In 2002 EDiT iD Limited, a New Zealand based RFID Reader development company, discussed with ELPIJI Sdn Bhd of Malaysia who manufacture items that are used in the commercial and domestic LPG (Propane) sector, the opportunities that may be realised by deploying RFID tags onto each cylinder.

By the end of 2002 the direction was clear. EDiT iD Limited would commence the development of a low frequency RFID Reader solution that would meet the standards set by IECEx, an international standard for equipment operating in a potentially explosive environment.

The initial target for introducing the RFID system was to speed up the process of filling LPG gas cylinders when they are in an automated filling plant.

The ultimate target is to track and trace each gas cylinder as it moves from filling plant to distributor, to delivery to the end user, and back again to the filling plant. The process of distribution in many countries is torturous, with potentially many companies and individuals involved. For example, in Malaysia it is normal that a distributor obtains cylinders from a filling plant, then passes some of those cylinders to a sub distributor, who then passes them on to a delivery person for delivery to the end user. In the ideal scenario the end user, when the cylinder is depleted of gas, will hand the empty cylinder back to the person who delivered it originally, who will then return it to the sub distributor, who will at some stage return it to the main distributor, who will in turn return it to the filling plant. While this does occur most of the time, it does not happen every time. As usual, the exceptions to the rule create the necessity to have sophisticated software solutions.

ELPIJI and EDiT iD decided to concentrate on meeting the initial target's requirements, and then tackling the ultimate targets at a later time.

EDiT iD's first task was to be able to provide RFID Readers that could be safely used within the hazardous area of an LPG filling plant. Internationally there are two standards for equipment operating in hazardous areas where gas is involved. They are the ATEX standard and IECEx standard. It was mutually agreed that EDiT iD should develop their RFID equipment to meet the IECEx standards.

The IECEx standards are very demanding, very precise and in some instances open to interpretation. However, regardless of how EDiT id interpreted any sentence within the standard, the Approval Authority had the final decision without debate.

And so, by mid-2008 the world's first IECEx Approved RFID Readers were delivered.

In the meantime, Kosel Industries Sdn Bhd was busy modifying their filling plant software to enable the RFID system to be operated in filling plants where their equipment was installed.

While each cylinder may physically appear to be the same, they all potentially have a tare weight that is different from the norm. The tare weight is one of the two critical pieces of information that is required before attempting to fill the cylinder.

The other piece of critical information is the Date of Manufacture. Every country has a requirement for every LPG cylinder to be tested by a competent testing company on the ten-year anniversary from the date of manufacture. Some gas companies also require their cylinders to be refurbished every five years, again starting from the date of manufacture.

In the pre-RFID era of LPG filling plant operation, as each empty cylinder arrives on the conveyor, an operator keyed into a numeric keypad the tare weight of the cylinder, and visually verified that the cylinder was within the countries requirements for testing and within the company's requirements for refurbishment.

If the date requirements were not within the statutory or company requirements, those cylinders were removed from the conveyor.

Even with the operator solely concentrating on this verification process, each cylinder takes on average at least 30 seconds to verify that it should continue on the conveyor to be filled. As the cylinders cannot pass this point until verified, there is often a further delay, especially if the operator is busy doing other tasks as well.

The filling plant software, allocates each verified cylinder to a position in a queue. When the cylinder eventually comes to the front of the queue, it progresses onto a carousel. The carousel is a rotary platform that has the gas filling apparatus per position and a set of weigh scales per position. The cylinder exits the conveyor queue onto the carousel and the first action is to weigh the cylinder. While the cylinder is theoretically empty, it does always have some residual gas. The carousal's weigh system weighs the cylinder and knowing the tare weigh from the operators input and the type of cylinder from the initial set up, the filling plant software can calculate how much gas to pump into the cylinder. If the incorrect tare weight was input earlier, then the filling dispenser would attempt to put too much gas into the cylinder, thus wasting some through overflow, or not put enough gas in the cylinder and therefore having the possibility that an end user could get a partially filled cylinder. There are other processes to detect that the cylinder has not been fully filled in some plants. When the cylinder is deemed to be filled, the cylinder is automatically off- loaded from the carousel to the conveyor to continue its travel on the conveyor to other processes such as leak detection, weight check, cleaning, valve protection cap attachment etc. before being placed on pallets awaiting collection by distributors.

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Identified earlier in this report, the two most critical pieces of information that can delay the filling of the cylinders is the inputting of the tare weight information and the checking of the date of manufacture. With RFID this delay is eliminated.

Each cylinder has its own 125KHz tag attached. That tag's unique identity has a database record of the tag id together with the tare weight and date of manufacture. The creation of the database records and the installation of the tags on the cylinders is not done on the filling plant conveyor. It is done in a non-hazardous area, where there is no filling plant pressure. Each cylinder takes less than a minute to place the non-removable tag and record the tare weight and date of manufacture.

With RFID identification on cylinders, the process up to the time of joining the queue for filling is:

The cylinders are placed on the conveyor. They are stopped at the verification point. The RFID tag is read and the date of manufacture and tare weight is retrieved. If no tag is present, then the cylinder is automatically pushed to a side conveyor for rejected cylinders. If the database date of manufacture is not within the bounds of acceptability, the cylinder is automatically pushed to the side conveyor of rejected cylinders. If the date is acceptable the tare weigh is recorded in the queue position for later processing when the cylinder arrives on the carousel.

Using RFID, the process of accepting or rejecting a cylinder is two seconds. Compare this to a manual system where it takes at least thirty seconds, and requires a human operator. ELPIJI's decision to invest in RFID and new filling plant software is clearly justified.

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