

# Technical News Bulletin

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Fig. 1 PPC System at a AIS 10 Section

## Plunger Process Control (PPC)

- The system records continuously the entire plunger stroke on all cavities across the machine in real time.
- PPC provides a precise gob weight control through automatic feeder tube height adjustment and optional needle height adjustment.
- User friendly software supported process analysis.

## Introduction

The Plunger Process Control (PPC) provides for the first time a complete visualization of the parison forming for Narrow Neck Press and Blow as well as Wide Mouth Press and Blow.

The system records continuously the entire plunger stroke on all cavities across the machine in real time, as the plunger actually travels through the glass whilst forming the parison. PPC also provides a precise gob weight control through automatic feeder tube height adjustment and optional needle height adjustment. The wireless connection from base plate adapter to plunger mechanism with full stroke sensor eliminates the risk of cable damages during a mechanism exchange. Full Stroke Sensors fit into existing Emhart Glass Quick Change Plunger Mechanism. The Quick Change feature of the Plunger Mechanisms is fully supported even with the 4 ¼ TG – 6 ¼ DG conversion.

The Emhart Glass PPC system “opens the door” to currently unknown variations in the NNPB and PB process, offering the potential to improve production quality. Especially finish defects can be detected and rejected by using the innovative software features and the automatic Hot End Ware Reject (HEWR).

## PPC Features

### Gob weight control

The PPC gob weight control algorithm provides close loop gob weight control adjusting the feeder tube height and as an option the feeder plunger needle height. The adjustments are calculated in function of the different plunger strokes on the machine, so that the system maintains a very accurate gob weight. The high resolution of the sensor allows even in wide mouth press and blow operation a very high accuracy of the gob weight control.

It also provides the machine operator with an immediate source of information about possible detrimentally changing forming conditions. These can be instantly recognized and remedied at the hot end.

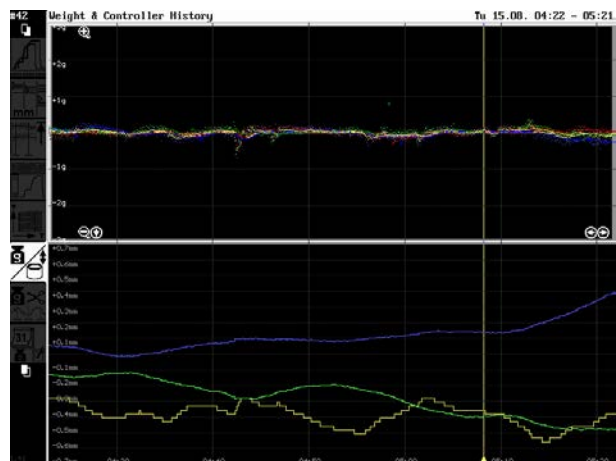


Fig. 2 Gob Weight History in TG tube & needle height

## Wireless Connection

Another big advance that PPC brings is the wireless connection between the plunger sensors and the adapter plate. This means when a plunger mechanism has to be exchanged there is no need for disconnecting and connecting a lot of troublesome cables in non accessible places. The risk of damage or destruction of cables at plunger mechanism exchange is thus also eliminated.

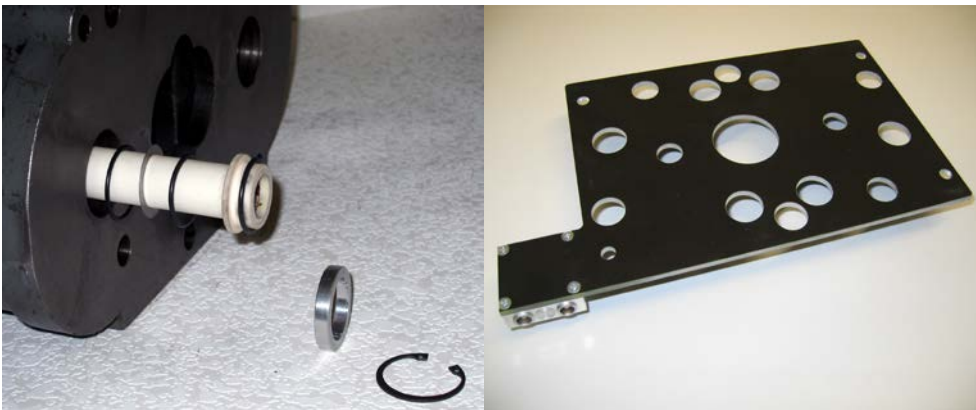


Fig. 3 Sensor in Emhart Glass QC Plunger Mech. and DG Adapter Plate for Wireless

The adapter plate, mounted on the base plate of the plunger mechanism for the wireless sensor signal transmission, reduces the maximum plunger mechanism adjustment range by approx. 3mm. This can give some restrictions on the maximum invert height on machines where the plunger mechanism adjustment range sets these limits. This is the case on 5"DG and 5 ½ DG.

## Quick conversion 4 ¼ TG ⇔ 6 ¼ DG

The AIS provides the capability to convert the machine within less than six hours from 4 ¼ TG to 6 ¼ DG. With the new quick conversion feature of the PPC this is maintained.

During the conversion no base plate, no PPC adapter plate and not even a cable must be changed. This is possible due to the unique wireless signal transmission between the Emhart Glass Quick Change Plunger Mechanism and the PPC adapter plate.

The requirements for the PPC quick conversion feature are the base plate 62-3034-05 with the PPC adapter plate 59-27198 and the plunger mechanism 62-11116-01.

A retrofit of existing machines is possible with the plunger mechanism 62-11020-04 (6 ¼ DG on TG base plate). This requires a new base plate 62-3034-05 with the PPC adapter plate 59-27198. Parts of the plunger mechanism must be exchanged and modified. The piston and rod must be modified according to 62-7279 to accept the PPS sensor 59-27222.

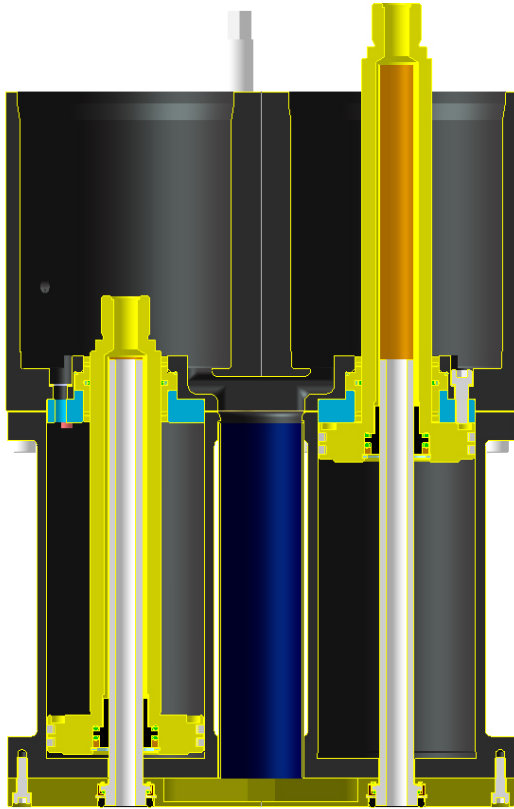


Fig. 4  
6 ¼ DG Plunger Mechanism on TG base plate with PPC sensors



Fig.5  
PPC adapter plate for 4 ¼ TG and 6 ¼ DG  
Automatic HEWR  
PPC with

Continuously increasing demands from fillers for process control can be met with the PPC. Analyzing parameters such as plunger end position, press duration and variations of the plunger position, provide a tool to reject defects already at the hot end. The HEWR is available for T600 and FlexIS.

## Process data collection

The software also allows all monitored data to be collected and stored easily and quickly recalled and displayed with user defined 'acceptable ware thresholds' This allows the tracking of issues which may have happened days or weeks earlier.

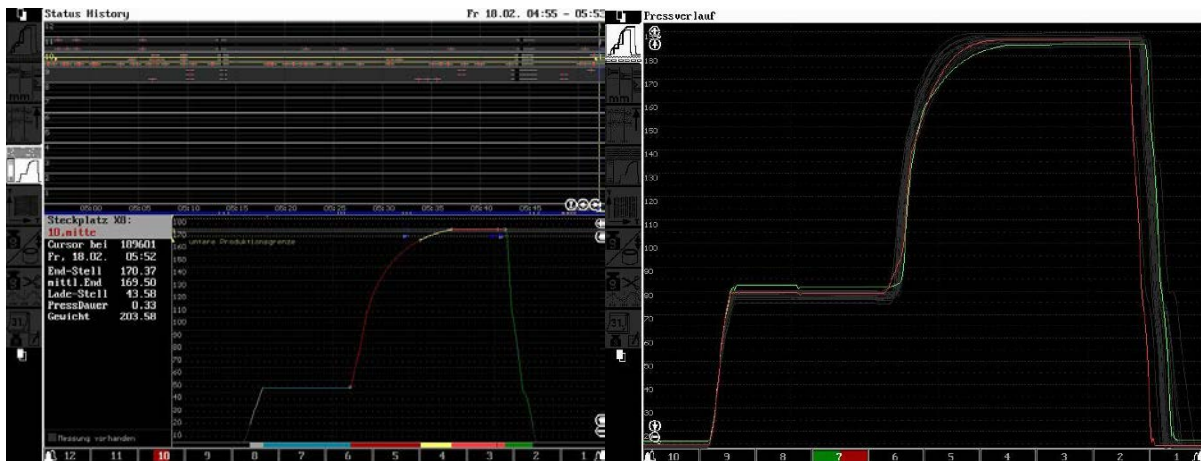


Fig. 6 Press Motion recording and analysis on a 10 section DG machine – real time stroke comparison

It also allows selective recording. This for example may be set up to record what was happening hours before an issue occurred. This makes diagnosis easier to identify by the characteristic footprint left behind and so allowing the possibility to avoid replication in the future. Thus a learning process can begin with the detection and elimination of fault conditions at the hot end where it is most effective.

## Software supported process analysis

Furthermore PPC comes with very powerful diagnostic software and a user friendly interface allowing the operator to display from a single cavity profile up to literally hundreds of detailed profiles, simultaneously overlaid on one screen in a form which highlights instantly any one which may be behaving differently or any trend toward unconformity.

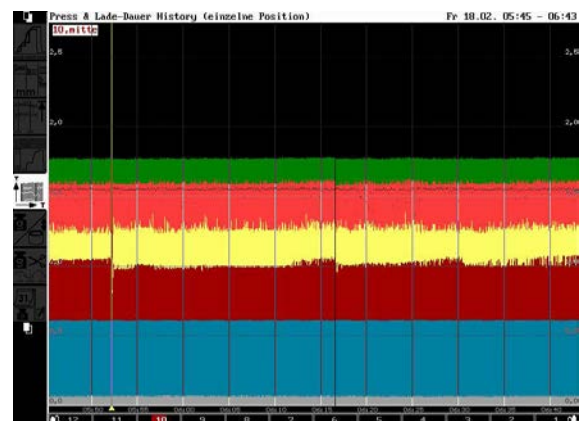


Fig. 7 Press and Loading History 12 section TG

## Connection with Plant Information System

PPC can be connected to existing plant information systems, closing the loop to a plant wide quality control. A scale can be shared between PPC and the plant information system as well as the HEWR information can be transferred.

## Equipment Tester

The newly developed PPC Equipment Tester supports the plant repair, maintenance and production. It provides trouble shooting possibilities which allows the production staff to react quickly on any malfunction and locate the source of potential problems. The tester also provides features to test plunger mechanisms with PPC sensors after repair in the work shop.

The PPC Equipment Tester provides function to test the sensor, adapter plate, cables and the signal input of the Master. The device has an integrated mini adapter plate and a sensor simulation output, which serves a PPC sensor replacement. For the input channel test of the Master a high precision variable frequency generator is incorporated to simulate the entire signal chain to the Master.

The Tester is strongly recommended for every plant with a Plunger Process Control System.



Fig. 8 PPC Equipment Tester Case with Accessories



Fig. 9  
PPC Equipment Tester

## Operation Principles

Each individual Emhart Glass plunger cylinder is fitted with its own ceramic position sensor and replacement cooling tube which communicates wirelessly via the adapter plate to the master controller which transmits information to the tube/needle height motor controllers and the control box.

## Specification

Refer for PPC System specification to drawing Plunger Process Control (62-11107-00) and to the PPC Sales Questionnaire.

The system is applicable to Emhart Glass IS and AIS Quick Change Plunger mechanisms of the following center distances. Each center distance has its unique base plate while the sensor is the same for all types of machines.

Configuration	4 ¼ DG	5 DG	5 ½ DG	6 ¼ DG	4 ¼ TG	4 ¼ TG – 6 1/4 DG
Base plate	62-3003-06	62-11045-02 62-3011	62-3064- 06/07	623065-06	62-3034-03	62-3034-05

The System covers machines from 6 to 12 sections. Tandem machines require two individual Systems.

The possible restrictions on the maximum invert height on 5"DG and 5 ½ DG apply to the Type 62-3036 Quick Change Cartridge for the Blow & Blow Process, the standard Emhart NNPB and PB Positioners as well as the neck ring heights according to the Emhart Mold Design Data. These limits may change with different cartridges, positioners and/or neck ring heights. Modifications may available on request to overcome the restrictions.

## Technical Data

Voltage	230V, single phase
Frequency	50Hz
Power consumption	75 W
Ambient temperature Master	max. 55 °C
Humidity of the Master	max. 95%, not condensing
Ambient temperature	max. 85 °C Universal Adjustment Drive
Humidity Universal Adjustment Drive	max. 95%, not condensing

## Key System Components

- |  |   |
|--|---|
| <p>1 <b>Master</b></p>                     | Is the center of the system for control and visualization   |
| <p>2 <b>Control Box</b></p>                | Supplies Master with energy, enables control loops and transmits weighing information from an electronic scale to Master  |
| <p>3 <b>Full Stroke Sensor</b></p>         | The signal source is mounted in the Emhart Quick Change Plunger mechanism   |
| <p>4 <b>Adapter Plate</b></p>              | Mounted on plunger mechanism base plate for wireless sensor signal transmission   |
| <p>5 <b>Motor Controller</b></p>           | Needle height and tube height motor control for machine without FlexIS control. On machines with FlexIS the tube height control is connected direct to the Master |
| <p>6 <b>Universal Adjustment Drive</b></p> | For optional needle height adjustment and on non FlexIS installations used for tube height adjustment   |

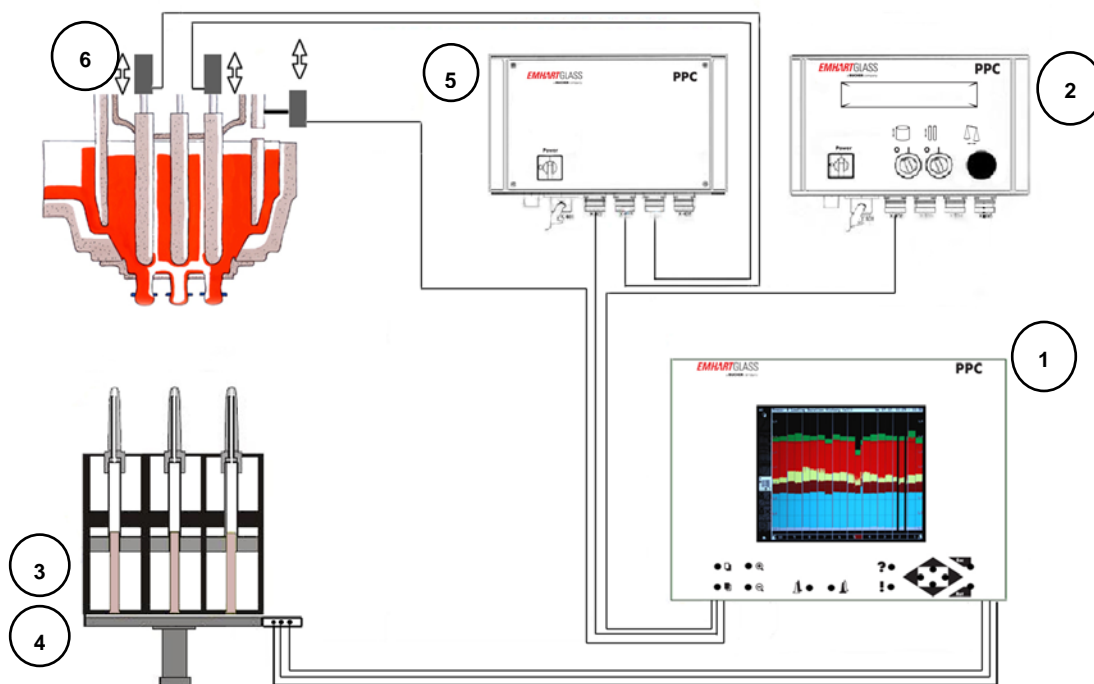


Fig. 10 PPC System Overview of key components TG with FlexIS and 555 Feeder



## Features of the PPC

- Full Stroke Motion recording ⇒ PPC records continuously the entire plunger stroke on all cavities across the machine in real time, as the plunger actually travels through the glass whilst forming the parison
- Gob weight control ⇒ The PPC gob weight control algorithm provides close loop gob weight control adjusting the feeder tube height and as an option the feeder plunger needle height
- Wireless Sensor connection ⇒ Wireless connection between the plunger sensors and the adapter plate avoiding damage or destruction of cables during cylinder exchanges
- Hot End Ware Reject (HEWR) ⇒ Providing tools to reject defects already at the hot end
- Process data collection ⇒ The software also allows all monitored data to be collected and stored easily and quickly recalled and displayed with user defined 'acceptable ware thresholds'
- Software supported process analysis ⇒ PPC comes with very powerful diagnostic software and a user friendly interface allowing analyses of a single cavity profile up to literally hundreds of detailed profiles
- Connection with Plant Information System ⇒ The Plunger Process control can be connected with existing plant information systems, closing the loop to a plant wide quality control

Emhart Glass works continuously on further developments and improvements. Therefore, we reserve the right to alter any parts of the equipment or technical specification any time.