ICC: A Breakthrough In Quality

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STMicroelectronics is known as a global independent semiconductor company and as a leader in developing a wide spectrum of microelectronics solutions. The ST Group was formed in 1987 through the unification of SGS Microelectronics of Italy and Thomson Semiconducteurs of France. The corporate headquarters is located in Geneva, Switzerland.

ST Muar began its operations at Tanjung Agas Muar in 1974. It first employed 250 staff and expanded comprehensively. In 2016, the company recorded an employment of 4,000 staff of which 1,200 are engineers and technicians. The Muar manufacturing site is a part of the Back End Test & Manufacturing group which also includes manufacturing plants in Casablanca (Morocco), Malta, Calamba (Philippines) and Shenzhen in China.

Today, the company has diversified its products and solutions towards smart driving and Internet of Things (IOT). In addition, ST constantly looks into ways in innovation and product creation that upholds energy saving, improves healthcare and promotes security.

The five business segments of ST are smart power, MEMS and sensors, automotive, microcontrollers and digital consumer & ASICs. Since its first production, ST Muar has undergone rapid growth and has achieved many milestones, certifications and recognitions including ISO9001:2008, ISO14001:2004, OSHAS18001:2007, ISO/TS16949:2009.

Innovative & Creative Circle: People Engagement

The Innovative and Creative Circle (ICC) is a way of quality improvement that enhances employees' participation in contributing ideas and executing significant programs in ST. In 2014, a total of 34 ICC teams were formed in an effort of paving path towards better quality. ST Muar participated in the National ICC Convention held in Kuala Lumpur from 2nd to 4th November 2015.

The team which was known as Fast & Furious was represented by 6 members had embarked on "QFP Damage Frame Reduction" project. The project kicked off in January 2014 and was successfully accomplished in June 2014. The project was initiated to support a "Hand's Free-Zero Touch" program and to eliminate defects such as damaged wire, broken wire, bond-off, bent lead, weld-off, sagging wire and foreign material in ST products to give ST customers product with Zero Defects.

Every machine at ST Muar is equipped with Factory Work System (FWs). It is a Lot Tracking Platform that is able to capture yield losses and scrap volume produced in each production line. In December 2013, it was discovered that there were 4,840 damage frame unit which were rejected. After the launching of "Hand's Free- Zero Touch" program, rejected damage frame cases had increased drastically to 10,480 units. Thus, Fast & Furious Team was formed to find innovative and creative ideas to solve the frame damage issue.

The Factory Work System had recorded 85% of damaged frame at the input station and 15% at the output station of the molding machine. A frame is rejected when there is any physical indentation, dent, bent or twist on it. Furthermore, a frame has an elastic deformation. When the impact is greater than 330gm, it changed the frame structure and will be classified as permanent deformation, or damaged frame. Based on this scenario, Fast & Furious had defined the target to reduce the defect rate of the frames to 4,000 units per month. The team had targeted to reduce yield loss by 0.04%.

To illustrate further, a frame is a semi-final product that is produced after the mold process. A good structure of frame should be maintained at every level of QFP process flow. The complete process flow involves 15 processes. An additional 7 days is usually needed when damaged frames were detected in the mold process. Not only that, this problem resulted in more complaints from customers, shareholders and suppliers as well as internal and external stakeholders.

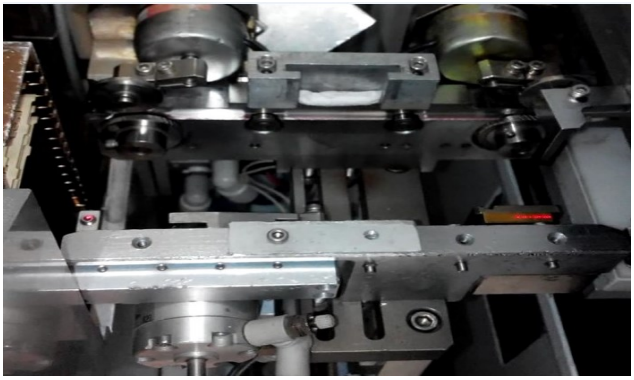
Fast & Furious knew that this problem must be resolved immediately. The team used Fishbone and Causal Relationship diagrams for root causes identification. They further used Tree diagram and concluded that there were five main causes with regards to high frame damages at the mold process that were categorised under machine, material, method and man.

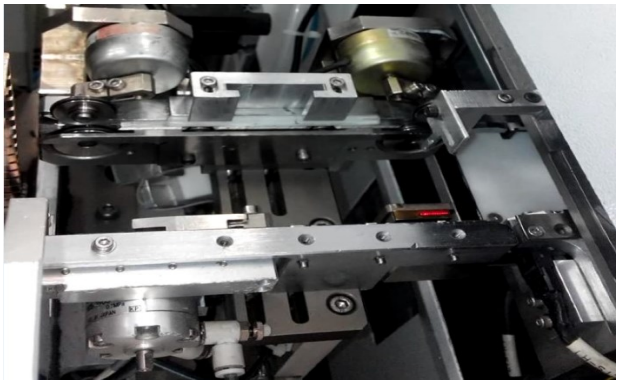
Root Cause	Action Taken
Frame stuck at metal roller	1. Metal roller was changed to rubber roller • The surface of the rubber roller balanced and the frame moved without any vibration as well as absence of foreign materials were recorded
Frame stuck in between Feeder motor 1 & 2	2. Feeder motor was equipped with speed control • Incorporated circuit that regulates speed of the feeder motor 3. Electronic circuit with sensor was used to cut off current supply if jamming occurs
Dented magazine blocked frame movement	4. Developed a magazine inspection jig • Magazine inspection jig is used to inspect magazine condition before using it
Alignment out of original position at the input loader	5. Developed a metal jig • Metal is used for a perfect jig setup by maintenance operators for alignment between magazine and track 6. Changed the track width to fix position by activating the sensor to prevent any reset action
Input elevator shifted from actual position	7. Placed a bracket in between the input elevator and the mold track • Plastic guard around the machine is placed to prevent the trolley from hitting the input elevator

ICC IN IMPROVING REJECTION RATE OF THE FRAMES

1. Metal roller was changed to rubber roller

BEFORE

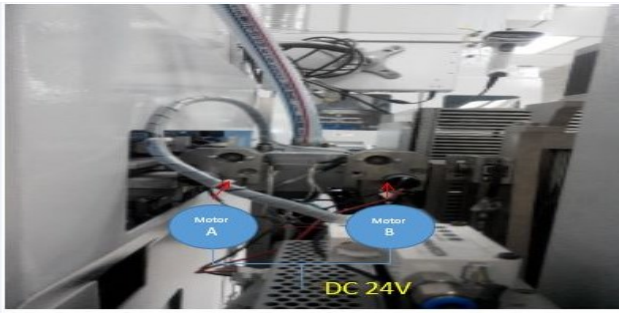




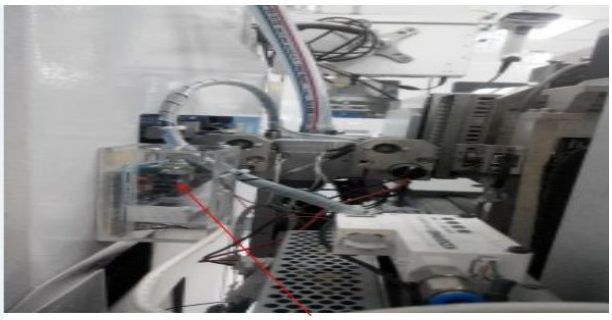
AFTER

2. Feeder motor with speed control

BEFORE



• Rotation Of DC 24 V Motor without speed control.

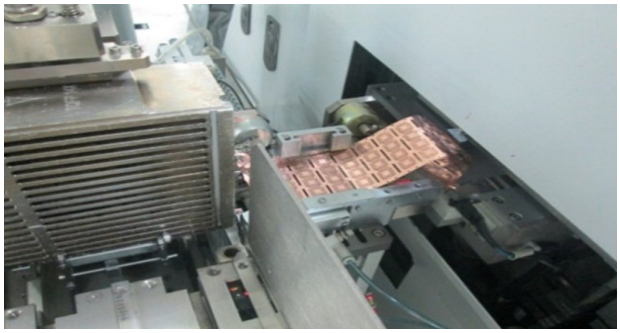


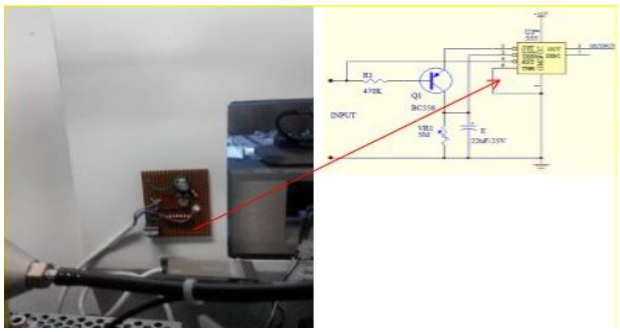
• Incorporated circuit that regulate speed of the motor.

AFTER

3. Electronic circuit with sensor to cut off current supply if jamming occurs

BEFORE

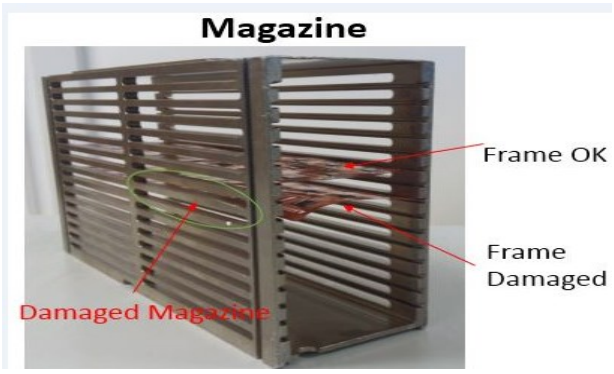


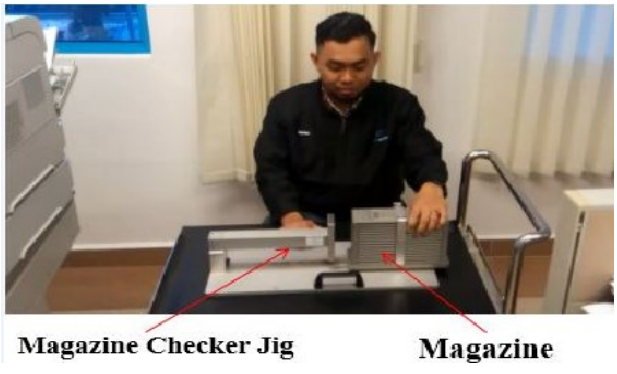


AFTER

4. Developed magazine inspection jig

BEFORE



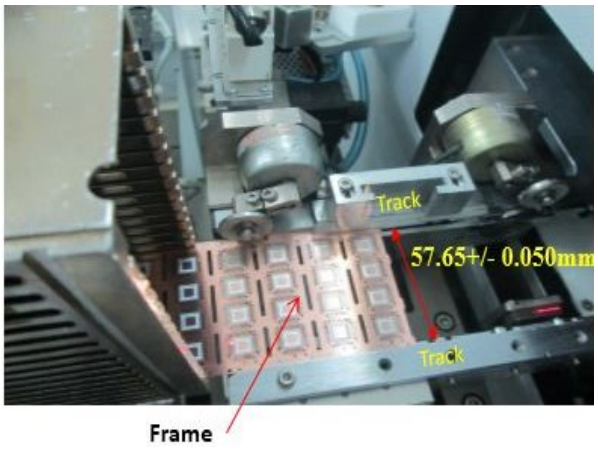


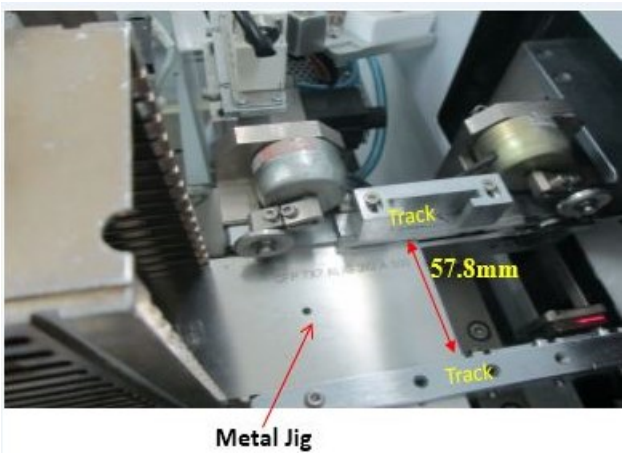
AFTER

ICC IN IMPROVING REJECTION RATE OF THE FRAMES

5. Developed metal jig

BEFORE

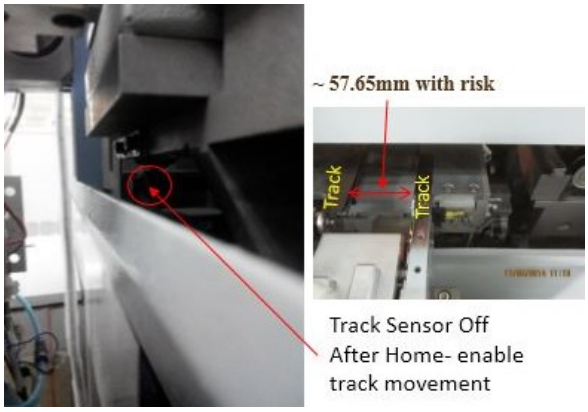


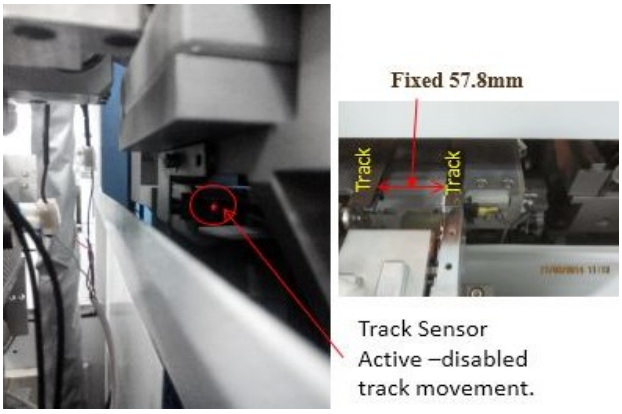


AFTER

6. Changed the track width to fix position by activating the sensor to prevent any reset action

BEFORE

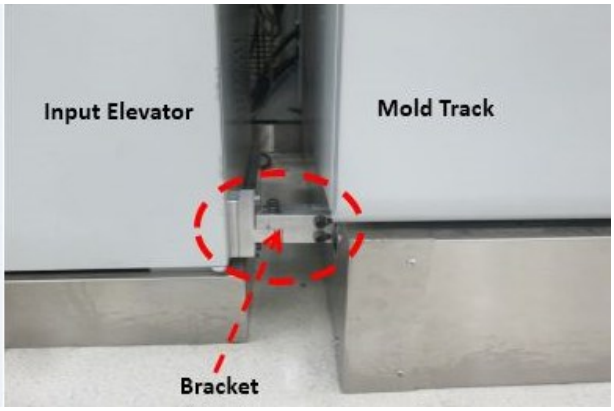




AFTER

7. Placed a bracket in between the input elevator and the mold track

BEFORE



AFTER

Analysis of ICC project in ST Muar

ICC brought tremendous benefits in overcoming the issue of high reject cases of damaged frame during the molding process. The seven ICC kaizen had decreased Damaged Frame from an average of 9,740 units to 3,907 units, amounting to a 59% improvement. It is recorded even today that the reject cases have been reduced to 3,440 units. Furthermore, this achievement had reduced the number of customer complaints. Previously, it was recorded that ST had received 49 complaints, and ST has simultaneously reduced it to 10 complaints. In 2015, ST did not receive any complaints with regards to the defects on frame. This ICC project had also reduced the frame yield loss from 0.1088% to 0.0369% after the implementation phase.

Furthermore, the average of hold lots for damages frame verifications by engineers has also been reduced to 85 lots as compared to 229 lots before the implementation of ICC. This has also decreased the time spent for holding the lots from 343 hours to 128 hours until today. With this achievement, Mean Time Between Interventions (MTBI) had increased to 30.8 minutes as compared to 24.2 minutes previously. This has resulted an improvement in equipment efficiency.

Most importantly, ST is proud to announce that the cost saving of this ICC initiative is RM2,861,323 per year. It was discovered that the reduction in the number of frame damaged had reduced the operation costs to RM97,250 per year. Overall, it is believed that ICC is able to channel ST towards efficiency in business sustainability.

COMPARISON BEFORE AND AFTER ICC IMPLEMENTATION