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BULLETIN # 26 – R.E. SEL # 8.1.1 and 8.1.2
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NIGHT VISION REQUIREMENTS and GENERATION TECHNOLOGY DESCRIPTIONS

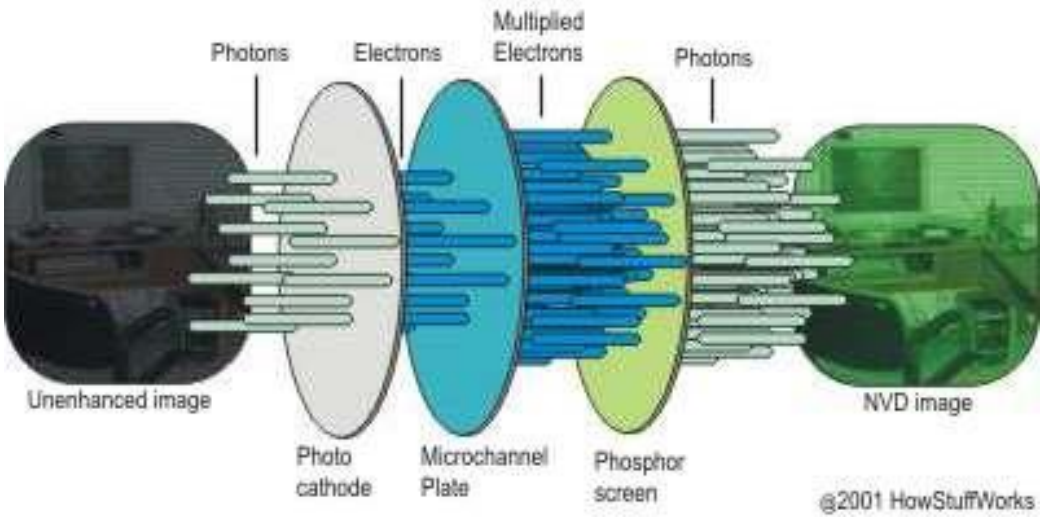
INTRODUCTION:

The FIRESCOPE SEL, in the *Advanced Technology Sub-Section (8.1),* requires that equipment items # 8.1.1 and/or # 8.1.2 (Light Amplification, Basic or Interchangeable) must meet the additional specification requirement of meeting "Generation 2 or 3". This Bulletin # 26 discusses and explains what is meant by a "Generation" technology as it applies to these night vision and star light devices.


Night Vision Devices (NDV), i.e. scopes, binoculars, monoculars, and lenses for standard SLR 35 mm cameras, are designed to use unique technology to enhance extremely low ambient light and starlight. These devices consist of several main parts: an objective lens, an eyepiece, a power supply, and the image intensifier tube (Photocathode Tube). Early technology and development of the concept of night vision devices (NVD) grew out of U.S. Army programs from WW II and the Korean War. However, they required some Infra-Red light to bathe or shine on the target image to enhance light amplification. Today's NVD's do not require that.

IMMAGE ENHANCEMENT:

An image is created by first collecting tiny amounts of visible light that are present but which may be imperceptible to the human eye. The collection of light may also include the lower portion of the infrared light spectrum. This miniscule amount of background or ambient light is amplified to the point where the human eye then can observe an image.



A large front lens gathers the existing background or ambient light (moonlight, starlight). Visible light consists of photons. These photons are then focused to go into and through a photocathode tube. This changes the stream of photons to electrons. (Refer to diagram on next page).

The stream of electrons are now amplified through a chemical and electrical process from 1000 times up to 50,000 times depending on specified "Generation" technology. Generation technology and specifications are described below. After significant amplification (increased number) of the electrons, they are hurled against a phosphor screen that changes the amplified electrons back into visible light. It is observed through the eyepiece. The image will now be a green hued recreation of the scene being observed.

GENERATION TECHNOLOGY:

Today NVD's are classified according to meeting a 1st, 2nd, 3rd, or 4th Generation Specification. What these designations represent is the type of image intensifier tube is used for that particular NVD. The image intensifier tube is the heart of the NVD.

Generation 1 (Gen 1): These NVD's were introduced during the 1960's in the midst of the Vietnam conflict. The major improvement was their capability to enhance pure ambient light amplification and they do not require Infra-Red light sources. Light is amplified up to 1,000x times. Early units were large and bulky. However, anything less that moonlight did not allow Gen 1 NVD's to function very well. The image periphery suffers from some serious optical distortion. The image may also appear to be fuzzy and slightly blurry. Because of significant price reductions Gen 1 still remains the most popular NVD in the world, especially in the public recreation realm.

Generation 2 (Gen 2 and Gen 2+): These NVD's have improved image resolution, sensitivity, and reliability. Brightness is better too. Light amplification and clarity were improved with the addition of a new image tube utilizing a special micro-channel plate. This improvement enhanced and increased the number of electrons. The result is a more clear image and less distortion. Because of the increase in electrons they are also brighter than earlier NVD's. These improvements allowed the Gen 2 to increase their light amplification to over 20,000x times. These devices can now work on a moonless (or cloudy) night, forested areas, and for some indoor applications.

Gen 2+, which has even a slightly higher increase in electron number, is popular today with law enforcement agencies and hazardous materials response teams. Costs have continued to come down and a good Gen 2 or Gen 2+ device can be found about $500 to $1,000 over the cost of a Gen 1.

Generation 3 (Gen 3): Significant increases in image resolution (sharpness) and increased ability to observe target images from still greater distances was achieved with a new photo cathode tube using gallium arsenide and a special ion barrier film coating on the micro-channel plate. This improvement increased light amplification to 30-50,000x times. This allows for a more clear image showing better detail in focus. Images are far less fuzzy than Gen 1 or Gen 2 NVD's. Although more expensive than a Gen 2 (about double), some law enforcement agencies find these devices suitable for SWAT teams and other uses.

This is currently the most popular generation with the U.S. Military but they are also employing the next version (Generation 4), see below.

Some Generation 3 devices can be found about $1,000 to $3,000.

Generation 4 (Gen 4): Another recent breakthrough in generation technology came with the removal of the ion barrier film. With other improvements, this change allows the Gen 4 NVD to have a light amplification in excess of 50,000x times. The resulting image is the most clear and focused to date, with almost no blurring or fuzziness.

Further, tests showed that by removing the ion barrier film from the micro-channel plate allowed for more electrons to reach the amplification stage so that the image is significantly less distorted.

It is this version that the U.S. Military is moving toward quickly. As of this writing, this technology is only being shared with law enforcement such as SWAT teams, and is not available for civilian usage. However, as the technology advances, and the U.S. Military perfects yet a better Generation (see next), it is only a matter of time that Generation 4 will become available.

GENERATION 4

On The Horizon – WP Technology: A new technology based upon using white phosphorous technology (WPT) instead of gallium arsenide is already in the testing and experimental phase. It is being used in Beta Tests by the U.S. Military in perfecting Generation 4 even further. Using white phosphorous allows for the image to be viewed in shades of gray rather than in shades of green. This allows for the human eye the ability to distinguish shapes and shadows better. It also enhances clarity and focus.

Currently this technology is being made available for civilian use with the Generation 2, Generation 2+, and 3 devices but at considerably higher prices. Becoming popular with law enforcement.

VIEW THROUGH WPT™ DEVICE