CABLE INDUCED TRANSIENTS

Application Information

FOR SPACE SHUTTLE PROGRAM

The design requirements for electrical equipment on board the Space Shuttle vehicle include cable induced currents, called "indirect lightning effects" as described in Rockwell International Specification MF0004-002. A system for providing "component number one" described in Figure 15(b) of that specification has been developed and includes three items as follows:

Type No.	Description
7512-1	Spike Injection Probe
7519-1	Pulse Shaping Network (for use with Model 6254-5S, Model 7054-1 or Model 8282-1 Spike Generator)
7541-1	Spike Receptor Probe (calibrated for use with oscilloscope)

The test method described in paragraph 4.2.7.2 and Figure 16 of the specification requires two probes which are torodial transformers using the cable under test as the coupling between them. The injection probe and the receptor probe are different in character and cannot be used interchangeably. When using the **Model 6254-5S** or **7054-1** or the **8282-1** (in 10 μS mode) **Spike Generator** as the signal source, it is necessary to modify the shape of the pulse to comply with the waveform shown in Figure 15(b). The **7519-1 Pulse Shaping Network** is used between the spike generator and the injection probe to provide the appropriate waveform. The block diagram on the back of this page depicts the arrangement. A brief description of the three ancillary items follows:

Type 7512-1 Spike Injection Probe — Since it is possible to pass the test cable through the window of the injection probe, it is not a split construction, but it is a complete toroid fitted with a BNC connector. The core used in this probe has been specially selected to adequately transmit the low and high frequency components of the required spike waveform. The inside diameter of the injection probe is 1.25", suitable for most cable diameters. Because it is necessary to feed the cable through the window of the probe, the connector on the cable must be less than 1.25" diameter or the connector must be removed before inserting the cable through the probe.

Type 7519-1 Pulse Shaping Network — The waveform of **Model 6254-5S**, **Model 7054-1** and **Model 8282-1** (in 10 μS mode) **Spike Generators** decays to zero in approximately 10 microseconds. Since the waveform of Figure 15(b) for component number one is longer, the basic waveform is stretched by the **7519-1** network at the expense of rise time and amplitude. However, the generators have sufficient range in peak amplitude to overcome the loss and the slightly lengthened rise time is still within the requirements. The shaping network and the injection probe have each been designed so that short circuit current of 10 amperes flows through the cable under test. This is achieved at a generator setting which delivers 50 volts when the cable under test is open circuited at the receptor end.

Type 7541-1 Spike Receptor Probe — The receptor probe is assembled with a hinged construction allowing it to be placed around the cable under test. The design of this probe includes a calibrating resistor mounted in the housing. This resistor has been adjusted so that the display on the associated oscilloscope accurately indicates the value of spike current detected. **The vertical amplitude in volts/cm is converted to amperes/cm by multiplying the displayed peak value by a factor of ten.** The waveshape displayed on the oscilloscope should be similar to the requirement specified in Figure 15(b) of specification MF0004-002, decaying to zero in approximately 100 to 120 μS.