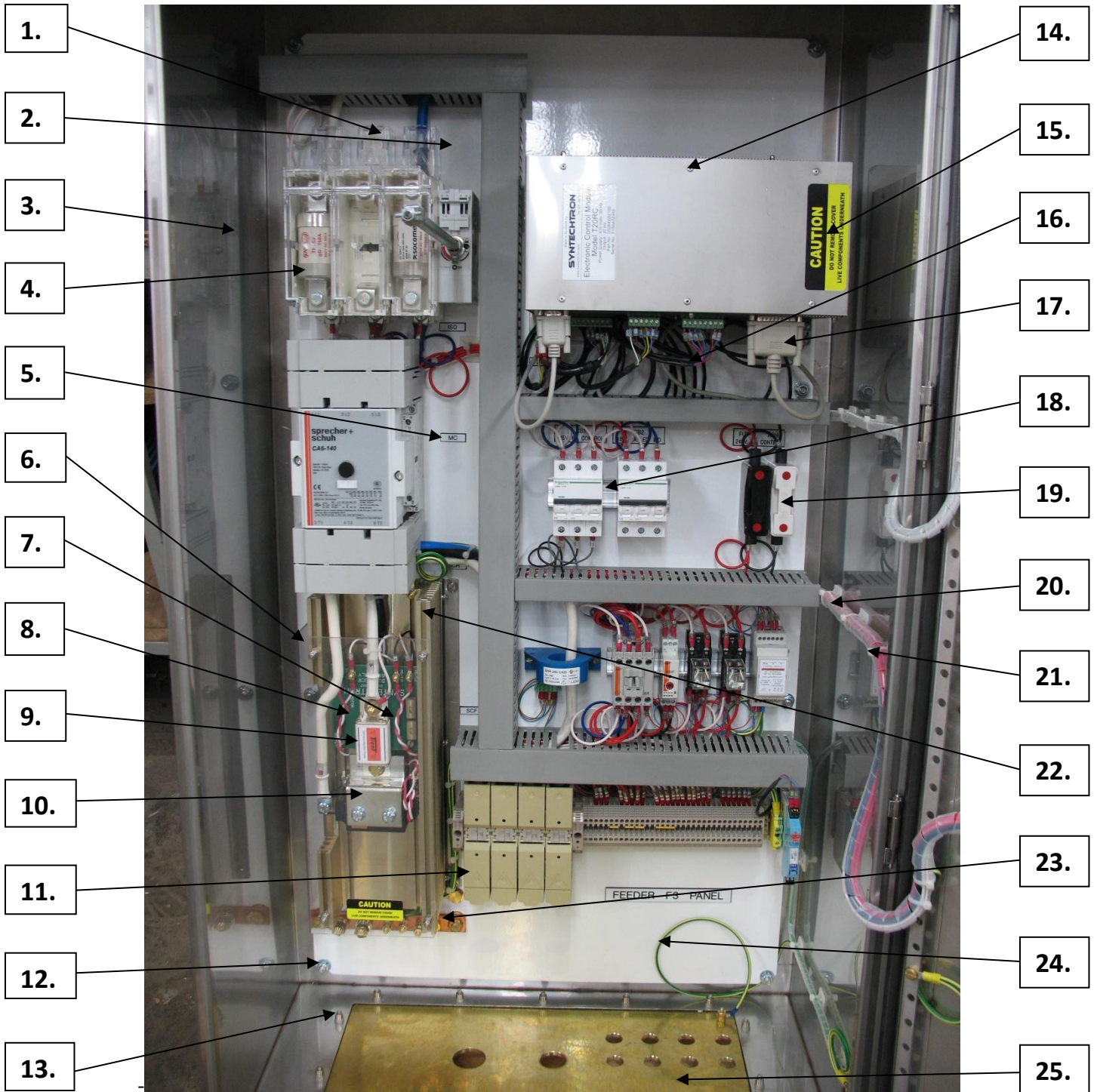


# MEM30007A Select Common Engineering Materials

## Product Study

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Part No.	Name	Material Type	Process
1	Fuse Holder Cover	Polystyrene  Translucency, intricate shape, and feel (rigid borderline brittle).  Alternative:	Injection molded.
2	Controller Panel Base	Mild Steel Powder Coated  Weight, strength, and that its powder coated for corrosion  Alternative: Stainless steel, or aluminium	Steel is hot rolled into a sheet which is then cut to size, sand blasted to remove scale then powder coated painted. Powder coating is a dry powder typically applied electrostatically and then cured under heat. The powder can be either a thermoplastic or thermoset polymer.
3	Controller Enclosure	316 Stainless Steel  Weight, strength, look. 316 over 304 for corrosion resistance which is priority for appearance.  Alternative: 445M2 Stainless steel for superior otherwise 304.	After casting into a slab the steel goes through hot rolling forming. After the steel is formed most types go through an annealing (controlled heating and cooling) process to relieve internal stresses and soften the metal. To which then the steel is descaled either through a number of processes such pickling, or electro-cleaning to which then the steel is cut to size by water jet, punched, guillotine, sheared, etc. The steel is then finished as stainless steel is often in situations where appearance is critical, before then going to the fabricator/end user.
4	160A Supply Fuse	Tin Plated Electrolytic Annealed Copper  No alternatives die to design rules & requirements.	The copper is formed into a tube then annealed to soften the copper before it is formed so that the copper does not crack during forming and crimping. The copper tube is cut to length, the inside is then sized before the end is pressed flat and the excess trimmed and finally the bolt hole is then punched. Then the lug is tin plated to resist corrosion.
5	Label	Traffolyte  When look at side on differing layers visible coupled with text engraved contrasting colour and label thickness.  Alternative: Polyester label	Traffolyte is made from phenolic plastic sheets that are sandwiched together. The sheets need to have different colours to each other so that when one layer is engraved away it reveals a contrasting colour. Phenolic is a type of plastic that is made from the reaction of formaldehyde and phenol.
6	SCR Cover	Polycarbonate  Translucency, strength and reason for use.  No alternative due to reason for polycarbonate, (safety guard).	Polycarbonate pellets are melted to a desired temperature before adding various additives it is then it is formed under pressure through either extrusion or into a mold.

7	SCR Control Wires	<p>PTFE (Teflon) Insulation Identification by feel and area of use (high temperature resistance required).</p> <p>Common for electrical insulation requiring higher than normal heat rating.</p> <p>Alternative: silicon wrapped fiberglass insulation.</p>	<p>Cold molding. Fine powdered PTFE is forced into a mold under high pressure. After a setting period the mold is then heated allowing particles to form a single mass.</p>
8	PCB Board	<p>Epoxy Glass Fiber Sheet (FR4 Fiberglass).</p> <p>The most common for PCB board material.</p> <p>Alternative: FR2 phenolic cotton paper or FR3 cotton paper &amp; epoxy.</p>	<p>FR4 is made from sheets of Prepreg which itself is constructed from glass fiber matting which has been impregnated with the epoxy resin. A standard 1.6mm is made up of 8 layers of Prepreg and the outer copper layers. The Prepreg and copper layer are stacked up together and placed into a large press which bonds all the layers into the final laminate. Note "FR" denotes flame retardant.</p>
9	SCR Fuse	<p>Ceramic</p> <p>Hard feel, high temp resistant properties, electrically insulating.</p> <p>Alternative: Epoxy Resin</p>	<p>The ceramic made by taking mixtures of clay, earthen elements, powders and water being shaped into desired forms. To which then the part is fired in a high temperature oven.</p>
10	SCR Link Plate	<p>Tin Plated Copper</p> <p>Surface finish and colour. Common on electrical components.</p> <p>Alternative: Zinc plating.</p>	<p>Plating the copper in tin is primarily done with two methods either the hot dip process or electroplating process. The hot dip process consists of the tin being melted within a pot and copper is dipped through this melted tin. The electroplating process consists of the object going through a chemical bath to which with the help of a rectifier and DC electric current is passed through this results in electroplating.</p>
11	Line Termination Bar Cover	<p>Polyphenylene Sulfide (PPS)</p> <p>Good shiny surface finish, commonly used on covers &amp; switches.</p> <p>Alternative: ABS plastic.</p>	<p>PPS in this application was processed through injection molding. Other common methods of processing are extrusion and extrusion blow molding. Processing can be hampered due to its high melting point, PPS can be processed in the range of 300-350 degrees C.</p>
12	Panel Hold Down Nut	<p>G8.8 Steel Zinc Coated</p> <p>Very common bolt coating for corrosion resistance.</p> <p>Alternative: Nickel plating.</p>	<p>The zinc plated coating is applied through electrolytic treatment. This process is where the nut is submerged in a liquid containing zinc and an electric current is applied so that the zinc forms a coating over the nut.</p>

13	Controller Gland Plate Bolt	<p>304 Stainless Steel G70</p> <p>Bolt head marking, colour.</p> <p>Alternative: 304 stainless steel bolt. Must be of stainless steel for corrosion resistance and good appearance.</p>	<p>Stainless steel bolts are made by cold forging large steel wire rods which are uncoiled and cut to length. Using special tooling the wire/rod is then cold forged into the right shape using a series of dies and/or molds. For more complex bolt designs some additional turning or drilling may be needed. After these processes the bolt is then heat treated to harden or soften the bolt to the required properties.</p>
14	Control Module Rivet	<p>Aluminium 6082</p> <p>Colour, and common alloy number used for stressed members with good corrosion resistance.</p> <p>Alternative: Stainless steel rivet.</p>	<p>Rivets stem and rivet bodies are made from wire. The wire is cut before being punched into multiple dies to form the required shapes. The stem is then put through a roller die to form grooves. Both the stem and rivet body are then annealed to relieve internal stress before the stem is then inserted into the body.</p>
15	Control Module Label	<p>Polyester with 3M 467 Adhesive</p> <p>Finish, toughness, chemical resistance.</p> <p>Alternative: Polyethylene label.</p>	<p>For polyester a laser printer is required as they use a powder toner rather than liquid ink. This toner is actually powdered plastic and during the printing process the toner is fused/melted onto the surface of the label sheet.</p>
16	Signal Cable Heat-shrink	<p>PTFE (Polytetrafluorethylene)</p> <p>Most common type of heat shrink material.</p> <p>Alternative: Fluorinated ethylene propylene (FEP).</p>	<p>Heat shrink tubing is heated to just above the polymer's crystalline melting point and expanded in diameter, often by placing it in a vacuum chamber. While in the expanded state it is rapidly cooled.</p>
17	D25 Cable	<p>ABS Plastic</p> <p>Most common polymers that electrical equipment structure is made from. Good molding characteristics, strong.</p>	<p>ABS is made commonly through the process of emulsion. Too which then it is injection molded to then form the required plug shape.</p>
18	DIN Rail Mount	<p>Aluminium 6061</p> <p>Colour, weight, common extrusion alloy.</p> <p>Alternative: Zinc coated steel.</p>	<p>Aluminium is extruded by forcing it through a shaped opening in a die to which it becomes an elongated piece with the same profile as the die opening.</p>

19	Control Fuse Holder	<p>Phenolic Plastic Identification by research. Previous industry materials used were Bakelite or porcelain.</p> <p>Most superior for design and common material for fuse holders.</p> <p>Alternative: Porcelain, ceramic, these were industry standard previously.</p>	<p>A laminated plastic created by the impregnation of layers of a substrate with a resin, which is then formed utilizing heat &amp; pressure. The resins are generally phenolic, silicone or melamine epoxies while the substrate materials range from paper and cotton to glass.</p>
20	Spiral Cable Wrap	<p>Polyethylene</p> <p>Cheap, tough, flexible, high chemical resistance, shiny surface finish.</p> <p>Alternative: Heat stabilized nylon.</p>	<p>Made by extrusion from granules of plastic heated until melt then forced through a die.</p>
21	Cable Tie	<p>Nylon</p> <p>Identified by knowledge and strength, toughness properties.</p>	<p>Injection Molding. Pellets are introduced into an injection molding machine where converted to a molten state, which is then injected into steel molds.</p>
22	SCR Heat Sink	<p>Anodized Aluminium 6063</p> <p>6063 alloy due to its good extrusion properties the complex intricate profile required of the heat sink. Anodization due to its ability to stop galvanic corrosion.</p> <p>Alternative: Copper although much more costly.</p>	<p>Aluminium is extruded. The anodizing is usually performed in an acid solution which dissolves the aluminium oxide at a balanced rate to form a coating with nano-pores to which allows dye to be absorbed after which a sealing solution seals the dye.</p>
23	Earth Bar	<p>Annealed Copper</p> <p>Industry Standard.</p> <p>Alternative: Copper clad aluminium or tin plated aluminium are considered best alternative.</p>	<p>Copper billets are cast to which then they are hot formed into bar before being annealed so that copper bars resists cracking when being fabricated.</p>
24	Gland Plate Earth Wire	<p>PVC Plastic Insulation</p> <p>Insulating properties, good heat resistance, tough, flexible</p> <p>Alternative: Chlorinated Polyethylene (CPE) is industry favoured alternative.</p>	<p>Process of extrusion at high temperature.</p>

25	Gland Plate	<p>Annealed Brass</p> <p>Colour, and location of use. Plate used for structural rigidity, brass used for softness (easier drilling for cable entry) and preferred over aluminium for earthing properties.</p> <p>Alternative: Stainless steel sheet metal, or aluminium plate if plate required.</p>	<p>Brass is cast into “cakes” to which then it is hot rolled into the shape required. The brass may need to be annealed along this process as the brass gets more difficult to work and loses its ductility. The brass is annealed one last time before its final cold roll to achieve final precise dimensions and finish.</p>
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