TECHNICAL MEMORANDUM

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JUSTIFICATION FOR SPECTRONIC STANDARDS WAVELENGTH ACCURACY TEST

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This Technical Memorandum addresses the justification for use of the 525 nm wavelength filter supplied with the Thermo Spectronic Calibration Standards Set (GEX Part# P4220) that is used for calibration of the Genesys 20 model spectrophotometer.

Wavelength performance testing of the Genesys 20 spectrophotometer uses a special filter included in Spectronic Standards Set (GEX Part# P4220). This filter has three absorbance peaks at 400 nm, 525 nm and 780 nm. Only the primary 525 nm peak is directly traceable to a calibration spectrophotometer maintained by Thermo Spectronic. The reference instrument at Thermo Spectronic has been standardized to be within 0.1 nm of the selected spectral lines of deuterium and mercury spectra.

Measurements of radiochromic B3 films are performed at 550-554nm wavelengths. These wavelengths are the absorbance peak of the radiochromic dye used in B3 dosimeters, with actual peak at 552nm. One may question if using the wavelength accuracy filter and testing at 525nm safely assures that wavelength of, say 554nm, is within the instrument specification as well, or for that matter other wavelengths used to measure any other type of dosimeter.

Thermo Fisher Scientific, the manufacturer of the Genesys 20, states that among the tests performed during the POST (Power On, Self Test) that the instrument performs during startup, it checks the *zero order position* of the diffraction grating. During this test, the diffraction grating is rotated in such a way that its plane is perpendicular to the incoming light beam. In this orientation the grating acts as a mirror and not as a wavelength dispersing element. The position is also equivalent to “zero nanometers” on the wavelength scale of the instrument. The instrument’s stepper motor is used to rotate the diffraction grating and select any desired wavelength to pass through the exit slits of the monochromator. The controlling software uses an embedded look-up table to determine of the number of steps of the stepper motor for a given wavelength. The software then instructs the stepper motor to rotate the grating precisely into the desired position based on the calculated value.

The wavelength scale of Genesys 20 extends to approximately 1100 nm and the selection of 525 nm as a checkpoint for wavelength verification test is driven by the fact that 525 nm is approximately at the mid point of the scale. By verifying wavelength performance specification at this location, it is safely assured that wavelengths below the 525 nm and above the 525 nm are properly selected by counting number of steps on the stepper motor.

In addition, GEX recommends the performance of a B3 peak verification test at scheduled intervals, per GEX WINdose Procedures document 100-254, Genesys 20 Calibration & Maintenance. Since the B3 film has a well defined peak at 552nm, users can verify that the B3 peak is found within the accuracy of the instrument specifications. The B3 film peak testing allows the user to verify instrument performance in and around the wavelength of measurement, complimenting the wavelength accuracy testing performed in accordance with the manufacturer’s recommendation.