In the context of a water-based heating system, such as a boiler, the graph would depict the flow of

energy through hydrodynamics and thermodynamics. Nodes in the graph represent specific

components within the boiler system, while edges represent the transfer of energy or interactions

between these nodes. In this case, the energy transfer within the boiler is facilitated by the principle

of

hydrodynamics and thermodynamics. Hydrodynamics would represent the movement of water and

the energy transfer associated with fluid flow. As show in Fig. 19, this could include the flow of water

through pipes, valves, and other components within the boiler systems. Thermodynamics, on the

other

hand, would encompass processes such as heat transfer, energy conversion, and the overall

efficiency of the heating system. This would involve interactions between the water, heat source,

and

various components like heat exchangers and pumps.

DM-PCV01-DEV

B2016

PCV01D

PID

Boiler

PIT01

PCV02D

Saturation Rate Limiter

F()

(P1)

P1-Pressure Control (PC)

Function

PP01A/PP01B

DM-PIT01

1001.3

1001.4

1001.1

TEST-AOUT

DM-PIT01

1001.2

DM-PIT01

DM-PP01-R

1001.2-OUT

1001.16-OUT

DM-PP01-R

1001.17-OUT

1001.10

1001.11

1001.17

1001.18

DM-PCV01-DEV

1001.19

1001.17-OUT

1001.7-OUT

DM-PV01-Z

PV

PV

CP

1001.7

1001.8

DM-PCV01-Z

1001.08-OUT

1001.6

1001.7-OUT2

HMI

1001.09-OUT

1001.20-OUT

PV

PV

1001.5

1001.9

1001.20

1001.21

SP

CP

DM-PCV01-D

DM-PCV01-D

1001.22

1001.23

CP

GATEOPEN

GATEOPEN

DM-PCV02-D

HIL

1001.12

1001.13

1001.24

1001.13-OUT

DM-PIT01

1001.14-OUT

1001.15-OUT

1001.5-OUT

EWS

1001.14

1001.15

1001.16

CP

CP

FIGURE 16. ATTACK PROPAGATION CHAIN WHEN COMPROMISED HMI

43