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Design and Development of B20 TKD Lid Air Leakage Testing Unit

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***Abstract* - Battery is very important factor nowadays as the world is going to be Changes to Electric vehicle (EV) instead of petroleum or diesel vehicles. There are many challenges for battery manufacturing industries as we need reliable batteries with high backup and charges within less time. If battery has less leakages, their working and chances of accidents are less. As a battery lid leakage is main challenge for manufacturing industries. There are many leakages tester, but battery manufacturing industry uses air leakage tester for testing lid leakages.**

Keywords: Battery, EV, Air leakage tester.

I. Introduction

As we know, World is going to step forward in automotive industry as well as in smartphone manufacturing hub. In this automotive industry, for some applications we need electricity. But, instead of electricity we use battery because of its mobility, simple construction and its automatic charging feature. So, battery is an alternative back up option these days.

As example, automotive as well as smart phone needs batteries. Because this is electronically connected world. Everyone needs high power back up batteries for their smart phones for long time use as well as batteries for vehicle as fossil fuels are vanishing as use day by day increases.

So, battery is very important product these days. But this battery manufacturing industry faces some problems. Battery lid leakage is one of the main problems. So, this industry needs units for leakage testing units for battery lid. There are many units are available for leakage testing but their costs are very high. So, industries need units at optimum cost.

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II. Overview of Battery Manufacturing Process

In battery manufacturing process, there are two parts i.e., a. battery cage and lid formation b. formation and filling electrolyte.

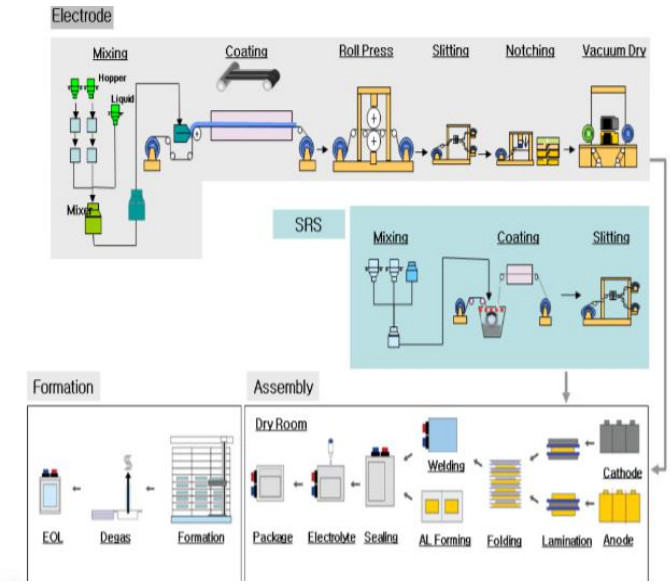

Figure 1: Manufacturing Process of Battery

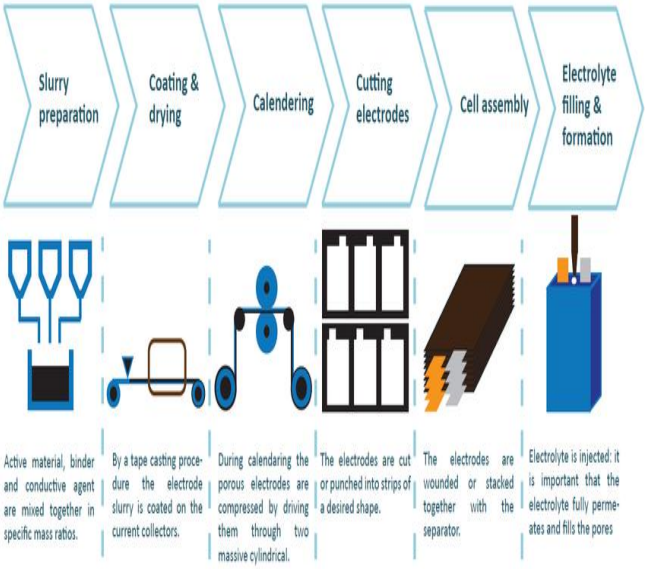

Figure 2: Manufacturing Process of Battery

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III. Need of Leakage Testing

As shown in above figure (manufacturing process), when we manufacture battery lid by molding process to form terminal hole, we need to insert core rod from one side. Due to this core rod after molding, holes present on sides of battery lid will remain open.

Figure 3: Hole created on side of battery lid

That open hole created after molding of battery lid, we need to close that open hole. So, we use filler material to close the hole on side of battery lid.

Figure 4: Filler Material

Only filler material is not enough to close that hole. After filling filler material, we need do ultrasonic welding for perfect closing of that hole.

Mainly, ultrasonic welding is the joining or reforming of thermoplastic through use of heat generated from high-frequency mechanical motion. It is accomplished by converting high-frequency electrical energy into high-frequency mechanical motion.

Here, ultrasonic welding is performed on hole after filling the filler material for proper closing of hole.

Figure 5: Filler Material fill in hole created after molding process

Figure 6: Ultrasonic Welding

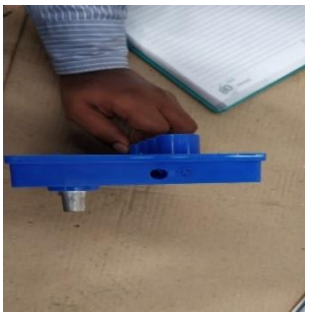

Figure 7: After Welding

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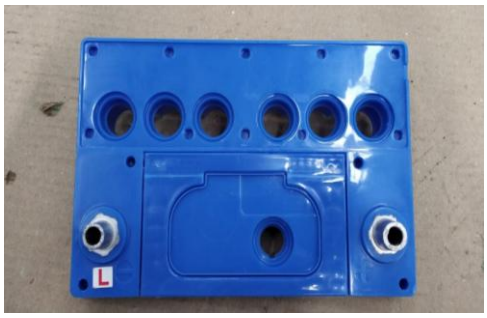

Figure 8: Battery lid

After performing ultrasonic welding operation on hole of battery lid, we need to check leakage. If there is no leakage, then ultrasonic weld performed on hole is correctly welded.

So, to check weld quality we need to take leakage test on point where ultrasonic welding is done.

IV. Details of Present Method Battery Lid Air Leakage Tester

4.1 Present Procedure

After manufacturing of Battery body and lid, we need to check the leakage of lid for successive operating of battery.

Figure 9: Leakage Testing Unit

Figure 10: Leakage Marking Manually

The above fig. shows Leakage testing unit in which air is passed through value to testing object, which inspects the leakages of battery lid of two sides where ultrasonic testing is performed. Here, compressor is used for source of air for testing purpose.

First, air is passed in battery lid through valve which is clamped on a table. Then water is spread manually on ultrasonic welded point present on side of battery lid whose leakage have to check. If bubbles are formed on point which is ultrasonically welded, then we consider as there is a leakage and vice versa. During testing if we get bubbles on point of ultrasonic weld mark on side of battery lid i.e., we consider there is a leakage, and then we mark that leakage manually using pencil. Similar process is done on another point created due to ultrasonic welding on side of battery lid.

And then the lid who has leakage, they were send for rework.

V. Design of Proposed Unit

5.1 Design of Proposed Unit

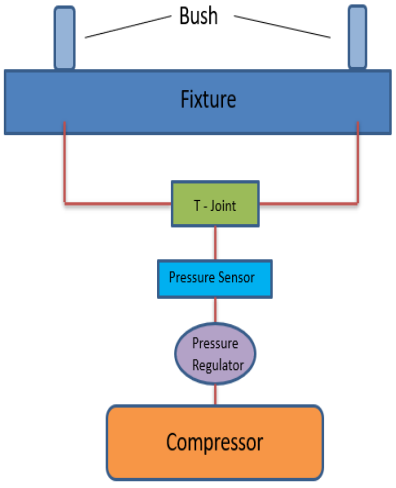

Figure 11: Block Diagram

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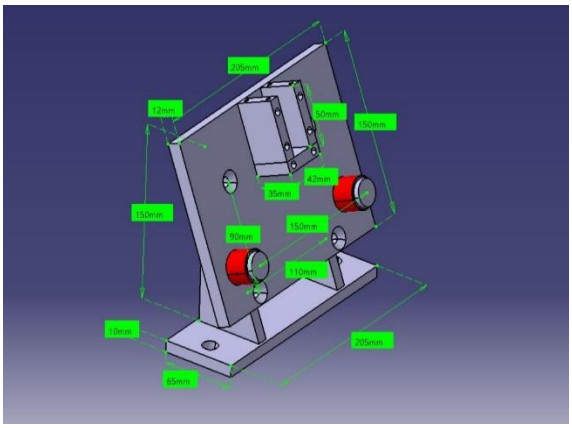

Figure 12: Cad Model of Proposed Unit

Construction Details

Part Name: Ground Base Plate
Material Used: Aluminum
Dimensions: 205 x 85 mm
Operations performed: Cutting, Grinding, Drilling, etc.

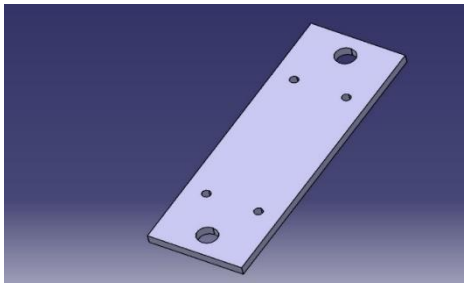

Figure 13: Ground Base Plate

Part Name: Base Plate (Vertical)
Material Used: Aluminum
Dimension: 205 x 150 mm
Operations Performed: Cutting, Grinding, Drilling, Tapping, etc.

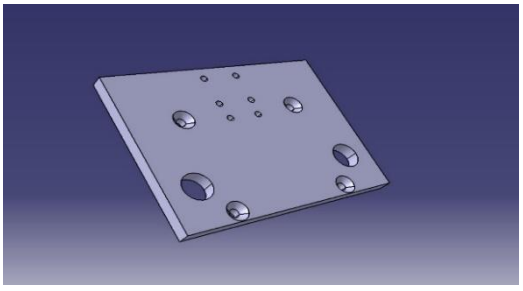

Figure 14: Base Plate (vertical)

Part Name: Support Block (To guide Marking Pointer)
Material Used: Aluminum
Dimension: 42 X 35 mm
Operations Performed: Cutting, Grinding, Drilling, Tapping, etc.

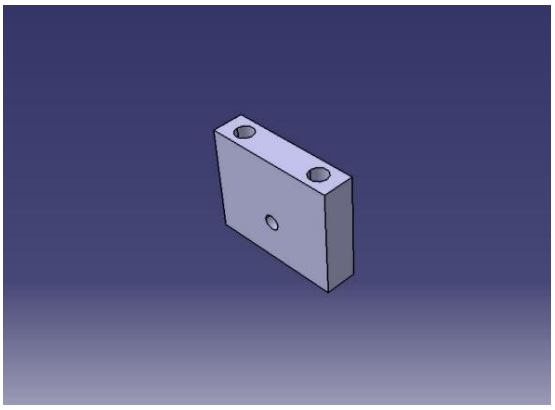

Figure 15: Support Block (To Guide Marking Pointer)

Part Name: Support Block (To keep toggle)
Material Used: Aluminum
Dimension: 35 x 50 mm
Operations Performed: Cutting, Grinding, Drilling, Tapping, Threading, etc.

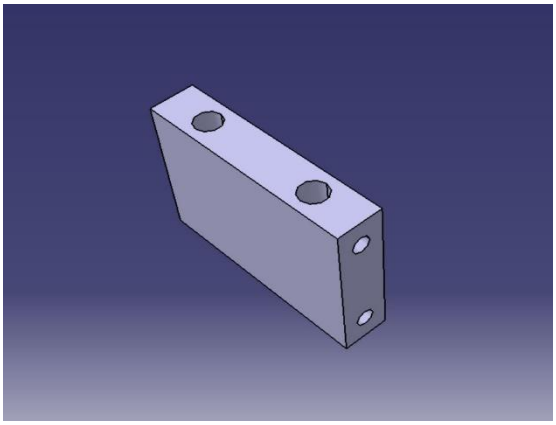

Figure 16: Support Block (To keep Toggle)

Part Name: Support Plate (vertical)
Material Used: Aluminum
Dimension: 150 x 60 mm (17^0 inclination angle)
Operations Performed: Cutting, Grinding, Drilling, Tapping, Threading etc.

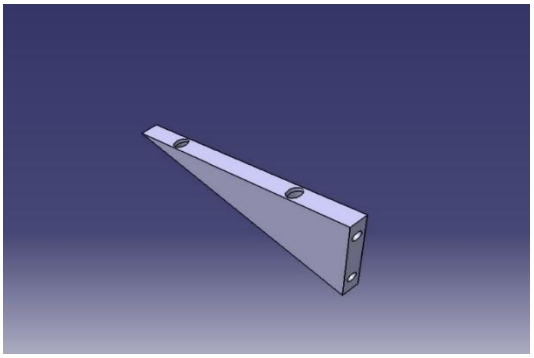

Figure 17: Support Plate (Vertical)

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Part Name: Valve
Material Used: Aluminum
Dimension: Dia.25 mm
Operations Performed: Cutting, Turning, Facing, Drilling, etc.

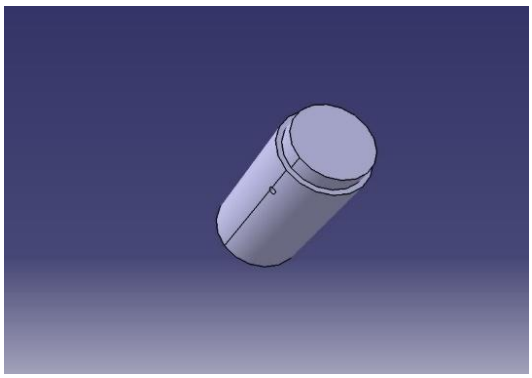

Figure 18: Valve

Part Name: Bush
Material Used: Silicon Rubber
Dimension: Dia.27 mm
Operations Performed: Cutting, Grinding, Drilling, etc.

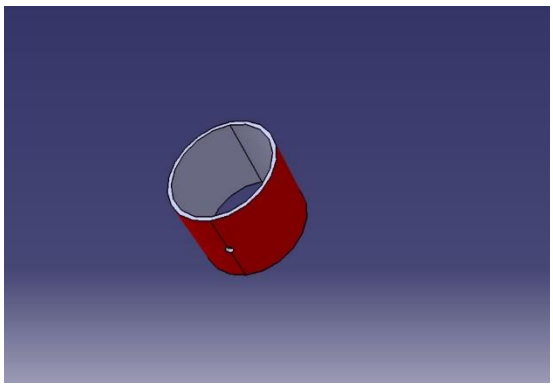

Figure 19: Bush

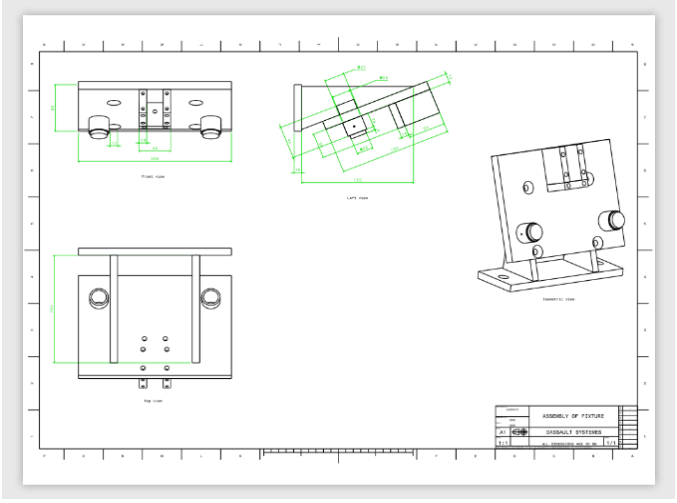

Figure 20: Assembly

VI. Working of Proposed Unit

Working medium is air and water is eliminated in this proposed unit. It is purely pneumatic system. As there is central compressor present, we connect our proposed unit to that compressor.

Air is passed through compressor line to pressure regulator. Here, Pressure regulator is used to convert high pressure input of compressor to low pressure i.e., required system pressure for leakage testing. Then converted pressure is passed through pressure sensor which confirms the required pressure is gain or not. Then air is passed through T-joint.

T -joint is used for circulating equal pressure to both sides, where leakage test is performed. Then air is passed to valve. Valve is covered with silicon bush on which battery lid is kept which is to be tested. In bush there is a hole which is as same as on lid where is leakage to be tested. Bush is used between valve and battery lid for tight fighting. And silicon bush is sticked on Aluminum valve with help of additive.

Air passed from compressor is kept some couple of min. in a system for accurate leakage testing. And this holding and controlling of system is done by relay circuit, which have a timer arrangement also. Also, there is a cylinder-pointer arrangement for automatically marking of undefeated work piece.

Besides this there is a relay circuit which is between pressure sensor and T-Joint. Relay circuit is basically heart / control unit of proposed unit.

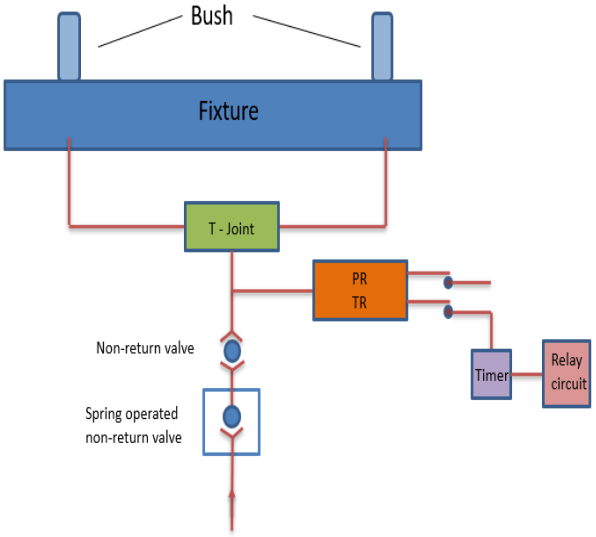

Figure 21: Relay Circuit

Relay circuit is used for actuating cylinder motion which is used to mark the defected workpiece i.e., during testing if workpiece is not defected, then relay circuit actuates cylinder-

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pointer arrangement which marks that workpiece due to which we easily understood defected and undefeated workpiece.

Also, main use of relay circuit is to maintain or control pressure in the system. As system is working on low pressure, we need to maintain that pressure during testing. As we are holding the air in system for accurate leakage finding, relay circuit is main thing for this controlling and holding air for accurate leakage testing. Because accurate leakage testing is only possible when there is a relay circuit with timer arrangement, then and then only we can hold the air in system and detect the there is a leakage or not.

VII. Advantages and Disadvantages of Proposed Unit

6.1 Advantages

As we are eliminating drawbacks of pervious system in proposed system. We get following benefits:

a) Increased Productivity:

As we are decreasing time of inspection in proposed unit as we are doing inspection of both sides of lid at same time with this, we are replacing manually marking system to automatic. In this way we are increasing productivity.

b) Decrease Inspection Time:

As in proposed unit we are doing inspection of both sides of lid at same time than pervious method, therefore inspection time decreases.

c) Less Fatigue to worker:

As in previous method inspection for both sides of lid done separately, due to this worker gets fatigue. But. In proposed unit we are doing both side inspection at same time, due to this worker gets less fatigue.

d) More Safety:

As we are eliminating water in a proposed system, so there are less chances of accident. And wastage of water after use is also eliminated as total water required for inspection in previous system is totally eliminated in proposed unit.

e) Automatic Marking system:

In previous system, we mark non-leakage product manually due to this inspection time increase. So, we replace this manual system with automatic marking system which is operated by relay circuit.

6.2 Disadvantages

As we are overcome from most of drawbacks of previous system, we have some disadvantages with proposed system. They are as follows:

a) Requires Proper Maintenance:

As all parts are pneumatic, they require proper maintenance. If proper maintenance is not done, then they don't work properly and we get improper inspection results.

b) Replace Silicon Bush after certain Inspections:

As we are using bush of silicon in between valve and product for tight fitting. Dur to air pressure there are chances of bush wear as air passes through hole in bush to product.

VII. Material Selection

SR.NO	COMPONENT	MATERIAL	QUANTITY
1	Pneumatic Cylinder	Aluminium	1
2	Base Plate	Aluminium	1
3	Toggle Clamp	Aluminium	1
4	Supporting block	Aluminium	3
5	Frame Plate	Aluminium	2
6	Pneumatic Pipe (Dia. 6mm)		1
7	Digital Pressure Sensor		1
8	Rubber Bush	Silicon	2
9	Valve	Aluminium	2
10	Pneumatic Nipple		2
11	Pneumatic T		2

(Aluminum is used for most of parts because of its properties like low specific weight, easily shaped, rolled, drawn and welded, and good resistant against corrosion, etc.

And Silicon is used for bush as air is directly contacting with it. As it is good resistant against corrosion and don't react with air.)

VIII. Result Analysis

Before	After
Water is used for inspection purpose.	100% Elimination of water and pure pneumatic system is developed.
Inspection time is 19 sec.	Inspection time is 12.05 sec.
Manual Marking System for marking non-leakage product.	Automatic Marking System for marking non-leakage product.
Productivity is less due to improper inspection method.	Productivity is increased up to 10-15% due to accurate inspection.
Sometimes delays to meet targets due to improper inspection method.	Meets target before or on time.

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IX. Actual Photos of Proposed Unit

Figure 22: Actual Photo of Proposed System

X. Conclusion

After observing all process of inspection of battery lid, we conclude that present method has some drawbacks like wastage of water, fatigue to labor and required more time for inspection. So, we need to modify testing unit by eliminating above drawbacks mentioned.

And proposed unit will overcome all drawbacks of present testing method like elimination of water, automatic marking system, system with relay circuit, etc.

And Due implementation of proposed unit, productivity increases up to 10-15% than previous method.

Due to elimination of water, firstly accident chances decrease with this wastage of water is totally eliminated.

XI. Future Scope

It has a vast and wide scope to develop the similar solutions as per the need of individual industry. This has large scope all over India for the similar industries.

The most of units used for testing are conventional and have some limitations. It is very difficult to modify this conventional unit as it is process industry.

In future, we will visit other plant located all over India, and try to propose the solution for the respective problem of Battery lid leakage testing unit. By providing an alternative method, we will try to eliminate wastage of water, simple unit with less fatigue to labor and main safety of operator working on it.

REFERENCES

[1] Catalogue of various battery manufacturing industries.
[2] Articles on battery leakages and accidents happen due to this problem.
[3] By visiting battery manufacturing industry.

Review Papers:

[4] Battery Manufacturing Process - Heiner Heimes, Achim Kampker
[5] Ultrasonic leakage testing - Yuji Watanabe
[6] Method and apparatus for testing battery casing for leaks - Daniel Orlando, Brookfield
[7] Method and apparatus for detecting the location of a leak in a pipe - Leslie William Bedwell

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