

## 1 GENERAL TEST BENCH STATUS REPORT

Time Range: 2016-05-17 ... 2019-02-05

## 2 SOFTWARE USAGE

Signal: SW\_OperationMode\_Main

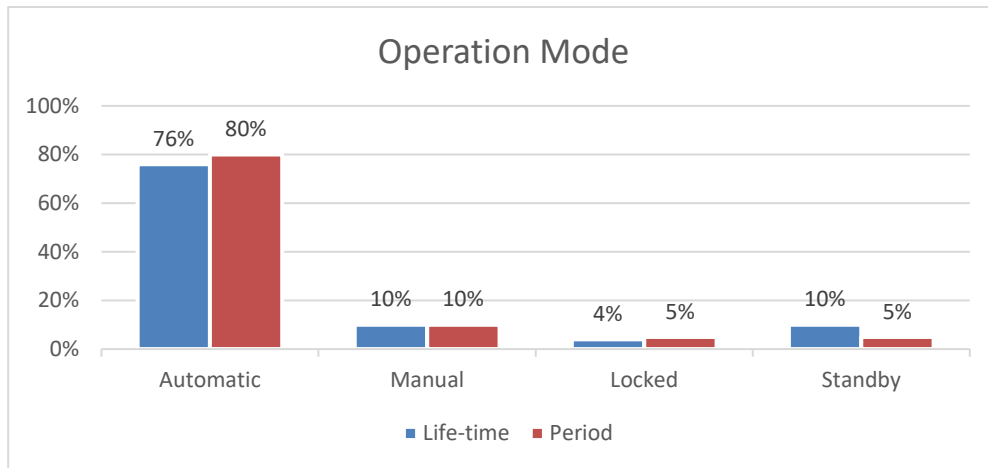


Figure 1: Operation Mode SW

### 3 HARDWARE USAGE

#### 3.1 HYDRAULIC LOAD

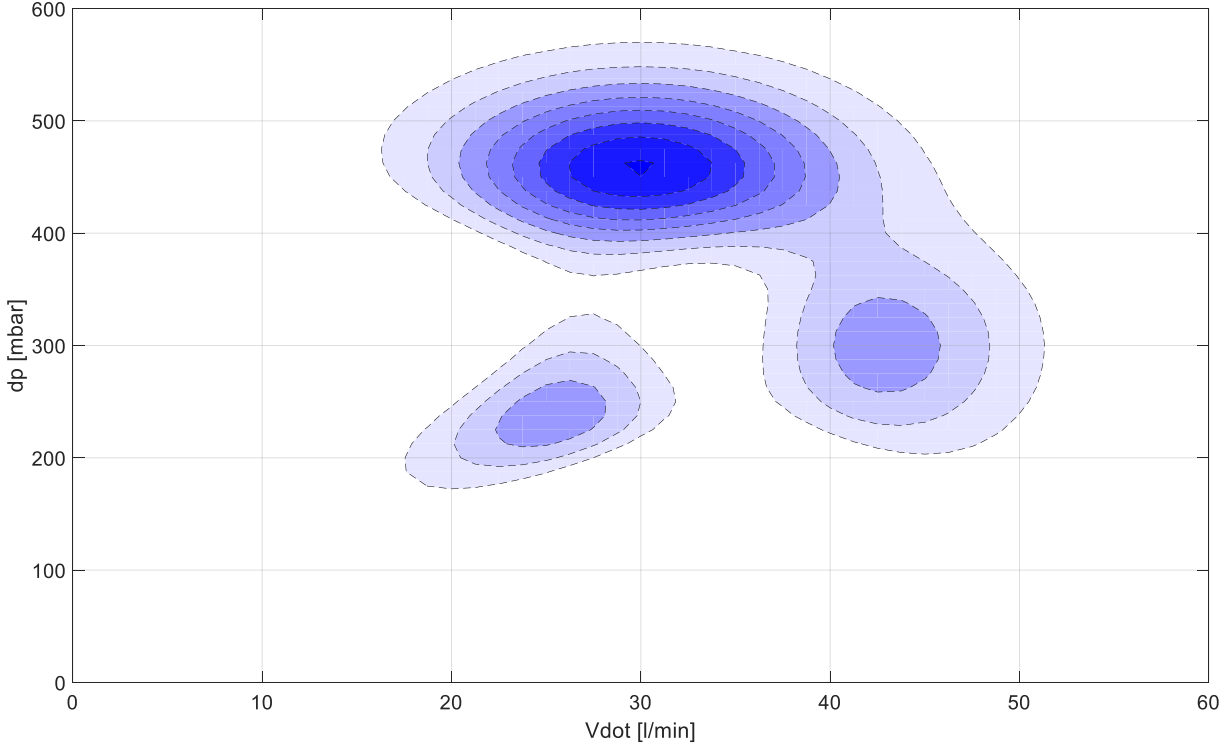
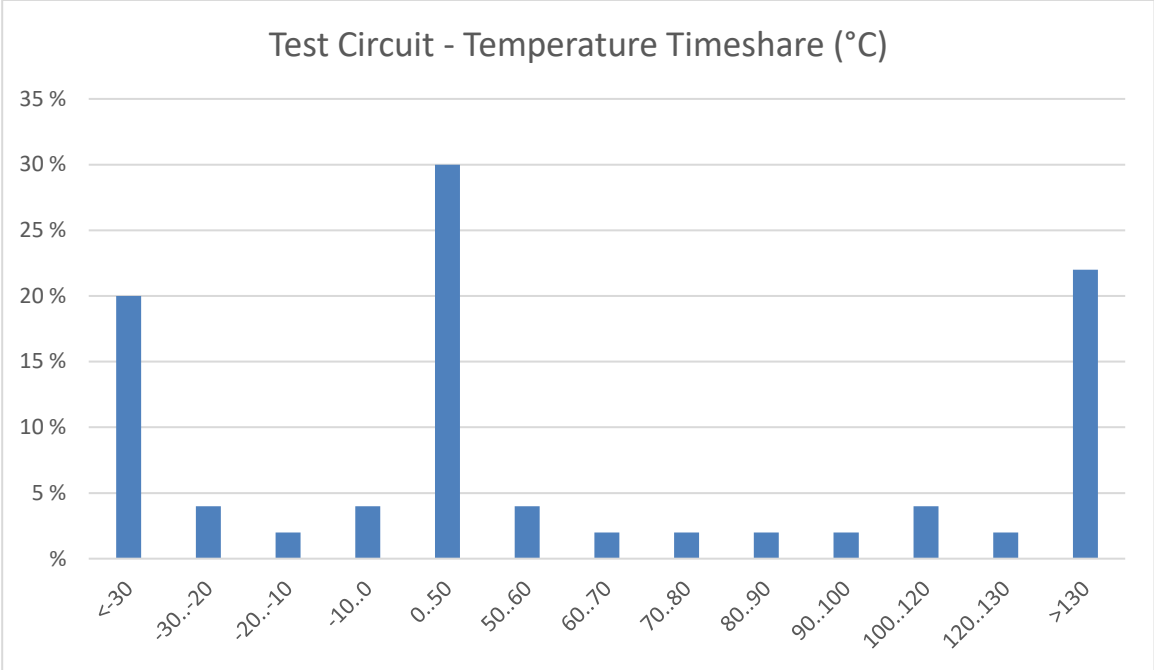


Figure 2: Usage Profile Hydraulic Load

### 3.2 THERMAL LOAD



**Thermal stress**

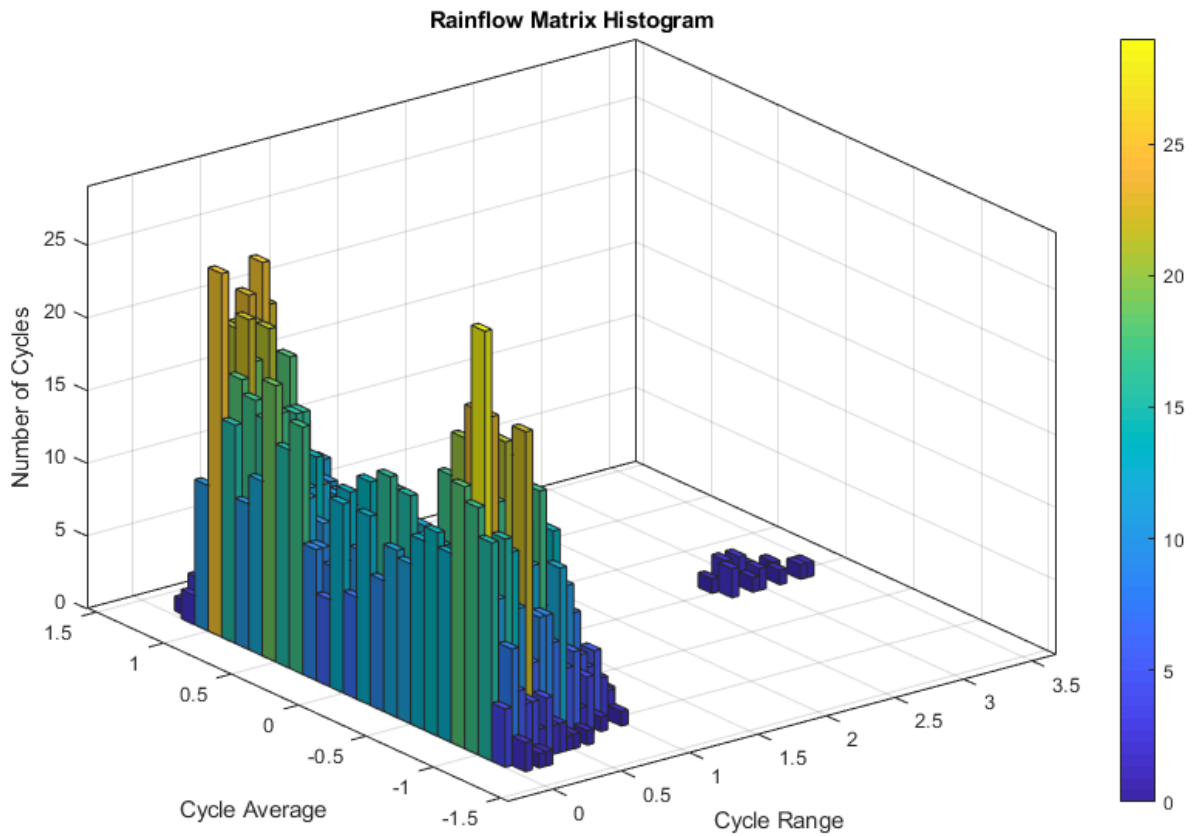


Figure 3: Thermal stress on main module

**3.3 COMPONENT LIFECYCLE MONITORING**

Switching Cycles (Valves & Relais)

Switching Component	Number of Cycles	MTBF	% of MTBF	Estimated Remaining Useful Life *
<b>V101</b>	546	5000	0,1 %	2 years
<b>V102</b>	67829	50.000	135 %	0
<b>Relais X01</b>	0,9 * 10 <sup>6</sup>	1 * 10 <sup>6</sup>	90 %	2 months
<b>Relais X02</b>	1,1 * 10 <sup>6</sup>	1 * 10 <sup>6</sup>	110 %	0

(\* according to current usage profile within the last 3 months)

### 3.4 ACTOR USAGE

#### 3.4.1 Control Valve V101

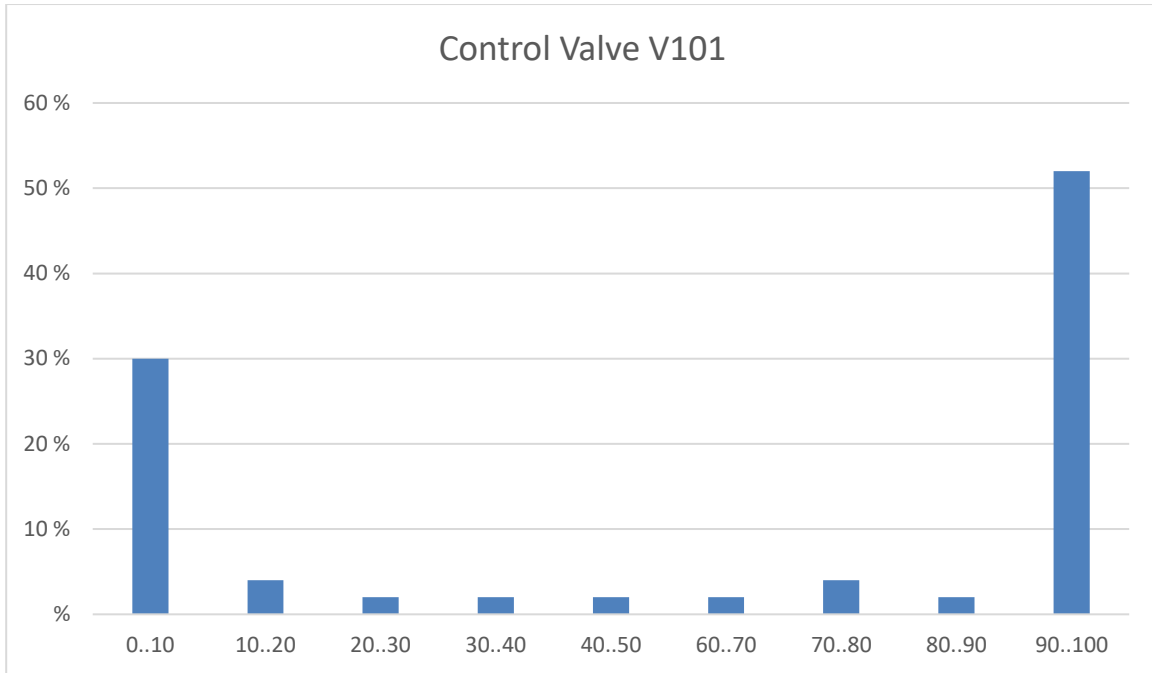


Figure 4: Actor Usage - Position time-share

#### 3.4.2 Heating EH101

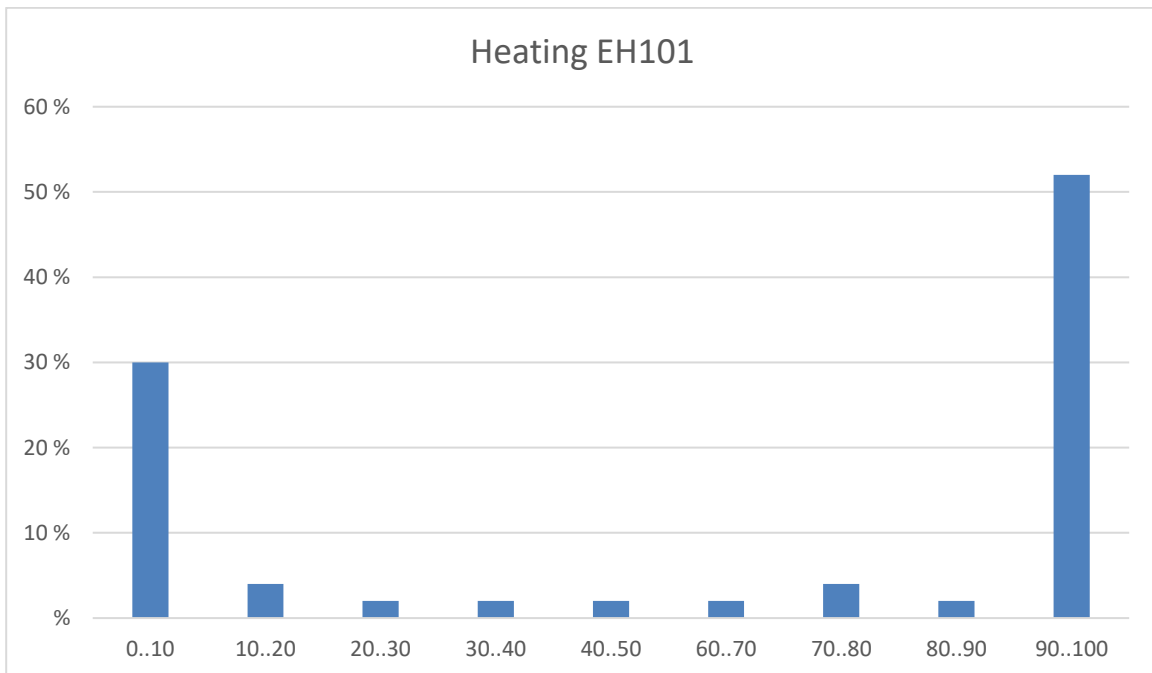


Figure 5: Actor Usage - Load time-share

### 3.4.3 Controller Performance Monitoring

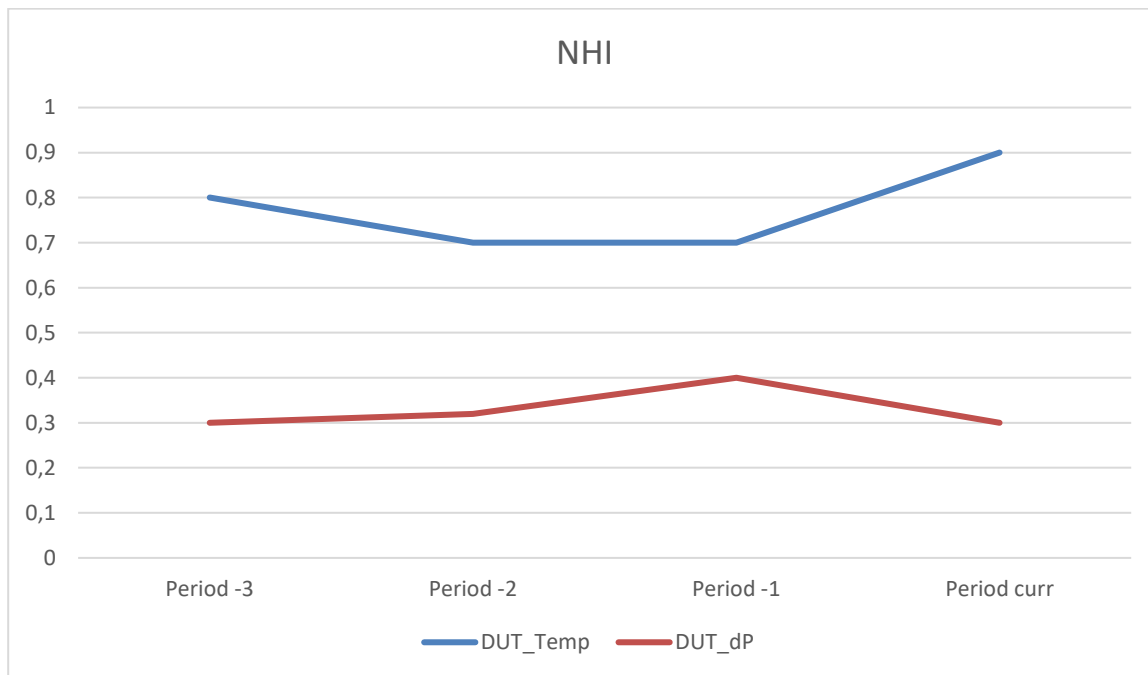


Figure 6: Normalized Harris Index for most important control loops

## 3.5 ERROR MESSAGES

### 3.5.1 Alarms

A-Id	Type	Alarm	# Life-time	# Current Period	First Occurrence	Last Occurrence
1528	E	Valve V101 blocked	58	17	2016-06-12 10:17:22	24.12.2018 20:48:22
1442	W	T in measurement circuit to high	22	12	2018-01-17 10:12:12	22.10.2018 20:48:22
166	E	Pressure drop in circuit 2	3	3	2019-01-13 14:44:21 (!)	2019-01-16 11:24:10

### 3.5.2 Error Messages of Operating Software

Id	Type	Message	# Life-time	# Current period	First Occurrence	Last Occurrence
124887	E	Modul MSR / HW Driver CAN Driver XYZ unknown property bla recognized – error code 172136AF77	8	0	17.1.2018 10:17:22	24.10.2018 20:48:22
16647	W	Modul MSR / HW Driver Electric Load – error code 172136AF77	8	0	17.1.2018 10:17:22	24.10.2018 20:48:22

### 3.6 REFERENCE TEST

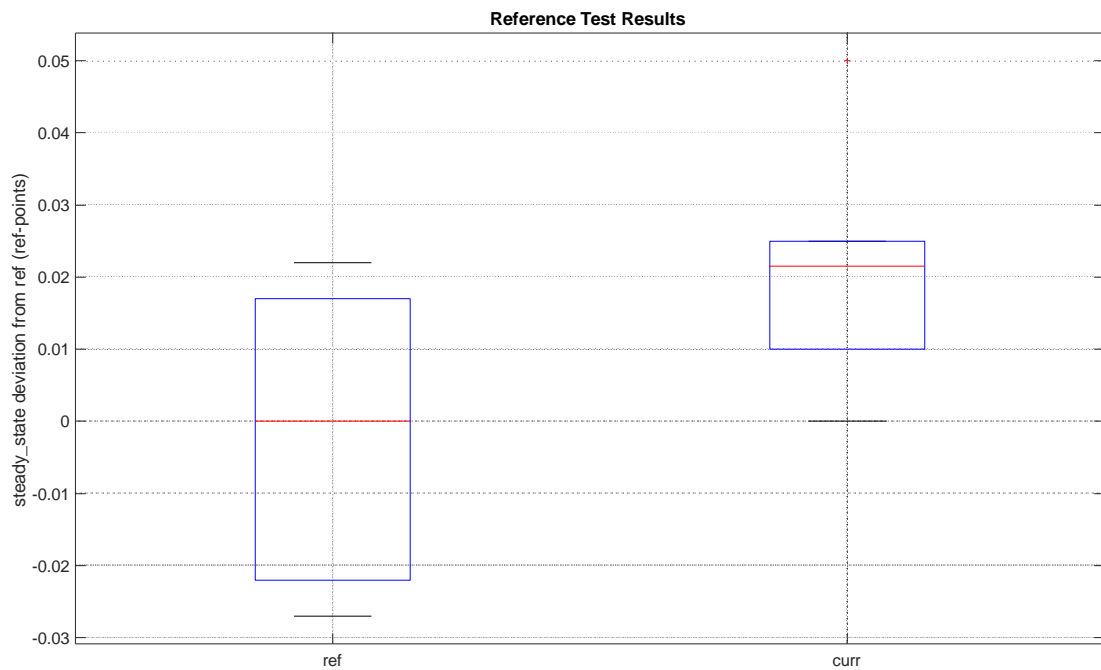


Figure 7: Reference Test Results (reproducibility)