Chapter 68

Styrene-Maleic Anhydride Copolymer

General Discussion of Joining Techniques

Arco: Dylark

All Dylark resins work very well with a multitude of assembly procedures including mechanical fastening, solvents, adhesives, spin welding, ultrasonic welding, and vibration welding.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Welding

Arco: Dylark

Any technique which creates a melting of the joint surface of the Dylark parts can usually be successfully employed in assembly operations. Vibrations to create frictional heat are useful for joining large parts. Spin welding, which develops frictional heat by rotating one Dylark resin part against another is useful for round parts. Hot plate or fusion welding uses a heated surface, momentarily in contact with the mating surfaces to create the weld with localized melting. Heat staking (or swaging) uses a heated platen or probe to flatten a stake or deform an edge to create an assembly. Elecromagnetic induction welding (EMI) creates melting and welding through controlled electromagnetic heating of metal particles within a special plastic gasket applied to the joint interface.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Ultrasonic Welding

Arco: Dylark

Dylark resin parts may be rapidly and economically joined to each other using ultrasonic equipment, which induces high frequency (ultrasonic) vibrations at the joint between the parts. The resultant heat, together with applied pressure causes a discrete area within the joint to melt and then resolidify, welding the two pieces of plastic together.

Dylark resins have been successfully ultrasonically welded to other amorphous thermoplastics with similar melting temperatures.

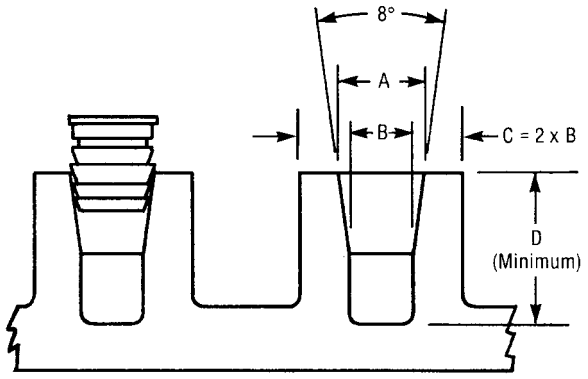
Ultrasonic welding is generally used with, but not limited to, smaller parts due to equipment size limitations. Ultrasonic equipment is also used for staking and spot welding of Dylark resin parts.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Ultrasonic Inserts

Arco: Dylark

Ultrasonic insertion is a fast, economical, and reliable method for installing permanent metal threads in molded Dylark resin parts. Inserts can often be inserted right at the molding machine by the machine operator. In properly designed Dylark resin bosses, ultrasonically installed inserts result in low residual stress since the plastic uniformly melts around the insert during insertion.



Thread Size	Insert OD "	Length "	Lead-In Dia A "	Diameter B "	Minimum Depth D "
4-40	.171	1/4	.160	.136	5/16
6-32	.217	5/16	.210	.177	3/8
8-32	.250	3/8	.240	.200	7/16
10-32	.295	7/16	.280	.235	1/2
1/4-20	.375	1/2	.355	.325	5/8

These are typical values. Since ultrasonic insets vary in size and design, contact manufacturer of inserts for their recommendations.

Figure 68.1: Typical boss hole design for the use of ultrasonically installed inserts, Dylark styrene - maleic anhydride copolymer.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Mechanical Fastening

Arco: Dylark

Mechanical fastening systems are commonly used when assembling molded Dylark resin parts to metal parts, mechanical devices, electrical or electronic components, or other plastic parts. The key consideration in mechanical fastening, usually with metal fasteners, is that the part molded in Dylark resin does not become over-stressed due to improper installation, excessive loads, or poor joint design.

Although tapped threads and molded threads can be used with Dylark resin parts, the most prevalent fastening systems use various types of self-tapping screws, common bolts and nuts, threaded metal inserts, and rivets.

In a typical bolted assembly, both the male and female threads are made from steel or other metal. Because of the relatively high strength of these fasteners, it is likely that the plastic parts can become over-stressed well before the fasteners will strip. In general, these problems can be avoided with molded Dylark resin parts by following certain good design practices:

- The area under the fastener which bears on the plastic part should be kept large enough to distribute the clamping load and applied forces. This is usually done with large head screws, flanged nuts, or washers. This will help to avoid stresses that could cause fracture or long term relaxation problems.
- Assemblies involving Dylark resin parts should be designed so that the plastic part bottoms against a supporting member before extensive deformation occurs. This avoids unnecessary high bending stresses.
- The assembly torque should be controlled with the use of automatic torque controlled wrenches. Where assembly torque cannot be controlled, or must be high for other reasons, stepped washers or shoulder screws can be very effective since the axial force exerted on the plastic part is limited by the metal to metal contact.
- Flat head screws should be avoided unless the assembly torque can be accurately controlled. The wedging action from the tapered underside of the head can easily create damaging stresses. If the screw head must be below the surface, a pan head screw and a counterbored hole is preferred.

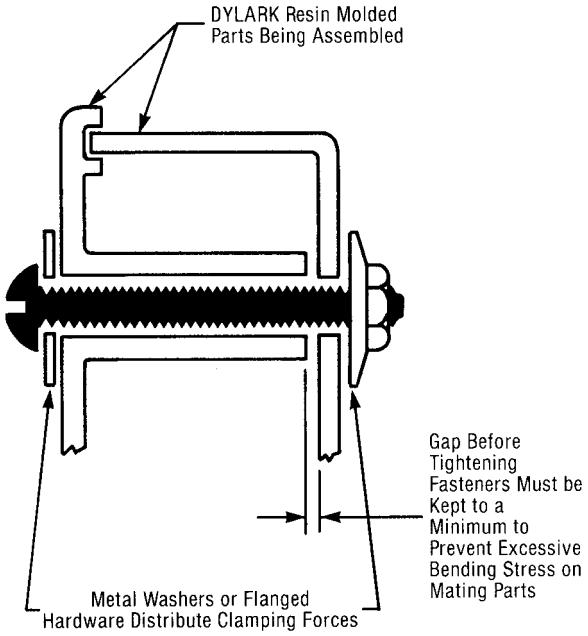


Figure 68.2: Bolted assembly, Dylark styrene maleic anhydride copolymer.

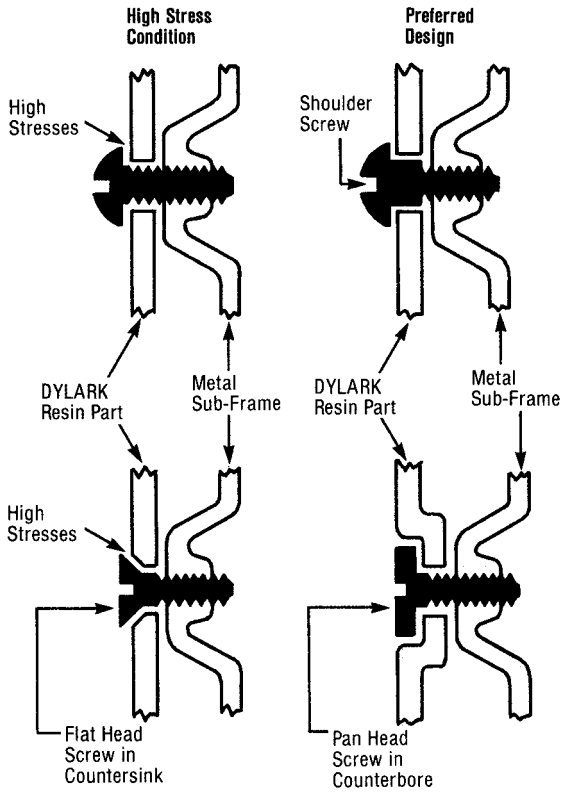


Figure 68.3: Managing stress levels in the plastic part when assembly torque cannot be controlled, Dylark styrene maleic anhydride copolymer.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Tapping and Self-Tapping Screws

Arco: Dylark

In a wide variety of applications, molded Dylark resin parts are used in assemblies which are put together only once. In these cases, or when only a few disassembly and assembly operations are anticipated, self-tapping screws work very well. There are many types of self-tapping screws. Some cut the thread, some cold form the thread, and some do a combination of both. Generally, the thread cutting variety are preferred with Dylark resin parts since they tend to exert less hoop stress on the boss than the thread forming type. A wide variety of self-tapping screws are specifically designed for plastic parts. These screws are well suited for high volume, assembly line production, have excellent pull-out resistance, and do not over stress a properly designed Dylark resin boss.

As with all mechanical fasteners, torque should be controlled to acceptable limits, the boss must be sized properly to handle the screw installation stresses as well as the applied loads, and the bearing areas under the screw heads must be adequate.

Oils used on screws for protection or lubricity can adversely affect end-use performance of engineering resins. Dylark resins have demonstrated superior performance under end-use conditions with and without applied strain. Testing with the specific screw oil is suggested.

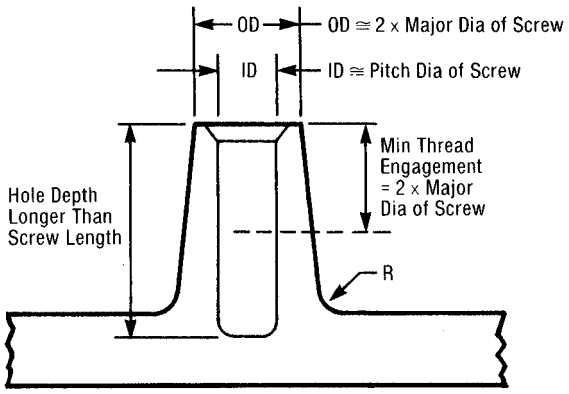


Figure 68.4: Boss design guidelines for self tapping screws, Dylark styrene maleic anhydride copolymer.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Threaded Mechanical Inserts

Arco: Dylark

Since it is often inconvenient and uneconomical to use loose machine nuts in plastic part assemblies, threaded metal inserts are usually used when frequent disassembly and reassembly is required. This also avoids cross-threading which could occur if self-tapping screws are disassembled and then reassembled. The same basic considerations used with bolted assemblies must be observed. In addition, the strength of the mounting boss must be considered.

There are many types of threaded metal inserts which can be used with Dylark resin. Where ultrasonic equipment is not available or can't be used, similar threaded metal inserts can be installed by heating the insert. Others are designed to push-in, spin-in, or expand after insertion when the mating screw is installed. Some of these inserts can create high hoop stresses in the accepting boss; they should be used with adequate boss design and checked with final product testing. Where assembly requirements are less demanding, boss caps, which go over the boss, can provide an economical metal thread which actually reinforces the boss against the expansion that might be created by a self-tapping screw.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.

Adhesive and Solvent Bonding

Arco: Dylark

Several solvents can be effectively used to join together parts molded in Dylark resin with similar parts or with parts molded from other plastic materials. The principle involved is to use a solvent which will dissolve the surface of the mating parts sufficiently to allow the parts to be joined together after the solvent has evaporated. A key advantage of this method is that it is fast, usually no joint surface preparation is required, and the final joint does not depend upon chemical bonding of a separate adhesive material.

The key limitation of solvent welding is the precautions which must be taken in handling the solvents. Federal, EPA, and local regulations must be observed regarding ventilation, worker protection, and solvent recovery.

Solvents such as methylene chloride (dichloromethane) or methyl ethyl ketone (MEK) which work well with polystyrene, ABS, and polycarbonate also work well with all Dylark resins. A thicker, slower evaporating solvent cement can be prepared by dissolving 10 to 20% Dylark resin into the solvents.

Parts molded in Dylark resin may be bonded to other plastic parts, metals, ceramics, glass and most other substances using a variety of commercially available adhesives. In general, epoxies, polyurethanes, and acrylics work very well with molded Dylark resin parts. Silicone rubber adhesive/sealants (RTV) and cyanoacrylates (instant adhesives) have also been successfully used with Dylark resins.

Cleaning and surface preparation is important with all adhesives since they must make intimate contact with the part surface for maximum adhesive strength. The preparation, mixing, application and safety recommendations from the adhesive manufacturer must be followed.

Reference: *DYLARK Engineering Resins Design Guide*, supplier design guide (ACC-P120-882) - ARCO Chemical Company, 1988.