EFCOG BEST PRACTICE #163

Best Practice Title: Field Tool for Estimating Incident Energy at Distance Using the Inverse Square Law

Facility: DOE Complex

Point of Contact:
Gregory Christensen, Phone: (208)526-5380, email: gregory.christensen@inl.gov
Jackie McAlhaney, Phone: (803)557-9002, email: jackie.mcalhaney@srs.gov
Michael D Hicks, Phone: (208)526-3724, email: HICKSMD@id.doe.gov
John Whipple, Phone: (208)526-9858, email: john.whipple@inl.gov

Brief Description of Best Practice: Estimating Incident energy based on a known (calculated) incident energy level at a given distance can be achieved by application of the inverse square law. Application of a calculation method for incident energy considers arc-in-a-box factors in order to apply this tool. The inverse square law is geometric in origin and applies to diverse phenomena including incident energy. This tool can be used to determine incident energy levels between the working distance and the arc flash protection boundary in the field.

Why the best practice was used: This tool can be used to apply strategies to reduce incident energy levels by increasing the distance from the source.

What are the benefits of the best practice: This is a tool for field personnel to determine practical working distances to estimate incident energy and reduce risk associated with arc flash hazard.

What problems/issues were associated with the best practice: No consistent guidance applied to complex.

How the success of the Best Practice was measured: Success will be measured by the use of this Best Practice into complex site operating procedures.

Description of process experience using the Best Practice: N/A

EFCOG BEST PRACTICE #163

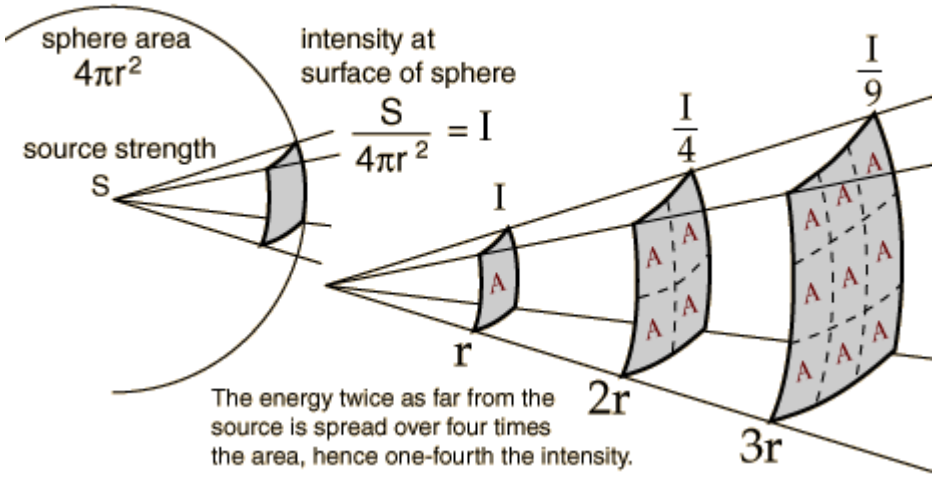
Attachment

Field Tool for Estimating Incident Energy at Distance Using the Inverse Square Law

Estimating Incident energy based on a known (calculated) incident energy level at a given distance can be achieved by application of the inverse square law. The path and intensity of radiant heat energy is influenced by distance. The calculation method for incident energy must consider arc-in-a-box factors in order to apply this tool.

Inverse Square Law

The inverse square law is geometric in origin and applies to diverse phenomena. Point sources of gravitational force, electric field, light, sound or radiation obey the inverse square law. The intensity of the influence at any given radius r is the source strength divided by the area of the sphere.



The lines represent the flux emanating from the source. The total number of flux lines depends on the strength of the source and is constant with increasing distance. The density of flux lines is inversely proportional to the square of the distance from the source because the surface area of a sphere increases with the square of the radius. Thus the strength of the field is inversely proportional to the square of the distance from the source. The energy twice the distance from a given source is

spread over four times the area, hence ¼ the intensity. The application of the inverse square law indicates radiant heat energy falling dramatically as distance is increased. Examples of the application of the inverse square law for a given (calculated) incident energy level at 18 inches is provided below.

Application of Inverse Square Law to Incident Energy

	1D = 18″	2D = 36″	3D = 54″	4D = 72″	5D = 90″	6D = 108″	7D = 126″	8D = 144″	9/D = 162″
Incident Energy cal/cm2	100	25	11	6.2	4	2.7	2	1.5	1.2
	90	22.5	10	5.6	3.6	2.5	1.8	1.4	1.1
	80	20	8.8	5	3.2	2.0	1.6	1.2	
	70	17.5	7.8	4.4	2.8	2.0	1.4	1.1	
	60	15	6.6	3.75	2.4	1.6	1.2		
	50	12.5	5.5	3.1	2.0	1.4	1.0		
	40	10	4.4	2.5	1.6	1.1			
	30	7.5	3.3	1.9	1.2				
	20	5.0	2.2	1.2					
	10	2.5	1.1						
	5	1.2							

This tool can be used to apply strategies to reduce incident energy levels by increasing the distance from the source. Field personnel may use this tool to determine practical working distances to minimize incident energy and reduce risk associated with arc flash hazard.

2D = 1/4
3D = 1/9
4D = 1/16
5D = 1/25
6D = 1/36
7D = 1/49
8D = 1/64
9D = 1/81