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▶ Partial stroke testing

# PARTIAL STROKE TESTING

Reliability matters

- Process interlocking
- Valve positioning
- ▶ Partial stroke testing
- Valve operation



# Netherlocks FAITH partial stroke testing

Partial stroke testing is an important safety step to ensure that an ESD (Emergency Shut Down) or HIPPS (High Integrity Pressure Protection System) valve will operate as intended when needed. The Netherlocks FAITH (Fail Action Integrity Test Handling) partial stroke test device facilitates the partial stroke testing of valves without any risk of overshoot or process interruption.

The FAITH is mounted between valve and actuator. During partial stroke testing, steel blocking pins ensure that the valve can only turn to the preset test angle (i.e. 20 degrees). This also allows for maintenance during production. The system is available for both linear and rotating actuators.



## Suitable for SIL 3 applications

An FMEDA done by Exida shows that the PFD AVG value of FAITH comfortably falls within the range  $\geq 10^{-4}$  and  $< 10^{-3}$ . Therefore, the FAITH partial stroke testing Device is perfectly suited for SIL3 applications.

## No risk of overshoot

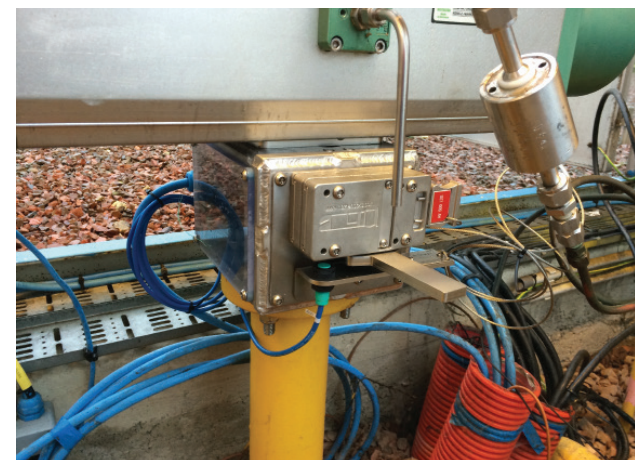
The FAITH partial stroke test device physically prevents the valve from moving past the specified test point, excluding the risk of actual shutdown due to trip or overshooting.

## The ideal maintenance tool

FAITH is perfectly suited for maintenance purposes. When the actuator is in its blocked position, critical components can be replaced at any time without interrupting the process. Without the Netherlocks partial stroke testing system, control system components could only be replaced during a plant stop, when the actuator is in its fail position.

## ATEX Certified

The FAITH is ATEX certified and can therefore be used in any type of process environment, following the highest safety standards.



## Testing without interrupting process flow

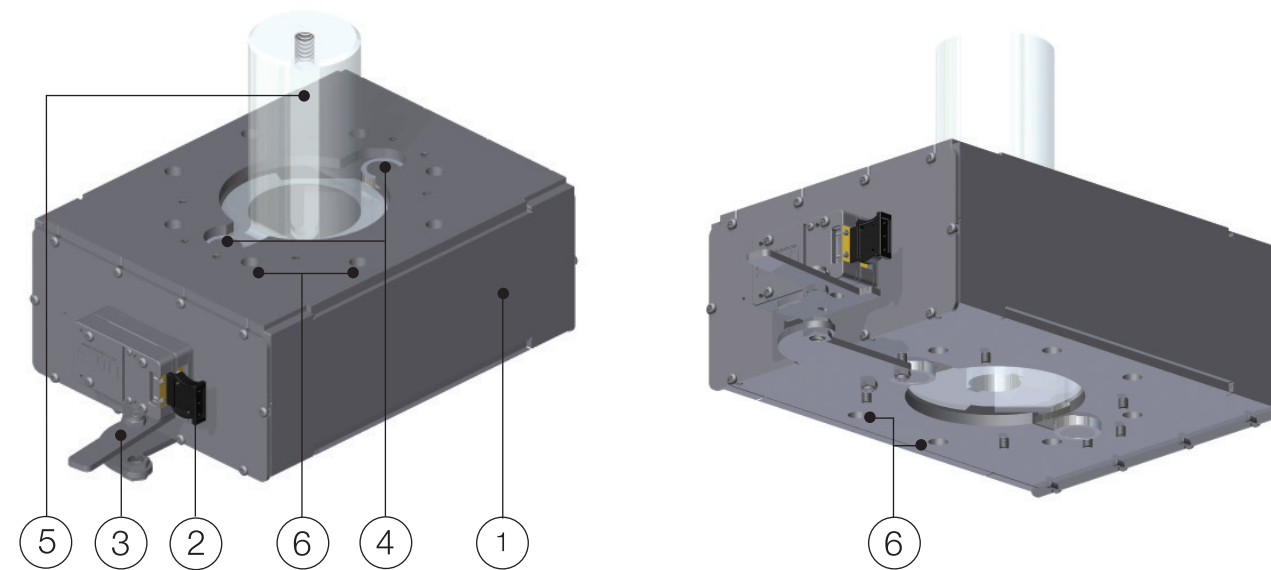
The Netherlocks FAITH enables testing without interrupting process flow. Tests can be carried out more easily and more often, which ensures proper operation and also reduces the deterioration of the valve. International standards such as IEC61508 & IEC61511 highly recommend testing of all the ESD and HIPPS valves on a regular time schedule.

### Main characteristics

- > Simple and 100% reliable mechanical solution
- > No complicated software, no fragile wiring and no process interruption due to testing
- > No overshoot; valve is 100% mechanically blocked
- > Guaranteed safe testing in a live plant
- > No production interruption due to a wrong test
- > Real life test instead of a manipulated test at low speed
- > Perfectly suited for maintenance purposes, saving valuable time
- > Guaranteed test results, no test is aborted
- > Standard use of double pin blocking above 1000 NM
- > No additional mounting parts required between valve and actuator

The mechanical blocking mechanism of FAITH is 100% reliable, which encourages operators to frequently perform a partial stroke test.

figure 1



**Legend figure 1**

- 1 Custom made bracket
- 2 Linear key enables test mode
- 3 Lever puts system in test mode
- 4 2 pins block travel of drive bush when in test mode
- 5 Custom made coupling (drive bush between valve and actuator)
- 6 Custom made hole patterns for directly coupling valve and actuator to FAITH device, without additional bracketing

**Operation**

The Faith partial stroke test device consists of a custom made bracket and coupling drive bush and is mounted between the valve and actuator. No additional mounting parts between valve and actuator are required. The FAITH bracket is equipped with 2 blocking pins (standard above 1.000 NM) to centralize forces. This avoids damage to the valve and actuator seals during blocking of the stem at the test angle. FAITH's design is simple and reliable. Being an easy to operate tool, it is used without any hesitation by operators as a standard device to perform a regular test.

**Manual operation**

- > System can only be put into test mode after inserting a key
- > System is put into test mode by pulling the lever
- > One key for all systems or a unique key for every system
- > During testing, key is trapped
- > Key can only be removed when system is in normal operation
- > Once removed, key is stored in the control room
- > Custom Key Cabinet is available to store the unique keys in an orderly manner

**Remote operation**

- > Test is initiated and performed from control room
- > Same usability and functionality
- > Faster and easier test procedure
- > System put in test mode by actuated lever, which is operated from the control room

**No spurious trip**

Mechanical partial stroke testing is the only partial stroke testing system system with 0% chance of a spurious trip. For this reason, it is recognized by operators as a comfortable test method on critical systems.

figure 2

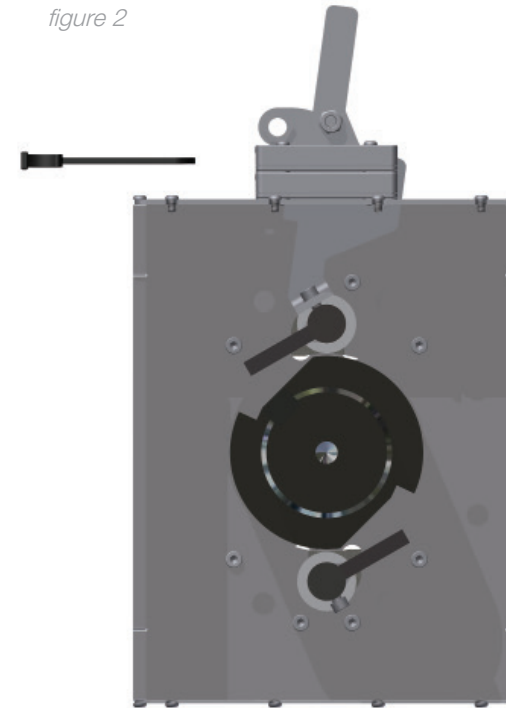


figure 3



**Test procedure**

During normal operation, the key is in the control room. The valve can be operated freely, so it can be opened or closed when necessary. When the valve needs to be tested, the following procedure must be followed:

- Figure 2: Insert the linear key into the FAITH partial stroke test system to release the handle
- Figure 3: Pull the handle to move the blocking pins into place for testing. The key is now trapped.

The system is now ready for testing. The blocking pins will restrict the linear or rotating movement of the actuator to the requested percentage. After testing, when the actuator is back in its original position, pull the handle back and release the key to lock the handle and return key to the control room.

Double pins centralize forces during blocking of the drive bush, which avoids damage to the valve and actuator seals during the test.



## FAITH data sheet

Technical specifications	Description	Maximum Torque ranges	Max. torque NM	Max. torque lbs
<b>Mechanical blocking system</b>				
Safety factor	2.5	FT 2	226	2.000
<b>Materials</b>				
Locking & blocking components	SS 316	FT 5	566	5.000
Adaptor & bracket	Steel	FT10	1.130	10.000
<b>Blocking pins</b>				
Rotating valves		PP 25	2.825	25.000
< 1000 NM	1 pin	PP 50	5.650	50.000
> 1000 NM	2 pins	PP 75	8.475	75.000
Linear valves	2 pins	PP 130	14.670	130.000
<b>ATEX certification</b>				
ATEX certification	CE Ex II 2 G D c IIC T4	PP 300	33.895	300.000
<b>SIL level</b>				
SIL level	applicable for SIL 3	PP 500	56.490	500.000
		PP 600	67.791	600.000
		PP 750	84.750	750.000
		PP 1.000	113.000	1.000.000
		PP 1.250	141.250	1.250.000
		PP 1.500	169.500	1.500.000
		Custom	> 169.500	> 1.500.000

General options	Description
<b>Communication</b>	
Limit switch	Identifies test mode position of the blocking pins. Signal can be used as an integral part of the operating sequence (not a critical part of the mechanism). As a standard, Atex certified proximity sensors are applied. Other types of sensors can also be applied, based on customer specifications
<b>Bracket coating</b>	
	Powder coated as a standard
	Alternatively coated to client specifications
<b>Partially transparent bracket</b>	
	In order to visually witness the position of the block pins and the movement of the valve during testing, two sides of the bracket can be made transparent

## FMEDA test results

The FMEDA considers the FAITH System PP-Series a component of the valve-actuator combination. The failure rates of the correct version of the FAITH System PP-Series must be added to the failure rates of the valve-actuator combination when determining the PFDavg and Safe Failure Fraction (SFF) for the final element. For applications where the valve-actuator combinations employ an intermediate bracket and adapter shaft the following values for the FAITH PP device are applicable:



### FAITH PP DEVICE VALUES

Proof Test Coverage	Random Failure PFDavg	Test Time PFDavg	Total PFDavg <sup>1</sup>	% of SIL 3 Range <sup>2</sup>	Random Failure PFDavg For 100% Proof Test coverage <sup>3</sup>
97 %	1.07 E-04	1.14 E-04	2.21 E-04	22%	6.57 E-05

### FAILURE RATES ACCORDING TO IEC 61508

Δ SD (FIT)	Δ SU (FIT) <sup>4</sup>	Δ DD (FIT)	Δ DU (FIT)
0	39	0	15

\* When valve and actuator are connected to each other directly without coupling set, other values will be applicable. Please consult Netherlocks for these cases.

1. This value includes the 'Test Time PFDavg' for increased probability of failure in case ESDdemand occurs during testing.
2. For SIL 3 applications, the PFDavg value needs to be  $\geq 10^{-4}$  and  $< 10^{-3}$ .
3. The PFDavg results are based on a simplified equation that assumes 100% Proof Test Coverage. These PFDavg results can be used for comparison with the PFDavg results of other products that also used the simplified PFDavg equation.
4. It is important to realize that the Residual failures are included in the Safe Undetected failure category according to IEC 61508. Note that these failures on their own will not affect system reliability or safety, and should not be included in spurious trip calculations.