



Remanufacturing & Repair for complex equipments

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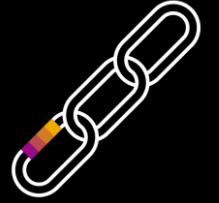
How can equipment manufacturing be sustainable?

3R's

Recycle



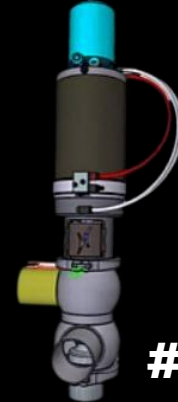
#234



Remanufacture



#234

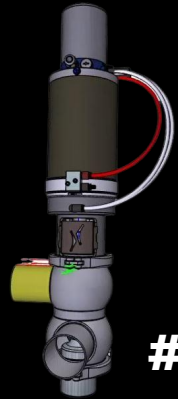


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Repair

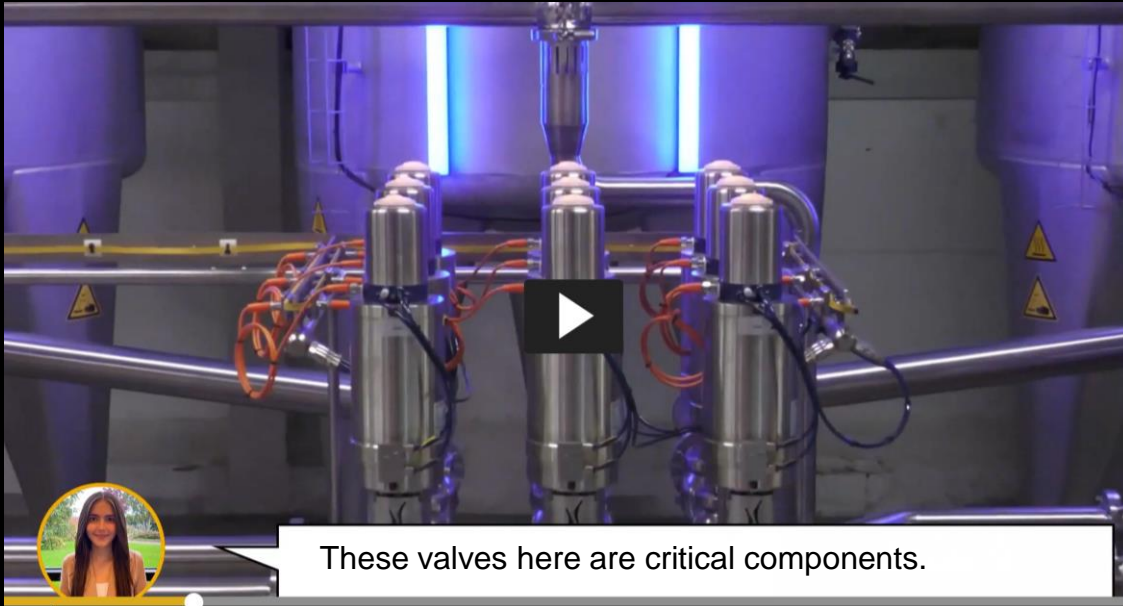


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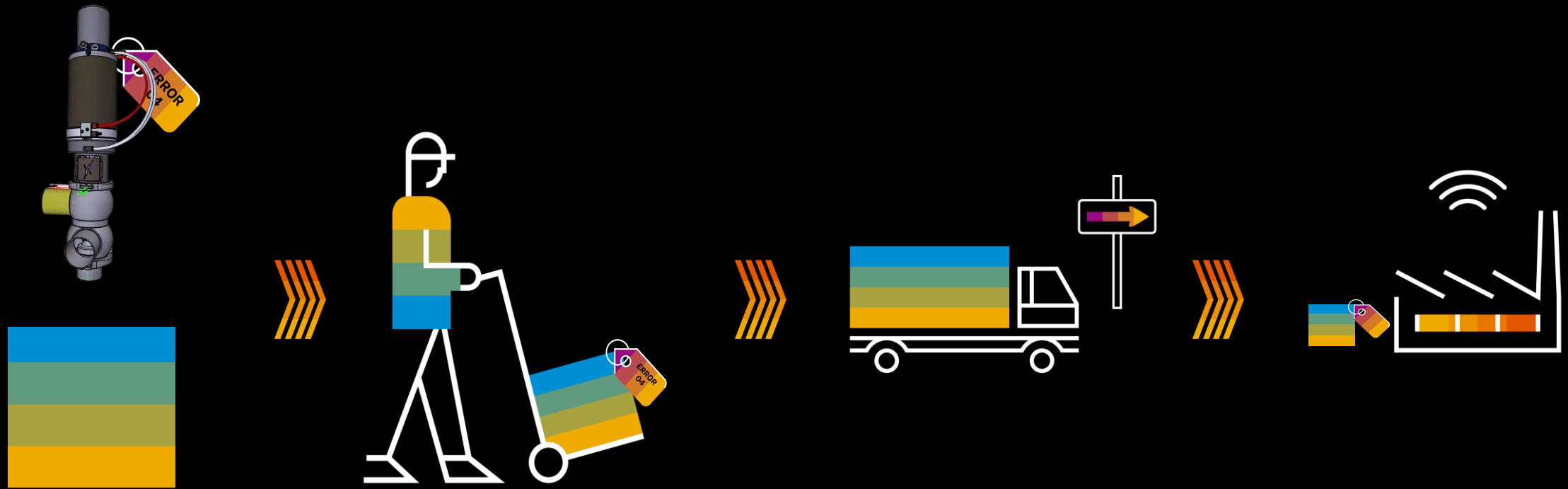
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**Could we know upfront what
needs to be repaired?**



Asset health monitoring predicts failures and generates an error code

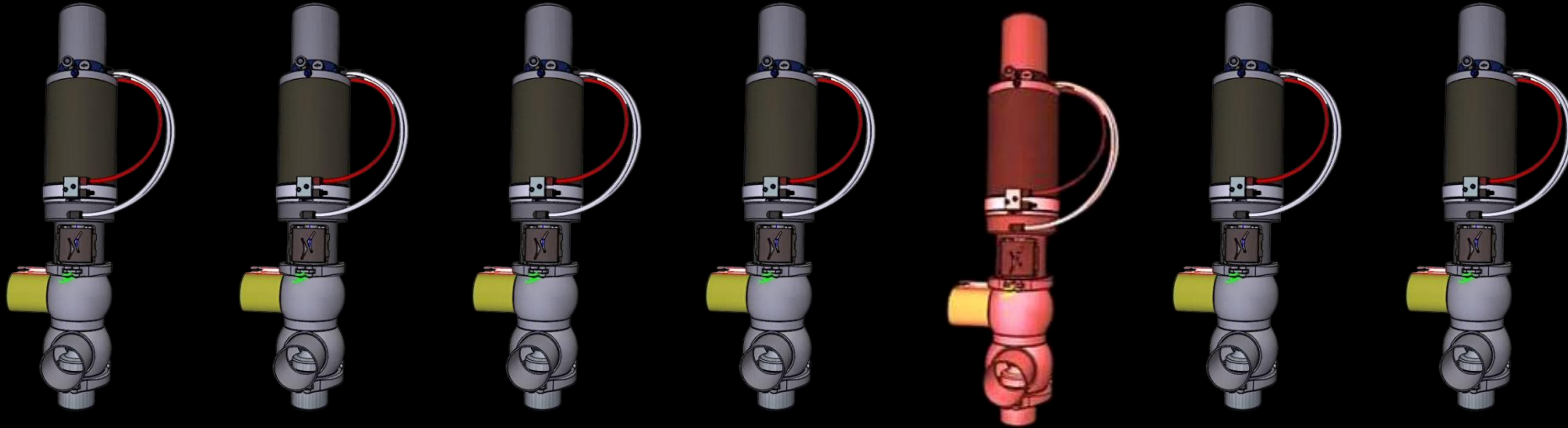




If a major malfunction is predicted or occurs the customer returns the equipment for repair or scrap.

Why “was” repair and remanufacturing costly?

Product variance drives up cost



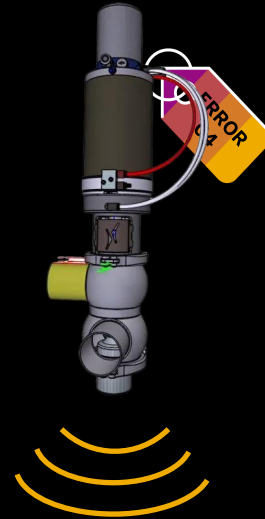
Configure-to-Order or Engineered-to-Order

The SAP solution: Industrialization & Automation

Industrialization & Automation

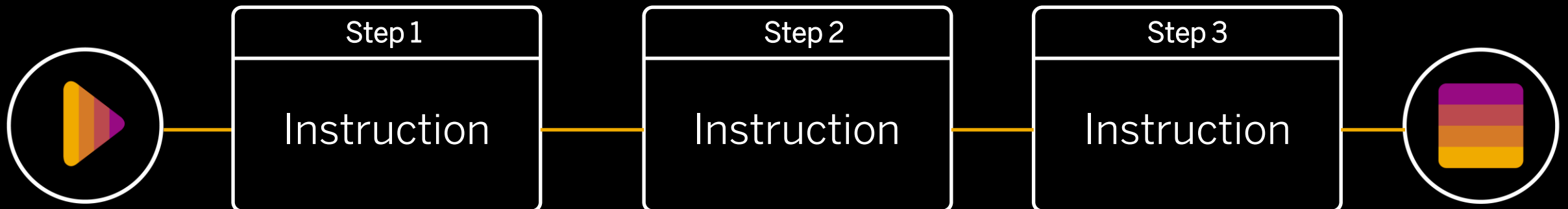
Industrialization:

We create a sequence of work steps (routing) for disassembly and then for reassembly.



Automation:

Creation of the routing is automated and able to consider product variance and many error codes.

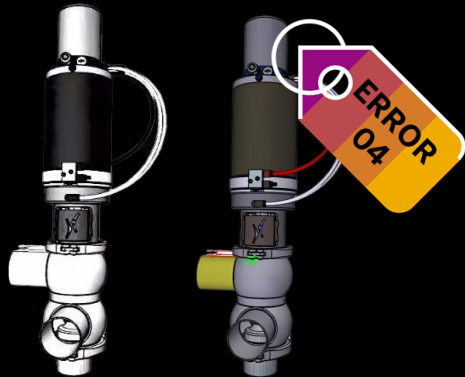


The SAP solution

applies SAP Standard functionality for manufacturing to reduce cost of repair & remanufacturing at no additional cost.

S/4 HANA

MES



S/4 HANA – How does it work?



Disassembly: Embedded in S/4HANA or ERP we apply SAP Product Process and Governance to derive with a classification system automatically the routing for a specific error code and product variance.

Reassembly: Embedded in S/4HANA or ERP we apply SAP Product Process and Governance to derive from the NC code of the disassembly the reassembly BOM and routing.



SAP PPG

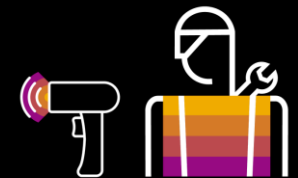
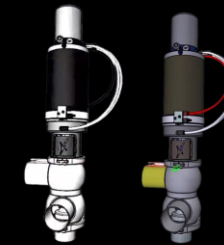
SAP DMC

SAP DMC – How does it work?



Disassembly: SAP DMC receives the disassembly order from S/4HANA and guides the worker step by step through the disassembly and validation process of the failure. It uses the digital twin according to the serial number.

Reassembly: SAP DMC receives the assembly order from S/4HANA and guides the worker step by step through the assembly and updates the digital twin accordingly.



SAP S/4HANA

SAP DMC

Repair & Remanufacturing

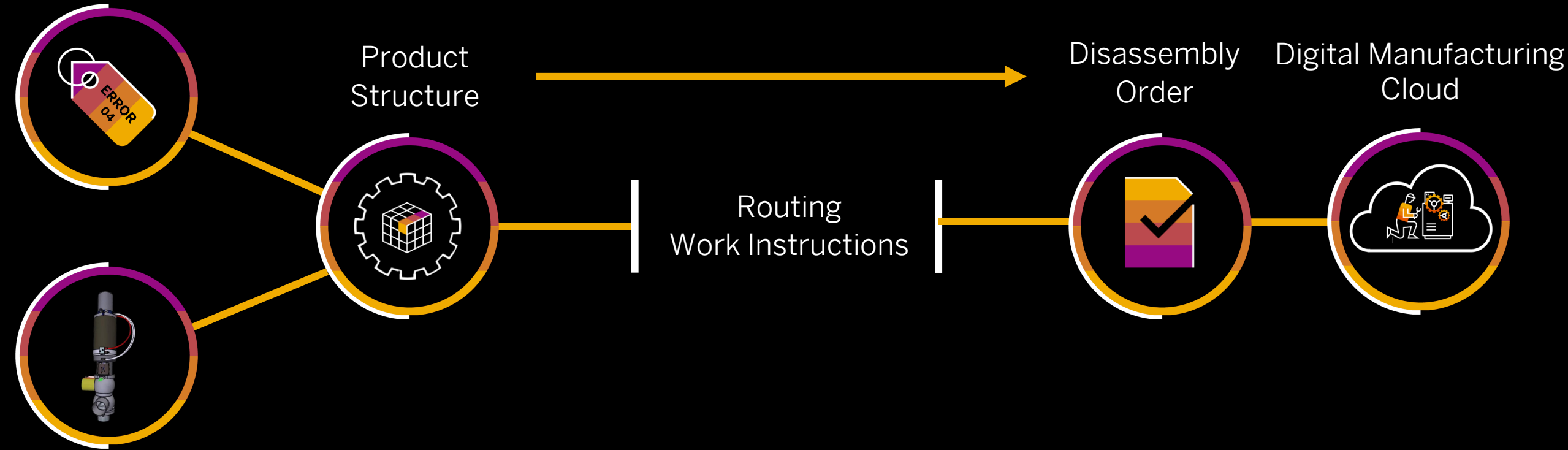
Failure Code

Product Structure

Disassembly Order

Digital Manufacturing Cloud

Routing Work Instructions



Product Variant

Repair & Remanufacturing

Failure Code

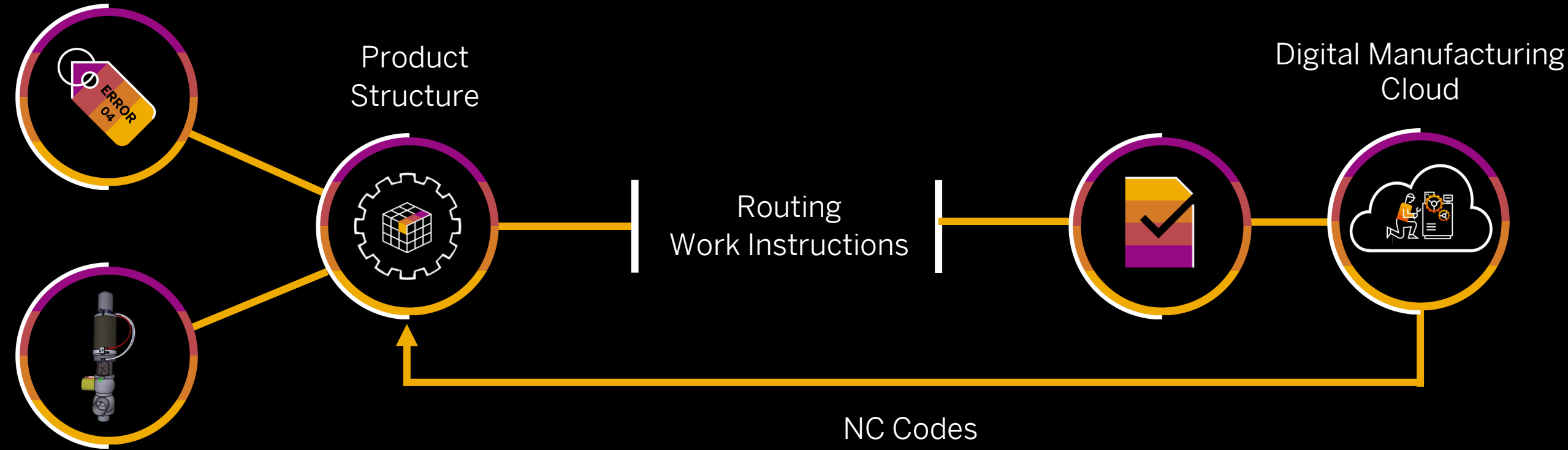
Product Structure

Digital Manufacturing Cloud

Routing Work Instructions

NC Codes

Product Variant



Repair & Remanufacturing

Failure Code

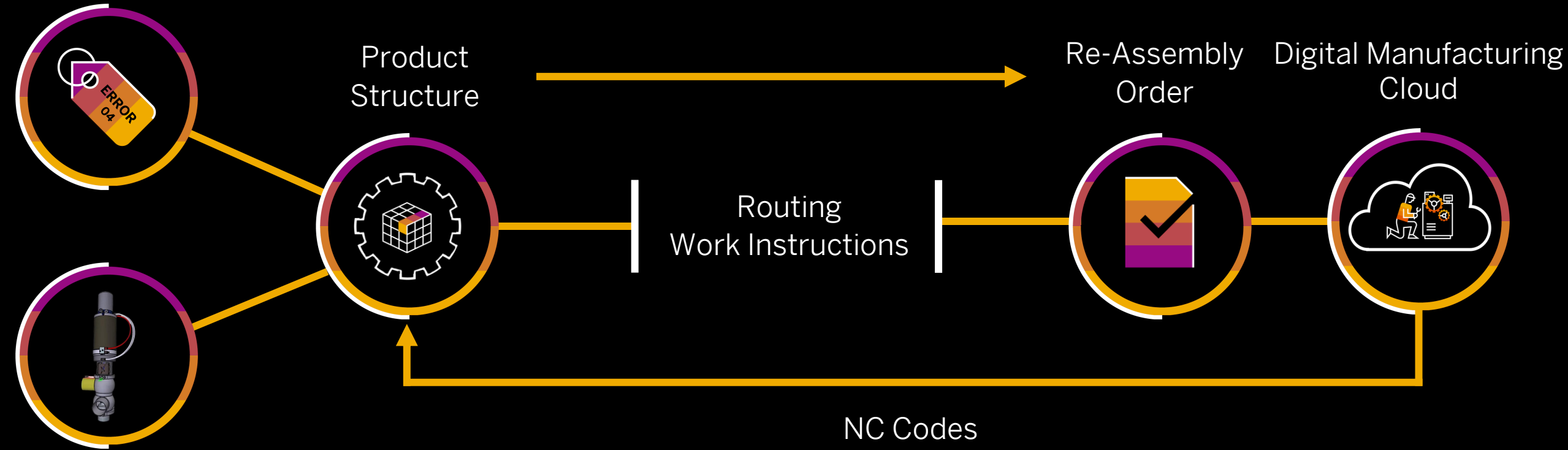
Product Structure

Re-Assembly Order

Digital Manufacturing Cloud

Routing Work Instructions

NC Codes

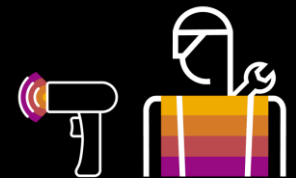
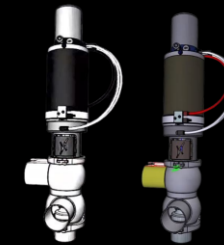


Product Variant

Error code missing or wrong?



Diagnostics: Use PPG to create a diagnostic order which collects iteratively NC codes during the routing.

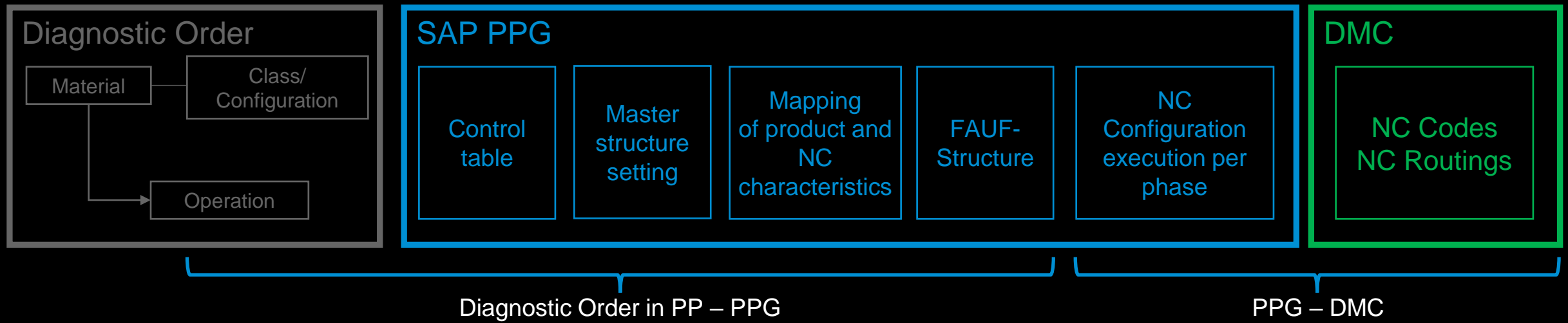


SAP PPG

SAP DMC

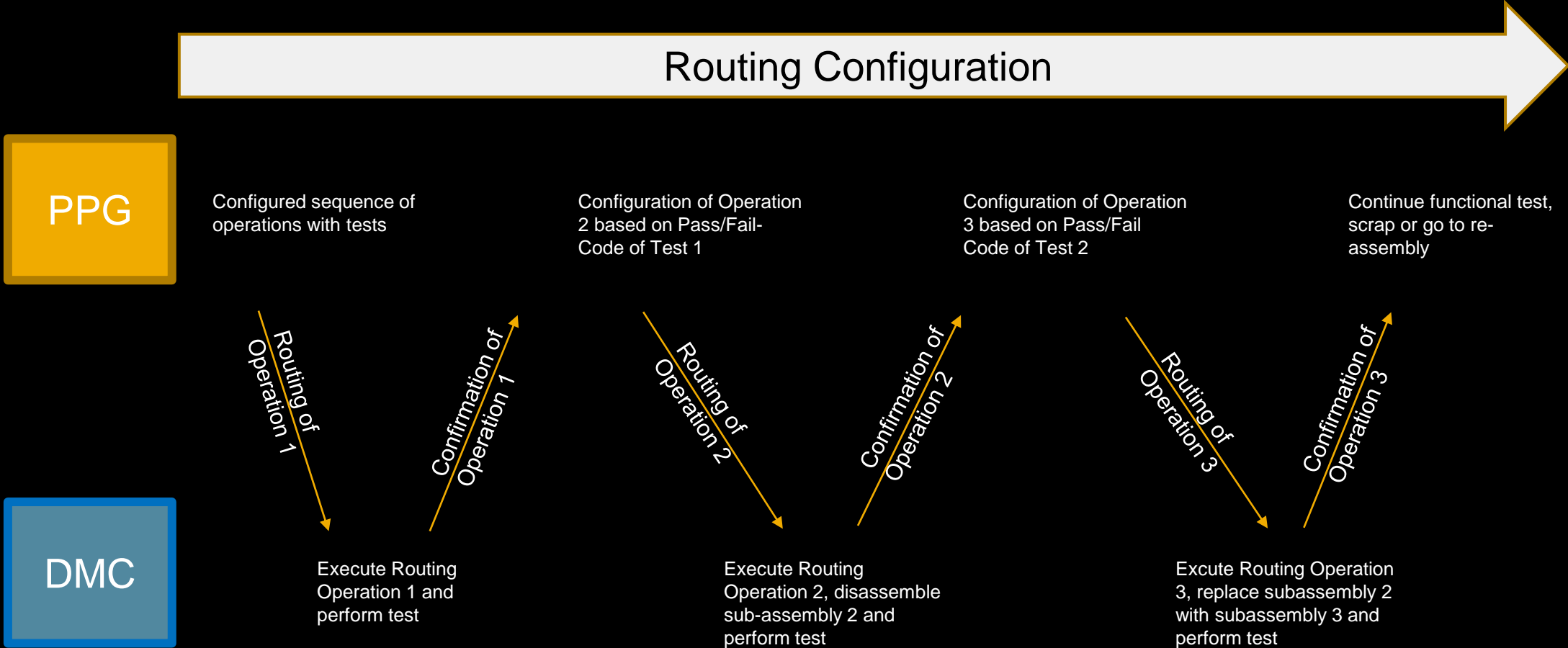
Data Model and Integration Approach

- ❑ Attribute driven MES is an universal approach which supports shopfloor configuration for different purposes. Here we apply this capability for repair and remanufacturing.
- ❑ The attributes can be used to dynamically configure the routing or to instruct DMC to use specific NC routings.
- ❑ PPG includes the business logic to process the NC codes (= test results) and derives from the NC codes either a new routing or attributes to trigger DMC to use a specific NC routing.

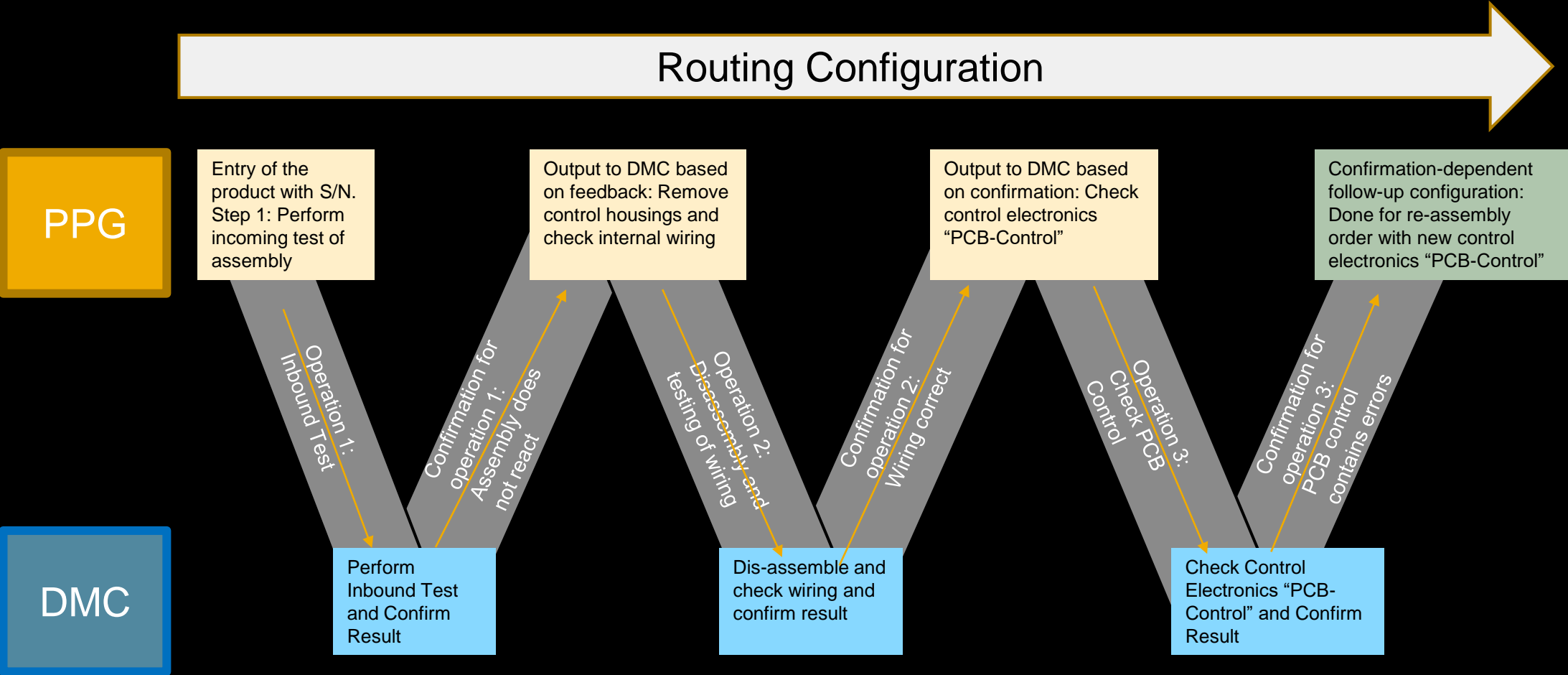


Diagnostic Order with dynamic routing

PPG guides DMC through an iterative diagnostics process, which is based on a step by step configuration of the routing. The step by step configuration of the routing is driven by the findings in DMC.



Example: Diagnostic Order with dynamic routing

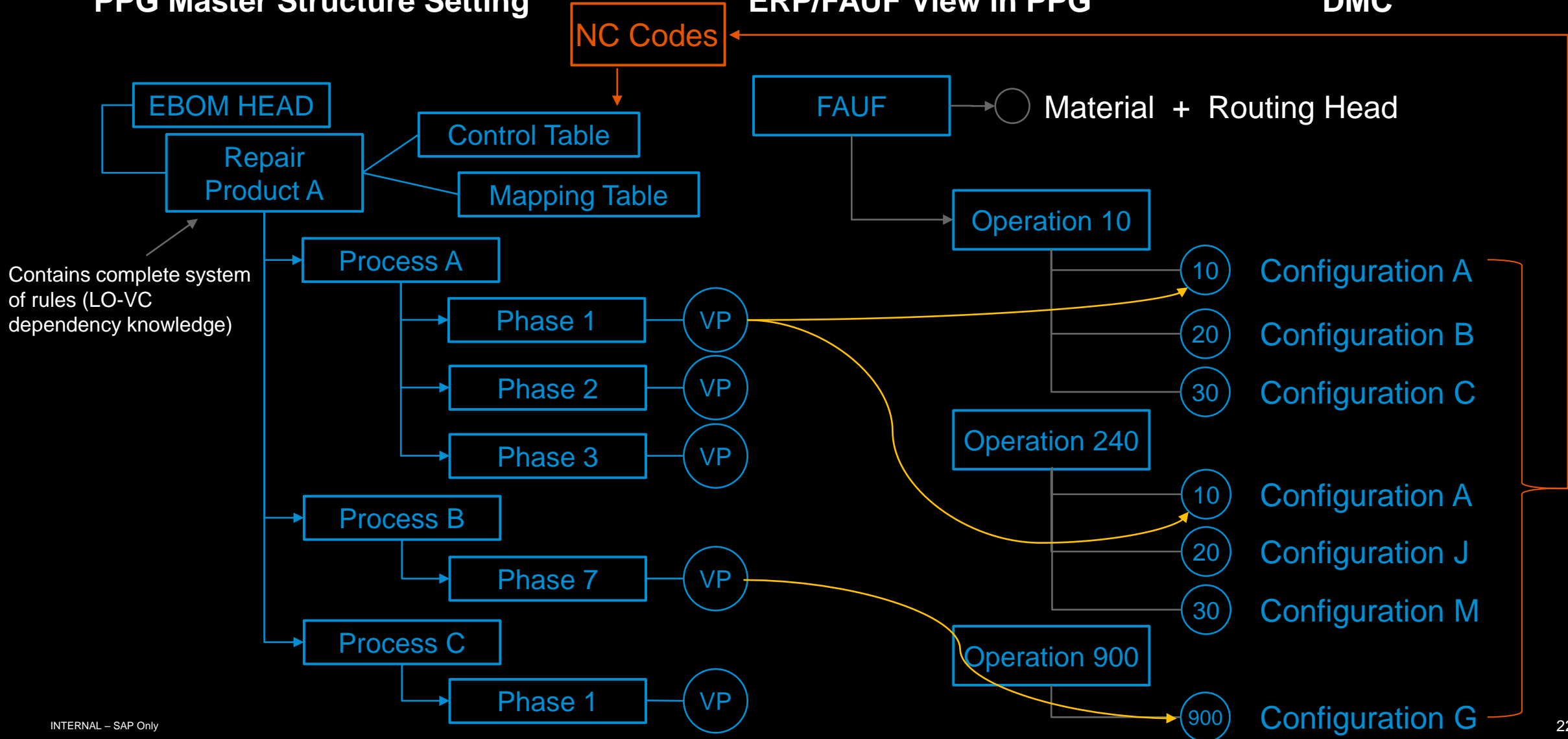


Dynamic Routing & Diagnostics

PPG Master Structure Setting

ERP/FAUF View in PPG

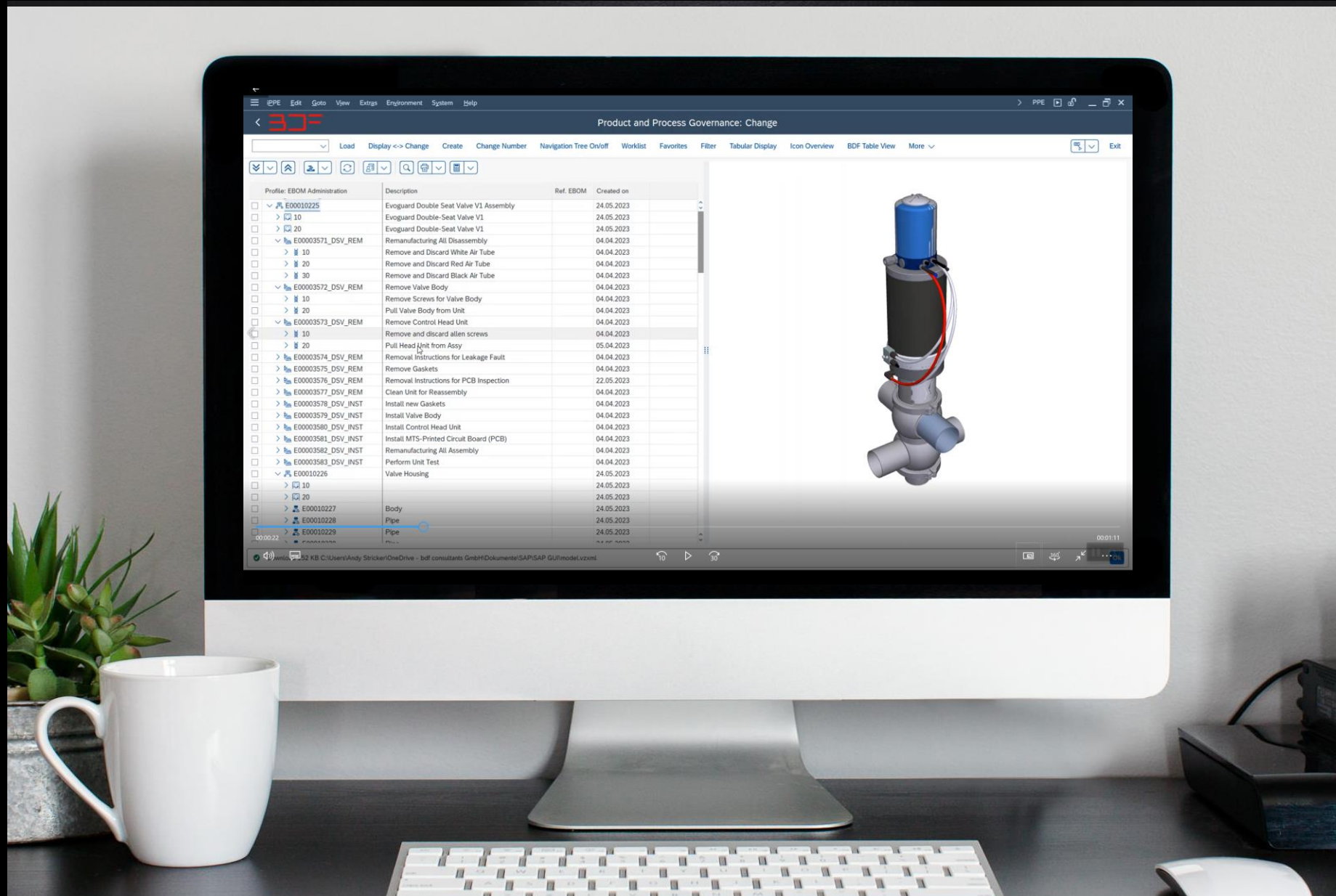
DMC



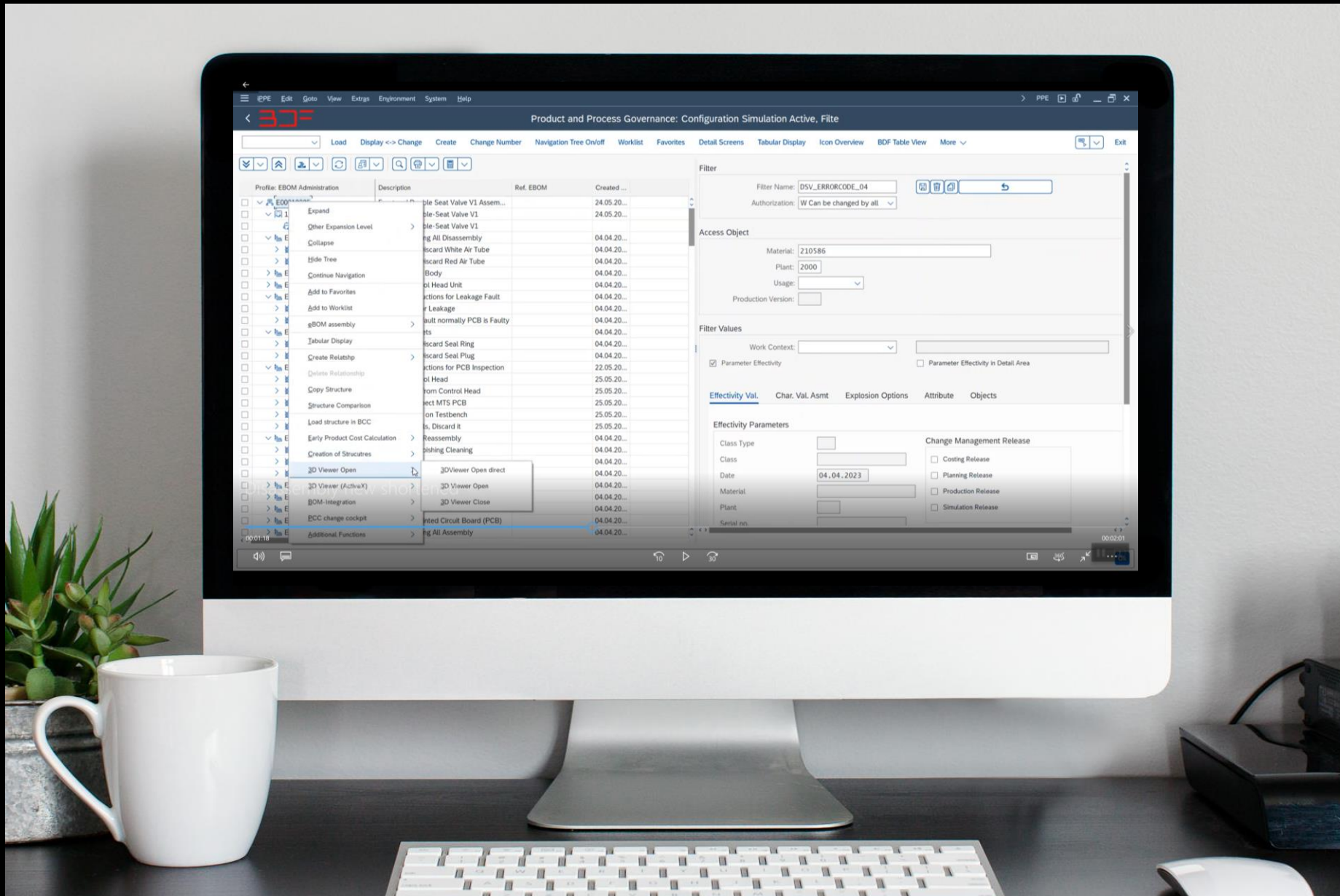
Step 1: Diagnostic Information from the equipment or the customer



Step 2: The product structure manages the repair master data



Step 3: The disassembly/diagnostic order is created



Step 4: The worker disassembles and tests step by step with dynamic routing

SAP Service Disassembly POD - Plant: CM100 (Cross Manufacturing) - Search in: "Apps"

Main Page / Activities 07:09:40

CM100121 SFC
Status: Work Center: D20_MFG Resource: D20_WORKBENCH_A SFC Quantity: 1 Order: DISASSEMBLY_DEMO_2 Material: D20_EVOGUARD_DOUBLE_SEAT_VALVE/A Material Description: Krones Evoguard Double-Seat Valve

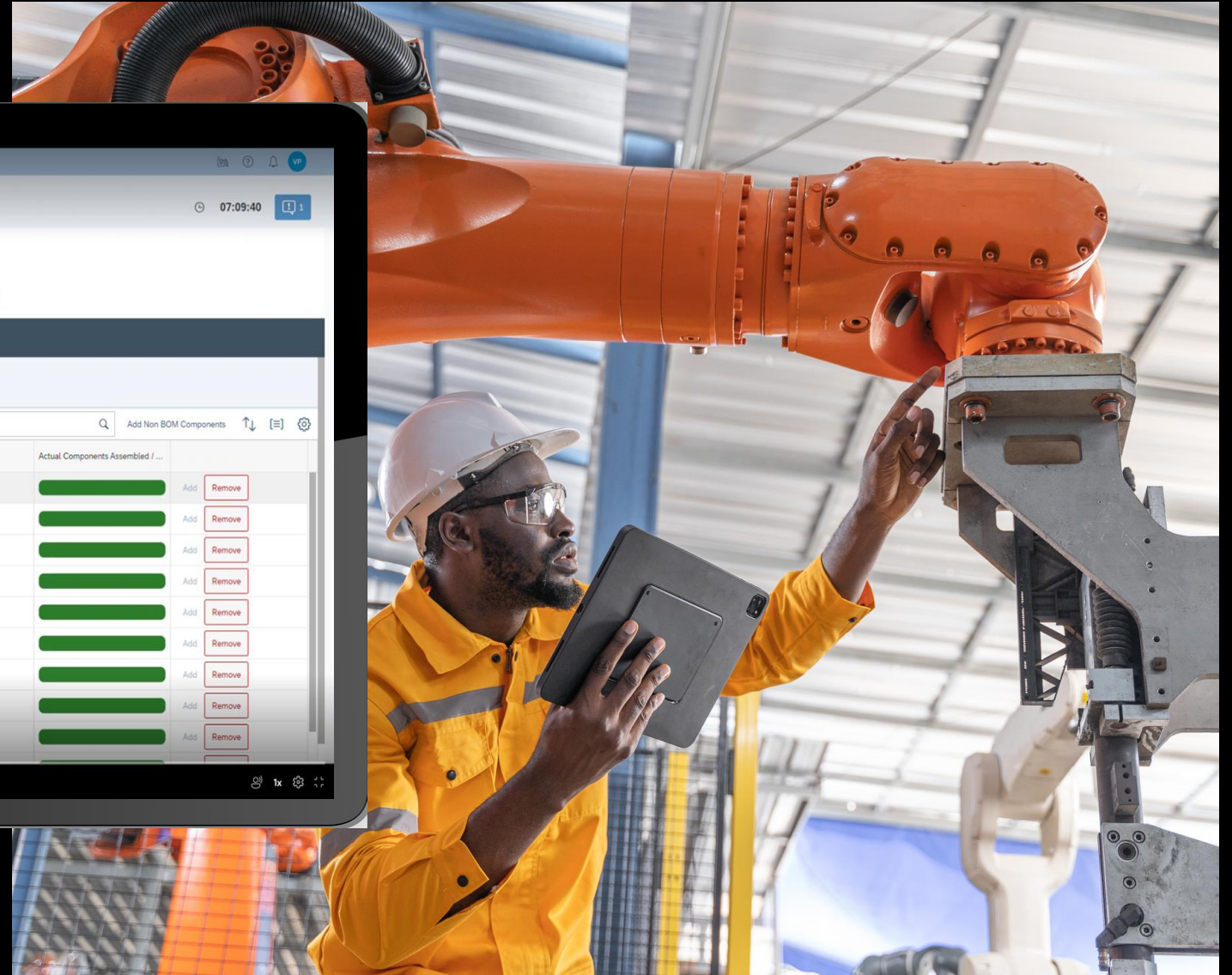
Start Sign Off Complete Nonconformance Actions

Operation Activity List (5)

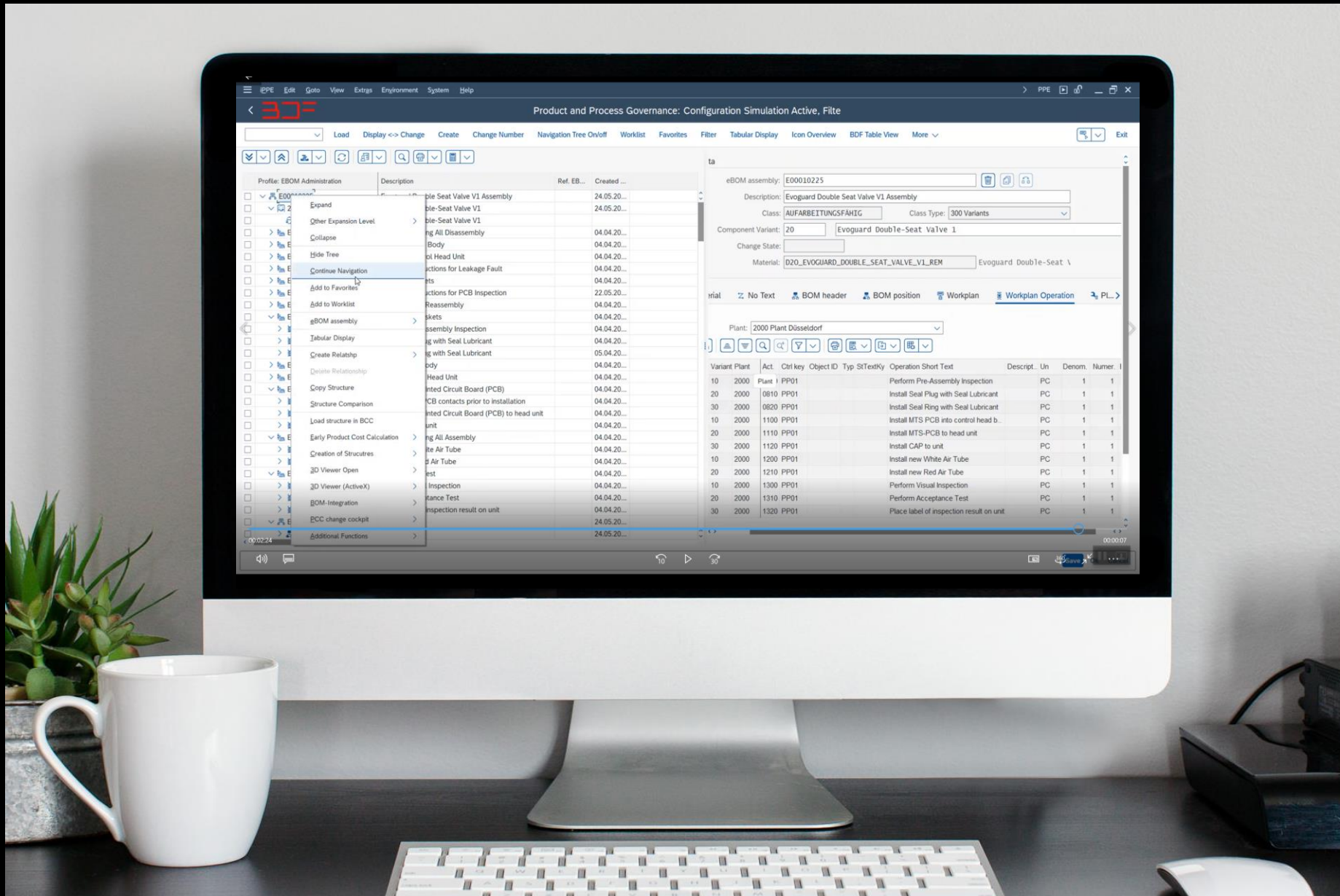
Activity Description Status...
Remanufacturing All Disassembly

BOM Components / Version	Description	Operation	Assembly Sequence	Actual Components Assembled / ...
D20_DOUBLE_SEAT_VAL...	Evoguard Double-Seat Valve Body	Assembly of Head	10	██████████ Add Remove
D20_AIR_TUBE_RED / A	Air Tube Red	Assembly of Head	100	██████████ Add Remove
D20_AIR_TUBE_WHITE / A	Air Tube White	Assembly of Head	110	██████████ Add Remove
D20_DMC_CONTROL_HE...	Head Unit - Blue Cover Wiring	Assembly of Head	120	██████████ Add Remove
D20_1627849_1_0_METAL...	Hood Metallic	Assembly of Head	20	██████████ Add Remove
D20_0902414268 / A	Screw-In Bearing	Assembly of Head	30	██████████ Add Remove
D20_0902943597 / A	Magnet Bracket	Assembly of Head	40	██████████ Add Remove
D20_1691856_1_0 / A	Cap with Krones Logo	Assembly of Head	50	██████████ Add Remove
D20_CA35030144 / A	Sound Absorber	Assembly of Head	60	██████████ Add Remove

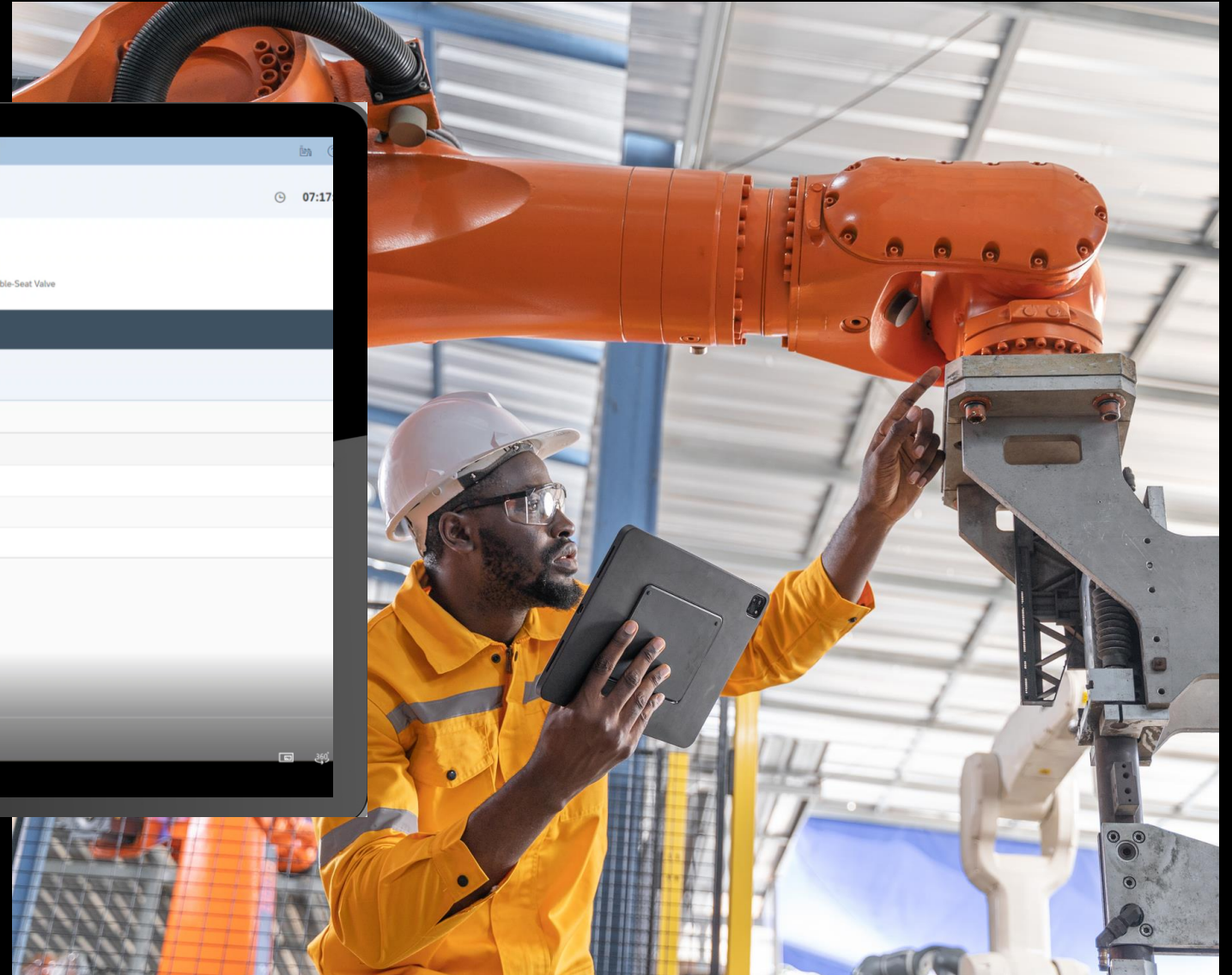
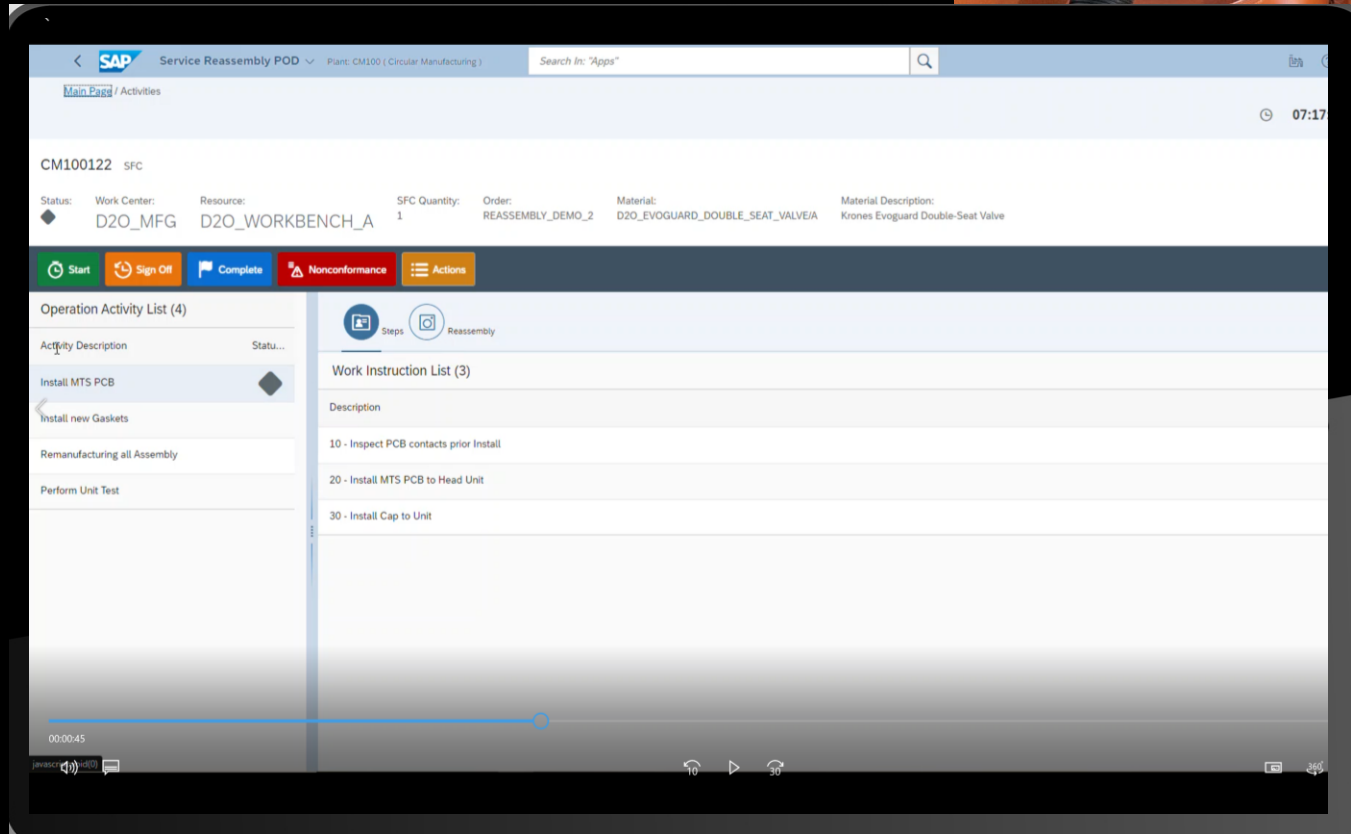
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Step 3: The reassembly order is created



Step 4: The worker reassembles and tests with dynamic routing



SAP PPG & SAP DMC References

SCHÜCO

rexroth
A Bosch Company

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