

INPO ICES Report #316497

Wolf Creek Plant Trip; Manual Transfer of
MFRV/Bypass Flow to S/G During Plant
Startup – 5/3/15

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FSRUG Meeting

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Main Feedwater Regulating Valve (MFRV) Control System Overview

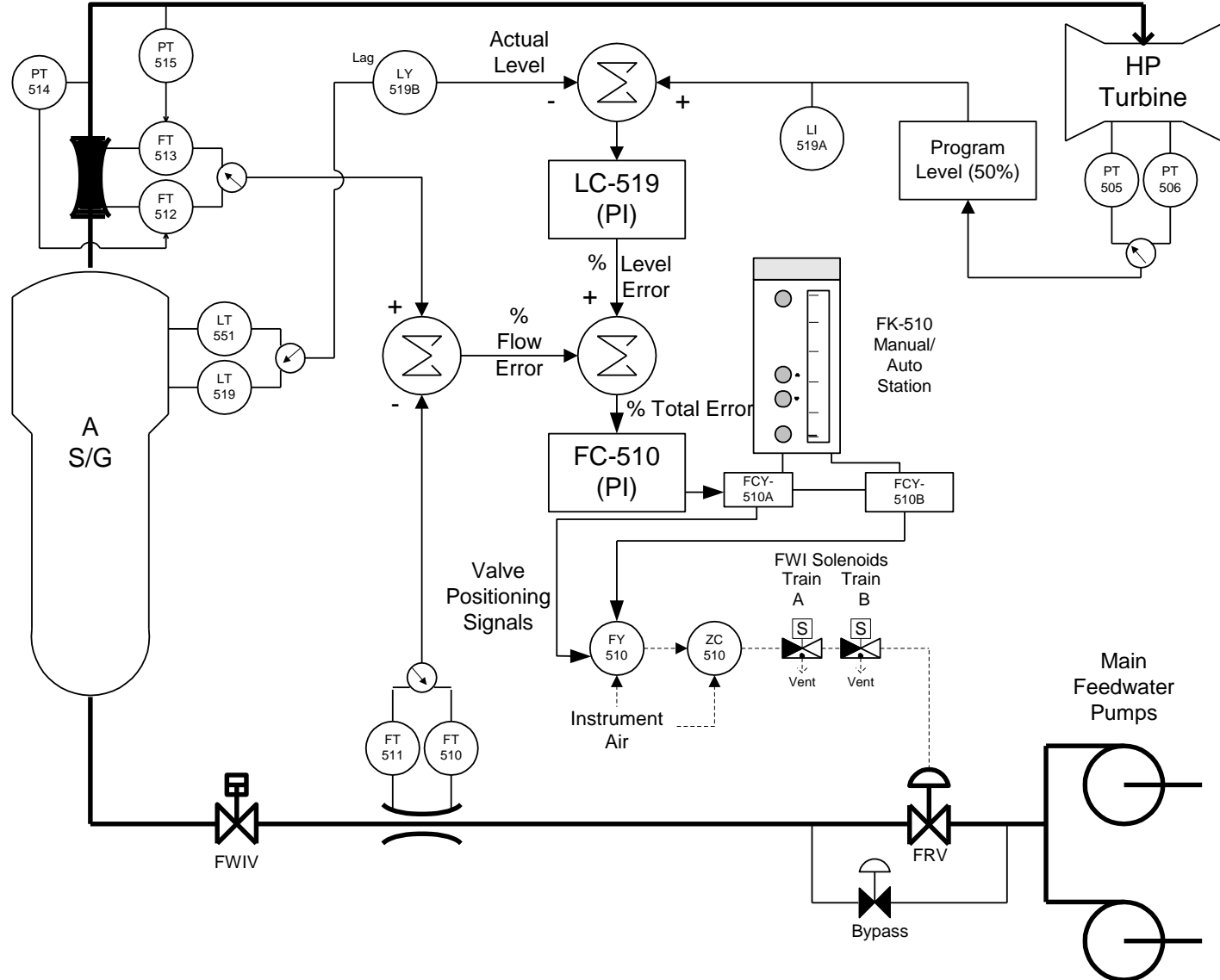
Three input control loop:

- Feedwater Flow
- Steam Flow
- NR S/G water level

MFRV valve position can be manually controlled from control room

Controls S/G level when power is >25%

MFRVs are 16" air-operated valves



MFRV Bypass Valve Control System Overview

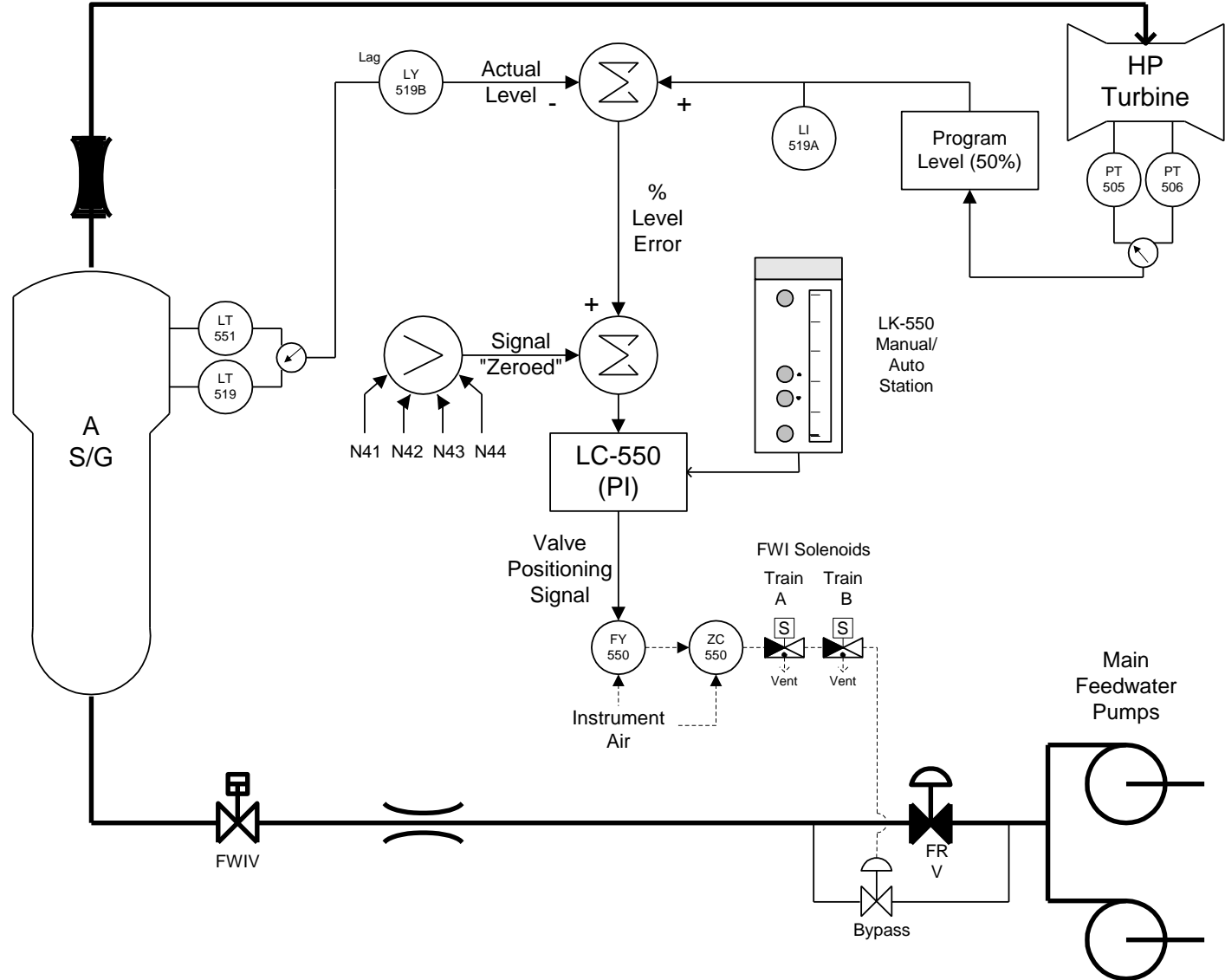
One input control loop:
- NR S/G water level

Ignores steam and feedwater flows since the signals are unstable at low power levels

MFRV bypass valve position can be manually controlled from control room

Controls S/G level when power is <25%

MFRV bypass valves are 6" air-operated valves



RF20 Plant startup steps:

- Start powering up using MFRV bypass valves and with feedwater preheating in service
- Adjust feedwater ΔP to maintain MFRV bypass valves at 60-80% open
- Secure feedwater preheating prior to exceeding 25% reactor power; Stabilize reactor power between 25 – 30%, maintain ΔP around 75 psid per chart
- With one or two operators, each place one MFRV in MANUAL and MFRV bypass in MANUAL
- Both operators (simultaneously) manually jog OPEN MFRV and jog CLOSE MFRV Bypass Valve until MFRV is fully closed; maintaining stable S/G level; place MFRV in AUTO
- Once transferred, move to remaining MFRV and transfer
- Continue power up

Wolf Creek Operating Experience

- CR 96064, May 3, 2015
 - During initial startup from RF20, 'C' S/G received a HI-HI level signal while the Reactor Operator was manually transferring feedwater control from the Main FW Control Bypass Valves to the Main FW Control Valves at the Control Room panel. This resulted in a Turbine trip, feedwater isolation and a manual reactor trip.

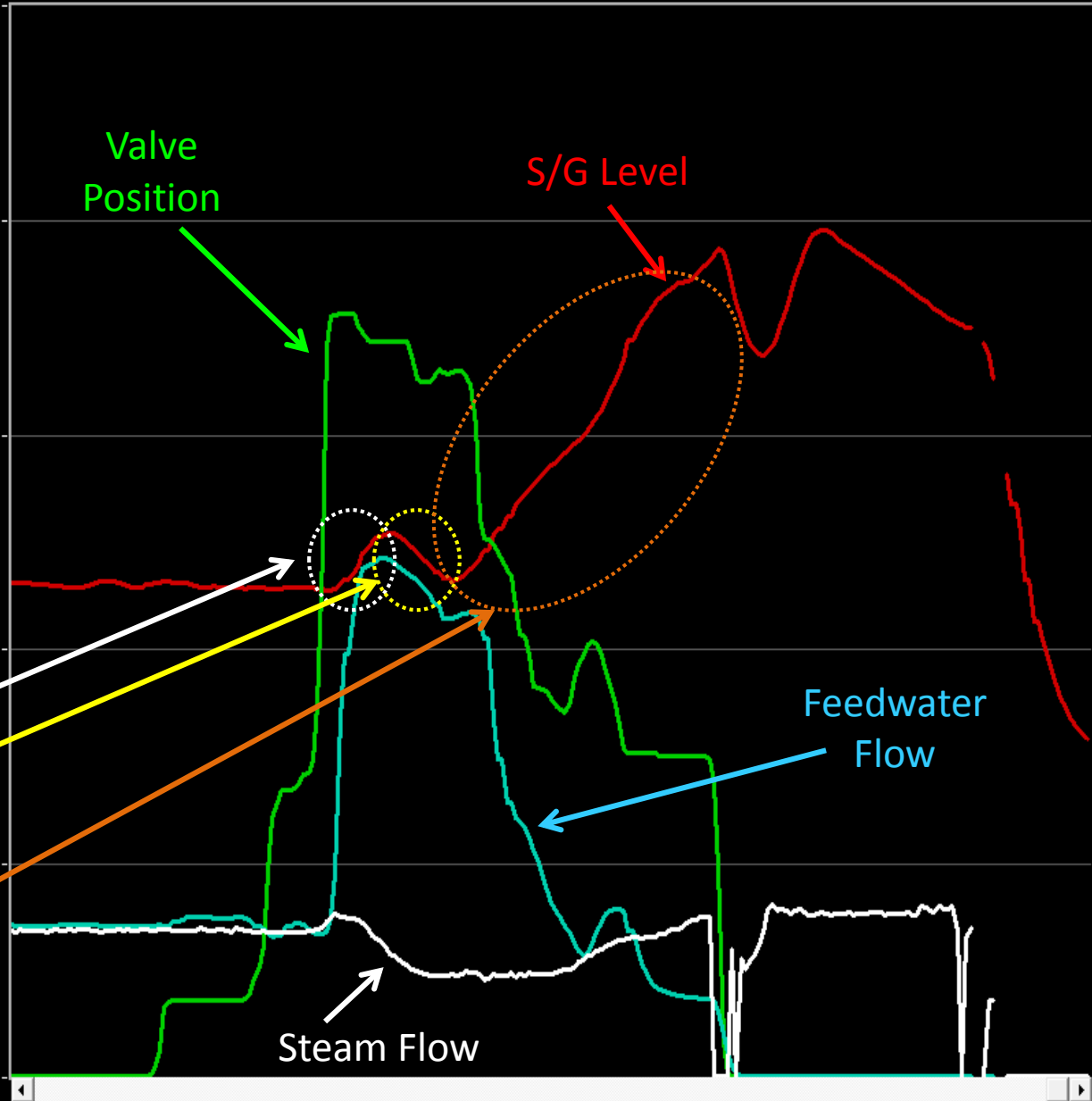
Trend NOT
Realtime

Start Time: 5/03/2015 10:19:00
End Time: 5/03/2015 10:23:00

Archive Sample Rate: 1 second
Real-Time Sample Rate: 1 second

Trend Markers: OFF
Toggle State

AEU0003	100.00
S/G C WATER LEVEL AVERAGE	100.00
49.59 PCT	GOOD
4800.00	4800.00
AEF0530A	80.00
FW LOOP#3 AUTO CONTROL SIGNAL	80.00
83.03 PCT	GOOD
3840.00	3840.00
AEU0007	60.00
S/G C FEEDWATER FLOW AVG	60.00
3963.47 KBH	GOOD
2880.00	2880.00
ABF0532	40.00
STM GEN 3 STM OUT 1 F	40.00
3904.02 KBH	GOOD
1920.00	1920.00
	20.00
	20.00
	960.00
	960.00
	0.00
	0.00
	0.00
	0.00



1. Level rises due to excessive increased Feedwater Flow
2. S/G temperature lowers Shrink
3. RCS heats up cool water, begins to boil = Swell

1. Level rises due to excessive increased Feedwater Flow

2. S/G temperature lowers Shrink

lowers - Shrink

5/03/15 10:20

5/03/15 10:22

Revised Plant startup steps:

- Start powering up using MFRV bypass valves and with feedwater preheating in service
- Adjust feedwater ΔP to maintain MFRV bypass valves at 60-80% open
- Secure feedwater preheating prior to exceeding 25% reactor power; Stabilize reactor power between 25 – 30%, maintain ΔP around 75 psid per chart
- **Place one MFRV in AUTO and one MFRV bypass in MANUAL**
- **Jog close MFRV bypass until closed, keeping MFRV in AUTO; control MFRV in MANUAL as needed to maintain FW flow**
- **Continue transfer of remaining MFRVs**
- Continue power up

Trend NOT
Realtime

Start Time: 5/13/2014 20:14:00
End Time: 5/13/2014 20:24:00

Archive Sample Rate: 1 second
Real-Time Sample Rate: 1 second

Trend Markers: OFF
Toggle State

AEU0003
S/G C WATER LEVEL AVERAGE
49.75 PCT GOOD ✕

100.00
100.00
4800.00
4800.00

AEF0530A
FW LOOP#3 AUTO CONTROL SIGNAL
82.44 PCT GOOD □

80.00
80.00
3840.00
3840.00

AEU0007
S/G C FEEDWATER FLOW AVG
3949.19 KBH GOOD ▲

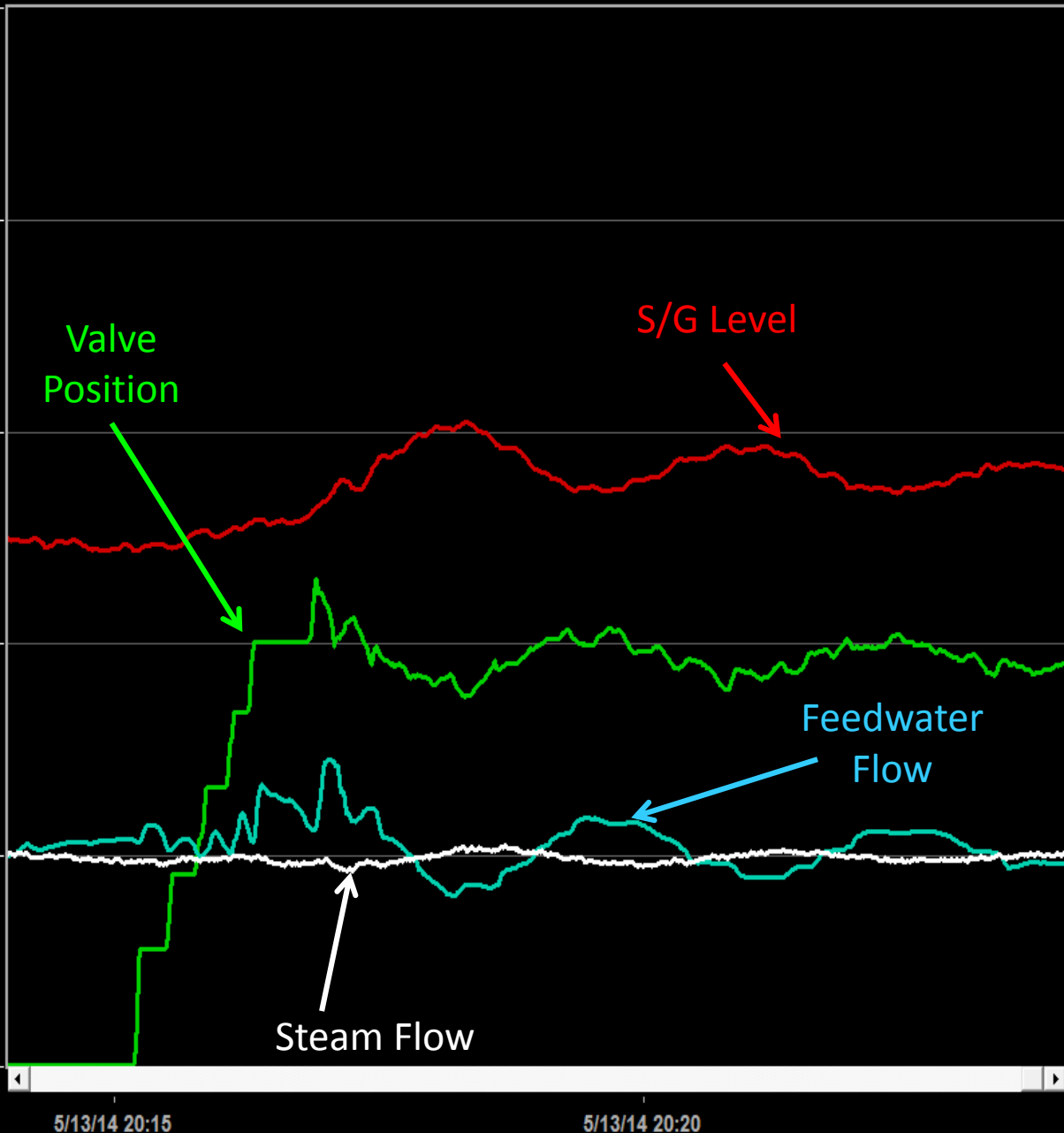
60.00
60.00
2880.00
2880.00

ABF0532
STM GEN 3 STM OUT 1 F
3906.97 KBH GOOD ○

40.00
40.00
1920.00
1920.00

20.00
20.00
960.00
960.00

0.00
0.00
0.00
0.00



Current Plans / Questions

Action Plan: Upgrade SGWLC (and full 7300 controls) to a Digital Control System in RF23 (fall 2019)

Bridging Strategy: Perform a SGWLC Tuning Study for plant tuning adjustments in RF21 and/or RF22

- What do other plants maintain for the feedwater ΔP across the MFRV bypass valves during plant startup?
- How do other plants differ on how to transfer flow from MFRV bypass to MFRVs?
- Do other plants place the MFRV in AUTO and manually close MFRV bypass during startup?