HVAC standardisation
@ Janssen Pharmaceutica Belgium: status update

SIEMENS Life Science DAY 2009

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June 2009
HVAC standardisation
@ Janssen Pharmaceutica Belgium: status update

- Speakers Corner
- Case study 1
- Once upon a time….
- Siemens PLC S7 (Janssen Pharmaceutica anno 2003)
- Siemens Desigo (Johnson & Johnson anno 2009)
- Case study 2 (Chemical Development Pilot Plant)
- Lessons Learned
Mario Don Porto Carero
senior manager HVAC @ Johnson & Johnson

HVAC engineer since 1992

Different roles and responsibilities
- technical owner
- start up/commissioning & verification manager
- HVAC design engineer

Contact
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This is Siemen, he’s the future user of a new project …

- The project URS
- A new building with: 1 front door / 3 windows / roof
- A contractor is involved, he is an expert in composing blocks
HVAC standardisation
Case study 1: Siemens Blocks

- First approach
- 100% compliance with URS but not what the user had in mind
- Total project time (>30 minutes / parts were missing)
HVAC standardisation

Case study 1: Siemens Blocks

- Second approach: use of small predefined functional blocks? How to combine these small functional blocks?

- Result: more similarities with what user had in mind but still many points of discussion (project time 25 min)
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Case study 1: Siemens Blocks

- Third approach: A detailed functional description is now available.

- But the Siemens is still not completely satisfied: 1 mistake was made and it takes too long (7 min 29 sec)
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Case study 1: Siemens Blocks

- From previous projects they learned that they need always a door, walls with windows, a roof and a certain floor layout.

- Having these functional combinations available upfront, they might be able to complete the job faster and with the same quality.
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Case study 1 : Siemens Blocks

- Final result
  project finished in 50 seconds : 0 mistakes

→ a happy customer
HVAC standardisation
Once upon a time….

History

● Early 90’s
  - start using typical PID objects (see next page)

● Late 90’s
  - mechanical contractor (Keysers): 8 standard PID’s for AHU
  - start using copy / paste of system description

● 2003
  - generic PID (incl. Tagging) (see p19)
  - generic functionalities in DSD
  - generic functionalities in program
HVAC standardisation

Once upon a time....
HVAC standardisation
Once upon a time....

History
- **Question from system owner (2002)**
  “How can we defend the cost for Siemens PLC controllers to our customers?”
  Are we still doing the right thing?

- **Survey**
  * matrix containing different items (*project, life cycle, quality, costs, ...*)
  * weight factors for different items
  * **facts and figures**
  * scores
  * conclusion and decision via committee
HVAC standardisation
Once upon a time…..

**History**

Results and conclusions

*Siemens +:* organisation, quality procedures, free programming possible

*Siemens -:* HVAC knowledge is depending on integrator

*DDC provider +:* good general HVAC knowledge, if you can use their standards it’s OK ...

*DDC provider -: ...* but if you want to change it’s difficult.

*DDC provider -: Qualification*

--> *Siemens PLC is still the best choice for us but we have to do something about the HVAC knowledge.*
HVAC standardisation
Once upon a time….

Why a change was needed…

- In the past the quality and integrity of a system (specifically the software) was depending on the contractor. Many surprises occurred and many changes were needed during development, construction and start up.

- Time schedule and/or lack of detailed information during detailed design versus lack of HVAC knowledge by software integrator.

> Gaps in transfer of information between HVAC main contractor and software integrator.
HVAC standardisation
Siemens PLC S7 (JPH anno 2003)

Complete integrated mechanical design, functional description, software and testing

- Goal: make a standard design that is flexible and easy in use and the performance is (almost) independent from project team.

- (generic) PID --> standard construction (example see page 19)
  PID based on standard components with fixed tags (to prevent as much as possible changes in software)

- (generic) System and functional description --> standard functionalities \(\rightarrow\) 80% of all possible needed options are already foreseen
HVAC standardisation
Siemens PLC S7 (JPH anno 2003)

DRC / DSEC and CSU projects - the ideal innovation environment
HVAC standardisation
Siemens PLC S7 (JPH anno 2003)

DRC / DSEC and CSU projects - the ideal innovation environment

- Total HVAC budget: +/- 23 million $
- 3 of 3 HVAC contractors involved
- 2 of 3 Software Integrators involved
- 3 of 3 Internal Customers Involved

--> Interdepartmental, “Intercontractoral” teams.
The experience of the past meets the state of the art of today and the requirements of the future.
An example: Recovery Coils

- PID
- DSD
- Software = DSD
- Testing -> based on certificates and integration testing
HVAC standardisation
Siemens PLC S7 (JPH anno 2003)
HVAC standardisation
J&J anno 2009

Specification Design & Verification Guidance Document

Johnson & Johnson
World-Wide Engineering and Real Estate

Requirements for functional specs and verification

CLEAN ROOM HVAC AIR HANDLING SYSTEM TEST MATRIX

GUIDELINE For BUILDING MANAGEMENT SYSTEMS DESIGN
<table>
<thead>
<tr>
<th>Task</th>
<th>Status</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVAC typicals</td>
<td>Done</td>
</tr>
<tr>
<td>HVAC controls related to the typicals</td>
<td>Draft available</td>
</tr>
<tr>
<td>Test matrix development for HVAC</td>
<td>Done</td>
</tr>
<tr>
<td>Test script develop for HVAC, BMS, Chiller</td>
<td>under construction</td>
</tr>
</tbody>
</table>

--- Example of test template (non QBMS system JPH Belgium"")

--- Example of test template J&J
HVAC standardisation
J&J anno 2009 (testing and verification)

(extra) INPUT

- green tag / blue tag (buckets) aligned with SD&V / SDP cleanroom and integrated in list
  - Construction testing / Pre-functional testing / Green Tag / Functional testing / Blue tag...

- Splitt Controller / HVAC system / Clean room
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J&J anno 2009 SDP cleanroom

General: Goal is to create ready for use (= ready for copy/paste +
small project specific modifications) PID & DSD in compliance with
SDP cleanroom guideline “Air Handling PIDs”

- Advantages:
  - standard practice - proven technology
  - Reuse of documents / test templates / test reports (module testing) / program
  - High speed development of documents / short review periods
  - High predictability of quality level

- Disadvantages
  - “Reduced creativity/innovation” level for (automation) contractor -
motivational aspects
  solution can be - dedicated “expert team”
**HVAC standardisation**  
**J&J anno 2009 SDP cleanroom**

- **Existing**: generic PID and DSD for PLC - controllers  
  (Siemens PLC S7 with CFC HVAC library)

  since 2002 more than 30 HVAC systems are programmed with “the same Siemens PLC S7 software” (in vitro and in vivo labs, pharma inlc. Sterile manufacturing, offices, chemical production, )
- **What’s New**: generic PID & DSD for DDC -controllers (see recommendation SDP automation)  
  (Siemens Desigo PX with CFC HVAC library)
- **Future (dream?)**: same WW approach including “other preferred (*1) software contractors”

  (**1) based upon location (US-EU-Asia), corporate frame work agreements.
HVAC and SDP cleanroom PID (SDP cleanroom)
HVAC and SDP cleanroom
PID Siemens PLC = PID Siemens Desigo
HVAC and SDP cleanroom
PID (Siemens PLC / Siemens Desigo) functions/option 1,2,3,4
### TEMPERATURE CONTROL LOOP TYPE 2

Each room is equipped with two fixed setpoints and two controllers. One for heating and one for cooling demand.

If in one of the rooms a cooling demand exists then the cooling controller will generate a signal to the main AHU supply air temperature loop TT01/TT05 to reduce the supply air setpoint.

<table>
<thead>
<tr>
<th>Gebruikte blokken</th>
<th>C_PI1</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>PI regelaar + genereren van grensalarmen op de temperatuurmeting</td>
</tr>
</tbody>
</table>
TEMPERATURE CONTROL LOOP TYPE 2

Each room is equipped with two fixed setpoints and two controllers. One for heating and one for cooling demand. If in one of the rooms a cooling demand exists then the cooling controller will generate a signal to the main AHU supply air temperature loop TT01/TT05 to reduce the supply air setpoint.
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Case study 2

- Chemical Development Pilot Plant
- Total project cost = 130 million Euro
- NON gmp critical BMS with on top a independent QBMS
- 3 + 1 AHU: in total +/- 220,000 m³/h (210,000 single pass)
- Question from SDP (2006)
  “How can we defend the cost for PLC controllers to our customers?”
  Are we still doing the right thing?

- → 3 Desigo PX controllers / 1 Siemens S7 plc
- → connecting Desigo with the existing BMS for alarming and reporting was challenging
HVAC standardisation
Lessons Learned: Projects

- only if you have multiple projects (>5) it is beneficial to create your own standard
- only if you have multiple projects (>2) it is beneficial to the user to implement an existing standard approach
- standard can be reused for +/-80% in pharma - lab buildings – offices – chemical plants
- once you have the standard, mechanical design, software design and integration, start up and maintenance cost will be reduced by factor 0.5 to 10 (depending on team !!!)
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Lessons Learned : Team

- Keep a core team available on both sides (user and software integrator)

- New user: results in additional (other) functionalities because
  - he isn’t aware of the initial possibilities (changing functionality with parameters)
  - he is referring to other projects/experiences of the past
    → focus is lost

- New software integrator (can be @ the same company)
  - misinterpretations: extra time needed to explain again the site or plant specific requirements
  - is spending more time to create documents, is making new documents, ....
    → routine is lost

- → you need more time and get lower quality
HVAC standardisation
Lessons Learned : WWE

- Keep a core team available on both sides (user and software integrator)
- Compose user requirements based upon standard PID, functional description (user, SDP-representative, representative software integrator)
- Software can be developed and preFAT tested at home office of software integrator
- Small affiliates can benefit from the knowledge and lessons learned
HVAC standardisation
The future (anno 2003)

How others can benefit from our standards

- J&J is not a software company so we are not going to sell the HVAC standards. But we are going to promote them.

- There is an interest of companies who have already Siemens PLC’s for water/HVAC systems or who need a high degree of flexibility / accuracy / testing (validation) (other pharmaceutical companies, nuclear industry, ... )
HVAC standardisation
The Future (anno 2003)

How can we have a benefit because of others having a benefit of our standards

- Because of this interest we will get more and better motivated contractors.
  > Leveraging knowledge and experience
HVAC standardisation
We can make the difference

- 03-sep-08: The Netherlands will invest $100 Billion Euro to prevent from flooding

- 03-sep-08: windrecord for cuba: hurricane Gustav 340 km/h

- 28-aug-08: the North Pole is melting "The sea ice cover this year has reached a new record low"

Climate change?

Please try to reduce your energy consumption