KiK|MPi
Kennis- en innovatiecentrum Maintenance Procesindustrie

BEMAS

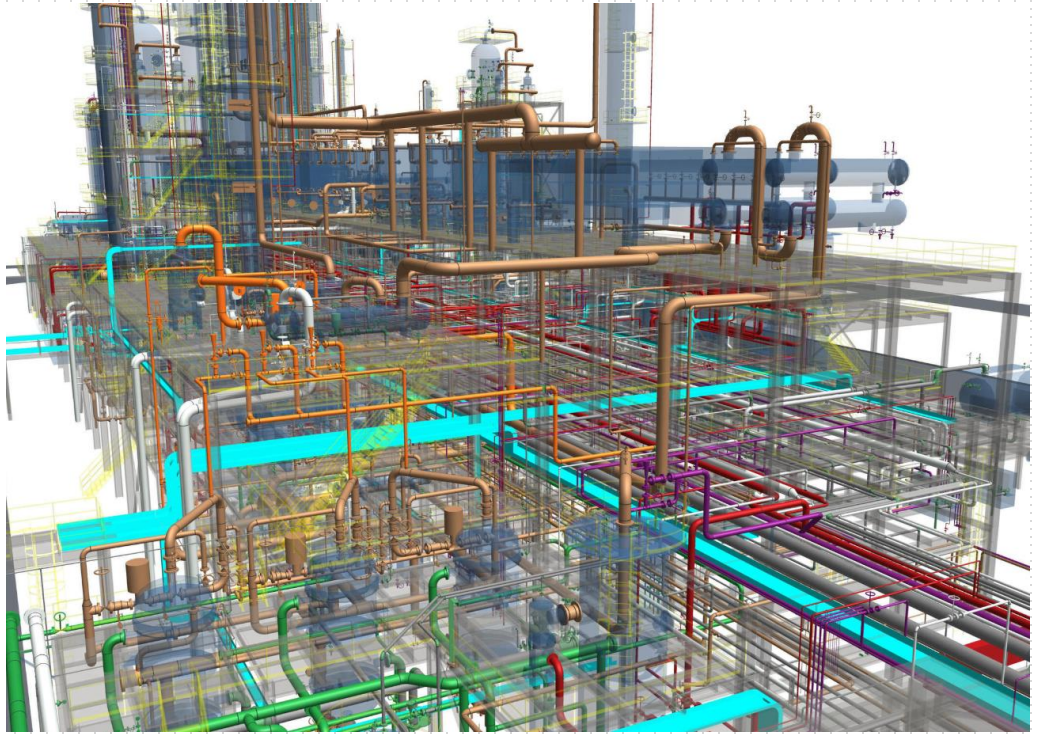
Interreg
EUROPESE UNIE
Vlaanderen-Nederland
Europees Fonds voor Regionale Ontwikkeling

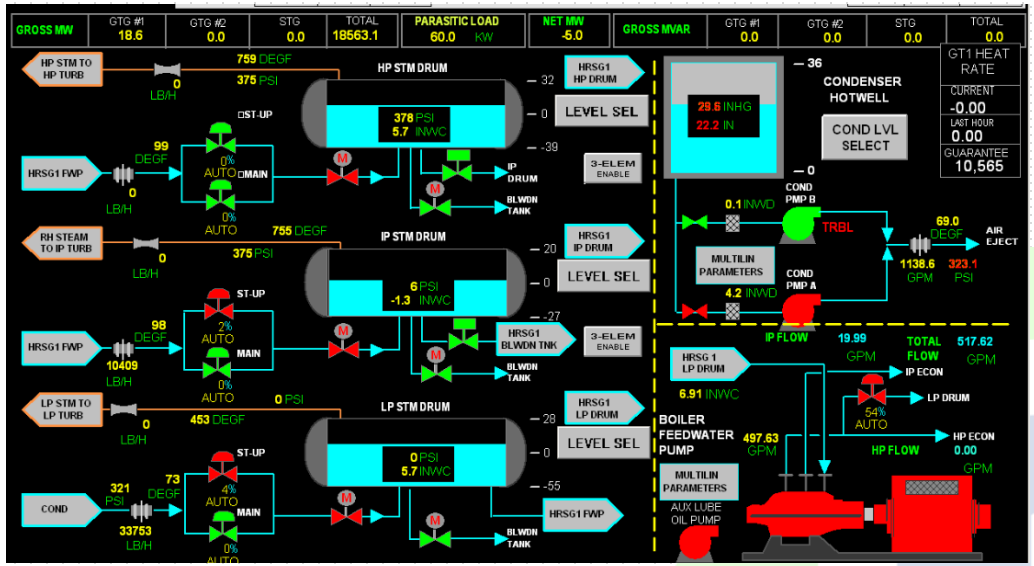
# Masterclass "Voorspellen levensduur van regelkleppen"

Interreg project
Circulair Onderhoud
22 november 2022

# Introductie

Knowledge grows

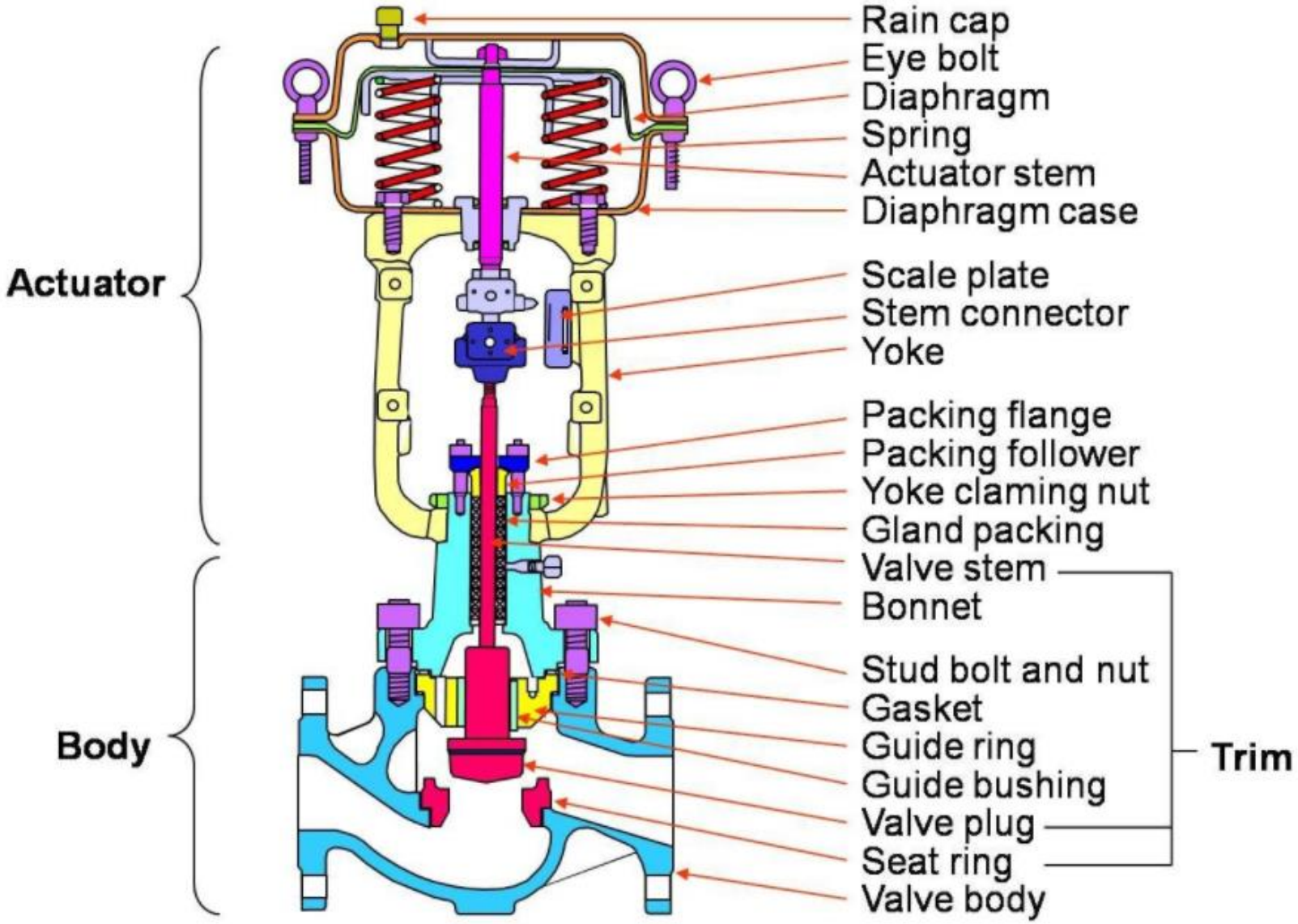




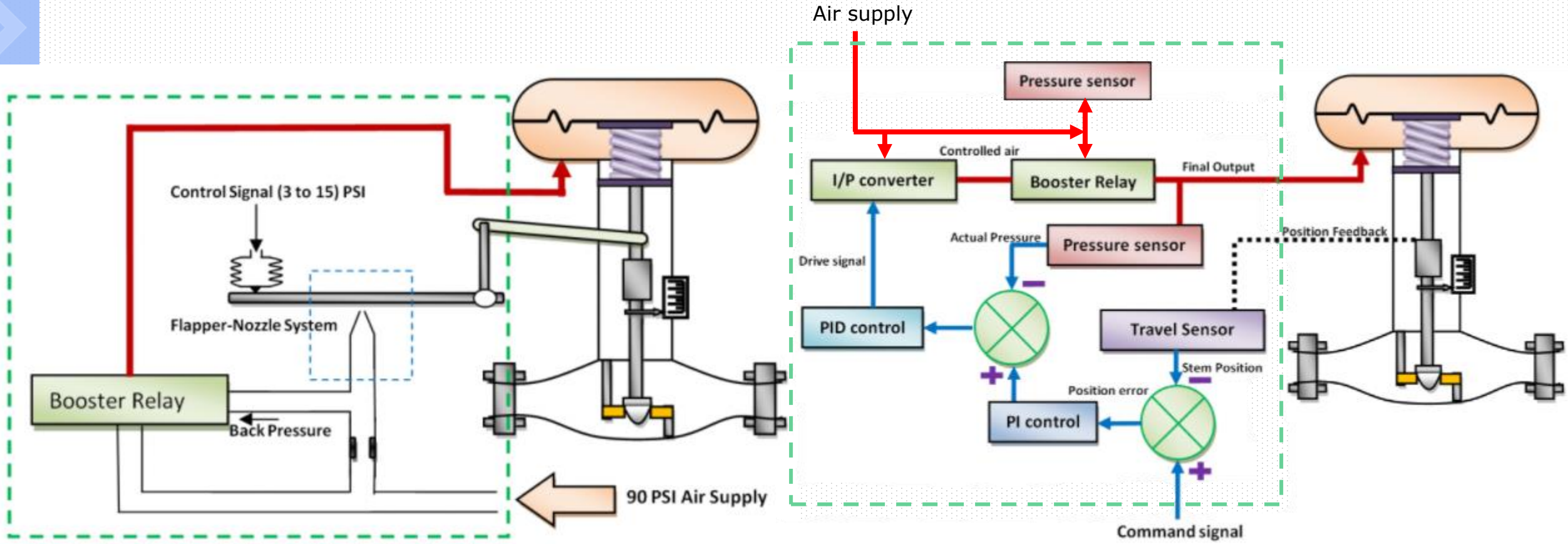
# Project doelstellingen

- Een gevalideerde methode om te komen tot het voorspellen van de (rest)levensduur van de regelkleppen
- Methode voor het periodiek verzamelen van diagnostische data uit klepstandstellers
- Software hulpmiddelen ontwikkelen die ingezet kunnen worden bij het toepassen van de ontwikkelde methode voor het daadwerkelijk doorrekenen/voorspellen van die (rest)levensduur
- Interactieve sessies om de opgedane kennis te delen/ optimaliseren/ borgen

# De regelklep

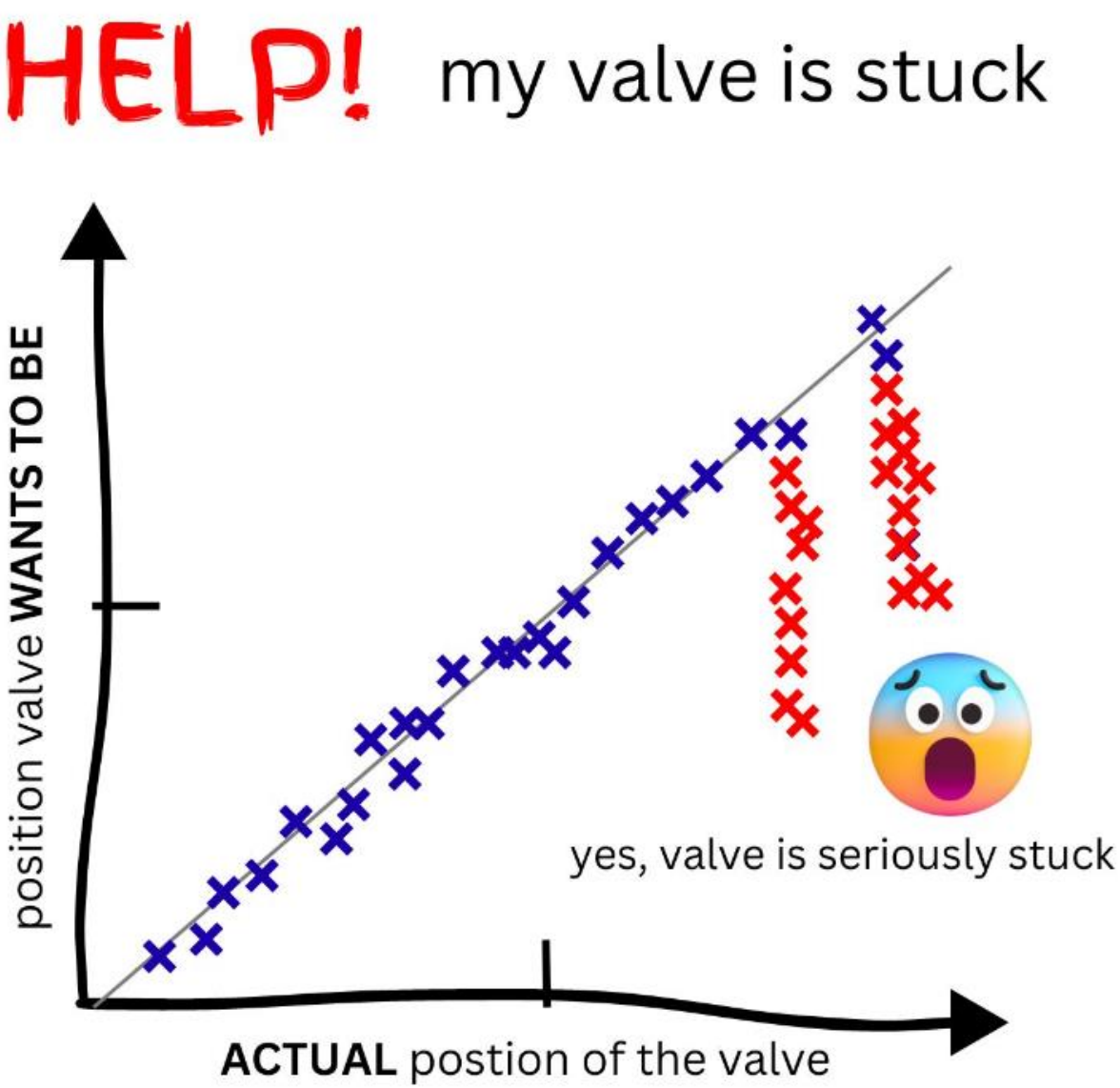


# Klepstandsteller oud vs nieuw



# Key parameters

- Cycle counter
- Travel
- Air leakage
- Setpiont deviation
- Friction?



# FMEA

| Component or Item | Sub-Component | Sub-component function | Failure Mode | Evident / Hidden Failure | Failure Mechanism | Failure mechanism detail | Process Effect | Failure characteristic (see comment) - optional | Control plan in place (see comment) - optional | Mtc. Strategy | Task | Frequency |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Actuator | Diaphragm | Provide linear/rotary motion to actuator/valve stem by air supply | Fail to operate / Fail to move to safe position / Reduced Controllability | Evident | diaphraghm ruptured | excessive air supply pressure (e.g. regulator failure or incorrect pressure setting) | Unsafe situation, offspec situation or plant shutdown | Random | Regulator setting according to OEM documentation (IOM)<br>Visual inspect regulator<br>Use of smart positioners with online diagnostics capability will give an indication of this type of failure developing. | Predictive | Check air pressure against maximum allowable air pressure<br>Check setting and proper functioning of regulator. air set | During commissioning<br>Visual inspection frequency shall be based on maintenance history and plant experience between turn-a-rounds |
| Actuator | Spring | Provide valve air fail safe action | Fail to operate / Fail to move to safe position / Reduced Controllability | Evident | spring broken | Improper spring material selection | Creates unsafe situation | Random | Check material with supplier and/or material specialist, check number of cycles | Failure elimination | Check and repair/replace/upgrade when needed | Inspection shall be based on maint history and plant experience. Also observe manufacturer's recommendations |

| Occurrence (or probability) | Severity | Detection (do nothing) | RPN (before) | Possibilities to observe | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Visual inspection | Detection | RPN | Comments | Smart positioner with pessuresensor in supply | Detection | RPN | Comments | Smart positioner with pessure-sensor in supply and to actuator | Detection | RPN | Comments | DCS/Historian | Detection | RPN | Comments |
| 4 | 7 | 8 | 224 | Yes but with limitations | 6 | 168 | not always a pressure gauge present, detectable throug vent | Yes | 4 | 112 | | Yes | 2 | 56 | | | 5 | 140 | |
| 3 | 4 | 8 | 96 | No | 7 | 84 | in case of fail close, the valve will no longer close completely. | Yes but with limitations | 5 | 60 | control parameter for travel will deviate from initial commissioning | Yes | 4 | 48 | When the spring is broken the benceset deviates. Theoretically it should be possible to detect this with the pressure sensor | | 6 | 72 | poor controllability |

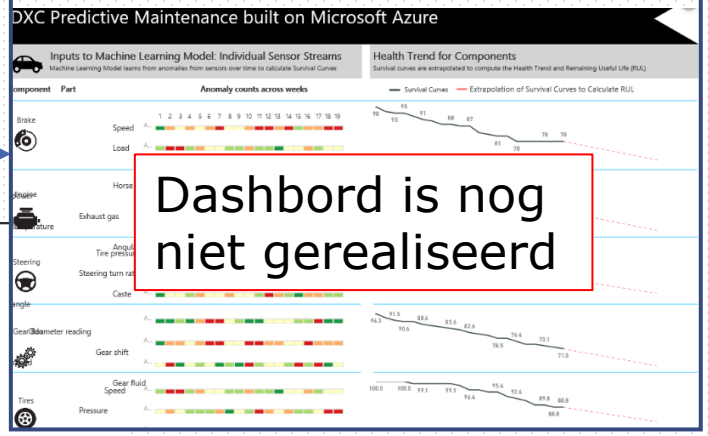
# Overzicht proces control systeem

Samson
Klep analyse

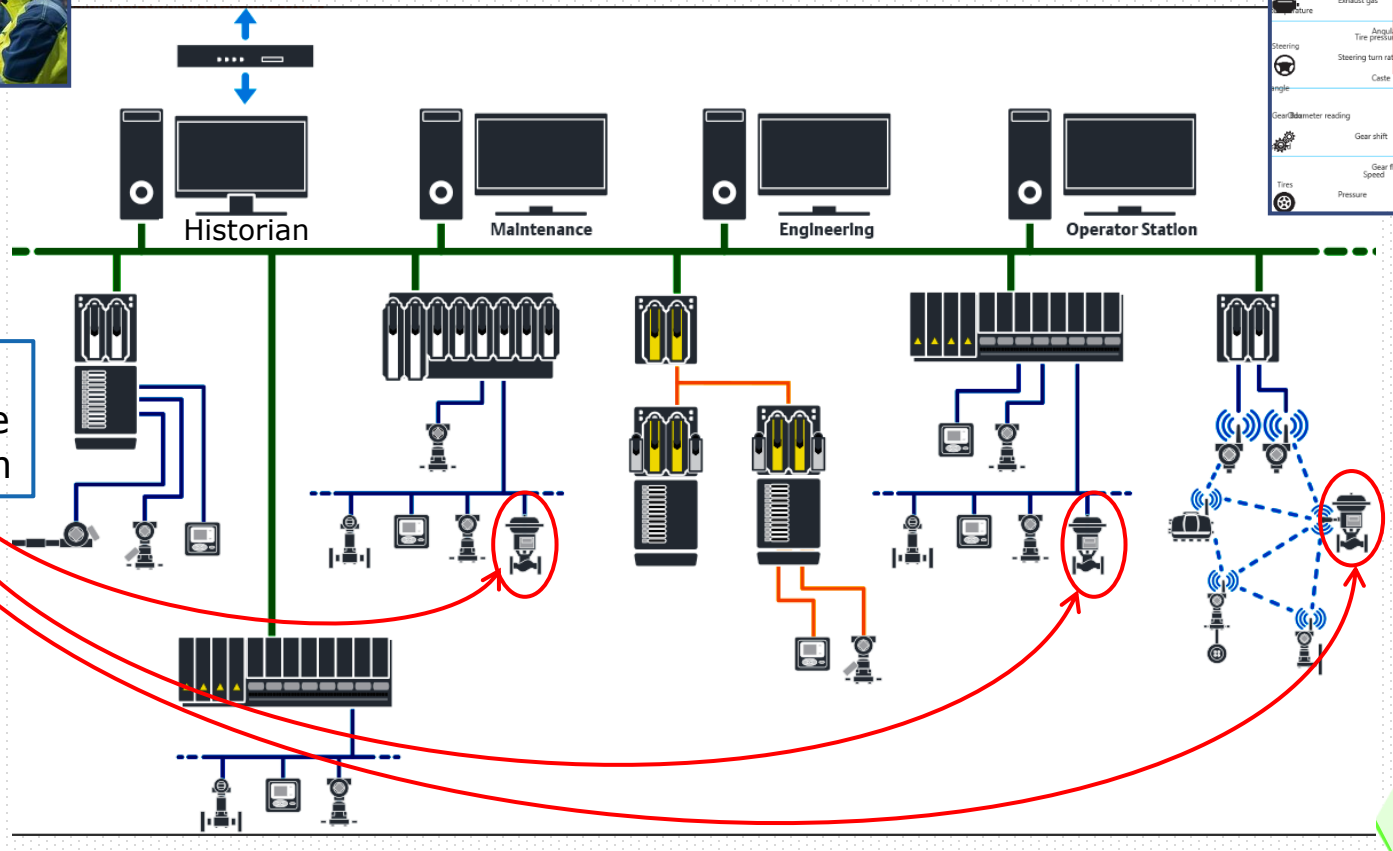
HZ University
Data analyse

Interactie asset owner in geval van onregelmatigheden

Dashbordoverzicht
staat kleppen



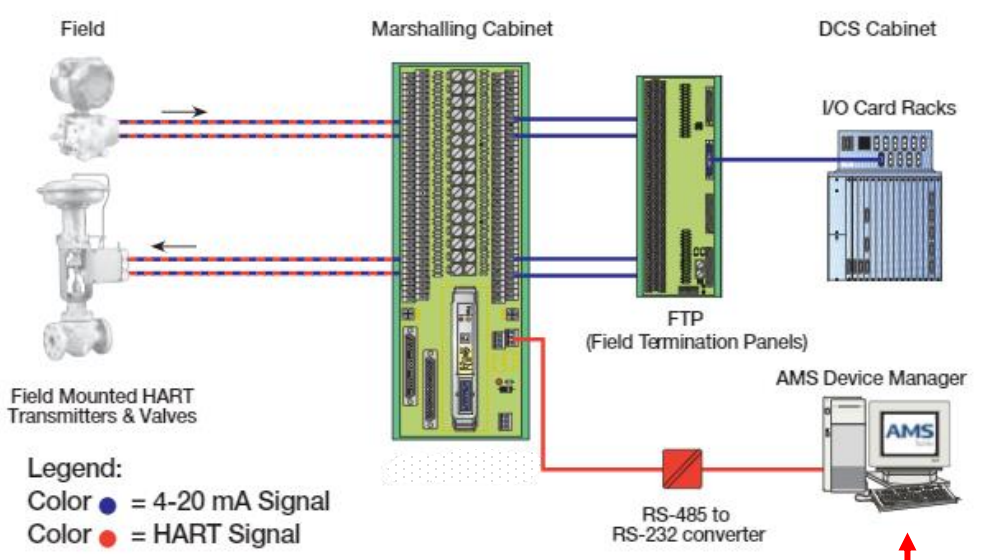

Dashbord is nog niet gerealiseerd

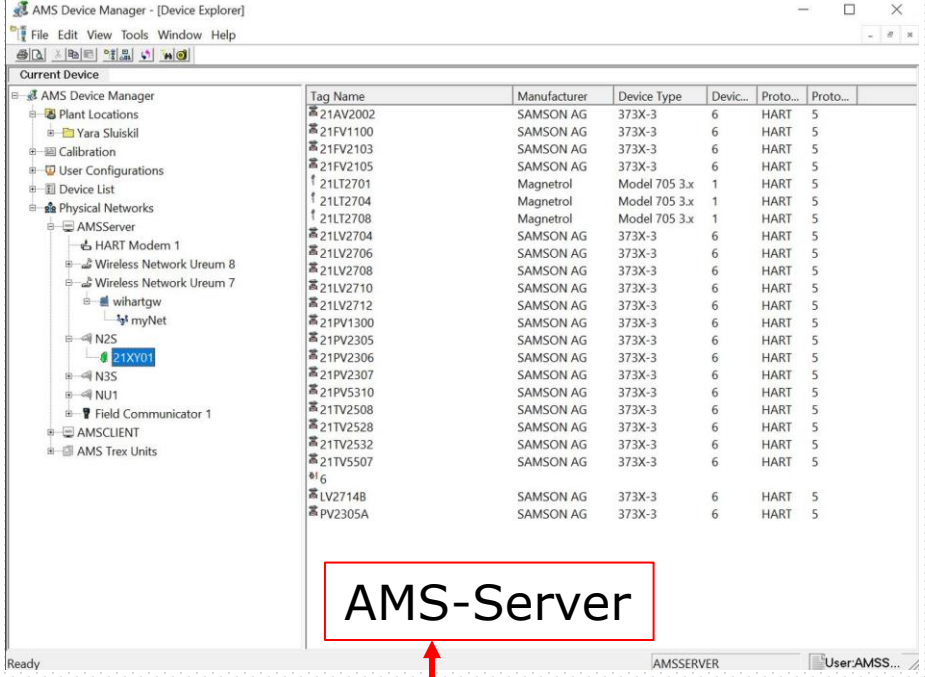



Offline
datapakket
Voor
analyse

Data
collectie
systeem

# Systeem overzicht



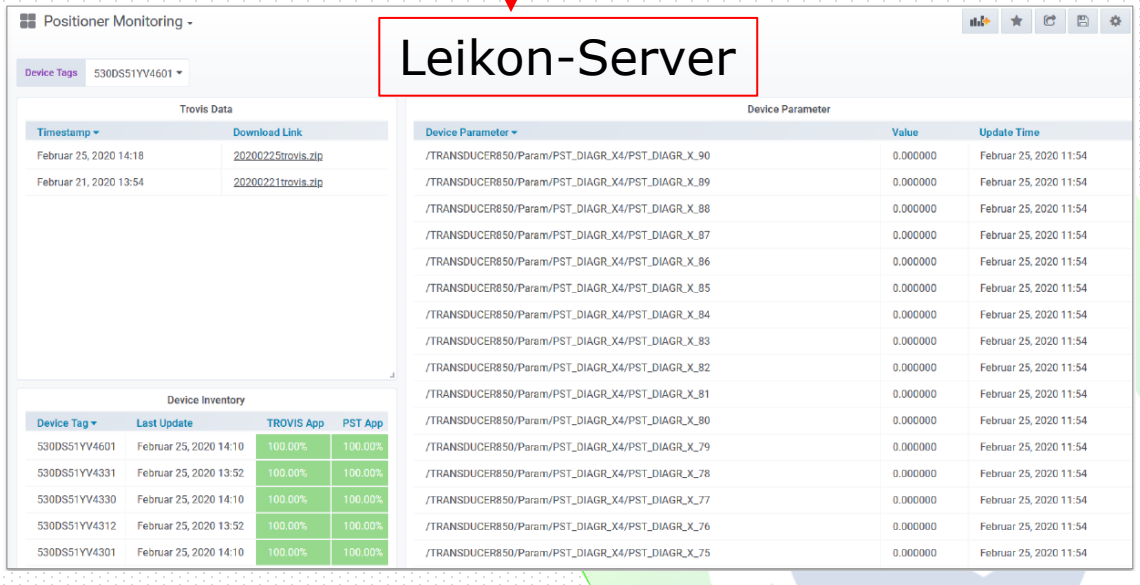




AMS-Server

OPC Verbinding tussen de twee systemen

OPC

Leikon-Server



SAMSON
Device Analysis

XML file
(offline)

UNIVERSITY OF APPLIED SCIENCES

Interreg Vlaanderen-Nederland
EUROPESE UNIE
Europees Fonds voor Regionale Ontwikkeling

# De XML file

VIEW4_3730_6_8101277_2021-Apr-15.xml

```xml
3399      <Unit>bar</Unit>
3400      <Comment>Code 48 - d7</Comment>
3401      <Origin>From device</Origin>
3402      <HelpText>Current supply pressure</HelpText>
3403    </PARAMETER>
3404    <PARAMETER>
3405      <ID_x0023_>90648</ID_x0023_>
3406      <Name>Signal pressure p out</Name>
3407      <ProcessedValue>0.8</ProcessedValue>
3408      <Unit>bar</Unit>
3409      <Comment>Code 48 - d8</Comment>
3410      <Origin>From device</Origin>
3411      <HelpText>Current signal pressure.</HelpText>
3412    </PARAMETER>
3413    <PARAMETER>
3414      <ID_x0023_>77</ID_x0023_>
3415      <Name>Absolute total valve travel</Name>
3416      <ProcessedValue>608</ProcessedValue>
3417      <Comment>Code 23</Comment>
3418      <Origin>From device</Origin>
3419      <HelpText>Added-up full valve travel cycle.</HelpText>
3420    </PARAMETER>
3421    <PARAMETER>
```

VIEW4_3730_6_8101277_2021-Apr-15.xml

```xml
9911    <TRAVEL_HISTOGRAM_X>
9916    <TRAVEL_HISTOGRAM_X>
9921    <TRAVEL_HISTOGRAM_X>
9922      <x_x0020__x005B__x0025__x005D_>55..60</x_x0020__x005B__x0025__x005D_>
9923      <Frequency_x0020__x005B__x0025__x005D_>2.1</Frequency_x0020__x005B__x0025__x005D_>
9924      <n>196917</n>
9925    </TRAVEL_HISTOGRAM_X>
9926    <TRAVEL_HISTOGRAM_X>
9927      <x_x0020__x005B__x0025__x005D_>60..65</x_x0020__x005B__x0025__x005D_>
9928      <Frequency_x0020__x005B__x0025__x005D_>2.0</Frequency_x0020__x005B__x0025__x005D_>
9929      <n>190660</n>
9930    </TRAVEL_HISTOGRAM_X>
9931    <TRAVEL_HISTOGRAM_X>
9932      <x_x0020__x005B__x0025__x005D_>65..70</x_x0020__x005B__x0025__x005D_>
9933      <Frequency_x0020__x005B__x0025__x005D_>1.5</Frequency_x0020__x005B__x0025__x005D_>
9934      <n>144461</n>
9935    </TRAVEL_HISTOGRAM_X>
9936    <TRAVEL_HISTOGRAM_X>
9937      <x_x0020__x005B__x0025__x005D_>70..75</x_x0020__x005B__x0025__x005D_>
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9939      <n>30167</n>
9940    </TRAVEL_HISTOGRAM_X>
9941    <TRAVEL_HISTOGRAM_X>
9942      <x_x0020__x005B__x0025__x005D_>75..80</x_x0020__x005B__x0025__x005D_>
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9944      <n>40207</n>
9945    </TRAVEL_HISTOGRAM_X>
9946    <TRAVEL_HISTOGRAM_X>
9947      <x_x0020__x005B__x0025__x005D_>80..85</x_x0020__x005B__x0025__x005D_>
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9949      <n>40480</n>
9950    </TRAVEL_HISTOGRAM_X>
9951    <TRAVEL_HISTOGRAM_X>
9952      <x_x0020__x005B__x0025__x005D_>85..90</x_x0020__x005B__x0025__x005D_>
9953      <Frequency_x0020__x005B__x0025__x005D_>0.5</Frequency_x0020__x005B__x0025__x005D_>
9954      <n>47941</n>
9955    </TRAVEL_HISTOGRAM_X>
9956    <TRAVEL_HISTOGRAM_X>
9957      <x_x0020__x005B__x0025__x005D_>90..95</x_x0020__x005B__x0025__x005D_>
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9965    </TRAVEL_HISTOGRAM_X>
9966    <TRAVEL_HISTOGRAM_X>
9967      <x_x0020__x005B__x0025__x005D_>  &gt;</x_x0020__x005B__x0025__x005D_>
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9969      <n>0</n>
9970    </TRAVEL_HISTOGRAM_X>
9971  </Saved Thu x002C  x0020 15 x0020 Apr x0020 2021 x0020 14 x003A 43 x003A 31 x0020 GMT>
```
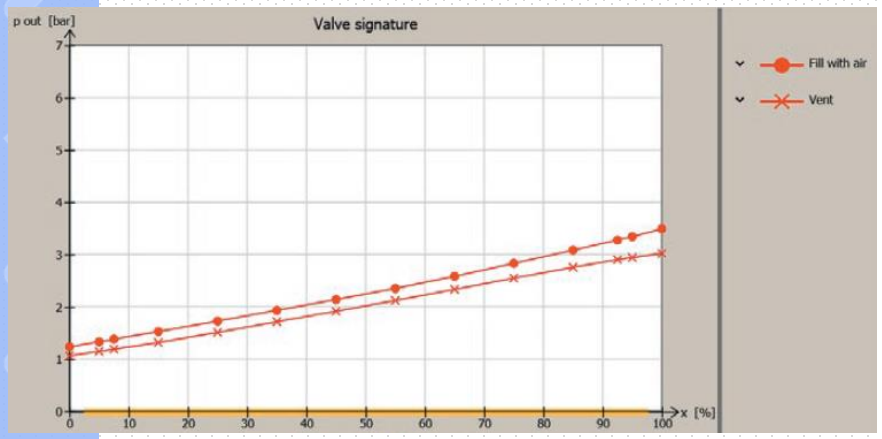
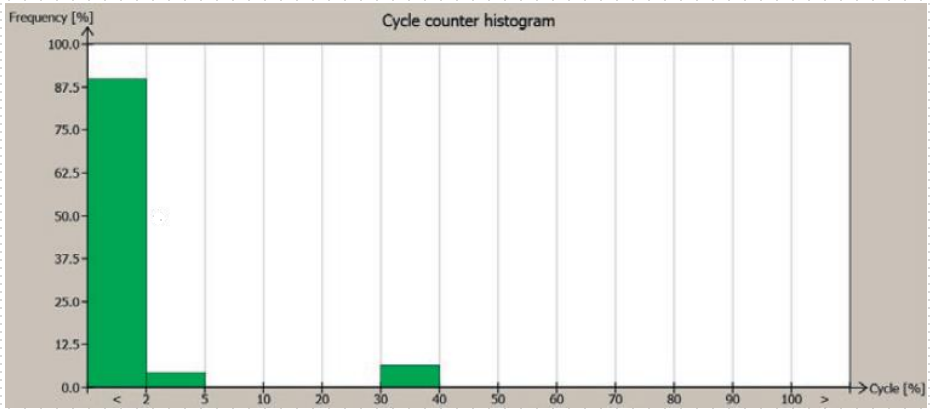
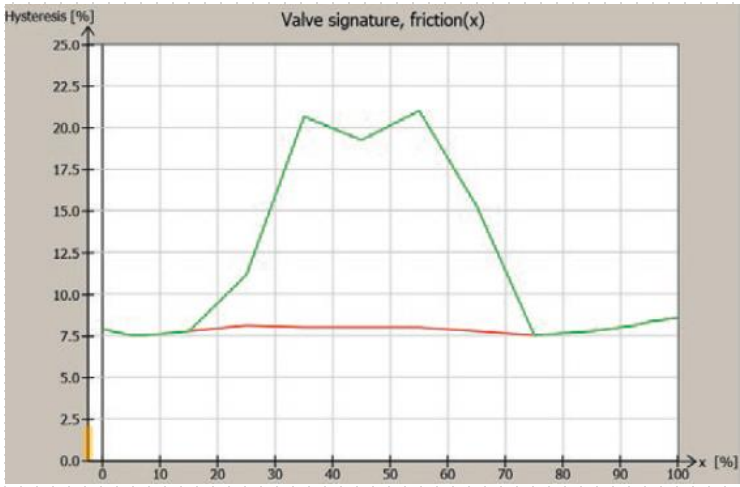
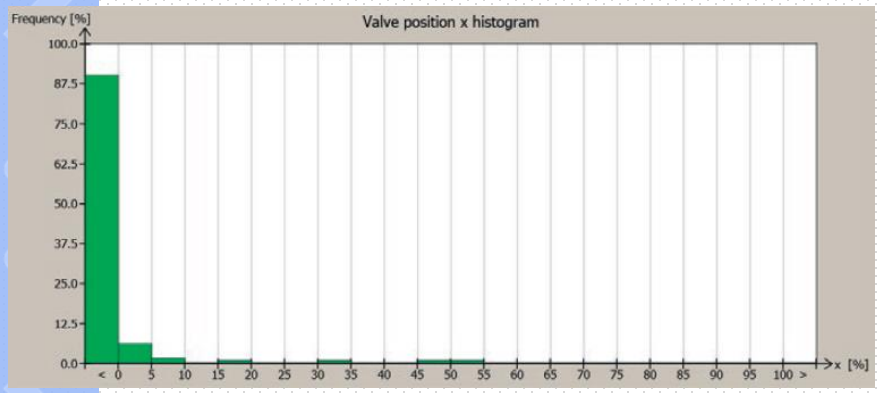
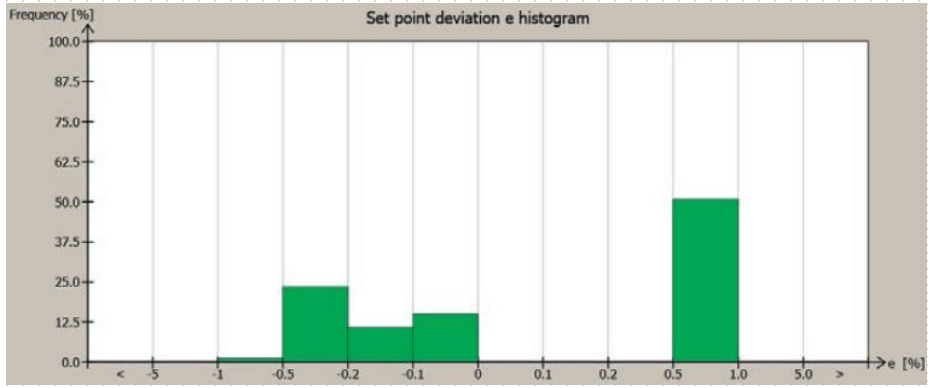

# XML file visueel (vanuit Samson software)



# Status rapport Samson

**SAM VALVE MANAGEMENT**
REPORT

| Tag no. | FRA1907S001PA04Y1973 | Valve status | |
|---|---|---|---|
| Location | | Customer | FRA1907S001PA04Y1973 |
| Valve type | 3241 | Last readout | |
| Actuator | 3277 | Valve size | 25 mm (DIN) |
| Positioner | 3730-3 | Fail-safe action | |

Image

| | | | |
|---|---|---|---|
| No. of initializations | 2 | No. of zero calibrations | 0 |
| No. of cycles | 480589 | Absolute total valve travel | 16,396 |

| Operating hours counter | |
|---|---|
| Device switched on since | 1153 d 15 h |
| Device in closed-loop operation | 34 d 6 h |
| Device switched on since initialization | 142 d 5 h |
| Device in closed-loop operation since last initialization | 23 d 1 h |

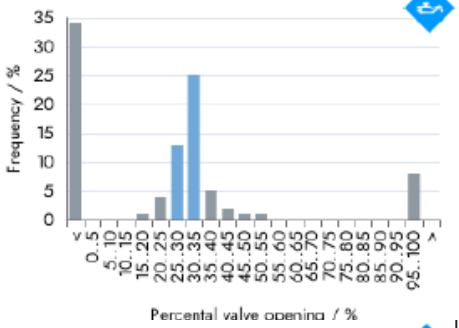
In total, the positioner has been in operation for 1153 d 15 h of which it was in closed-loop control for 34 d 6 h, meaning it was not in tight-closing function.
A new positioner initialization was performed 142 d 5 h ago. Since then, the positioner was in closed-loop control for 23 d 1 h.

| 2020-05-30 | 2020-06-20 | 2020-08-22 | 2020-09-19 | 2020-10-04 |
|---|---|---|---|---|
| ✓ | ✓ | | | |

**Diagnostic summary and recommendations:**

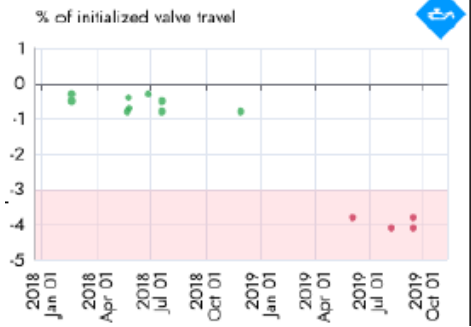
An increase in cycles has been noted. An increase in the number of cycles has been detected. It is recommended to check the process whether changes have taken place or whether the control loop can be optimized.

A slow zero point shift has been detected. Possible causes should be checked, e.g.:
1. Sliding clutch triggered.
2. mounting situation mechanically changed.
3. soft sealing.
4. wear seat/plug.

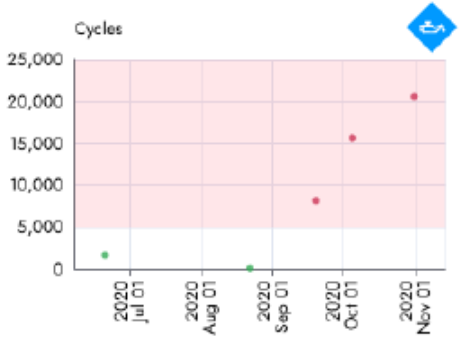



The long-term histogram covers the entire life cycle of 2453 d 13 h of operation.
The valve's operating range is between 25.0 % and 35.0 %.

The valve operates in a stroke range between 20% and 40%. The valve operates close to the closed position. Check sizing if necessary

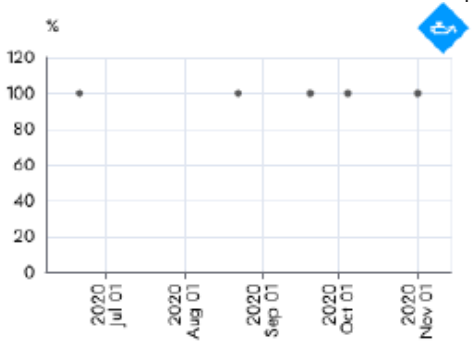



The progression of the zero point covers zero changes greater than 0.25 %. The last end position was recorded at -4.10 %.
The valve has a zero point shift. Possible causes should be checked, e.g.:
1. slipping clutch triggered.
2. mounting situation mechanically changed.
3. soft sealing.
4. wear seat/plug.




The valve has moved through a total of 2230090 cycles, which corresponds to an average of 20,562.3 cycles per day between the last two readouts.

An increase in cycles has been noted. It is recommended to check the process if changes have taken place or if the control loop can be optimized.




The stress factor indicates the load on the stem seal. The current load is 100 %.

The packing should be renewed. Because of:
1. stress factor too high (>90%).
2. if it is leaking
3. if serious friction changes are detected, e.g. stick/slip effects.
4. the valve has been in operation for more than x years.

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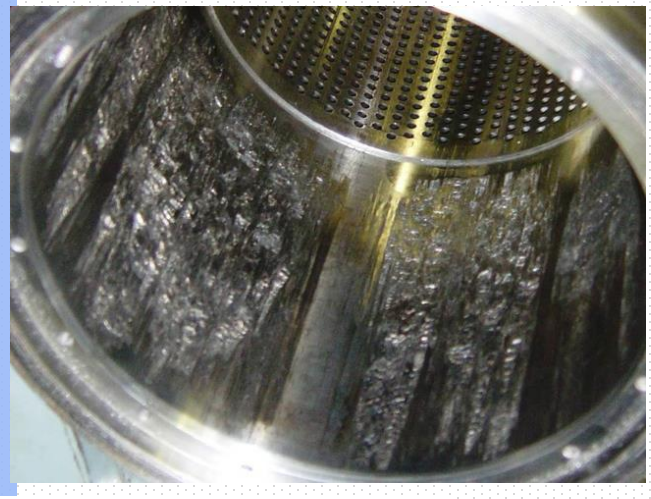
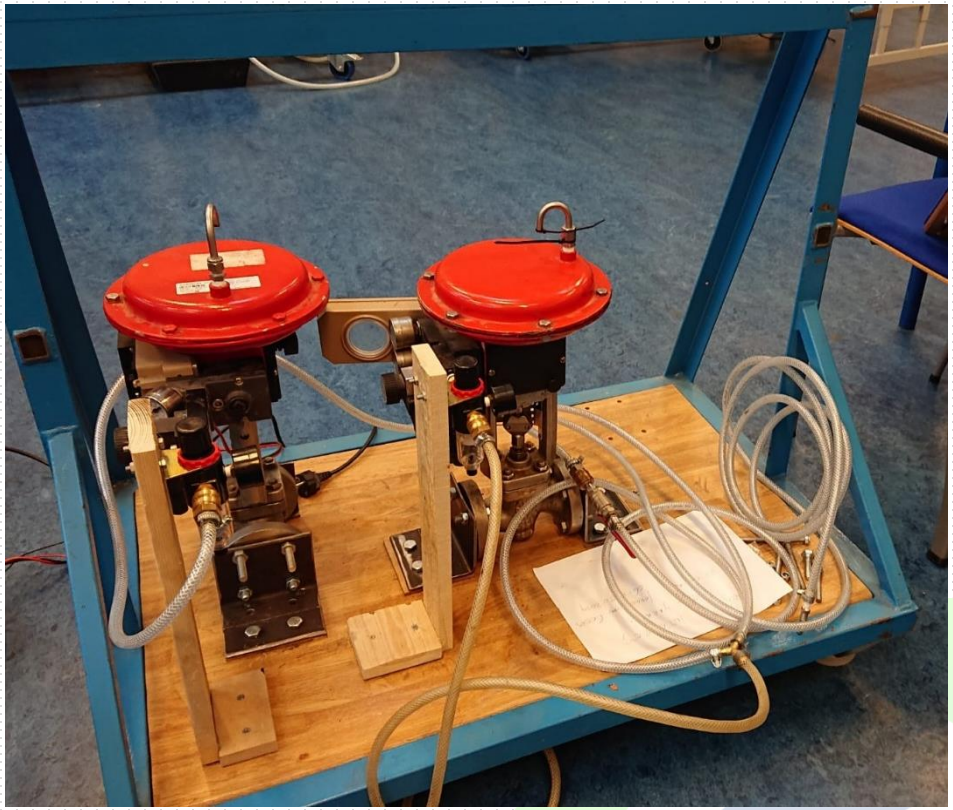
# Bevindingen/opvolging



# Project verloop

- Impact Covid-19
- Data collectie
- Samenwerking HZ
- Samenwerking Equans
- Samenwerking Samson



# Vragen