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Compact CBS II Product Introduction

Project Goal

Compact CBS II

Objective

- Develop a new cartridge improved handling unit for the ABB Cartridge Bell System, with better motion control, better process control and more compact design

Deliverables

- Optimized ABB CBS process solution; cleaning, filling and dosing
- New drive solution, new control electronics, improved overall motion control
- Simplify installation and commissioning
- Optimized for IRB 5500 robot with RB1000-WSC atomizer

Project Goal

Compact CBS II

Customer value

- Results in minimum time to exchange color (cartridge), keeping the robot available for painting
- Parallel processing (re-filling cycle and painting cycle) and securing low material waste, precise dosing, possible to customize for each color material, with timing priority or pressure control priority (controlling filling pressure)
- One ABB standard solution for (electrostatic) internal charge waterborne (WB)
 - Robot, controls, software, CBS handling unit, atomizer, application equipment and installation – all part of the ABB scope and supported by the global ABB organization
- Cost efficient, integration friendly harmonized with latest requirements for internal charge WB painting

Product History

Cartridge Bell System



- 1997** Project triggered by Toyota in Japan
- 1997** Joint project Toyota & ABB Japan
- 1998** First installation Toyota
- 1999** Car body and plastic fascia projects
- 2000** First installation in Europe
- 2001** Toyota Technology Development Price
- 2001** World wide Commercialization
- 2002** Flushable Cartridge

Product History

Cartridge Bell System



- 2003** Cartridge Gun System
- 2004** Special Vehicle Order
- 2006** First major EU Automotive installation
- 2008** Introducing RB951-WSC
- 2008** First major US Automotive installation
- 2013** Introducing the Compact CBS II with full servo control and dual DCU for filling and dosing

Customer Values

Compact CBS II

Compact Cartridge Bell System (II)

This new version of the CBS handling unit is considering the 'lessons learned' over the last 15 years since the first CBS system was introduced, in 1998

Most important changes from the last model are related to full servo controlled motion, guaranteeing accuracy of motion and process control, timing of motion and perfect position control

Customer Values

Compact CBS II

Compact Cartridge Bell System (cont...)

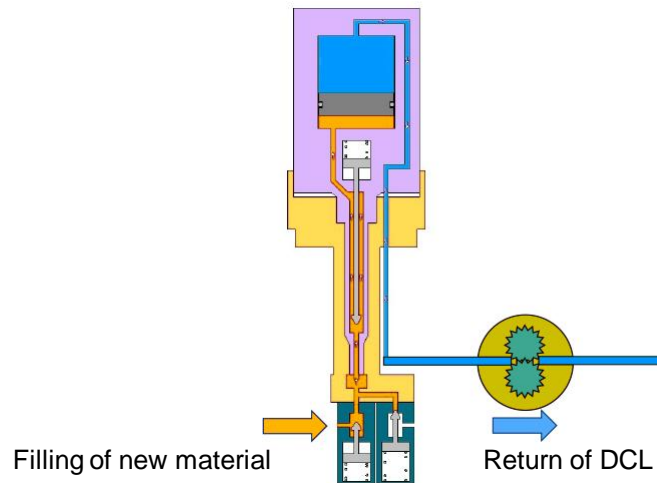
Dual **D**elivery **C**ontrol **U**nit (DCU) for precision filling and dosing of paint material. This second DCU replaces the previous gear flow meter on the **D**elivery **C**ontrol **L**iquid (DCL) on the return line DCL

Overall compact design, with a 1m x 1m x 0,6m (width, height, depth) base unit height, + 0,4 m gripper tower which will lift 0,6 m (max) for cartridge exchange motion.

All paint application components, filling station, parking station, color change stack, cleaning units pilot valves and more are all closely integrated into this compact unit.

In addition all control electronics are integrated into the purge cavity, making this a full Exp certified design

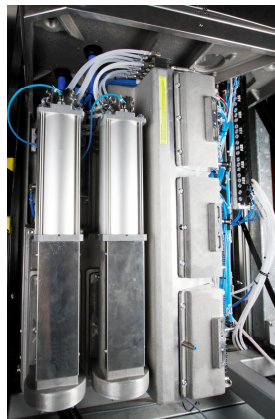
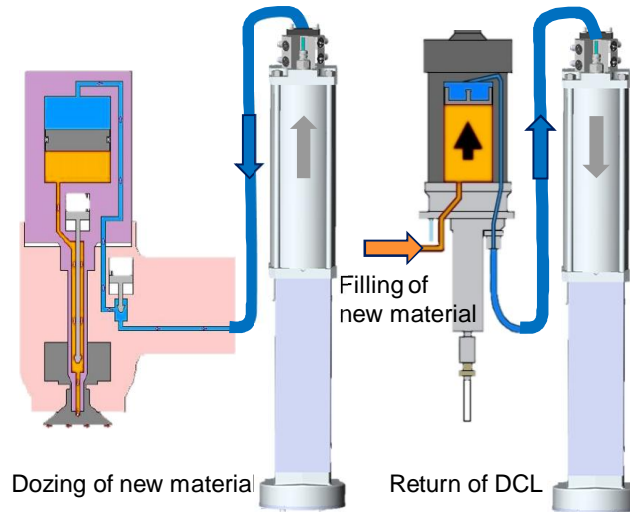
Filling Volume Control Compact CBS II



DLC volume measured during filling cycle – CBS (standard solution 2013)

- Paint material filling the cartridge with use of line supply pressure, pushing the cartridge piston and DCL out, through the gear flow meter for volume measurement

Filling Volume Control Compact CBS II

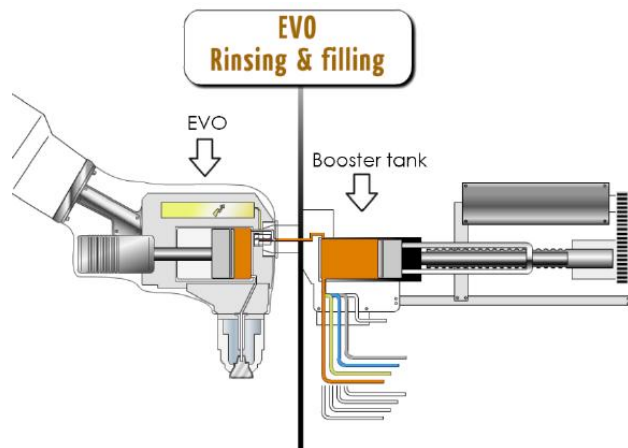
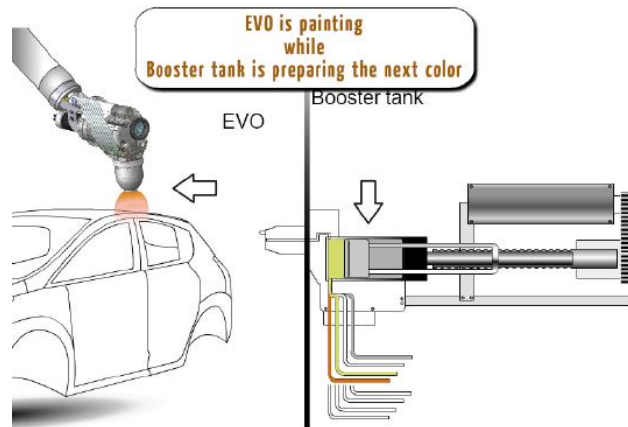


DLC volume measured during filling cycle – Compact CBS II (standard solution 2014)

- The first DCU is used for accurate dosing of paint during robot painting
- The second DCU is used to accurately measure the return of DCL, securing the refilling of paint into the cartridge. This filling sequence is done in parallel with the robot painting, not occupying robot paint cycle time
- The DCUs are dosing DCL and not exposing the seals for pigmented / abrasive paint materials. The main wear part would be the cartridge piston seals, which are quickly replaced with a new cartridge (minimum shared the wear between two cartridges)

Other Solutions

Prepared for internal charge WB material



SAMES Accubell 709 evo

- The latest solution from SAMES is prefilling a Booster tank during the painting cycle, this is an improvement from previous solution, but even this need to push the paint material with high pressure from the booster tank into the 709 evo atomizer
- Waterborne paint material is known to potentially cause problems with high speed filling and high pressure
- The robot docking time is used to dump, clean and refill new material, using the same built in cartridge inside the atomizer for all materials

ABB Solution

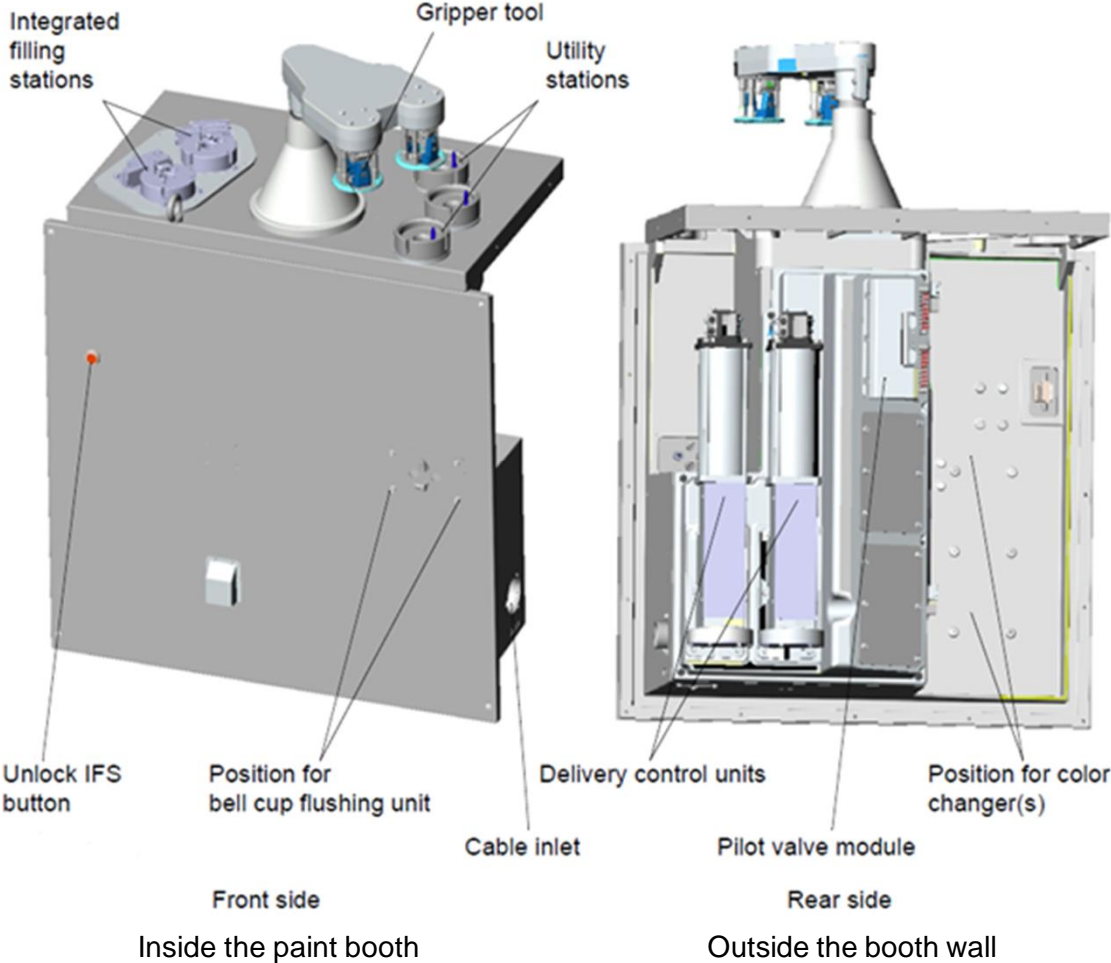
Prepared for internal charge WB material



ABB CBS

- Parallel processing the cleaning and filling with the paint dosing (robot painting)
- Designed to fill the actual cartridge, with controlled speed and pressure to prevent any unwanted effect on the WB material
- Filling and cleaning can be tuned with regards to time, solvent consumption, cleanliness, material waste, supply line pressure, and actual material properties
- After filling, the cartridge is exchanged with the used cartridge which takes about 7 sec.
(not including time for cleaning cycle)

IRB 5310 Compact CBS II Overview



IRB 5310 Compact CBS II

Main mechanical differences

Mechanical frame

- New Compact CBS II is made out of machined cast aluminum

The gripper tool

- Continuing with the same basic design, but with new design of the gripper arm
- The Integrated Filling Stations (IFS) and utility stations (parking stations) are basically the same, but more compact
- Each IFS is connected directly to the color change stack in order to reduce paint material waste

IRB 5310 Compact CBS II

Main differences

New drive system

- Axes now use servo motors for all motion and for DCU position and speed control

Servo controlled vertical axis

- Increased reliability and safety. Eliminating a possible point of failure with the previous air positioning vertical axis

IRB 5310 Compact CBS II

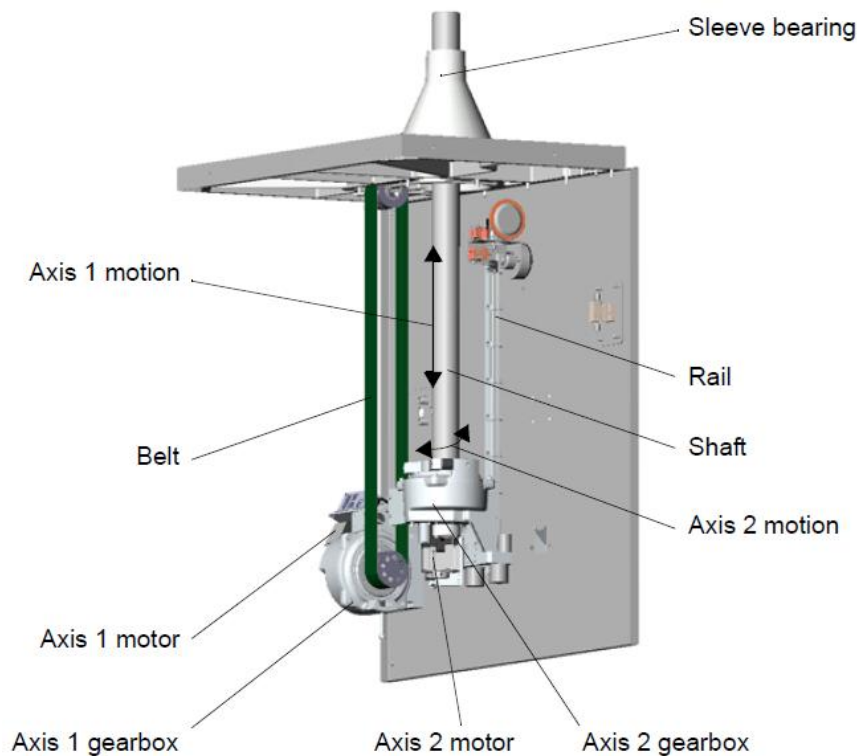
Main differences

Dual DCU system

- Faster and more precise filling of cartridge
- Prepared for both controlling **filling pressure** or controlling **time-to-fill** and adaptable to different paint materials
- Because there are two DCUs, they will swap roles and one will be «empty» and the other «full» after each cycle
- These points results in a potential for reduced cycle time between paint programs

IRB 5310 Compact CBS II

Main control differences



Servo motor vertical axis

- Increased reliability and safety, by eliminating issues with pneumatic solution
- The servo motor is integrated into the run chain circuit of the IRC5P controller

IRB 5310 Compact CBS II

Main process control differences



Dual DCU system

- One of the DCU's is acting as measuring device providing more accurate filling (less paint loss)
- This closed volume of DCL eliminates the need for a DCL distribution system. Volume inside the two pairs of DCU & Cartridge can be exchanged after a number of cycles, depending on the DCL resistivity, this will be paint material dependent, not one preset for all installations.
- Measuring DCL resistivity is done with a manual Paint HV tester (ADT01)

IRB 5310 Compact CBS II Purging system



Ex-p design

- The basic unit is designed for Ex-p (protected with use of controlled overpressure)
- The Compact CBS II handling unit need to be installed with an overpressure supplied to the integrated control electronics
- This is achieved either with a fully certified purging system with flushing and pressure monitoring control, or the more simpler none supervised overpressure
- In short: always a higher pressure inside the control electronics than on the outside (inside the paint booth)

Compact CBS II

Integrated Filling Stations (IFS)

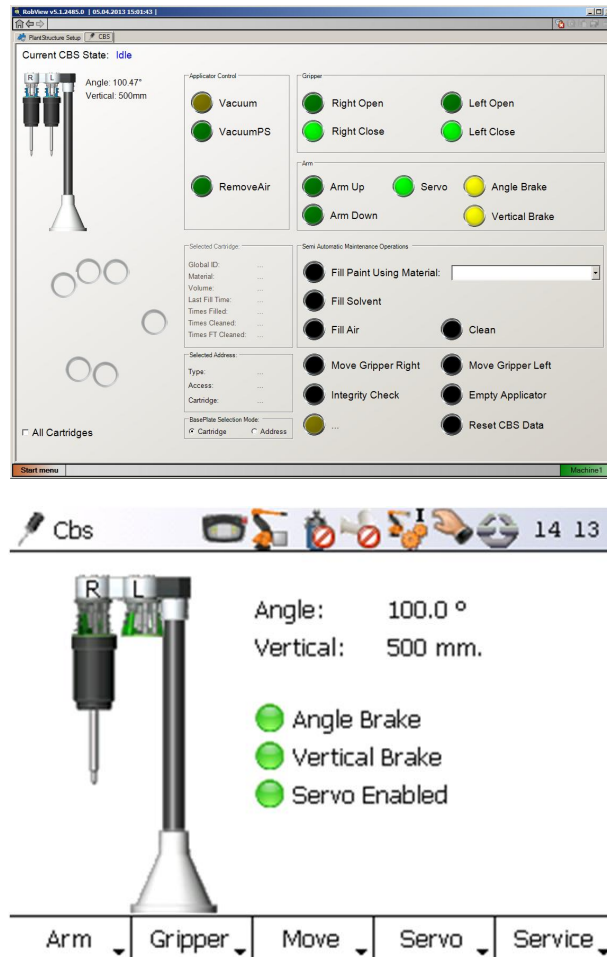
1 x IFS and 1 x Color change stack

- Requires 2 parking stations
- Most common configuration

2 x IFS and 2 x Color change stacks

- Requires 3 parking stations
- Can be used to reduce cycle time, if the filling and cleaning time is longer than the painting time. It's possible to split these operations and perform cleaning and filling in parallel on the two IFS stations.
- Can also be used to get a clean separation of colors (e.g. 1 IFS + 2 cartridges for metallic paint and 1 IFS + 2 cartridges for regular paint)

Compact CBS II: Software Paint TPU, RobView and RobotWare Paint (incl IPS)



- Software and control
 - New handling for motorized axes with resolvers
 - Other material change sequences due to new dual DCU system
- RobView 5 - Changes in graphics and buttons if connecting to new Compact CBS II
- P-TPU - Changes in graphics and buttons if connecting to new Compact CBS II
- IPS and color change sequences are adapted to the servo motor control. Apart from this, the same software is used to control the both CBS versions

Overview

CBS integration with Paint robot

- The main benefits with CBS would be the possibility to utilize high voltage internal charge in combination with conductive paint material like most WB paint materials
- Parallel cleaning and loading of next paint material, during painting, will reduce the overall color change cycle time
- Parallel processing in addition to the precise control of paint material dosing and reloading of paint material, makes the ABB CBS stand out from other solutions in the market

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