Advantages and disadvantages of mechanical joining engineering essay

Mechanical joining is the part method to joint components together, which mechanical joining is accomplished have expanded, the number of joints produced continuous to grow and the performance demands and expectations are becoming greater. The joining process can remain the prolific, pervasive, and important of joining process. There has two type of this process such as mechanical fastening and integral mechanical attachment, or simply integral attachment. Mechanical joining involves the attachments of components in an assembly or elements in structure through the either an integral of the components or elements or use of the supplement device called a fastener, which resulting in integral mechanical attachment and mechanical fastening. Mechanical joining is used joining or install structure from details parts and structural elements. For the both manifestations of mechanical joining, load are transferred from one component or element to another strictly through the development of purely mechanical forces rising from the interlocking and resulting interferences or vice versa of two or more components or components and fasteners. There are no dependences on the development of any primarily or secondary atomic, ionic, or molecular bonds between the components materials. Mechanical is the components to fabricated from different materials to be joint, There is no has for chemical and physical interaction. If the interaction occurs when seen as problematic such as galvanic corrosion or galling and seizing during adhesive wear. Mechanical joining is used to create assemblies or structures from detailed parts or structural elements.

Mechanical joining offers many advantages compare to other fundamental joining process. The first advantages of mechanical joining is this process unique in that is primarily dependent on the structures to be joined, and only dependent on the materials which these structures are composed. No bonds need to be formed to accomplish joining, nor do any need to be broken to accomplish disassembly. Where, mechanical joining methods or technique uniquely allow simple practical disassembly without damaging the parts involved. The second advantages is uniquely allows intentional disassembly without damaging parts involved. Where, this is very frequently essential for the purpose of portability, maintenance, services replacements, of damages parts, modification, of the assembly or structures. The third advantage is no bonds formed. Where, is the most form of mechanical fastening and some form of integral attachment permit relative intentional motion between joined parts. The fourth advantage is mechanical joining may no changes to the chemical composition or microstructures the materials compare the parts being joined. Where, this is because the forces needed to hold the joint components together. And no atomic â€" level bonding are created and no chemical interaction. The fifth advantage is this joining allows the different materials to be joined together such as metal to glass, and metal to polymers. The sixth advantage is provides a simple of achieving of structural damage tolerance beyond inherent material damage tolerance.

Mechanical joining also has disadvantages such as, all mechanical joining fastening and integral attachment is that stress concentrates at the point of fastening or attachment. For example of fastener requiring hole is screw, key, bolt, rivet and pin. The hole can create the stress concentration unless the fastener is interference is specially process to create a compressive residual stress to offset tension stress. For other type is virtually all integral attachment, stress concentrates at the point of attachment. Stress concentration is particular concern in fatigue critical structure, but it can more aggravate accelerate corrosion. The second disadvantages of mechanical joining is mechanical joining related to above mentioned stress concentration is that the utility of mechanical joining. Stress concentration can lead to fastener hole or attachment feature distortion and loss of effectiveness. The utility of mechanical joining can be limited by materials anisotropy, particularly if that anisotropy leads to weakness through the fastening thickness, as in most laminated composites. The result can be fastener pull through or pull out. The third disadvantages of mechanical joining can be the open nature of the joint between points of fastening, around fasteners and between points of attachment. Such as joint allows moisture, water, air, fluid intrusion, permits leaks, and can accelerate corrosion in the oxygen starved crevice and dissimilar electrochemical nature of the joined materials or any residual stresses. For example, the ever present stress concentration. Other disadvantage of mechanical fastening is more intensity for assembly can be high, especially for high performance system. There can also be a weight when compare to integrally attached as welding, brazing and soldering. The joining can loosen in service as a result of vibration. Most cost or other process can be higher for some integral attachment method. It also can experience loosening and disassembly from flexing especially during impact from dropping, or material stress relaxation.

As stated earlier, most joint are critical element of assembly and structure. They can be the weakest links in some assemblies or structures, thereby being the most likely areas of an assembly and structure to fail. Therefore, joints demand careful design for all forms of joining, including mechanical fastening and integral attachment. The most important aspects of the design joints is identifying the sources and estimating the magnitudes and directions of applied internally generated loads. The sources of loads can be weight or force, example from snow, water, wind, or other parts of the structure. The forces from interacting structures, internal inertial forces, vibrations, transients, especially from startups, shutdowns, and faults, temperature changes or thermal excursions, fluid pressures, prime movers. The joint element is held together by shear in the fastener and the bearing force or stress in the joint elements created by the fastener. For example of fastener properly used for bearing-type shear-loaded joints are nails, rivets, pins, and key. When these joint is operating properly, the frictional force developed precludes the fastener from having to carry and apply a bearing force by not allowing slip of the joint element. Bolt can be used for joining such as a rivet is used on occasion. Because of the mechanical fastener is a stress and develop a stress concentration in the joint element. Mechanical fastener also relative to one another help distribute loading and also to edge of the joint elements. Shear loaded types of joints and fasteners being described here, and for tension loaded types of joints and fasteners to be described in the next subsection. Bearing force is imposed by this type of fastener hole and plastic deformation of the material surrounding the hole on opposing structure elements. The bearing force also tear and slugs of material from the join element. This can occur under static loading and the situation can be even worse for dynamic loading by impact fatigue.

Mechanical joining is used to joining or install of structure from details parts and structural elements. For the both manifestations of mechanical joining, load are transferred from one component and also the element to another the development of purely mechanical forces and rising from the interlocking, and result can more components and fasteners. There are no dependences on the development of any primarily or secondary atomic, ionic, or molecular bonds between the components materials. Mechanical allows components fabricated from different materials to be joined, since there is no need for chemical or physical interaction. If the interaction occurs it is usually seen as problematic such as galvanic corrosion or galling and seizing during adhesive wear.

The procedure for design shear loaded fastened joint is the allowable stress design procedure. This procedure can be more fasteners are assumed to carry on equal share of the applied force and load. This procedure also is only truly valid for joint that are composed of perfectly material, which is not real case and at least valid for joint containing multiple row of fasteners. This procedure is generally accepted and is perfectly safe when conservative allowable are used, such as the result of imprecise analysis. Shared loading also depend on all fastener being same size and material. Shared loading also has fitting with equal tightness in fastener hole. Empirical used to determine the maximum working stress that can be allowed in the fastener. Under the stress design procedure for bearing type shear loaded joints, the various elements of the joint such as including structural members and fasteners and must be sized so that the following conditions are satisfied, the fasteners can be not damage in shear by overload, the joint plate can be not damage in tension by overload, the fastener holes cannot be deformed by bearing loads from the fasteners, and the fasteners will not tear out of the joint plates at edges. These various modes of potential failure are shown schematically. None of these modes will occur if the appropriate allowable stresses are not exceeded in the fastener, for example shear. The advantage of the allowable stress design procedure is not precludes failure under any conditions such as although it does so under normal operating condition, but that it allows the designer to choose the mode by which the structure would ultimately damage. This procedure allows the designer to choose the low joining in the structure. The double-lap shear is composed of ASTM A36 steel, contain five 22 diameter ASTM A325 steel bolts arranged as shown although the specific pattern does not matter for symmetrical loading, the bolts have a thread pitch of 2mm per thread or, in the Unified system. Shear plates in the double lap joint the unthreaded portion and one passes through the threaded portion of each bolt. The problem is to determine the various stresses produced in the fastener and in the joint plates by a load of 300kN (67, 000 lbs. force). The shear stress produced in a fastener given load depend on the actual cross sectional area of the fastener, and this is affected by whether the fastener is threaded and unthreaded in the region through which a shear plane in the joint elements passes. For example, the shear stress where F is the force in kilo Newton′s (or lbs. force), b is the number of shear planes that actually pass through the unthreaded fastener or portion of the shank of a fastener.

Joint is critical elements of assemblies and structures. They can be weakest link in some assemblies or structures, thereby being the most likely areas of an assembly or structure to damage or low joining parts. Joints demand careful design for all forms of joining, including mechanical fastening or integral attachment. The most important aspects of the design of all joints is identifying the sources and estimating the magnitudes and directions of applied and internally generated loads. The loads also can be static, for example for steady or unchanging and dynamic in combination. The sources of loads can be weights or forces as from snow, water, wind, or other parts of the structure. The forces from interacting structures, internal inertial forces, vibrations, and transients especially from startup, shutdown, and the temperature can be changes in thermal excursions, fluid pressures, prime movers. The joint element is shear in the fastener and the bearing force. Stress also created by the fastener. The examples of fasteners properly used for bearing type shear loaded joints such as nails, rivets, pins, and keys . In friction shear loaded joints, the fasteners must create a significant amount of clamping force on the joint, holding the joint elements together and prevent any motion and slip. The resulting friction created between the joint and the result of their coefficient of friction and applied normal force. When these joints are operating properly, the frictional force developed precludes the fastener from having to carry and apply a bearing force by not allowing slip of the joint elements. Only bolts can be properly used for such joints, certain rivets are used on occasion. The shear stress in bearing type connections is related to the arrangement of the pieces or structural elements comprising the joint. The advantages of single-laps are ease of assembly and cost, and the advantages of double laps are elimination of eccentric loading and reduction of shear stresses at each of the multiple shear planes in the fastener in bearing type joints.

Finally, the designer must ensure that fasteners will not tear out of the joint plate. This can only occur if the fasteners are located so close to the edge of the plate that the shear stress developed by bearing exceeds the ability of the plate material to sustain that stress over all shear planes from the fasteners to the edge. In fact, tear out cannot occur if there are multiple rows of fasteners, given sharing of load by all fasteners. This is because a slug of material near the edge could not tear out if the strain to elongation at the fastener holes, because by bearing did not exceed the strain needed to cause shear overload over all the aforementioned planes.

In this illustrative example there are multiple rows of fasteners, so tear out could not occur and the holes on the second and third rows from the edge would have to elongate in bearing by enough to cause tear out of slugs between the first row and the edge. If there were three bolts in a row, there would be six shear planes such as on areas to cause tear out. For friction joint, the design analysis is slightly different than for bearing type joint. Friction joint also the intent to have an appropriate fastener, for example a bolt or machine screw or, sand rivet to apply a clamping load high enough to cause sufficient frictional force to applied the load, The fastener is protect from ever having to carry shear or cause bearing. The necessary slip resistances, as the frictional force to apply in this way is called, depend on greatly of the surface conditions of the structural joint element materials at their joint faying interface. Typical slip coefficients of friction can be found. Values can be seen to be highly dependent on the treatment and condition of the joint surfaces, which must be carefully stipulated and controlled for such friction-type joints to work reliably. For example, surfaces cannot be painted unless painting is called for and an approved paint is used. No lubricants can ever be used if not planned for at the design stage. One even needs to worry about water infiltration in such joints, since water acts as a lubricant and drastically lowers the slip coefficient of a joint consider being dry during operational service. The ultimate strength of a friction type joint is considered to be the low of resistance or bearing strength. The bearing strength is more strong by using the same equations as in IE 2. 2, except that one would enter the related stress for each material used in the joint plates and fasteners and apply the force that would be required to produce a stress to cause shear overload in the fasteners, tensile overload in joint plates, elongation such as in bearing overload and can be fastener holes in every part joint plates, or fastener tear-out from the joint plate near its edge. The low force is then compared the force to cause slip because to earlier for an assumed value of average fastener joint preload. The lower of these determines the ultimate load-carrying capacity of the friction-type joint. Mechanical allows components fabricated from different materials to be joined, since there is no need for chemical or physical interaction. If the interaction occurs it is usually seen as problematic such as galvanic corrosion or galling and seizing during adhesive wear.

Mechanical joining is used to create assemblies or structures from detailed parts or structural elements. Mechanical joining, load are transferred from one component or element to another strictly through the development of purely mechanical forces rising from the interlocking and resulting interferences or vice versa of two or more components or components and fasteners. There are no dependences on the development of any primarily or secondary bonds between the components materials. Mechanical joining is actually processing in a locking feature plastic deformation. Such joints can only be employed with materials that exhibit plastic deformation, yet still retain their strength or mechanical integrity. Ductile metals and thermoplastic polymers are the two example such as formed in folded tabs, crimps, hems, and punched stakes are good example in metals, and crimps, hems, and punched or heat set stakes are example in thermoplastic polymers. Mechanical joining is allows parts to assembly to move relative to one another to provide needed system functionality, while maintaining part arrangement, proximity, and orientation. The process causes no chemical and microstructure will be changes in the material being joined, so dissimilar types can be combine easily, and all can be intentionally disassembled to allow maintenance, service, repair, upgrade, ultimate disposal, or portability The joining parts assemblies and a structure element is joining in structures mechanical joining, which involves two major subclasses of mechanical fastening and integral in mechanical attachment. Mechanical joining is to attachment of components in an assembly to use of either an integral feature is used the part to install the supplemental device called a fastener resulting in integral mechanical attachment and mechanical fastening, respectively. Mechanical joining is a load to transfer from one parts or element to another strictly and the development of purely mechanical forces arising from the interlocking and resulting interference of two or more components, or component and fastener. Mechanical is the components to fabricated from different materials to be joint, There is no has for chemical and physical interaction. If the interaction occurs when seen as problematic such as galvanic corrosion or galling and seizing during adhesive wear.

Mechanical joining is used to create assemblies or structures from detailed parts or structural elements. Mechanical joining has been critical to engineering such as in manufacturing, structure, and also in construction. Mechanical joining is very important because the result more fastener from other process. Mechanical joining has more advantages. The detailed methods by which mechanical joining is accomplished have expanded, the number of joints produced continues to grow, and the performance demands and expectations are becoming greater.