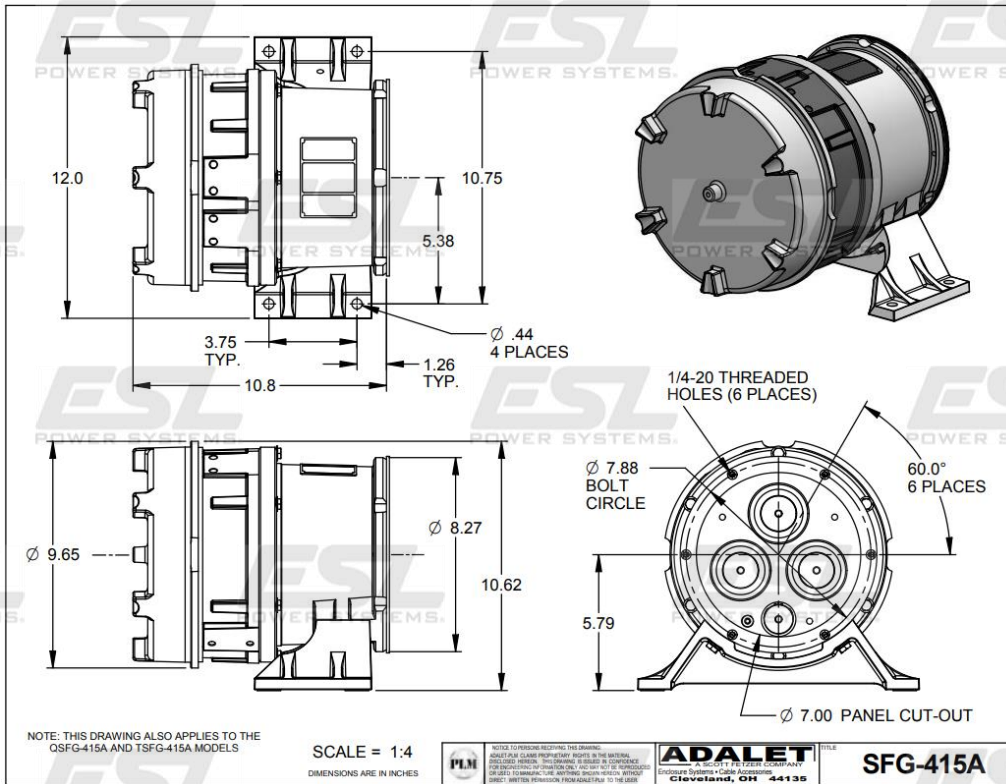
EQUIPMENT NOTE
REFER TO SECTION FOUR OF THIS CSTO
FOR THE TECHNICAL REQUIREMENTS OF
THE EQUIPMENT SHOWN.



Illustration (not to scale)	Dimensions	Weight	Illustration (not to scale)	Dimensions	Weight
CABLE MOUNTED MALE 	A 20 ¼" 514 mm B 10 ½" 267 mm C 24 ½" 622 mm	38.0 lb 17.0 kg	CABLE MOUNTED FEMALE 	A 24" 610 mm B 11 ½" 292 mm C 27" 686 mm	38.0 lb 17.0 kg
EQUIPMENT MOUNTED MALE 	A 4 ¾" 121 mm B 12 ¼" 311 mm C 9" 229 mm D 11" 279 mm E 1 ½" 38 mm	32.0 lb 14.5 kg	EQUIPMENT MOUNTED FEMALE 	A 5 ¼" 133 mm B 12 ¼" 311 mm C 8 ¼" 210 mm D 11" 279 mm E 4" 102 mm	27.0 lb 12.3 kg

Patton & Cooke
 600VAC – 25kVAC
 200A – 700A





Adalet
600VAC – 25kVAC
200A – 700A



Leviton, Crouse-Hinds, Hubbell 22 series Cams



Duraline



Questions?

Email: ethorson@eslpwr.com

