

Hennecke Inc.

Prepared for

**Bright Lite Structures
Peterborough, England PE6 9NF**

Proposal
No. 2017S14-4826 REV 1 Hennecke
PUR-CSM
High Temp Spray Honeycomb System

Table of Contents

Cover Letter	1
Description of Equipment	2
Price	3
Terms and Conditions	4
Division of Labor	5
Submittal and Acceptance	6

Section One

Cover Letter

Subject: Hennecke Inc. Proposal # 2017S14-4826 Rev 1
Re: PUR-CSM High Temp Honeycomb Production System Proposal

Dear

Attached is Hennecke's Revised Proposal 2016S14-4796 Rev 1 for your review. This proposal provides current pricing for a High Temp Spray System for Honeycomb parts.

Please Note:

This is a custom machine to meet the demands of your current spray needs. Unique features include:

- 100% heated system, with no cold bridges
 - **Added**—Heating cartridges in the mixhead
- Mass flow meters
- Magnetic Couplings
- Self-Cleaning High Pressure Mixhead
- Heated Hoses
- Shot data management system

If you have any questions or require additional information please contact me.

Section Two

Description of Equipment

TABLE OF CONTENTS

1	1 off.	Spray machine Custom configuration
2		Metering Line A
2.1	1 off.	Metering line HP6 in stainless steel
2.2	1 off.	Tank 60 L in stainless steel according to the European Pressure Equipment Directive
3		Metering Line B
3.1	1 off.	Metering line HP2 in stainless steel
3.2	1 off.	Tank 30 L in stainless steel according to the European Pressure Equipment Directive
4	1 off.	Mixhead MN8-CSM incl. nozzles
	1 off.	Packing and delivery
	1 off.	Services

1.0

Technical specification



Custom Spray machine with two main components

The Spray machine consists of two main components that are designed for the following reactive plastic systems:

Huntsman Araldite FST 40002 / 40003

1 1 off **Spray machine basic configuration**

Even in its basic configuration, the Spray machine has been equipped with high-quality parts. Mass flow metering of the main components allows the formulation to be preselected independent of density. Viscosity variations do not play a role because the temperature of the continuously recirculating main components is controlled to 100°C max. or 130°C optionally. A vacuum unit that is already included in the basic version prevents air inclusions when storing the components in the day tank. An uninterrupted supply to the main metering unit, independently of this vacuum, is ensured by a feed pump. All subassemblies are mounted on a mobile frame, thus enabling relocation on the production floor at short notice as well as a flexible operation in the technical center at any time. All metering lines are frequency-controlled and allow for a flexible preselection of the shot volume and mixing ratio. Remote access to all control components is possible at any time via the Hennecke-MPR-Router.

The **master control** of the metering machine mainly consists of:

- 1 electrical control cabinet with the complete machine and mixhead control system incl. the monitoring devices
- 1 Siemens programmable logic control
- 1 Multipanel HMI (Human-Machine-Interface) with fully graphic 12“ TFT-touch display for a convenient input of metering programs and machine parameters and display of status messages and failures in plain text
- 1 network connection for shot data acquisition on a Windows computer provided by the customer
- 1 control cabinet design according to European standards

The functions consist of:

- graphical plant overview as a flow diagram with all important

- process data
- 250 metering programs that can be started manually via the mixhead control box
 - timer for activating the machine heating at certain times
 - shot simulation (complete metering program without metering)
 - recording of operating hours of all important units
 - network connection for shot data acquisition on a Windows computer provided by the customer
 - language selection GER / EN
 - selective password protection (access control)

The **process data analysis** includes:

- 1 extension of the control system for recording the process data
- 1 extension of the software for internal data evaluation

The functions are divided into:

- **Limit monitoring**
At the operator terminal of the control system, setpoints for the flow rate, temperature and pressure of each component can be entered. In addition, it is possible to store two types of limits for these setpoints:
 - warning limits indicating that the tolerance limits have been exceeded or not reached. This does not result in a termination of the metering process.
 - Alarm limits stop the metering process immediately, even before the shot operation starts so that unnecessary and costly rejects are avoided.If the limits are exceeded or not reached, this is visually displayed in a detailed flow chart. In addition, an error message in plain text is issued. From this point, the operator can proceed to the relevant setting parameters by pressing a button.
- **Oscilloscope function:**
Trend display of tank temperature and tank level as well as indication of the pressure curve during the last metering operation.
- **Shot logging:**
The following data are displayed on the monitor in the form of a shot log and can either be stored on a memory card and/or a network computer.

The individual options of the sensor system are taken into account:

- Date and time
- Metering program number
- Name of metering program
- „Set“ metering time / „actual“ metering time
- „Set“ total quantity / „actual“ total quantity

Per component:

- „Set“ pressure / „actual“ pressure and pressure at metering start and metering end
- „Set“ flow rate / „actual“ flow rate
- „Set“ mixing ratio / „actual“ mixing ratio relating to 100 parts A
- „Set“ tank temperature / „actual“ tank temperature (measured inside the tank)

- **Shift logging:**
Moreover, the following data can be displayed and/or logged for the current and previous 21 shifts:
 - Date and time from shift start to shift end

- Name of the shift manager
- Number of metering operations
- Number of parts produced
- Part number and part name
- „Set“ number of each part / „actual“ number of each part

- **Non-shift-related data acquisition:**
Acquisition with reference to the parts produced:
 - number
 - total component consumption
 - single component consumptionAcquisition without reference to the parts produced:
 - number
 - total component consumption
 - single component consumption

- **Print-out of logs/data on external printer**
The following data can be logged using an enabled printer (only when the option „extension of control by one printer“ has been taken into account):
 - shot log (value of each shot)
 - print screen of the screen masks

- **Export of the data to**
 - Ethernet
 - USB stick

- **Shot processing**
Processing and control of the shot curve is provided as follows:
 - Shot retrieval through time
 - Shot retrieval depending on quantity
 - Back-pressure controlled shot curve in case of closed-mould injection. The output is adjusted to the admissible back pressure during the injection by means of flow rate control.

- **Hennecke standard Interface**
to connect the Spray machine to a system network with the following in- / outputs
 - 16 digital inputs
 - 8 digital outputs

2 **Metering Line A**

2.1 1 off **Metering line HP6 in stainless steel**

**Metering line HP6 for the A component -
Huntsman Araldite FST 40002**

For a good mixing and metering result the components are fed to the mixhead by high-pressure axial piston pumps. Apart from precise metering these pumps provide a comparatively high flexibility in terms of output. The pump speed can be adjusted by frequency control and the stroke can also be varied. As a result, the Spray machine system provides an extremely large output range as well as numerous mixing ratios for different matrix systems.

- 1 Metering pump HP6 , corrosion-resistant,
max. output 150 cm³/sec
min. output 6 cm³/sec
- 1 frequency-controlled threephase motor 5,5 kW/1450 min⁻¹
magnetic coupling
- 1 electronic pressure switch with digital display incl.
min. monitoring system, on the suction side
- 1 electronic pressure switch with digital display incl.
min./max. monitoring systems, on the pressure side
- 1 safety valve made of stainless steel

The standard piping of the entire metering line is made of stainless steel on the suction and pressure sides. In processes involving aqueous, highly active or aggressive components, corrosion and the resulting contamination are thus effectively prevented.

2.2 1 off **Tank 60 L in stainless steel according to the European Pressure Equipment Directive**



Tank module 60 L - A-component

The main component tanks are integrated into an efficient heating concept. This concept comprises a matching insulated heating booth that accommodates both the work tank and the metering line. Recirculation fans are used to heat the booth up to a maximum component temperature of 100°C.

For maintenance the booth can be opened in a few easy steps. All assemblies are conveniently accessible for maximum ease of service. Moreover, an efficient insulation fully prevents thermal bridging so that an energy consumption of only 1,5 kW/h* is achieved.

*measured at 70°C operating temperature on a 60-liter tank filled to 70% of capacity

Effective content 55 l; in one-walled design, tank and lid made of stainless steel, executed as a modular unit, consisting of:

- 1 pressure vessel, operating pressure –1 to 2 bar
- 1 stirrer incl. gear motor 0.25 kW, 51 min⁻¹ and magnetic coupling
- 1 level sensor installed in the tank lid
- 1 conditioning unit with reducing valve for dry compressed air
- 1 safety valve for components, 2 bar (fixed setting)
- 1 shut-off valve in the suction line to the metering pump
- 1 hand-operated filler cap DN 55 for manual filling
- 1 drain valve for emptying the tank

For processing hydrous, highly active or aggressive components, high-quality stainless steel tanks are used. Consequential corrosion and resulting contamination is thus effectively prevented. The standard piping of the entire metering line is made of stainless steel on the suction and pressure sides. In processes involving aqueous, highly active or aggressive components, corrosion and the resulting contamination are thus effectively prevented.

The tank design complies with the European Pressure Equipment Directive 97/23/EG and the national standards AD 2000. The CE declaration of conformity for the pressure vessel, issued by the tank manufacturer, is included in the delivery.

3

Metering Line B

3.1 1 off **Metering line HP2 in stainless steel**

Metering line HP2 for the B component - hardener

For a good mixing and metering result the components are fed to the mixhead by high-pressure axial piston pumps. Apart from precise metering these pumps provide a comparatively high flexibility in terms of output. The pump speed can be adjusted by frequency control and the stroke can also be varied. As a result, the STREAMLINE system provides an extremely large output range as well as numerous mixing ratios for different matrix systems.

- 1 Metering pump HP2 , corrosion-resistant,
max. output 45 cm³/sec
min. output 2 cm³/sec
- 1 frequency-controlled threephase motor 3 kW/1430 min⁻¹
magnetic coupling
- 1 electronic pressure switch with digital display incl.
min. monitoring system, on the suction side
electronic pressure switch with digital display incl.
min./max. monitoring systems, on the pressure side
- 1 safety valve made of stainless steel

The standard piping of the entire metering line is made of stainless steel on the suction and pressure sides. In processes involving aqueous, highly active or aggressive components, corrosion and the resulting contamination are thus effectively prevented.

3.2 1 off **Tank 30 L in stainless steel according to the European Pressure Equipment Directive**



Tank module 30 L - B-component

The main component tanks are integrated into an efficient heating concept. This concept comprises a matching insulated heating booth that accommodates both the work tank and the metering line. Recirculation fans are used to heat the booth up to a maximum component temperature of 100°C.

For maintenance the booth can be opened in a few easy steps. All assemblies are conveniently accessible for maximum ease of service. Moreover, an efficient insulation fully prevents thermal bridging so that an energy consumption of only 1,5 kW/h* is achieved.

*measured at 70°C operating temperature on a 60-liter tank filled to 70% of capacity

Effective content 30 l; in one-walled design, tank and lid made of stainless steel, executed as a modular unit, consisting of:

- 1 pressure vessel, operating pressure –1 to 2 bar
- 1 stirrer incl. gear motor 0,25 kW, 51 min⁻¹ and magnetic coupling
- 1 level sensor installed in the tank lid
- 1 conditioning unit with reducing valve for dry compressed air
- 1 safety valve for components, 2 bar (fixed setting)
- 1 shut-off valve in the suction line to the metering pump
- 1 hand-operated filler cap DN 55 for manual filling
- 1 drain valve for emptying the tank

For processing hydrous, highly active or aggressive components, high-quality stainless steel tanks are used. Consequential corrosion and resulting contamination is thus effectively prevented. The standard piping of the entire metering line is made of stainless steel on the suction and pressure sides. In processes involving aqueous, highly active or aggressive components, corrosion and the resulting contamination are thus effectively prevented.

The tank design complies with the European Pressure Equipment Directive 97/23/EG and the national standards AD 2000. The CE declaration of conformity for the pressure vessel, issued by the tank manufacturer, is included in the delivery.

4.0 1 off **Mixhead MN8-CSM incl. nozzles**

The CSM spray mixhead MN8-2 is a proven mixhead system that has been optimized especially for specific use in the Preg technology. The MN Mischkopf can either be installed in the spray booth or used for robotically positioned application. CSM spray mixheads are characterized by homogeneous spraying and high process reliability. The self-cleaning spray nozzle is ideally suited for all Preg materials used and cleaned with compressed air at the end of the shot. A long service life and long on-stream times in the individual shifts are thus ensured. The pipe arrangement was also optimized with regard to the booth and robot installation so that it offers sufficient flexibility for different outputs. Heated mixhead hose lines come in a standard length of 5 m.



Consisting of:

- 1 mixhead MN 8-2 CSM, self-cleaning via ejector and compressed-air supply (8 bar / 300 NI/min)

The functions consist of:

- output range 20 cm³/s – 160 cm³/s
- change from recirculation to shot via control piston with recirculation grooves
- high mixing quality through flow-optimized groove geometry and injector arrangement

ADDED

Integral Heating cartridges to maintain temperature throughout mixhead mixing chamber.

PLEASE NOTE:

Hennecke spray systems require dry (25 °C dew point), compressed-air supply @ 8 bar and 300 NI/min)