

Chapter Five

Simulation and Results

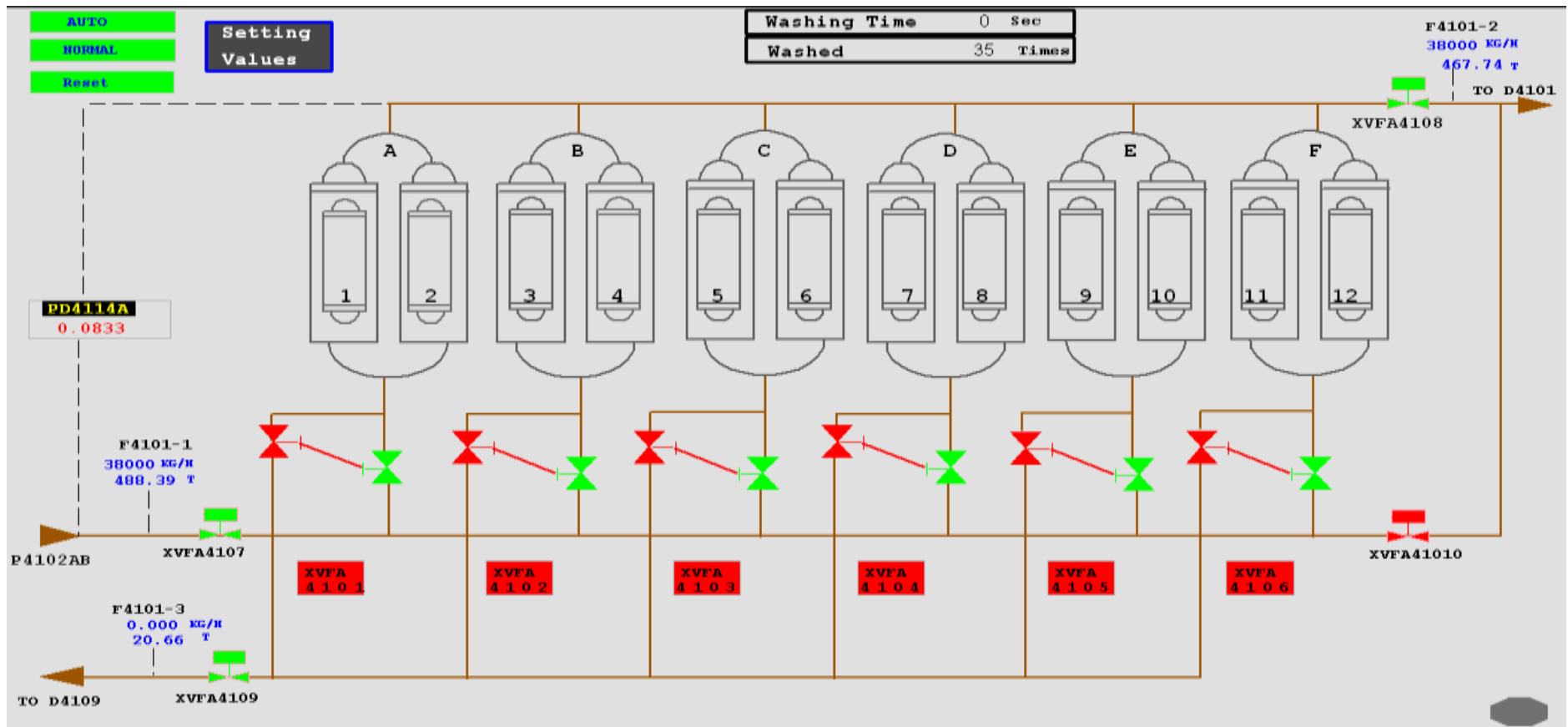


Figure 5-1: Backwash Filter Processing Mode

5.1 Testing of the control system

The main objective of this module is to cover the testing of the system operation and to prove that it is working successfully and satisfies the basic requirements. The filter shown on the diagram above (Figure 5-1) consist of six Banks A, B, C, D, E, and F. Each bank consists of two Elements as described below:

- Bank A Consists of Element 1 AND 2.
- Bank B Consists of Element 3 AND 4.
- Bank C Consists of Element 5 AND 6.
- Bank D Consists of Element 7 AND 8.
- Bank E Consists of Element 9 AND 10.
- Bank F Consists of Element 11 AND 12.

The following values must be set to the required values:

- Differential Pressure (0.19 Mpa).
- Washing Time (8 Seconds).
- Dwell time (2 Seconds).



Figure 5-2: Setting Values

The backwashing process starts automatically when the differential pressure reaches the setting value.

5.1.1 Bank (A) Backwashing Test

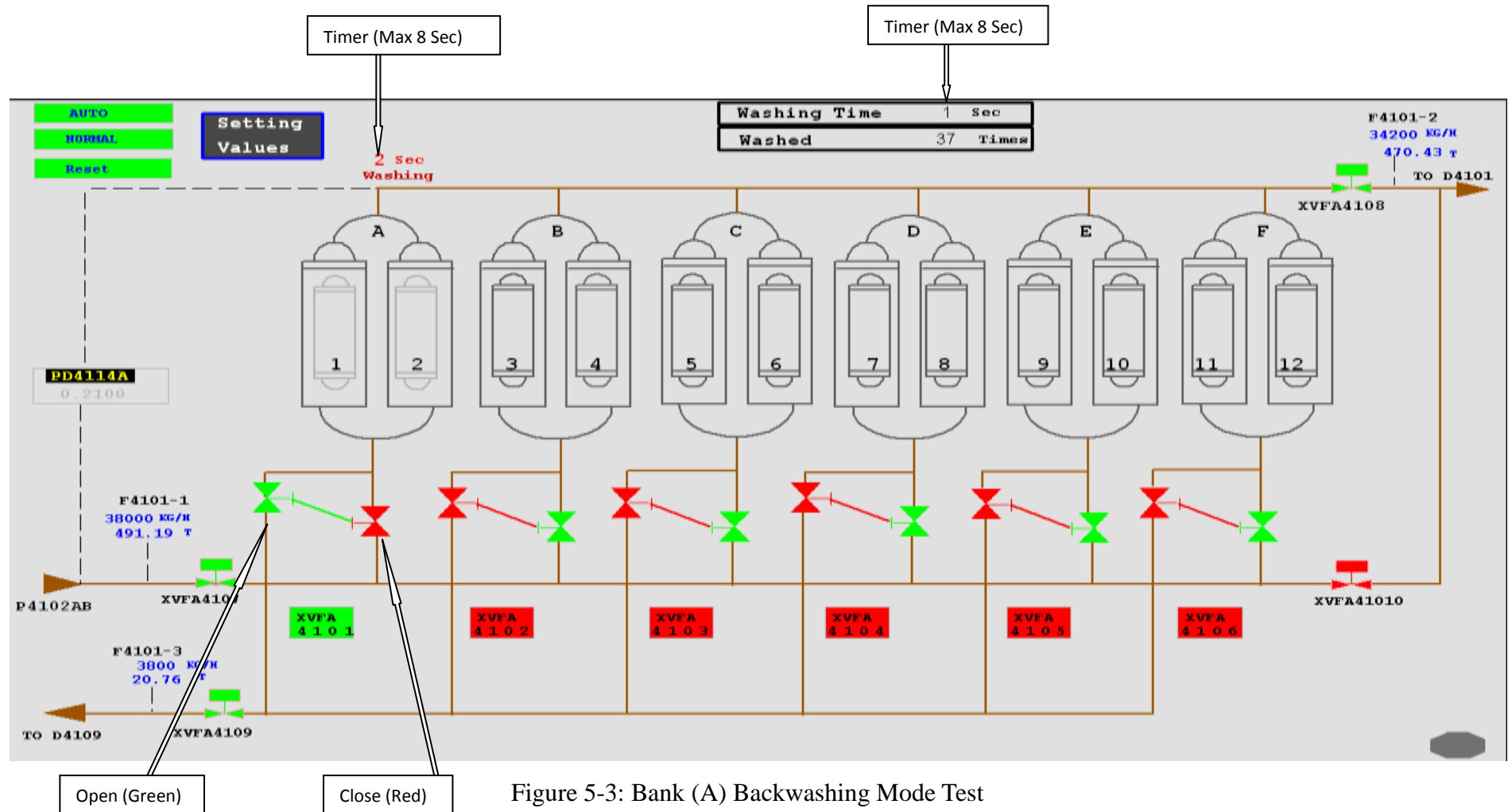


Figure 5-3: Bank (A) Backwashing Mode Test

The following events will take place when the differential pressure across the filter reaches its set point:

- Bank A starts the washing process.
- Output 1 which is represented by square XVA4101 is activated and its color changes from Red to Green.
- The valve to process will be closed and its feedback signal color changed from green (open) to red (Close).
- The inlet valve for washing will be opened and its feedback signal color changes from Red (Close) to Green (Open).
- The two Elements (1, 2) of Bank A will flash during the backwashing time.
- The washing counter for Bank A will come up and display the washing time taken by Element 1 (8 Seconds).
- The Total washing counter will displaced the total value. In this case it is (8 seconds).
- The differential pressure will drop after the successful execution of the cleanup explains in number 1 above. In this case it will drop by (0.2 Mpa).
- The amount of diesel used for washing Bank A will be accumulated and measured.

5.1.2 Bank (B) Backwashing Test

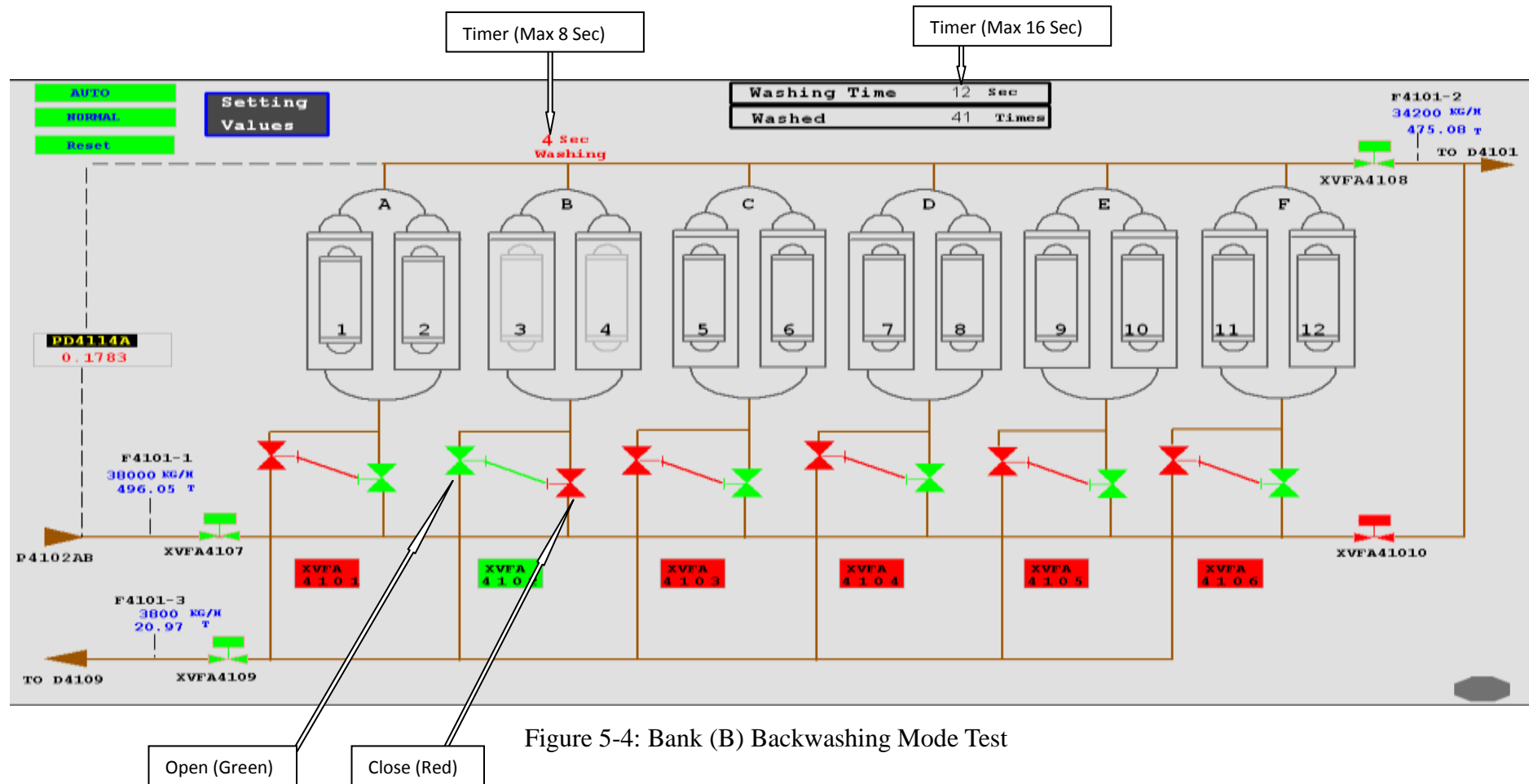


Figure 5-4: Bank (B) Backwashing Mode Test

The following events will take place once Bank A and the delay time (2 seconds) are finished:

- Bank B starts the washing process.
- Output 2 which is represented by square XVA4102 is activated and its color changes from Red to Green.
- The valve to process will be closed and its feedback signal color changed from green (open) to red (Close).
- The inlet valve for washing will be opened and its feedback signal color changes from Red (Close) to Green (Open).
- The two Elements (3, 4) of Bank B will flash during the backwashing time.
- The washing counter for Bank B will come up and display the washing time taken by Element 1 (8 Seconds).
- The Total washing counter will displaced the total value. In this case it is (16 seconds).
- The differential pressure will drop after the successful execution of the cleanup explains in number 1 above. In this case it will drop by (0.2 Mpa).
- The amount of diesel used for washing Bank B will be accumulated and measured.

5.1.3 Bank (C) Backwashing Test

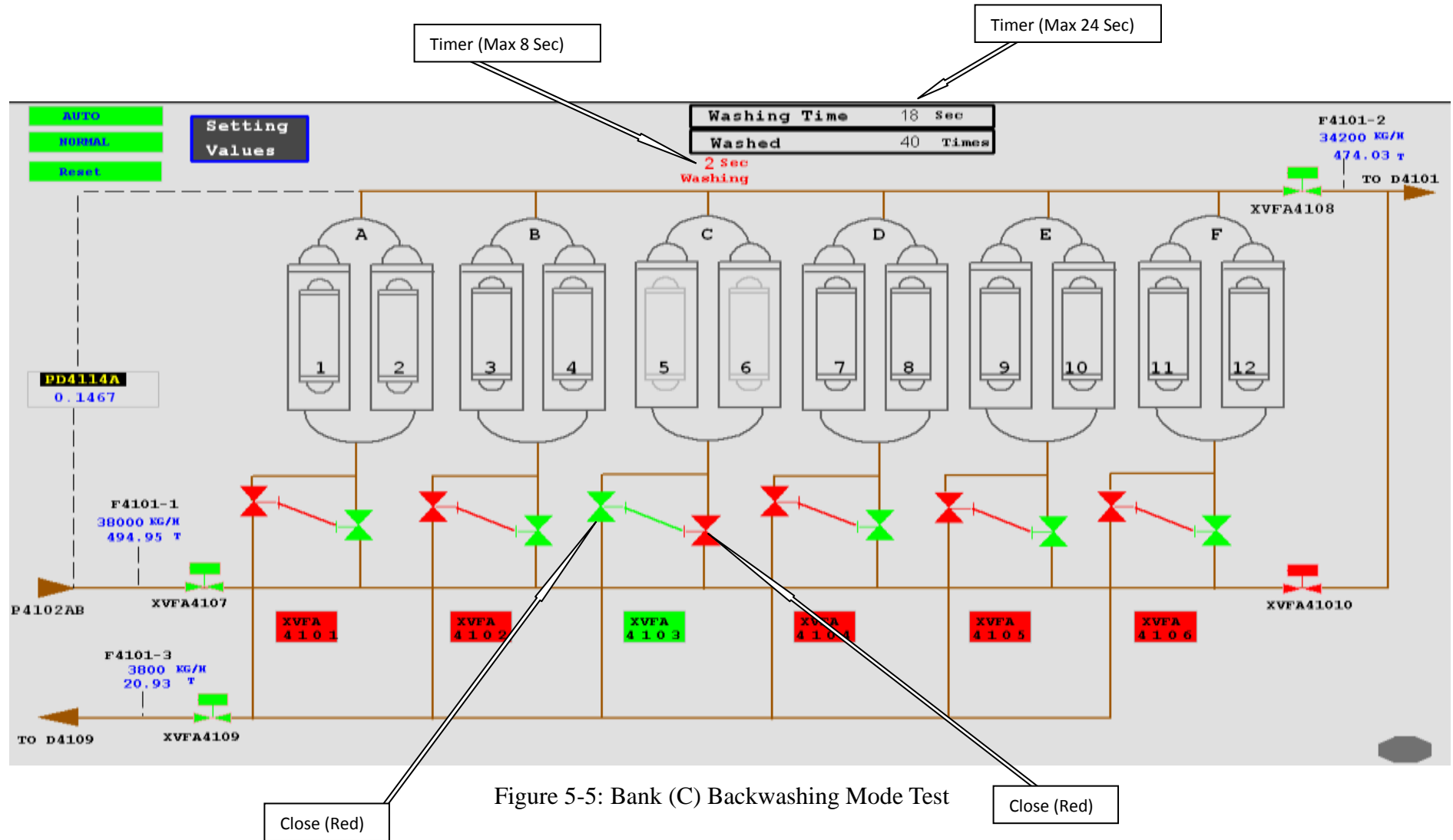


Figure 5-5: Bank (C) Backwashing Mode Test

The following events will take place once Bank (B) and the delay time are completed:

- Bank C starts the washing process.
- Output 3 which is represented by square XVA4103 is activated and its color changes from Red to Green.
- The valve to process will be closed and its feedback signal color changed from green (open) to red (Close).
- The inlet valve for washing will be opened and its feedback signal color changes from Red (Close) to Green (Open).
- The two Elements (5, 6) of Bank C will flash during the backwashing time.
- The washing counter for Bank1 will come up and display the washing time taken by Element 1 (8 Seconds).
- The Total washing counter will displaced the total value. In this case it is (24 seconds).
- The differential pressure will drop after the successful execution of the cleanup explains in number 1 above. In this case it will drop by (0.2 Mpa).
- The amount of diesel used for washing Bank C will be accumulated and measured.

5.1.4 Bank (D) Backwashing Test

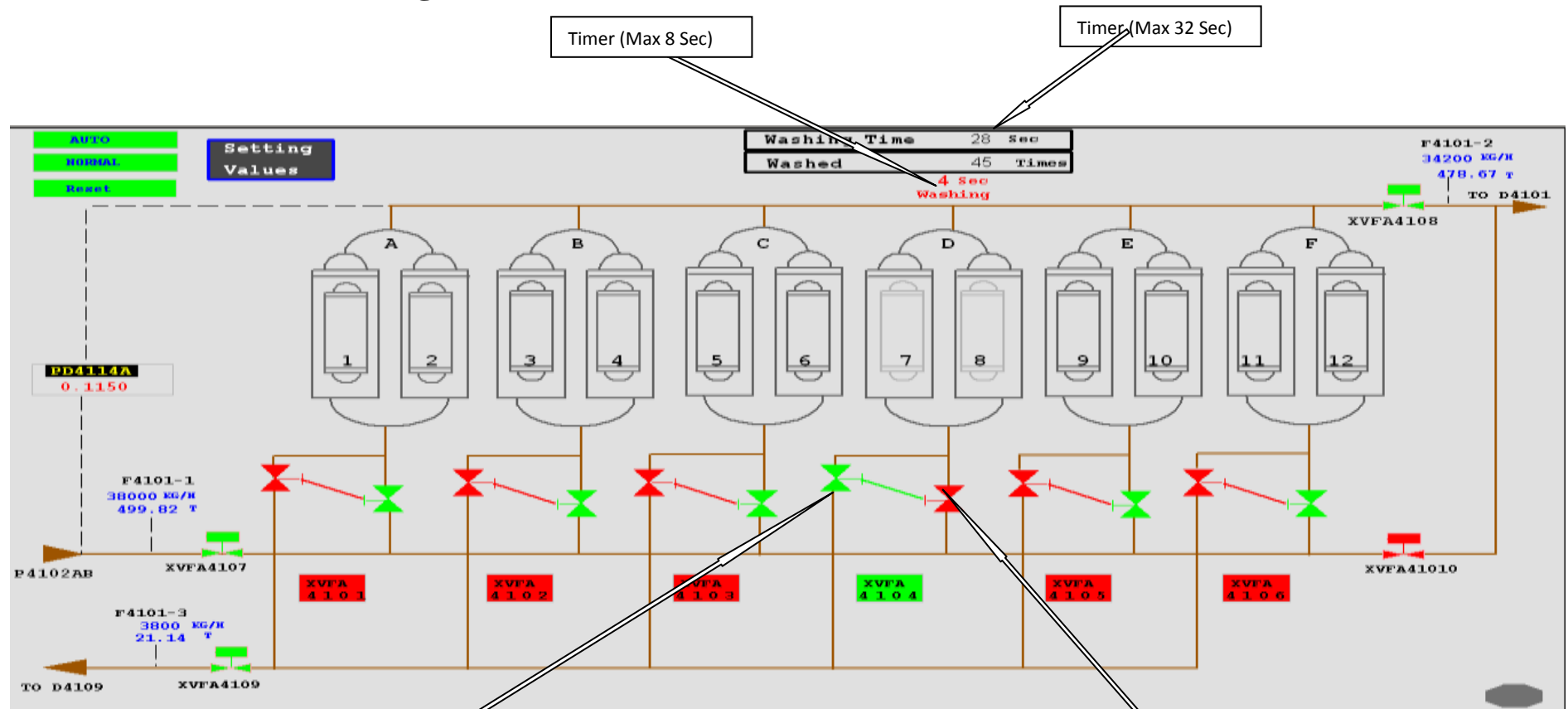


Figure 5.6: Bank (D) Backwashing Mode Test

Open (Green)

Close (Red)

The following events will take place once Bank (C) and the delay time are finished:

- Bank D starts the washing process.
- Output 4 which is represented by square XVA4104 is activated and its color changes from Red to Green.
- The valve to process will be closed and its feedback signal color changed from green (open) to red (Close).
- The inlet valve for washing will be opened and its feedback signal color changes from Red (Close) to Green (Open).
- The two Elements (7, 8) of Bank D will flash during the backwashing time.
- The washing counter for Bank D will come up and display the washing time taken by Element 1 (8 Seconds).
- The Total washing counter will displaced the total value. In this case it is (32 seconds).
- The differential pressure will drop after the successful execution of the cleanup explains in number 1 above. In this case it will drop by (0.2 Mpa).
- The amount of diesel used for washing Bank D will be accumulated and measured.

5.1.5 BANK (E) Backwashing Test

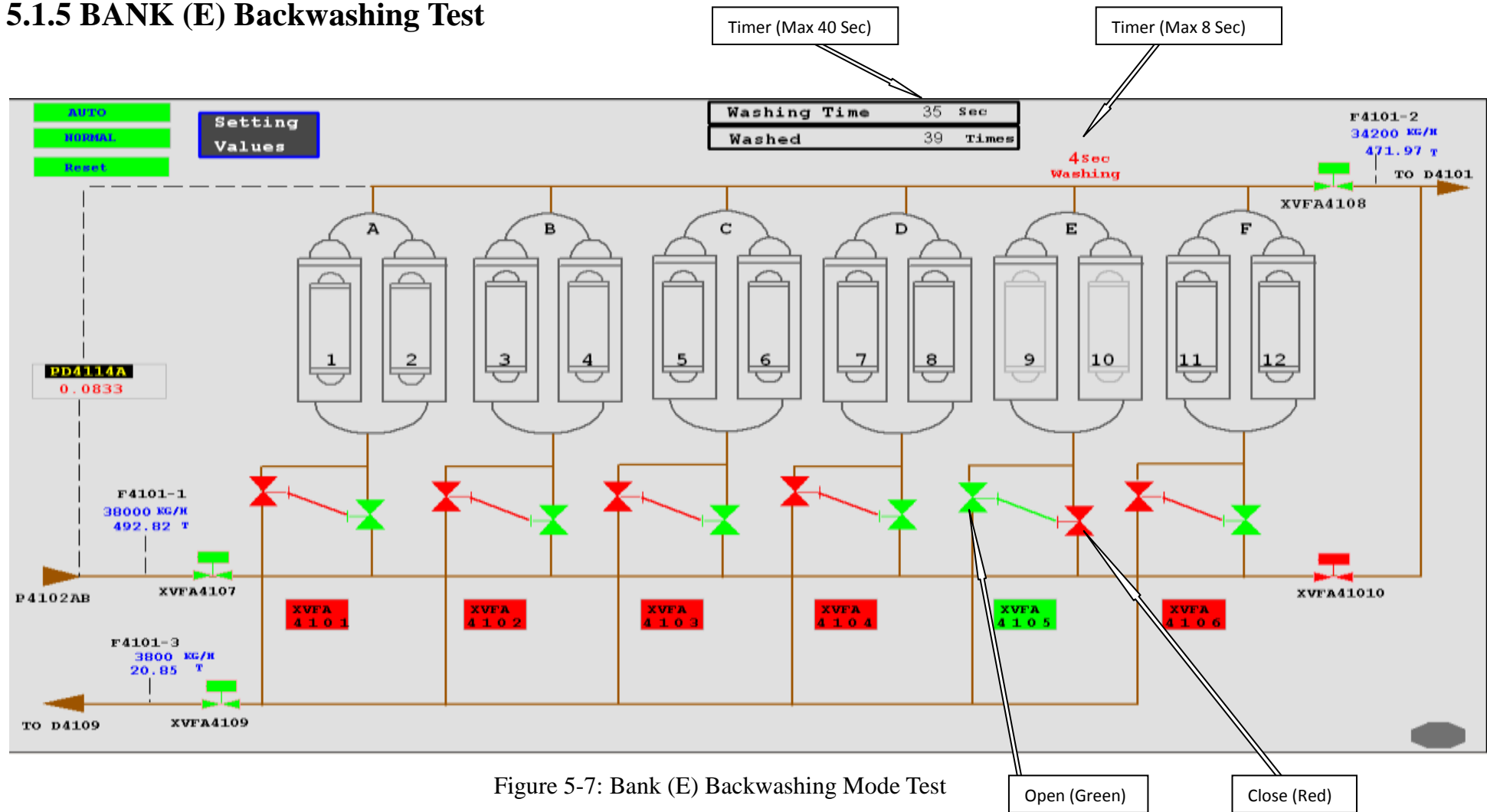


Figure 5-7: Bank (E) Backwashing Mode Test

Open (Green)

Close (Red)

The following events will take place once Bank (D) and the delay time are completed:

- Bank E starts the washing process.
- Output 5 which is represented by square XVA4105 is activated and its color changes from Red to Green.
- The valve to process will be closed and its feedback signal color changed from green (open) to red (Close).
- The inlet valve for washing will be opened and its feedback signal color changes from Red (Close) to Green (Open).
- The two Elements (9, 10) of Bank E will flash during the backwashing time.
- The washing counter for Bank E will come up and display the washing time taken by Element 1 (8 Seconds).
- The Total washing counter will displaced the total value. In this case it is (40 seconds).
- The differential pressure will drop after the successful execution of the cleanup explains in number 1 above. In this case it will drop by (0.2 Mpa).
- The amount of diesel used for washing Bank E will be accumulated and measured.

5.1.6 BANK (F) Backwashing Test

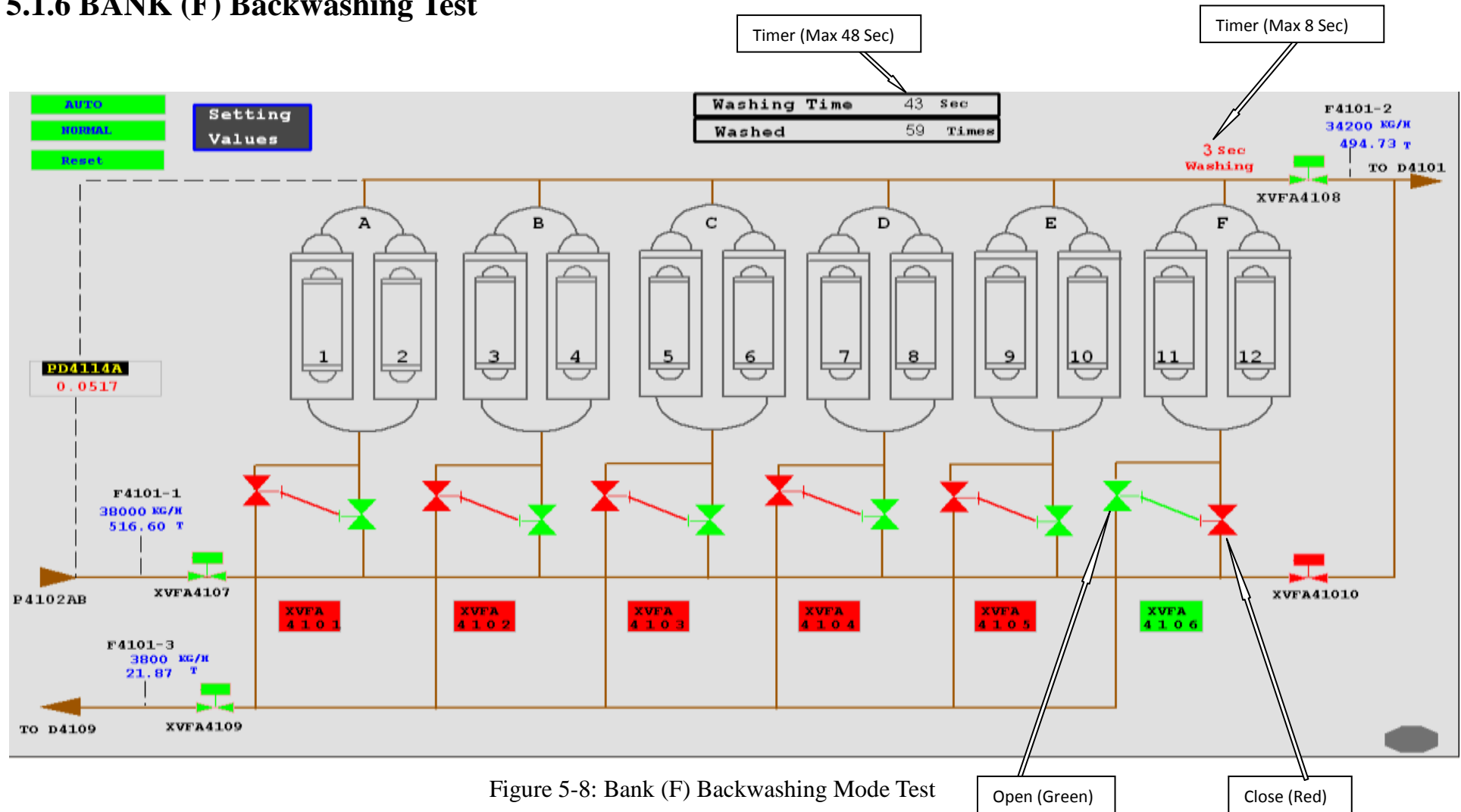


Figure 5-8: Bank (F) Backwashing Mode Test

The following events will take place once Bank (E) and the delay time are finished:

- Bank (F) starts the washing process.
- Output 6 which is represented by square XVA4106 is activated and its color changes from Red to Green.
- The valve to process will be closed and its feedback signal color changed from green (open) to red (Close).
- The inlet valve for washing will be opened and its feedback signal color changes from Red (Close) to Green (Open).
- The two Elements (11, 12) of Bank E will flash during the backwashing time.
- The washing counter for Bank (F) will come up and display the washing time taken by Element 1 (8 Seconds).
- The Total washing counter will displaced the total value. In this case it is (48 seconds).
- The differential pressure will drop after the successful execution of the cleanup explains in number 1 above. In this case it will drop by (0.2 Mpa).
- The amount of diesel used for washing Bank (F) will be accumulated and measured.

5.1.7 Filters Elements Replacement Test

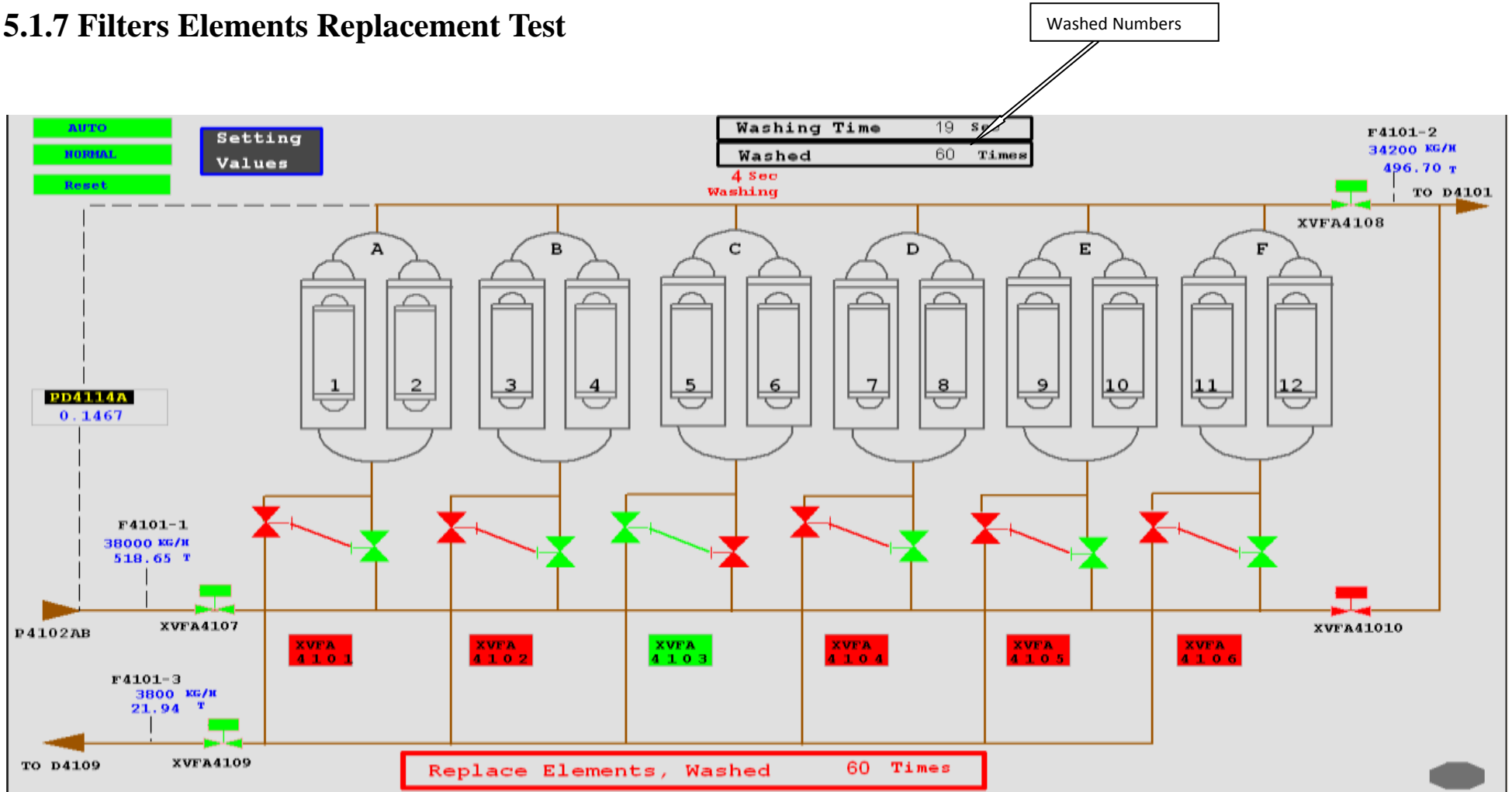


Figure 5-9: Filters Elements Replacement Mode Test

- The Washed Timers count how many times the filter has been washed. In case it is (60 Times).
- Once the filter elements used for specific times decided by Mechanical staff, then the Alarm with message will come out to ring a bell for the maintenance techniques to replace the filter elements.
- Fully controlled and monitoring system, allows the operator to keep an eye on the current operating condition of the filter at all times, and that result in high productivity, increase the diesel yield and also extends catalyst service life.
- Maintenance based monitoring and run time.
- Minimize the number of spare parts required for maintenance.

5.2 Result

The system was tested with two different washing times, and fixed D

5.2.1 Test No 1 Result

D. Pressure = 0.2, W. Time = 5 Seconds, D. Time = 2 Seconds, tested 4 Times.

Table 5-1: D. Pressure & Washing Time & Outputs Test Result

Step	DP	A		B		C		D		E		F		T. W. Time
		I	W	I	W	I	W	I	W	I	W	I	W	
1	0.2	○	○	○	○	○	○	○	○	○	○	○	○	8 Sec
2	0.173	○	○	○	○	○	○	○	○	○	○	○	○	16 Sec
3	0.146	○	○	○	○	○	○	○	○	○	○	○	○	24 Sec
4	0.115	○	○	○	○	○	○	○	○	○	○	○	○	32 Sec
5	0.083	○	○	○	○	○	○	○	○	○	○	○	○	40 Sec
6	0.051	○	○	○	○	○	○	○	○	○	○	○	○	48 Sec

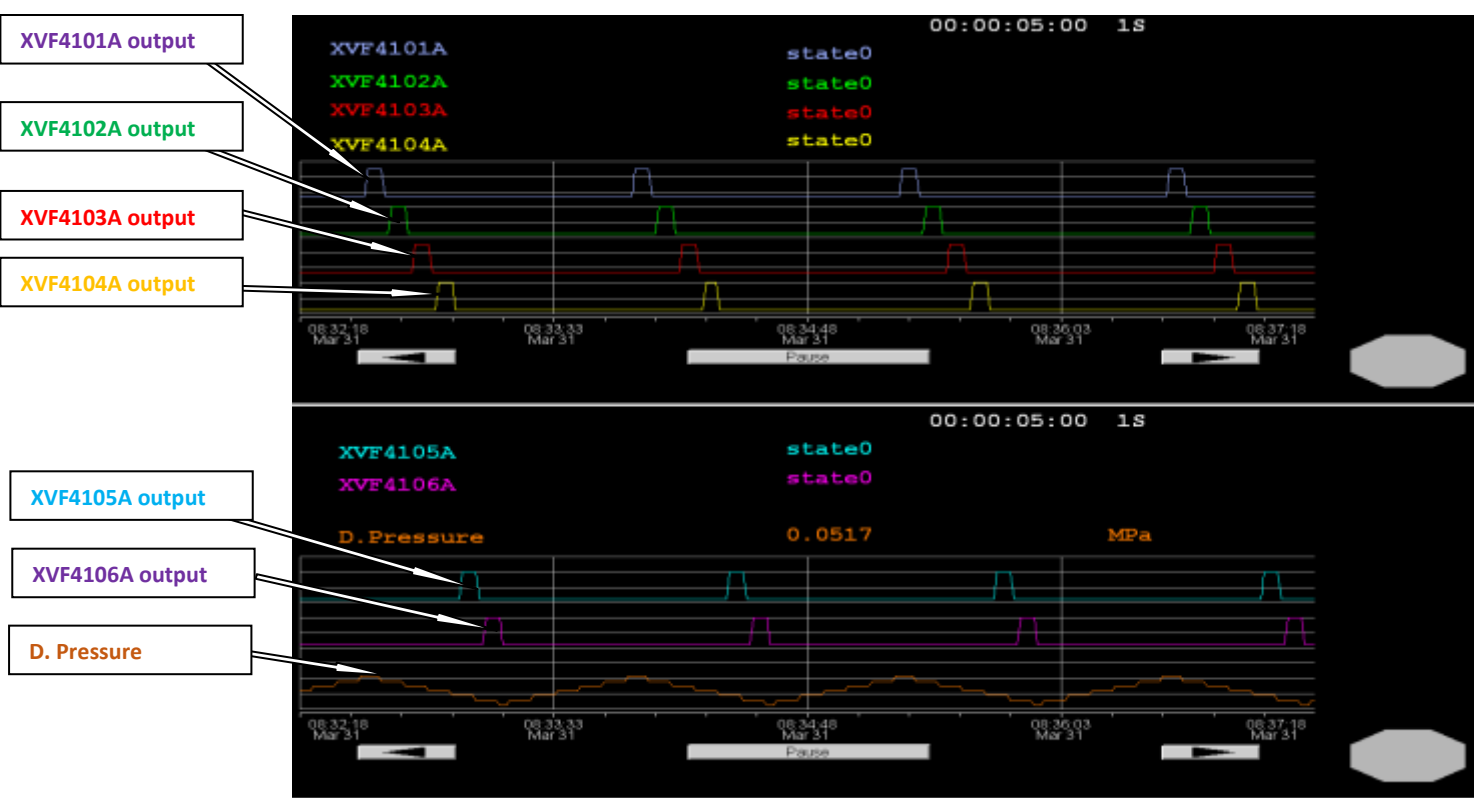


Figure 5-10: Filters D. Pressure and Washing Time & Outputs Result

5.1.2 Result No (2)

Setting (DP =0.2, W. Time = 10 Seconds, D. Time = 2 Seconds), (Tested, 2 Times).

Table 5-2: D. Pressure & Washing Time & Outputs Test Result

Step	DP	A		B		C		D		E		F		T. W. Time
		I	W	I	W	I	W	I	W	I	W	I	W	
1	0.2	●	●	●	●	●	●	●	●	●	●	●	●	7 Sec
2	0.173	●	●	●	●	●	●	●	●	●	●	●	●	14 Sec
3	0.146	●	●	●	●	●	●	●	●	●	●	●	●	21 Sec
4	0.115	●	●	●	●	●	●	●	●	●	●	●	●	28 Sec
5	0.083	●	●	●	●	●	●	●	●	●	●	●	●	35 Sec
6	0.051	●	●	●	●	●	●	●	●	●	●	●	●	42 Sec

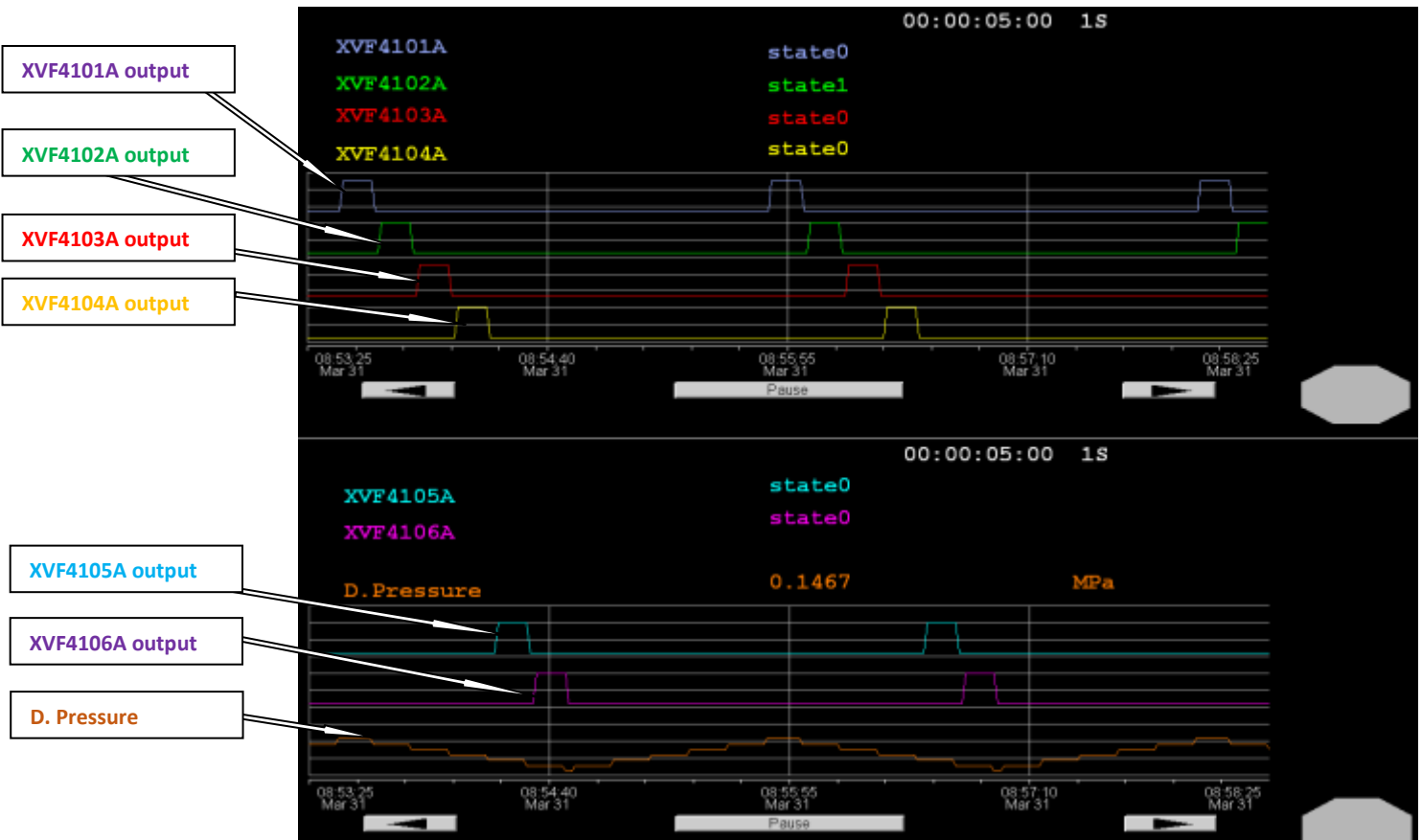


Figure 5.11: Filters D. Pressure and Washing Time & Outputs Result