GLOSSARY

1. Altered Metal Zone (AMZ) - The mechanically and mechanically altered zones created by the EDM process on the work metal surface.

2. Ammeter - An instrument for measuring electric current in amperes.

3. Amount of Acid Number: A specific quantity of KOH (potassium hydroxide) is required to counter-balance the acid characteristics. Acid number is a measure of oxidation stability; the lower the number, the higher the stability; and higher stability results in longer fluid life and greater predictability in your costs.

4. Amperage (A) - In EDM, the amount of average current measured during the cut.

5. Ampere - The unit of electric current. Equivalent to the steady current produced by 1m, volt across 1 ohm.

6. Anode - The positive terminal of an electrolytic cell or battery. Often incorrectly applied to the tool (electrode) in the EDM process.

7. Arc - A continuous flow of electrical current between an electrode and workplace. Should an arc occur in EDM, the workpiece, electrode, or both will usually be damaged. An arc is normally visually recognizable as a yellow flash.

8. Arc Suppressor - A circuit in the EDM power supply that reduces the possibility of arcing.
9. Automatic Depth Finder - An automatic depth finder is electrically connected to the servo and will stop the downward advance of the electrode at within 0.0001" of the workpiece surface and will hold it at this distance. Therefore, if the workpiece position is shifted by moving the table in any direction with its hand wheels, the servo will constantly adjust the vertical relationship of the electrode to maintain its distance at 0.0001" away from even a previously EDMed cavity, even one with an irregular surface.

10. Automatic Tool Changer (ATC) - A device used with computer numerically controlled (CNC) EDM to provide automatic operation.

11. Average Current - The average value of all the minimum and maximum peaks of amperage in the spark gap, as read on the ammeter. For any given available current setting, the higher the average current, the greater the efficiency of the particular cut being made. See machining rate.

12. Blind Hole - Any hole or cavity cut into a solid shape which does not connect with other holes.

13. Breakthrough - The exit end of a through-hole cavity at the moment of completion.

14. Capacitor - An electrical component that stores an electric charge. In some EDM power supplies, banks of capacitors are connected across the machining gap. The current for the spark comes directly from the capacitors when they are discharged.

15. Carbon - An abundant, naturally occurring element. Often used in place of the word graphite. Graphite is a form of the element carbon. There are four forms of carbon, the others being amorphous carbon
(having no definite crystal structure), diamond, and the recently discovered fullerenes (also known as Buckyballs).

16. Cathode - The negative terminal in an electrolytic cell or battery. In EDM, sometimes incorrectly applied to the workpiece.

17. Center Flushing - A method of flushing dielectric through a center hole in an electrode.

18. Circuit - A continuous path allowing and directing the flow of electric current.

19. Collet - A device used to hold electrodes with round shanks.

20. Colloidal Suspension - Particles suspended in a liquid that are too fine to settle out. In EDM, the tiny particles produced in the sparking action form a colloidal suspension in the dielectric fluid.

21. Composite - Made up of more than one material. In EDM, copper tungsten is an example of a metallic composite. The copper and tungsten do not alloy, but are simply combined together. Copper graphite is a metallic/carbon composite.

22. Computer Numeric Control (CNC) - Programmed control of EDM by means of microprocessors.

23. Conductor - A material that will carry electric current.

24. Contamination - The accumulation of debris in the dielectric fluid, causing a decrease in the fluid's dielectric strength.

25. Coolant - Sometimes used incorrectly to describe dielectric fluid.

26. Copper Graphite - A graphite EDM electrode material infiltrated with copper.
27. Copper Tungsten - A porous tungsten material infiltrated with copper.

28. Core - The slug that remains after EDMing with an electrode that has a flush hole in it.

29. Crater - The small cavities left on the EDMed surface of the workpiece by the EDM sparks. Also known as pits.

30. DC (Direct Current) - Constant polarity current, as opposed to Alternating Current (AC), which changes polarity from negative to positive in cycles.

31. Deep Hole - Arbitrarily set at a depth/hole diameter ratio of 8:1

32. Deionization - A return of the condition of the dielectric to a non-conductive state. Failure to accomplish deionization (through flushing) during off-time of the spark is responsible for DC arcing.

33. Depth Finder - An aid for machine set up. An electrical impulse is used to indicate when a downward moving electrode approaches to within 0.0001 of contact with the surface of the workpiece, either to start a cut or to reposition the electrode to resume cutting, as after dressing an electrode. Used when manually or power jogging an electrode downward. Usually used in conjunction with a dial indicator to set depth of cut at which EDMing will stop. NOTE: Do not confuse with Automatic depth finder.

34. Depth-to-Diameter Ratio - In small hole EDMing, the ratio of the depth of a blind hole compared to the diameter of the electrode used to make the hole.

35. Diameter - The length of a straight line through the center of a round object.
36. Diametral Sparking Distance - The difference between the electrode dimension and the dimension of the cavity produced.

37. Dielectric Fluid - In EDM, a nonconductive liquid. It fills the gap between the electrode and workpiece and acts as an insulator until a specific gap and voltage are achieved. It then ionizes and becomes an electrical conductor, allowing a current (spark) to flow through it to the workpiece. It also serves to cool the work and to flush away the particles generated by the spark.

38. Dielectric Strength - The voltage at which the insulating qualities of a material break down. In EDM, a specification applied to dielectric fluid.

39. Duty Cycle - The percentage of the on-time relative to the sum of the on-time and off-time setting for a particular cut.

40. Efficiency - A measure of EDM performance which varies with the on-time and off-time settings for an EDM cut. See Duty cycle (above).

41. Electrical Discharge Grinding (EDG) - An EDM machine resembling a surface grinder but using a wheel made from electrode material. Can also be done with a horizontal spindle attachment (mounted on the quill of a conventional EDM machine) which has a built-in motor drive for the electrode wheel.

42. Electrical Discharge Machining (EDM) - A metal removal process using a series of electric sparks to erode material from a workpiece under carefully controlled conditions.

43. Electrical Resistivity - The resistance of the flow of electricity through material. Measured in ohms.
44. Electrode - The tool in the EDM process. It must be made from an electrically conductive material. Its form, or shape, is a mirror image of the finished form or shape desired in the workpiece, with its dimensions adjusted to take into account the amount of overcut that occurs.

45. Electrolyte - A normally conductive liquid or gas.

46. End Wear - A reduction in the length of an EDM electrode occurring during EDMing. Can be given as a dimension, or as a percentage of the original usable length of the electrode.

47. Entrance Opening - The point at which the electrode first enters the workpiece.

48. Eroding - Material removal by the EDM process.

49. Exit Point - The point at which the electrode pieces the workpiece in through hole EDM.

50. Fine - A class of EDM graphite characterized by a particle size range from 11μm to 20μm.

51. Finish - The surface texture produced by EDMing. Usually given in min Ra (U.S.).

52. Finish Cut - The final cut made with EDM on the workpiece. The finer the finish desired, the longer it will take for the finish cut. Therefore, roughing cuts, done with conventional equipment or with EDM, should be planned to leave only enough material to be removed by the finish cut to gain final size and surface finish desired.

53. Flashpoint - The temperature at which any flammable material will burst into flame. A factor in selecting dielectric fluid for EDM.
54. Flexural Strength - A property of a solid material that indicates its ability to withstand a flexural or transverse load.

55. Flushing - Flowing dielectric through the gap to remove the debris caused by machining with EDM.

56. Flushing Hole - A hole through the workpiece or electrode used to introduce dielectric fluid to the gap for flushing purpose.

57. Flushing Pressure - The pressure applied to the dielectric to force it through the spark gap.

58. Frequency - The number of cycles (on/off) completed per unit of time. Usually expressed in Hertz.

59. Fuzzy Membership - Tool reclassifies or transforms the input data to a 0 to 1 scale based on the possibility of being a member of a specified set. 0 is assigned to those locations that are definitely not a member of the specified set, 1 is assigned to those values that are definitely a member of the specified set, and the entire range of possibilities between 0 and 1 are assigned to some level of possible membership (the larger the number, the greater the possibility). The input values can be transformed by any number of functions and operators in Spatial Analyst that can reclassify the values to the 0 to 1 possibility scale. However, the Fuzzy Membership tool allows you to transform continuous input data based on a series of specific functions that are common to the fuzzification process. For example, the Fuzzy Linear membership function transforms the input values linearly on the 0 to 1 scale, with 0 being assigned to the lowest input value and 1 to the largest input value. All the in-between values receive some membership value based on a linear scale, with the larger input values being assigned a greater possibility, or closer to 1.
60. Gap (Spark Gap) - The distance between the electrode and workpiece when the spark occurs.

61. Gap Voltage - This can be measured as two different values during one complete cycle. The voltage which can be read across the electrode/workpiece gap before the spark current begins to flow is called the open gap voltage. The voltage which can be read across the gap during the spark current discharge is the working gap voltage.

62. Graphite - One of the four forms of carbon. In EDM, a material used for electrodes which has high heat resistance and transfers electric current very efficiently. It is the most popular electrode material and probably the easiest to machine.

63. Head - That part of the EDM machine tool in which the quill or ram travels.

64. Heat-Affected Zone (HAZ) - The layer below the recast layer. This layer has been subjected to elevated temperatures that have altered the properties of the workmetal.

65. Hunting - An erratic bouncing movement of the quill of an EDM machine during a cut. Causes include poor flushing conditions in the gap, servo response set for too much sensitivity, and build-up of carbon deposits on the bottom of the cavity being EDMed.

66. Injection - The introduction of dielectric fluid to the gap under pressure.

67. Injection Flushing - An external flushing method, also known as jet flushing. Fluid is directed into the gap by means of a flexible tube.
68. Ionization - Generally accepted as a phenomenon by which the dielectric between two points on the electrode and workpiece become electrically conductive. See Dielectric.

69. Ionized Path - The path of electrically conductive dielectric molecules between the two points on the electrode and workpiece through which the spark current will flow.

70. Linguistic variables: While variables in mathematics usually take numerical values, in fuzzy logic applications, the non-numeric linguistic variables are often used to facilitate the expression of rules and facts. A linguistic variable such as age may have a value such as young or its antonym old. However, the great utility of linguistic variables is that they can be modified via linguistic hedges applied to primary terms. The linguistic hedges can be associated with certain functions.

71. Low Wear - The result of certain settings for EDM machining which produces a very low degree of wear on the electrode. In some cases less than 1%, this is also known as no-wear.

72. Machine Tool - It performs the purely mechanical functions and, along with the dielectric system and the power supply, makes up the complete EDM.

73. Machining Rate - Same as Metal removal rate. The rate at which material is removed from the workpiece by EDM.

74. Mean Overcut - The average of top and bottom overcut.

75. Metal Removal Rate (MRR) - The rate at which material is removed from the workpiece by EDM. In the U.S., usually expressed in cubic inches/hour (in/hr).
76. Micron - A unit of length equal to one-millionth of a meter.

77. Microprocessor - A computer-on-a-chip. Found in all advanced EDM systems, the microprocessors provide many control functions.

78. Miss - A pulse that does not produce machining due to too great a gap.

79. Multi Wall carbon nanotube - Carbon nano tubes which are related to graphite. In conventional graphite, the sheets of carbon are stacked on top of one another, allowing them to easily slide over each other. That is why graphite is not hard, but it feels greasy, and can be used as a lubricant. When graphene sheets are rolled into a cylinder and their edges joined, they form MWCNTs.

80. Multiple Electrodes - The simultaneous use of electrodes to produce multiple cavities in one or more workpieces.

81. Normal Polarity - Negative polarity to the electrode.

82. Off-Time - The time between sparks, measured in microseconds. Too short an off-time may result in DC arcing.

83. Ohm - A unit of electrical resistance equal to that of a conductor in which a current of one ampere is produced by a potential of one volt.

84. On-Time - The duration time of the EDM spark measured in microseconds.

85. Open Circuit - An electrical circuit which is not complete.

86. Open Gap Voltage - The voltage which can be read across the electrode/workpiece gap before the spark current begins to flow. See Gap voltage.
87. Oscilloscope - An electronic imaging device which can be used to visually check the shape and voltages of pulses being generated by the EDM power supply.

88. Output - The voltage and current of an EDM power supply.

89. Overcut - An EDM cavity is always larger than the electrode used to machine it. The difference between the size of the electrode and the size of the cavity (or hole) is called the overcut. When discussing or calculating overcut, be sure to specify whether you are referring to total overcut (diametral overcut) or overcut per side. Diametral overcut is most often used.

90. Overcut Per Side - One-half of the diametral overcut value. It is important to follow this procedure in designing electrodes: (1) Select surface finish settings to determine finishing cut overcut. (2) Design finishing electrode size with overcut allowance. (3) Design roughing electrode providing for overlap which will leave proper allowance for the finish machining cut to clean up the surface left by the rough cut.

91. Overlap - The area by which the electrode for the next cut exceeds the workpiece cavity. (2) The difference between the rough machined hole or cavity size and the size of the electrode to be used for the next cut.

92. Peak Current - The maximum current available from each pulse from the power supply/generator.

93. Percent Electrode Wear - The volume of electrode worn away as compared to the volume of workpiece worn away.

94. Plasma - A superheated, ionized gas which forms in the discharged channel due to the action of the thermoelectric force.
95. Polarity - In EDM, the designation of positive or negative electrical potential to the electrode.

96. Power Supply - The part of the EDM system that supplies the voltage and current that causes the sparks or discharges between the electrode and workpiece. It is usually housed in a cabinet separate from the machine tool and connected to it by a cable.

97. Pressure Flush - The forcing of dielectric up through flush holes in the workpiece or down through flush holes in the electrode.

98. Pulse - The discharge of a quantity of electrical energy having preset voltage and amperage and expended over a preset time.

99. Pulse Timer - This refers to the spark, not flushing. Used to set the length of on-time and off-time of the spark. On some machines, on-time and off-time can be set individually in microseconds.

100. Quench - The rapid cooling of the EDMed surface by the dielectric fluid. Partially responsible for the metallurgical changes forming the recast layer and the heat-affected zone.

101. Quill - The moving member of an EDM machine on which the electrode or electrode holder is mounted. A cylinder working in a bearing or bushing.

102. Ram - The moving member of an EDM machine on which the electrode or electrode holder is mounted. A dovetail guided arrangement.

103. Recast Layer - A layer created by molten metal solidifying on the work metal surface.
104. RMS (Root Mean Square) - An obsolete term used in surface finish measurement.

105. Roughing (Hogging) Cut - The mode of EDM that removes the most material in the shortest time.

106. Safety Cut - The method of under sizing roughing electrodes to compensate for differences between them and the finishing electrodes.

107. Servo-Mechanism - The device that drives and controls the movement of the quill or ram.

108. Slurry - A watery mixture of insoluble material and water. Used as an abrasive in ultrasonic machining.

109. Spark - An electrical discharge of very short duration between two conductors.

110. Spark Erosion - Another name for EDM. Used primarily outside the U.S.

111. Spark Gap - The distance between the electrode and the workpiece when discharges are occurring.

112. Split Electrode - Multiple electrodes on a single machine electrically insulated from each other. Used with multiple lead power supplies.

113. Stroke - The distance the ram/quill travels under servo control.

114. Suction Flushing - Using a vacuum to draw the contaminated dielectric away from the gap as opposed to forcing it out with pressure.

115. Superfine - A class of EDM electrode materials with a particle size from 6m to 10m characterized by moderately high strengths, usually isotropic.
116. Surface Finish - The relative roughness or smoothness of the machined surface. Usually measured in \( \mu \text{in} \, \text{Ra} \) in the U.S.

117. Surface Flushing - The use of nozzles or hoses to direct jets of dielectric at the cutting area to flush away the debris. Usually employed while pulsating the electrode.

118. Surface Integrity - The quality of the machined surface and subsurface.

119. Surface Roughness - Surface irregularities on a machined surface. See Finish, Surface finish.

120. Taper - The dimensional difference between the entrance and exit opening of a through-hole cavity, or between the entrance and bottom of a blind hole.

121. Through-Hole Flushing - The use of a pre-drilled hole in the workplace to inject dielectric fluid up toward the gap by injection flushing or down from the gap by suction flushing.

122. Tubular Electrode - A round electrode with a center hole.

123. Tungsten - A metal used in pure or near pure state as an electrode material. Melting point is 3380°C.

124. Viscosity - The tendency of a fluid to resist flow. High viscosity liquids are thicker.

125. Wear - The erosion of the electrode during the EDM process.

126. Wear Ratio - The volume of electrode worn away as compared to the volume of workpiece material removed by EDM.

127. Wire EDM, Wire Cut - The electrode is a continuously spooling conducting wire that moves in preset patterns around the workpiece.
128. Workpiece - Any part on which EDM is being used to cut holes or cavities.

129. Thermal Conductivity - A measure of the ability of a material to transfer heat. Given two surfaces on either side of the material with a temperature difference between them, the thermal conductivity is the heat energy transferred per unit time and per unit surface area, divided by the temperature difference. It is measured in watts per degree Kelvin. Since electric current is our “cutting tool”, higher conductivity (or conversely, lower resistivity) promotes more efficient cutting.

130. Melting point - The temperature at which a solid becomes a liquid at standard atmospheric pressure. Since EDM is a thermal process, it would be logical to assume that the higher the melting point of the electrode material, the better the wear ratio will be between electrode and workpiece.