Plant description,

functional description

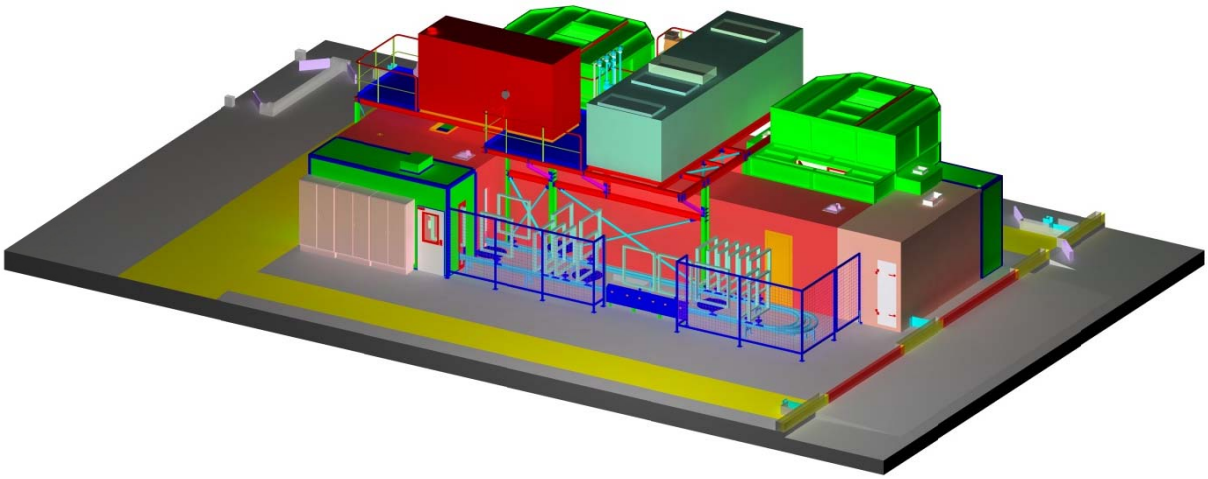
3 Plant description

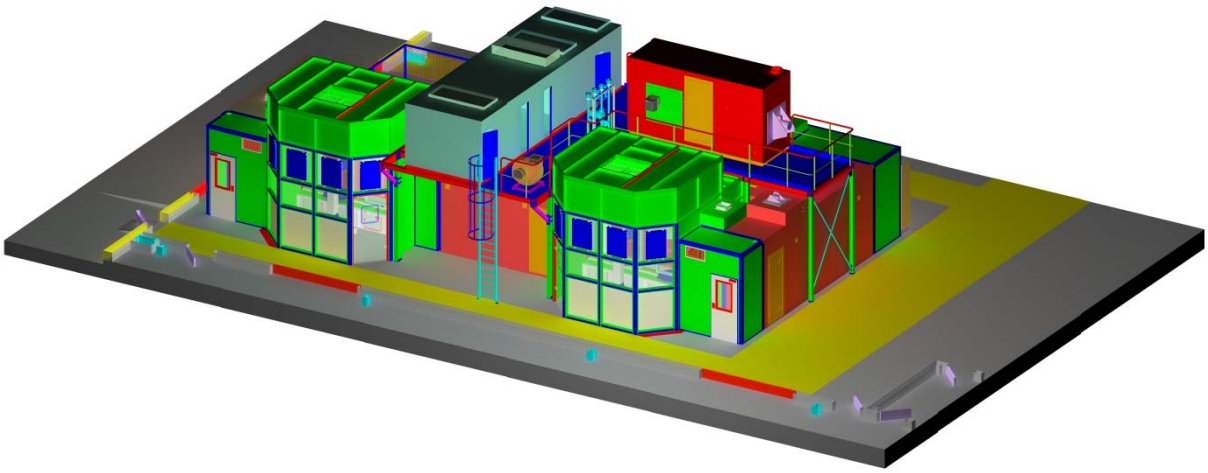
Project: Daiichi Toyoda Gosei – Rotherham UK

Project-No.: AB12038

Painting plant for rubber parts

3.1 Views of painting plant





3.2 Technical description

In the new plant rubber parts are painted in two cabins. The Primer first in Paint booth 1, the Top coat in Paint booth 2.
The parts are moved on a product carrier by means of a power and free conveyor system through the system.
The parts are placed in the task and delivery area.
In the first step be cleaned by blowing Automatic with ionized air.
The parts take the power and free conveyor system in a preheating zone are painted in booth 2 with the Primer. The Primer is pre-dried in the following infrared zone and in booth 2 painted with the top coat. The parts go through a flash-off zone and an air lock in the dryer, then again through an airlock and a cooling back to the task and pick-up area.
The heating of the drying zone is performed with a gas burner. The infrared region is electrically operated.
The air intake and exhaust system works with 41,500 cubic meters of volume, this is mounted on a steel Construction on level 2.

3.3 Basic Data

Maximum size of work envelope	1200 x 1100 x 100 mm (Height x length x width)
Max. weight jig and parts	5 kg
Minimum process time for coating including handling	35 seconds
Number of jigs per hour (at minimum process time)	103
Type of conveyor	Power and free floor chain conveyor With buffer before and after manual loading station
Max. conveyor speed	2,78 m/min
Electrical power supply	400 V; 3 Phases, 1 Earth; 50 Hz
Outside air temperature to be considered	Min: Temperature -5°C Max: Temperature +25°C
Spray booth Requested temperature Air speed inside the spray booth	Temperature 25 ± 2°C Air speed approx 0,4 m/sec
Way of Air Control	Heating by hot water register
Painting Robot	b+m painting robot T1
Paint materials to be worked with	Primer: Sipiol WP 8555 Waterborne single coat material Top Coat: Sipiol WL2015-22P/Sipiol WV21 Waterborne two component material
VOC	*Paint material contents no VOC*
Mix and Dosage System	b+m mix and dosage system
Paint Supply System	b+m paint supply

3.4 Process

Loading	Manual Loading have to be confirmed by pressing the push bottom
Cleaning	Automatic by blowing with ionized air
Pre heating	By IR heater Part surface temperature: up to 80°C
Primer	Automatically coating with robot from front and back size (Jig will be turned inside spray booth 180°)
second heating	By IR heater Part surface temperature: up to 80°C
Top Coat	Automatically coating with robot from front and back size (Jig will be turned inside spray booth 180°)
Flash off	Ambient temperature Approx 2 min
Baking ofen	Air temperature max 150°C Max. number of jigs inside oven: 18 Max process time inside oven 10,5 min
Cooling	Passively by ambient air
Unloading	Manually

3.5 Description of components Plant part

3.5.1 Housing

The housing of the paint line essentially consists of

- Wall and ceiling from insulated panels
- Emergency doors with a pane
- Sliding access doors with a pane
- Windows with pane in the sidewall
- Electric lighting
- Fresh air supply with filter
- Exhaust air ducts and ventilation

3.5.2 Cleaning Zone

- **1 piece cleaning zone**
  Cleaning by blowing with ionized air
  Mainly consisting of

- Wall and ceiling from insulated panels
- Ionization bar
- Air ventilator

3.5.3 Pre Heating Zone

- **1 piece Pre heating zone**
  Mainly consisting of
  - Wall and ceiling from insulated panels
  - Heating by IR radiator (installed heating capacity approx 100 kW)
  - Air circulation approx 4000 m³/h
  - maintenance door

3.5.4 Spray booths

There are two spray booths one for Primer and one for Top Coat,.

- **2pce. Spray booth**
  Each for one robotic with dry filter wall and 0,4m/s air velocity at spraying area:
  - approx. Length 4m x depth 4m x Height 3,9m
  - Galvanized sheet metal housing with safety pane
  - Front wall with big class portions
  - doors with safety pane, i/o-transfer system opening
  - Dry filter air cleaning system
  - air supply plenum, filter roof with filter EU5
  - temperature and filter control,
  - tlights installed outside booth
  - exhaust re-circ ducting with
  - steel plate for one robot
  - access door with safety switch
- **1 piece re-circ-Air-supply-unit 41.500m³/h**
  with air filter and air-heating system for the two booths 25+/-2 °C (no humidity control, no cooling)
  - under pressure in the booth against dust
  - mixing chamber for fresh air supply with one jalousie flap
  - 2 stage filter unit EU5 and EU7
  - Heating register for hot water 90 / 70 °C
    installed heating capacity approx. 425 kW
  - Circulation fan unit approx. 41.500m³/h air flow (controlled by frequency converter)
  - Exhaust fan unit approx. 41.500m³/h air flow (controlled by frequency converter)
  - supply in out or re-circ ducting with partly branch

3.5.5 Paint kitchen

- **2pce. Paint kitchen**
  Each mainly consisting off
  - Wall and ceiling from insulated panels

- 1 door
- 1 window approx 1,0 * 1,0 m
- Exhaust fan and duct above roof level

3.5.6 Second Heating Zone between spray booth one and two

- **1pce. heating zone**
  Mainly consisting of
  - Wall and ceiling from insulated panels
  - Heating by IR radiator (installed heating capacity approx 75 kW)
  - Air circulation approx 4000 m³/h
  - 1 maintenance door

3.5.7 Flash off zone

- **1pce. Flash off zone**
  Mainly consisting of
  - Wall and ceiling from insulated panels

3.5.8 Baking oven

- **1pce. Oven**
  Mainly consists of
  - Wall and ceiling from heat resistant insulated panels
  - 2 re-circ air locks against hot air exit
  - 1 maintenance doors
  - 1 exterior swinging electrical lighting
  - Filter ceiling with heat resistant re-circ filters
  - Fresh air supply from flash-off
  - Re-circ heating unit
  - indirect gas burner and waste gas exhaust air duct
- **1piece Conveyor system** (Including Option Power and free)
  Mainly consists of:
  - Power and free floor conveyor system Type PF 100
  - Conveyor profile
    - Approx. 56m straight profile
    - 7 horizontal curve 90 °
    - 1 inspection and service area
  - Clamping station
  - 2 Drive unit gear motor with clutch and incremental sensor
  - Kardan chain S 270-90 chain pitch 810 mm (approx 71m)
  - Kardan chain S 270-90 chain pitch 1620 mm (approx 58m)
  - 2 Pneumatically grease station
  - congestion stops inside baking oven with batch area
  - adjustable support for floor installation
  - 56 trolleys with turning device 180°

- 2 Mechanical rotation station (inside oven)
- 6 Pneumatically driven rotation station (inside spray booth plus before and after loading)
- 1 Manual rotation at the loading station
- Guiding bar inside the spray booths to keep the trolleys smooth moving

3.5.9 Steel construction Level

Mainly consists of:

- **1piece Platform on level +3450 for air aggregates and switch cabinets**
  - Platform on level +3450 for air aggregates, switch cabinet,
  - Approx 60 m² steel construction
  - Metal floor plate (bulb plate)
  - Hand rail around the platform
  - 1 ladder

3.5.10 Electrical control plant part

Application control system and operator interface.
The Robots and application systems will be controlled by a software PLC installed on an industrial PC. A central visualisation system for all application booths for operator interface will be installed.

Configuration:

- Software PLC installed on industrial PC
- Integrated UPS
- Basic software : Windows NT
- Standard bus system **CAN Bus**.
- Visualisation / control VISAM or ZENON.
- Programming language
  according IEC 1131
- Communication to other control systems
  CAN bus
  Interbus S
  Profibus
  H1 Bus
  I/O level.

Functions:

The main functions of the system controller are:

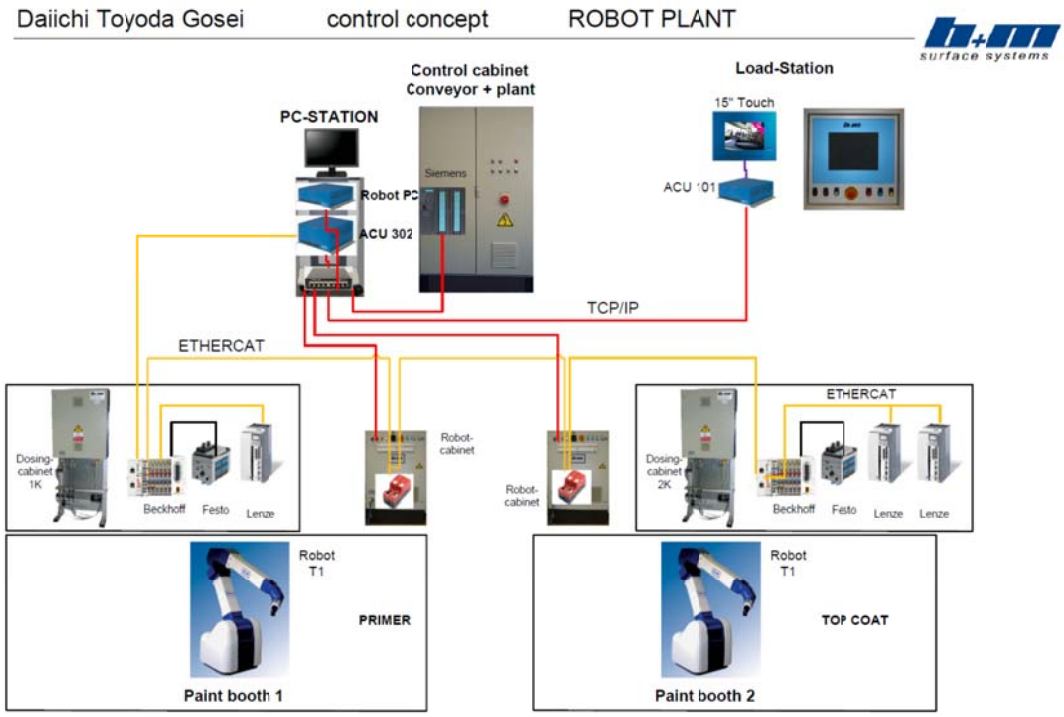
- Communication of program numbers and colour commands to each robot.
- Communication robot application systems
- Communication with conveyor and/or line controller.
- Safety controls and interlocks according to the regulations.
- Visualisation

All internal communication by CAN bus.

Visualisation system / operator interface:

All operator communication is done by the visualisation system. The menu driven software allows easy access in order to monitor and control all functions

- Robot mode selection
- Robot mode monitoring
- Robots status
- Program selection
- Program file monitoring and editing
- Spray application parameters
- Application offsets
- Colour change controls
- Fluid delivery and 2K mixing
- Material consumption recording
- Pump calibration programs
- Manual and automatic flushing
- Material supply status



- **1piece Control panel located at loading station**
  - 1 screen
  - 1 keyboard with mouse
  - 1 Industrial

Switching Cabinet +ST01; Pre-Treatment, Blowing Zone, CC-Dryer and Cooling Zone

Function Groups

ZL10	Fresh Air – Air Circulation Aggregate
VB50	Blowing off Zone
IR20	Infrared Radiator Zone upstream of Primer
SK20	Primer Booth
IR30	Infrared Radiator Zone upstream of Clear Coat
SK30	Clear Coat Booth
AZ30	Flash-off Zone
TR30	Dryer
FR20	Paint Room 1
FR30	Paint Room 2
FT10	Conveyor Circular Conveyor
FT20	Conveyor P&F Conveyor

Installation Site:

PLC-Control:	Siemens S7-300 (Component Groups ET200M), CPU 315-2 PN/DP
Visualising:	Wonderware Intouch
Field Bus System:	Profibus DP
Feed:	by Daiichi on site
Connecting Load:	280 kW
Main Switch	630 A
Network Feeders:	Feed 2 x Dosing Cabinet Feed 2 x Switching Cabinets Robots
Switching Cabinets:	Rittal, Coating RAL 7035 light grey
Dimensions:	B 1200mm, H 2000mm + 200mm foundation, T = 500mm
Voltage:	400V AC, 50Hz
Soft Starter:	≥ 7.5 kW
Control Voltage:	230V AC, 50Hz 24V DC
Protection Class:	IP 54
Others:	2 sockets for service work at the Switching Cabinet Double TCP/IP socket in the Switching Cabinet

Process Scheme: 12.038-1330-SB Air – Diagram