Table 11-1. Power line surge arrester criteria.

Parameter	Requirement
277/480-V, 3-Phase, 4-Wire System	
Clamp voltage	Less than 1200 V with kV/nsec pulse slope
Power consumption	Less than 600 MW per phase (device only)
Extreme duty discharge capability	Greater than 65 kA (8x20 microsec* pulse, 0.65 Coulomb)
120/128-V, 3-Phase, 4-Wire System	
Clamping voltage	Less than 750 V with 10 kV/nsec pulse slope
Power consumption	Less than 200 MW per phase (device only)
Exreme duty discharge capability**	Greater than 25 kA (8x20 microsec* pulse, 0.25 (Coulomb)
Common to Both Systems	
Minimum operational life	200 operations with 10 kA, 8 x 20 microsec pulse
Operating temperature	-40 F to =140 F
Self-restoration time	Less than 10 msec

*The first figure in the waveform is the 10 percent to 90 percent risetime. The second figure is the time to fall from peak value to 1/e, (approximately 0.368) times the peak value (e-fold time).
**Where a lightning threat is applied, the extreme duty discharge capability should be increased to 65 kA, 0.65 Coulomb.

Table 11-2. Power line filter criteria.

Parameter	Requirement
Insertion loss	100 dB from 14 kHz to 500 MHz measured per MIL-STD-220A
Minimum life	15 years (150,000 hours)
Current overload capability	140% of rated current for 15 minutes, 200% for 1 minute, and 500% for 1 second per MIL-F-15733
Operating temperature range	Continuous operation from -55 C to +65 C per MIL-STD-202, method 108A, test condition H. Shall also withstand temperatures cycling as specified in MIL-STD-202, method 102, test condition D
Temperature rise	Less than 40 C for individual filters suspended in ambient air at 20 C
Inductor linearity	Better than +3% from no load to full load
Voltage drop (at operating frequency)	Not to exceed 2% of rated line voltage when fully loaded (resistive load)
Dielectric withstanding voltage	200% of rated voltage for 2 minutes as specified in MIL-STD-202, method 301
Terminal resistance to ground	Greater than 1.5 megaohm when measured per MIL-STD-202, method 302, test condition B
DC resistance	No greater than 5 milliohms as measured per MIL-STD-202, method 303
Maintainability	Individual filters shall be replaceable units and like filters shall be interchangeable

Table 11-3. Signal and control line protection: coaxial penetrations.

Data: 2 Mb/sec, 75 ohm

Surge Arrester	
Parameter	**Requirement**
Clamp voltage	7 V +/- 0.5V
Maximum insertion loss	< 3 dB
Maximum peak pulse current; I_{pp}	139 A
Minimum operational life	2000 operations at I_{pp}
Filter	
Impedance (in-band)	75 ohm +/- 1 ohm
Insertion loss (out of band)	100 dB 14 KHz - 500 MHz
Bandwidth (40 dB BW)/center	15%/2 MHz
Insertion loss (in-band)	< 3 dB

Data: RF 70 to 700 MHz, 50 ohm

Parameter	Requirement
DC breakdown voltage	200 +/- 50 V
Impulse current (max), I_c	10,000 A (8x20microsec waveform)
Impulse breakdown (max)	1000 V 1 kV/nsec)
Impedance	50 ohm +/- 1 ohm
Insertion loss	< .25 dB
Minimum operational life	10 pulse at 1/2 I_c
Filter	
Double band pass may be required. Further information is needed.	

Table 11-4. Twisted shielded pair criteria.

Balanced Surge Arrester for All Twisted Pairs*	
Parameter	Requirement
DC breakdown voltage	300 V +/-50 V
Impulse current (max), I_c**	25 kA (8x20 microsec pulse shape)
Impulse breakdown (max)**	700 V (20 kV/microsec)
Balance (max)	10 ns firing
Minimum operation life	>50 pulse at 20 kA
Data: 10 Kb/sec and Voice Low-Pass Filter	
Insertion loss (out of band)	100 dB (14 kHz - 500 MHz)
Data: 10 Kb/s < Rate < 56 Kb/s***	
Parameter	Requirement
Impedance (in-band)	100 ohms + 1 ohm
Insertion loss (out of band)	100 dB 14 kHZ - 500 MHz
Bandwidth (40 dB BW)/center frequency (of)	15% of or as required
Insertion loss (in-band)	<3 dB

Twisted shielded pairs will have a 5-ohm 1-watt carbon composition resistor in series with each filter input, placed between the surge arrester and the filter input.

*Recommended Joslyn TRIGUARD Model 2022-24 or equivalent.
**To ground.
***Comment: specific line data rates must be defined. Custom filters may be required.

Table 11-5. Terminal protection device.

Parameter	Requirement	Type No.
Reverse standoff voltage	6 V 12 V	IN6036A IN6043A
Peak pulse power dissipation	1500 W	
Polarity	Bidirectional	
General semiconductors		TransZorb or equivalent.

Table 11-6. Shielding effectiveness check points.

Joints between steel panels (roof and walls)	-Test every 3 feet for small facilities
Corner seams (walls to floor surfaces)	- Test every 3 feet for small facilities
Corners (intersection of 3 surfaces)	- Test all corners
Single doors (hinged)	- Test at each corner and midpoint of each side longer than 4 feet and at center
Sliding doors	- Test each separately at same test points as with single hinged doors
WBC vents and vent panels	- Test in center (on axis) for all sizes (including single), and at all four corners if 1 x 1 feet or larger, and at the midpoint of each side longer than 4 feet
All treated penetrations of shield (and entry panel and backshield)	- Test as close to "on-axis" as possible or orient for maximum signal
All other shield joints, seams or corners	- Test every 3 feet

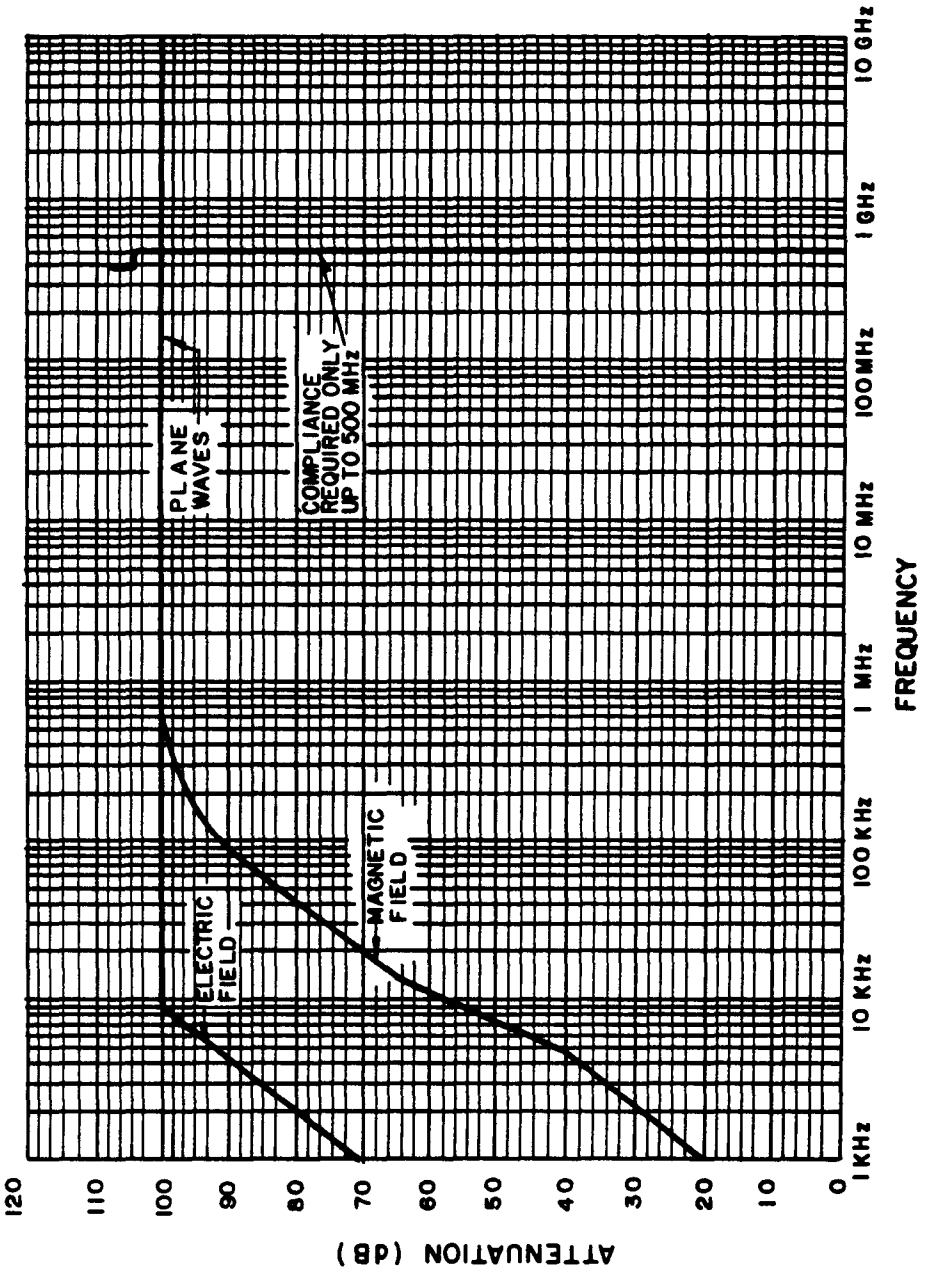

Figure 11-1. Required electromagnetic attenuation.

A. Specifications and Review

1. Shield

---- a. The level of shielding required is clearly stated in terms of decibels.

---- b. The shield material is clearly identified and meets the proper ASTM or equal qualifications.

---- c. The proper EMP hardness test is noted (MIL-STD-285, sniffer, and dipenetrant).

---- d. The methods of making seams and attaching the roof to walls and walls to floor are clearly defined.

---- e. The method of attachment for shield to structure is clearly defined.

---- f. QC and acceptance test procedures are required from the contractor as submittals to the Government.

---- g. The welding method is clearly defined and welding material and welder certification are identified.

2. Penetration protection

---- a. RF filters are clearly defined in terms of decibel protection and rating.

---- b. Electric surge arrester devices are clearly defined and properly specified for application.

---- c. Waveguide-below-cutoff devices are clearly defined and properly specified.

---- d. Utility penetrations are defined and treated properly.

---- e. RF doors are properly designed to provide the required protection.

---- f. Personnel entryways are defined properly in terms of interlocked doors and entryway waveguide.

---- g. Access covers/doors are proper.

Figure 11-2. Checklist for HEMP drawings. (sheet 1 of 3)

---- h. The fiber optic entering the shield is protected by WBS and completely devoid of conductive strengthening wire.

---- i. Conduits are clearly defined and properly joined.

---- j. Filter enclosures are clearly defined and proper.

---- k. Utility entry vault is clearly defined and proper.

---- l. A statement is included covering the protection for doors/WBC/filters/and shield materials during construction.

---- m. Any special certification required is noted.

---- n. Grounding method is clearly defined and proper.

---- o. A note covering construction changes and the care which must be taken to ensure no compromise in shield is included.

B. Drawings and Plans

1. General

---- a. A table listing filters is included in drawings giving size, type, rating, location, and other pertinent details.

---- b. A table listing penetrations, their locations, and their usage (ventilation, power, water, etc.) is included in the drawings. The table will reference penetration details.

---- c. A wiring diagram is included in the drawings which includes location of filters and filter identification noted on the filter table referenced.

2. Details

---- a. Details of filter attachment/mounting to shield are included showing all views.

---- b. Details of filter enclosures are included.

---- c. Details of shield seams and wall cuts showing the shield attachment to structural beams/support are included.

---- d. Details of the grounding method are included.

Figure 11-2. Checklist for HEMP drawings. (sheet 2 of 3)

---- e. All penetrations should reference a detail showing exactly how the penetration is treated.

---- f. Attachment to the floor and roof to the wall shield is shown in detail.

---- g. Expansion devices are shown in detail.

---- h. Doors are shown in detail. Subdetails such as frame, closure, handle mechanism, threshold and others are shown clearly.

3. Penetrations

---- a. Filters are shown clearly by some notation system (F1, F2, etc.).

---- b. The RF shield is shown clearly on all drawings.

---- c. A method for filter repair bypass is available (breakers) where applicable.

---- d. The grounding system is shown clearly and is proper for the protection method.

---- e. Conduits are identified and specified properly for the protection system.

---- f. All access panels to shield are shown in detail and clearly identified.

---- g. Where applicable, a built-in testing system is shown clearly on the drawings, including the proper details of attachment.

Figure 11-2. Checklist for HEMP drawings. (sheet 3 of 3)