

# Acid Unloading Arm Pressure Sensor System

Incitec Pivot Limited

## The Problem or Initiative:

At our Phosphate Hill manufacturing plant we decant approximately 900,000 litres of Sulphuric Acid per year. A series of interconnected Gatx rail containers are discharged through an air pressurised system. The transfer system is connected to containers with a Transfer Arm and the transfer itself is controlled via a remote DCS control system.

During the disconnection of the Transfer Arm it is vital that the system is brought to a neutral state to prevent the discharge of Sulphuric Acid or mist. The problem is that there is no way of positively confirming the neutral state of the arm other than control panel indication. This could result in an operator being sprayed with acid or being knocked over by the force of the arm being blown back.

## The Solution:

Previous attempts at a warning system relied upon a conductivity sensor which indicated that liquid was present in the arm. The sensor worked well under testing with water however Sulphuric Acid has a different specific gravity. This would tend to “Stick” to the sensor, bridging it out. This led to multiple false indications of a “Live” system and any subsequent repairs or diagnosis had to be carried out in full Acid PPE.

The system became so unreliable that the operators lost faith in the system and took no notice of the constantly flashing blue light. This in itself could have led to a serious incident if the Acid Arm was full of pressurised acid when it was disconnected from the Gatx container.

A new system has been developed and installed which picks up its data from multiple points. The system takes into account control valve positioning, system pressure (positive and negative) and control panel inputs. The system has an in-built prestart test panel and has been designed to “Failsafe” specifications. In the event of a fault with the control panel indication, the warning system triggers blue strobe lights which have been placed at eye level for maximum impact. It does not indicate what is wrong with the system but it does initiate the fault finding process.

## Benefits/Effects:

The system has been designed to monitor all the variables in the acid transfer control system. Being pressure related, it is also able to detect a negative pressure, which can have just as big a safety impact as a positive pressure. The pre-start and failsafe features reinforce its integrity and the blue strobe lights add that high impact notification.

This new approach has resulted in the elimination of carrying out the fault finding and repair process to the arm whilst it is connected to the Gatax container and potentially under pressure.

## Transferability:

The system would be able to be modified to suit any quick release system that relies on air pressure to transfer liquid.

## Innovation:

The problem was identified by our Materials Handling Department with the Health and Safety of the staff conducting the acid transfer being the driving influence. The challenge to find a solution was placed with our Electrical/Instrumentation Department. The initial indication system was designed and fitted on site, however it failed to deliver its promised results. This called for a total rethink on the

problem and the solution. The design underwent many changes on paper, before the new system was developed.

This new Sensor System has several pick up points for data. This allows for confirmation of multiple inputs. The system takes into consideration control valve positioning, system pressure (positive and negative) and control panel inputs. The true innovation lies in the ability to pre-test the Sensor System before it is connected. If a fault is detected, it can be repaired without the need to protect the operator from possible exposure to pressurised Sulphuric Acid. This has restored the confidence in the system.

The Acid Unloading Arm Pressure Sensor System was designed, built and tested on site.

The Acid Unloading Arm when connected.  
The Sensor System is mounted directly to the arm with the blue light clearly visible.



The pre-test unit mounted alongside the arm when stored.



Operator connecting Acid Unloading Arm to Gatax Container



Acid Unloading Arm with Sensor system mounted directly on top.

