Design of Jig and Fixture for Bending Of High Tensile Steel and Mild Steel L-Shape Plate

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Abstract:

Configuration is the element of a machine's life where the best effect can be made in connection with staying away from major calamities. The designer should ensure that the machine is safe to set up and work, safe to install, easy to maintain, easy to repair, and safe to decommission. In applied mechanics, the behavior of a slim structure component denoted by bending characteristics. When subjected to an external load which is perpendicular to the longitudinal axis of the given component. Some operation of bending, they performed manually means first they hot the particular part of L-shape plat from which plate has to be bend. In heating the plates they decide several temperatures of a furnace according to the material of plates, a gauge of plates and thickness of the plates. After heating the plates they bend the plates by operation of hammering which performed by a human. So, for this manual process skilled personnel are required and if it is not available then the bending process is stopped. Due to above problem, next process is a delay in material flow and then the not fulfill the customer requirement at a time. The aim our aim of the project is to develop of jig and fixture from scratch, which will be used for the fastest, time reducing, easy to handle the process, and less skilled workers are required for bending process.

Keywords: Jig and Fixture, Bending, Tensile Material, L-Shape Plate, Design.

1. Introduction to jig and fixture

Jigs:

It is a work holding device that holds, supports and locates the workpiece and guides the cutting tool for a specific operation. Jigs are usually fitted with hardened steel bushings for guiding or other cutting tools.

A jig is a type of tool used to control the location and/or motion of another tool. A jig's primary purpose is to provide repeatability, accuracy, and interchangeability in the manufacturing of products.

A device that does both functions (holding the work and guiding a tool) is called a jig. An example of a jig is when a key is duplicated; the original is used as a jig so the new key can have the same path as the old one.

Fixtures:

It is a work holding device that holds supports and locates the workpiece for a specific operation but does not guide the cutting tool. It provides only a reference surface or a device.

What makes a fixture unique is that each one is built to fit a particular part or shape. The main purpose of a fixture is to locate and in some cases hold a workpiece during either a machining operation or some other industrial process.

A jig differs from a fixture in that it guides the tool to its correct position in addition to locating and supporting the workpiece. Examples: Vises, chucks.

2. Limitations of the existing system

Some operation of bending, they performed manually means first they hot the particular part of L-shape plat from which plate has to be bend. In heating the plates they decide several temperatures of a furnace according to the material of plates, a gauge of plates and thickness of the plates. After heating the plates they bend the plates by operation of hammering which performed by a human.

So, for this manual process skilled personnel are required and if it is not available then the bending process is stopped.

There is 3 people are required, first one for hammering, second for adjustment of plates, third for checking the bend angle with the help of gauge and time requirement is also high.

Due to above problem, next process is a delay in material flow and then the not fulfill the customer requirement at a time.

3. Objective of the new system

The objective of new jig and fixture in bending is as follow:

- To reduce the time taken to complete the job
- To reduce excessive hot processes carried out on plates
- To reduce the skilled workers
- To reduce the damage to the product
- To fulfill the customer's requirement at a time
- To increase the safety of the workers
- To reduce the required workers for doing the job
- Jigs and fixtures increase the productivity by eliminating the individual marking, positioning and frequent inspection. The operational time taken by it is also decreased due to improvement in speed, feed, and depth of cut and due to high clamping rigidity.
- Interchangeability and quality: Jigs and fixtures assist the production of components in large numbers with a very high degree of accuracy, uniform quality and irreplaceability at a reasonable cost.
- Skill reduction: There is no need for skillful setting of work on the tool. Jigs and fixtures make it viable to enlist amateur or semi-skilled machine operator to significantly reduce the labor cost.
- Cost reduction: Higher production, depletion in waste, easy to assemble and savings in labor charges results in an ultimate deduction in cost per unit volume.

4. Problem Identification
Current scenarios

- Some operation of bending, they performed manually means first they hot the particular part of L-shape plat from which plate has to be bend. In heating the plates they decide several temperatures of a furnace according to the material of plates, a gauge of plates and thickness of the plates. After heating the plates they bend the plates by operation of hammering which performed by a human.
- So, for this manual process skilled personnel are required and if it is not available then the bending process is stop.
- There is 3 people are required, first one for hammering, second for adjustment of plates, third for checking the bend angle with the help of gauge and time requirement is also high.
- Due to above problem, next process is a delay in material flow and then the not fulfill the customer requirement at a time.

5. Development of jig and fixture

- In the development of jig and fixture for any type of bending process we just do the following things :
- Material selection
- Design
- Costing
- Planning
- Operation of anyone/two bending process in detail

For the development of jig &fixture, we have to take certain criteria like in industry which make tower parts for the transmission lines. So for that, they have heavy duty and light duty L-shape plates. By requirement of bending, we have to develop jig and fixture.

- For the development of jig and fixture first step is select perfect material for L-shape plates material, according to its mechanical properties as well as chemical properties are compatible with each other.
- Then costing and design of the jig and fixtures. Costing is related to material, its making cost, and its application cost. The design is based on measurement and it does also depend on its working application where it is used, like heavy duty or light duty.

6. Material Selection

- For the selection of material we doing various testing on different materials which described in types of steel grade and after performing them, we choose mainly three materials which properties described in mechanical properties.
- Types of testing :
- Universal testing machine

- Tensile testing machine
- Impact/compressive testing machine

7. Types of steel grade:

1. Mild steel IS 2062/e250
2. High tensile IS 2062/E250
3. Mild steel EN 10025-S275jo
4. High steel EN 10025-S355jo
5. Jisg3101 gr SS540
6. Nonconforming steel
7. Mild steel ASTM A36/A36M
8. High tensile ASTM A572/A572MGR.50
9. High tensile CSA 300W
10. Mild steel ASTM A36(-20C)
11. Mild steel CSAG40 21M GRADE 3WWP

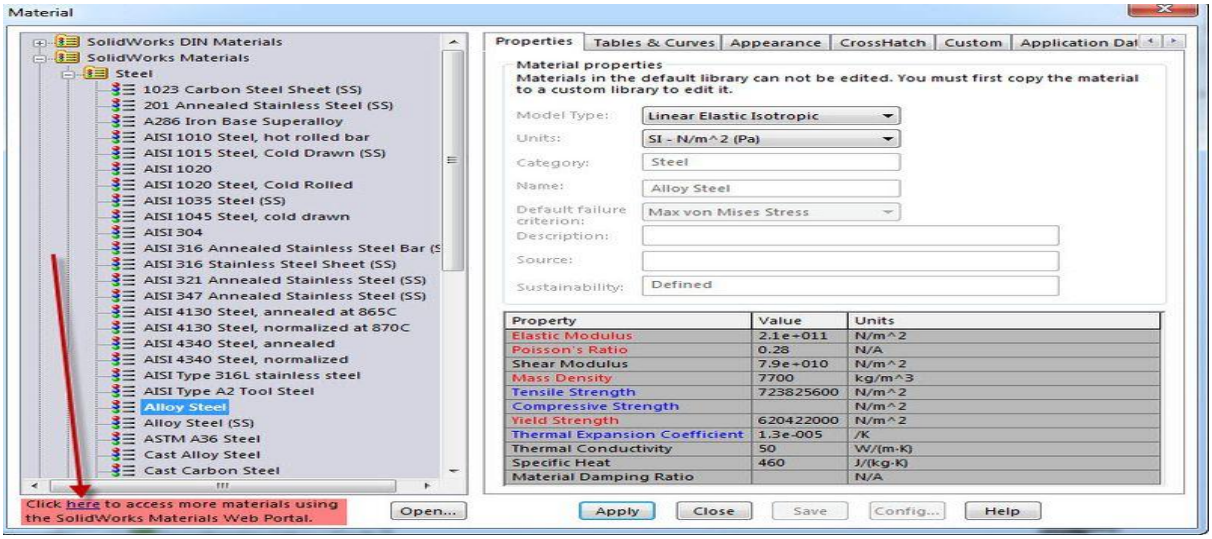
8. Mechanical properties:

SR no.	SPECIFICATION	GRADE	CHEMICAL COMPOSITION OF THE PRODUCT ANALYSIS % MAX	MECHANICAL PROPERTIES MIN. IN MPA (N/MM2)

			C	MA	S	P	CU	N	CE	YS	UTS	EL%
1	MILD STEEL EN 10025-2 2004	S275JO	0.21	1.60	0.045	0.045	0.60	0.014	0.40	275 265 255	410-560	23
2	HIGH TENSILE EN 10025-2 2004	S355JO	0.23	1.70	0.045	0.045	0.60	0.014	0.4	355 345 335	470-630	22
3	HIGH TENSILE GOST 27772-08	S345-1	0.70	1.20-1.80	0.045	0.04	0.35	0.014	CR-0.3 NI-0.3	4 TO 345	490 470 460	21

9. Model design

After the selection of material, for the simplification of design software, we take similar property material is alloy steel, which mechanical properties are close to the above-selected material.



Here above picture shows the mechanical property of the alloy steel. In the design software, we make the model according to previous requirements of the company and situation of the working environment.

8. Conclusion

These paper reflected basic design parameter of jig and fixture for bending material which having good tensile characteristics when taking data for L-shape Plate .

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