Appendix B.2 Beaver Valley Thermal-Hydraulic Results

This appendix presents the results of the Beaver Valley RELAP5 analysis. In early 2001, Westinghouse Electric Company created a RELAP5 input model of the Beaver Valley plant (Ref B.2-1) which was based on the H.B. Robinson plant model. This model was used as the starting point for this analysis. A noding diagram of the model is included as Figure B.2-1. Changes were made to this original model for several reasons. Setpoint changes were made when values have changed since the model was originally developed. Another set of changes are additional control/trip logic changes/additions. Other changes include corrections to the original model, and miscellaneous changes. These changes include the addition of control blocks to calculate parameters for information only (i.e., items such as minimum downcomer temperature), etc. The model was then adjusted to run a null transient (steady state) to assure a good starting point for transient analysis. Results from the null transient calculations were compared to desired plant values to assure valid starting conditions. All transient inputs use the RELAP5 restart feature, so cases can be started from the same initial conditions. The model was also re-initialized so cases could be analyzed at hot zero power conditions. For further information on model changes/details, see Reference B.2-2.

Results for each of the 118 cases analyzed are presented below as Figures B.2-2 through B.2-119. For each case, the following information is given in tabular format:

Case Category	LOCA, RT/TT, MSLB, etc.
Primary Failures	Description of the primary side failure
Secondary Failures	Description of the secondary side failure
Operator Actions	Description of any operator actions
Min DC Temp	The minimum average downcomer fluid temperature and associated time that minimum occurred
Comments	Any comments specific to the event

In addition to the information described above, plots are shown of: average downcomer fluid temperature, primary system pressure and downcomer wall heat transfer coefficient. These values are passed to the FAVOR probabilistic fracture mechanics analysis.

In Beaver Valley, the reactor coolant pumps are tripped when the differential pressure between the RCS and the highest steam generator pressure is less than 200 psid for normal containment conditions and 375 psid for adverse containment conditions. Unless otherwise noted, the operators are always assumed to immediately trip the reactor coolant pumps according to these criteria.

For some cases, operator control of the HHSI flow is assumed to occur. In Beaver Valley, the operators can not "throttle" HHSI flow to obtain a given flow rate, rather they must turn pumps on/off. If during an event, the HHSI flow is on, the operator is allowed to turn a pump off if the following conditions are met: core exit subcooling > 277 K

(40°F), steam generator narrow range level > 6% (normal containment conditions) or 32% (adverse containment conditions), pressurizer level > 5% (normal containment conditions) or 32% (adverse containment conditions) and the primary pressure is stable. After the operator turns the first HHSI pump off and if the above criteria are still met 5 minutes later, the second pump is turned off. If at any time the above criteria are not met, then both HHSI pumps are turned back on. No other operator actions are assumed, except as specifically noted.

Unless otherwise indicated cases are assumed to be initiated from hot full power (HFP) conditions. The reactor thermal power corresponding to HFP conditions is 2660 MWth. When a hot zero power (HZP) case is indicated, the event is assumed to be initiated from a core power of 5.32 MW, which is 0.2% of the full core power.

All large MSLB cases are assumed to be initiated by the double-ended rupture of the steam line connected to steam generator A. The rupture is assumed to be just outside of the steam generator and inside the containment. Steam line breaks outside containment are not of PTS concern for Beaver Valley because the early and automatic closure of the main steam isolation valves effectively terminates the transient event. Small steam line breaks are simulated by sticking open all steam generator A safety relief valves.

When safety injection is required, the cooling water comes from the refueling water storage tank (RWST). This tank's useable volume is between 1630 and 1670 m^3 (430,000 and 441,000 gallons). Per technical specifications, this tank is maintained at a temperature between 280 K (45°F) and 286 (55°F), which is considerably lower than most plants. When the volume in the tank lowers to between 973 - 1086 m^3 (257,000 - 287,000 gallons), the safety injection water source is switched from the RWST to the containment sump (where the water has collected from the break). This water will have a significantly higher temperature than the RWST, and will affect the PTS response. Upon switchover to the sump, the low head safety injection pumps suction is automatically switched from the RWST to the containment sump. The LHSI continues to deliver to the low head ECCS lines connected to the cold legs. Also, the HHSI suction is automatically switched from the RWST to the discharge of the LHSI pump. It is now recirculating containment sump water. The time of switchover depends on a large number of factors, e.g., size of the LOCA, the number of safeguards pumps operating, whether or not the operators try to terminate SI and/or initiate post LOCA cooldown and depressurization, and whether containment quench spray has been actuated by a high-high containment pressure setpoint. For small breaks [< 10.16 cm (4.0 in)] the sump temperature is assumed to be 324 K (124°F). For larger breaks, the sump temperature is assumed to be 342 K (155°F). The time of switchover occurs anywhere from 11,000 seconds for a 3.59 cm (1.414 in) small break LOCA to 343 seconds for a 57.47 cm (22.63 in) hot leg break.

The Beaver Valley RELAP5 results did not show any of the flow recirculation problems exhibited in other plants. Therefore, a high K loss coefficient in the cold legs was not included as in the Oconee and Palisades analyses.

References

B.2-1 Janke, M., "Beaver Valley Unit 1 RELAP5 Input Deck for PTS Analysis", Westinghouse Calculation CN-LIS-00-180, March 2001.

B.2-2 Beaton, R., Fletcher, C.D., "RELAP5 Input Model Development for Beaver Valley PTS Application", (in preparation).

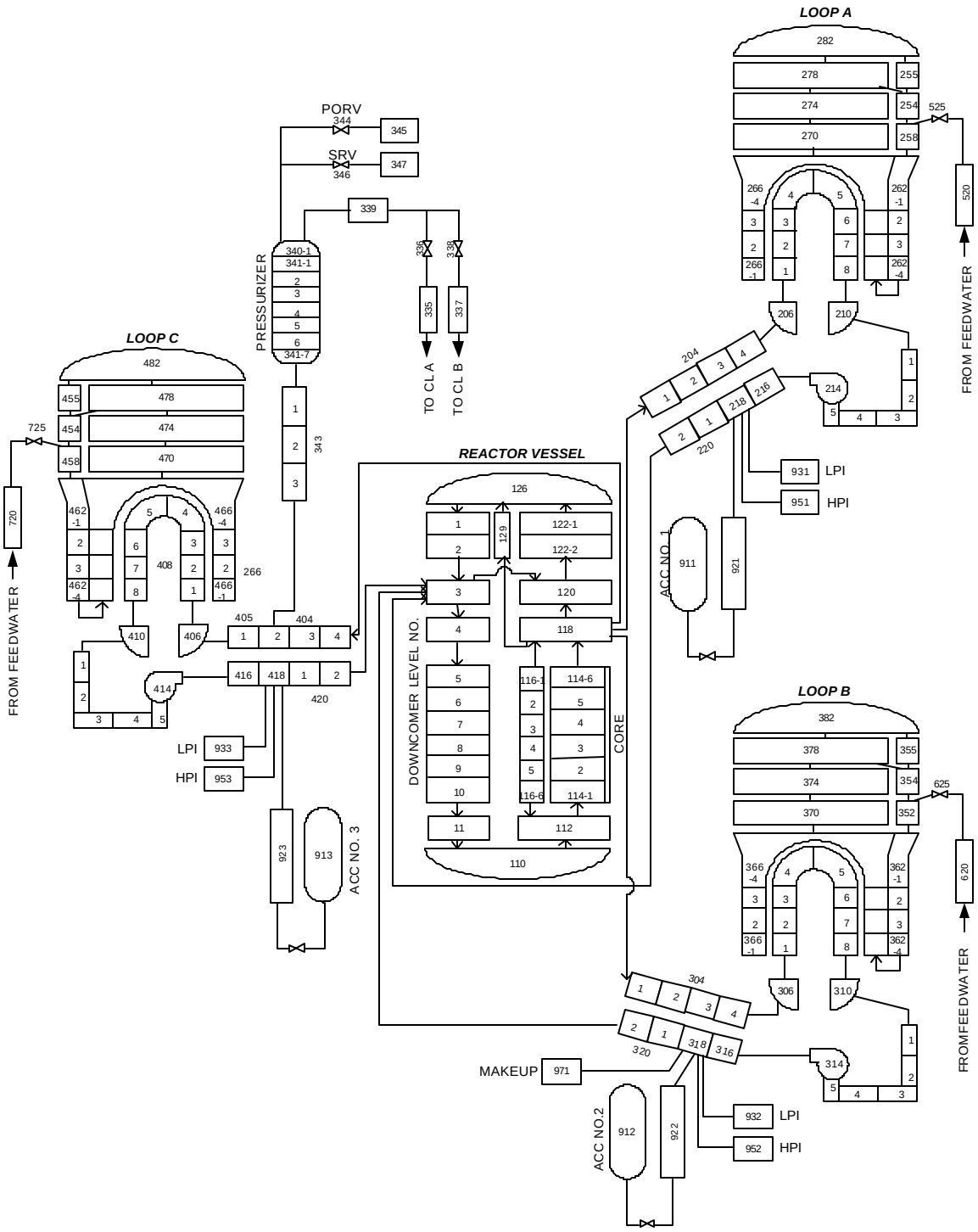
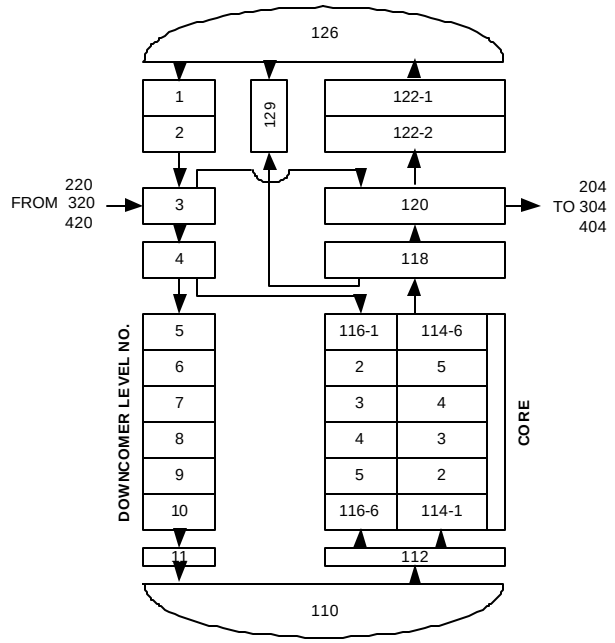


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram



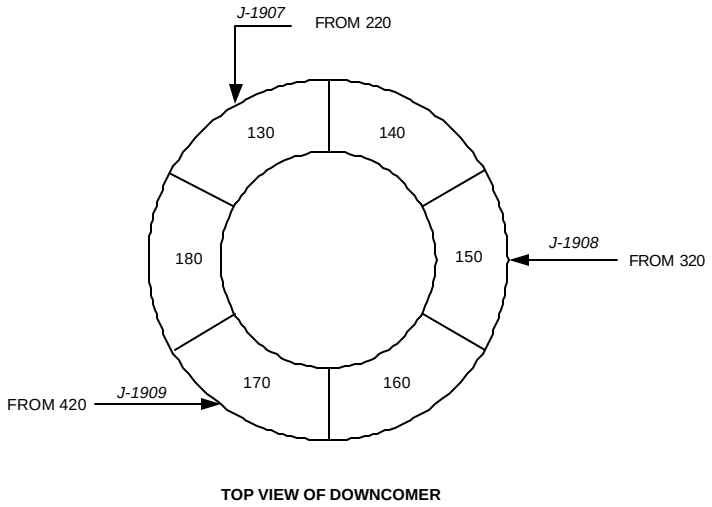


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram (continued)

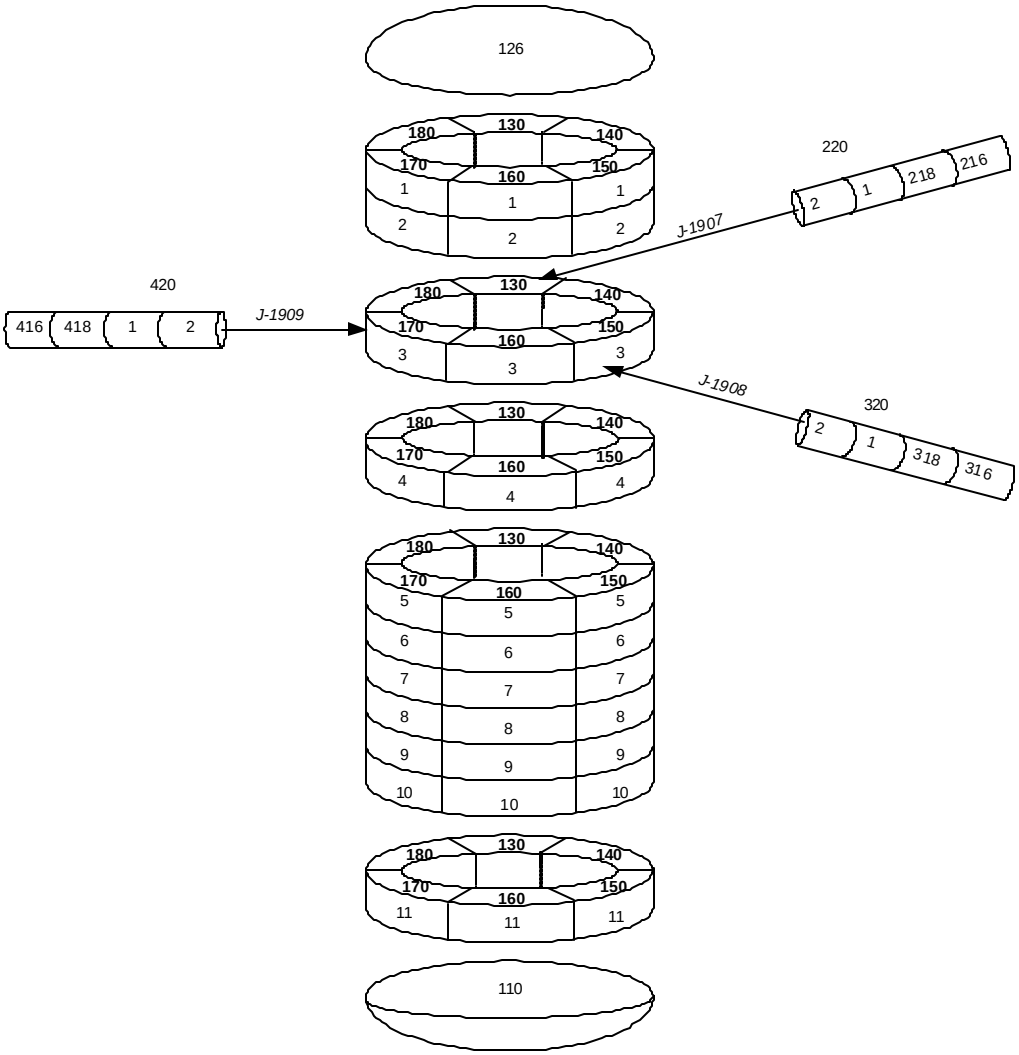


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram (continued)

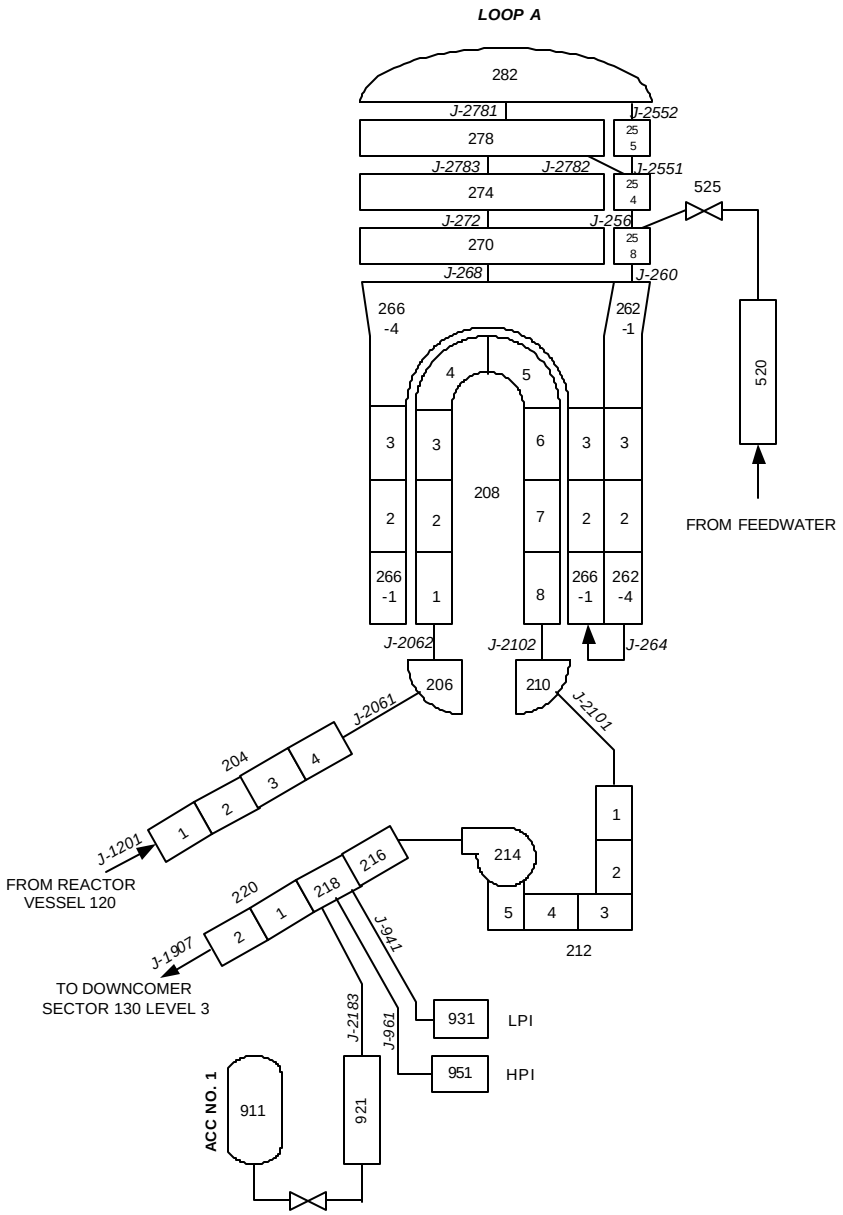


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram (continued)

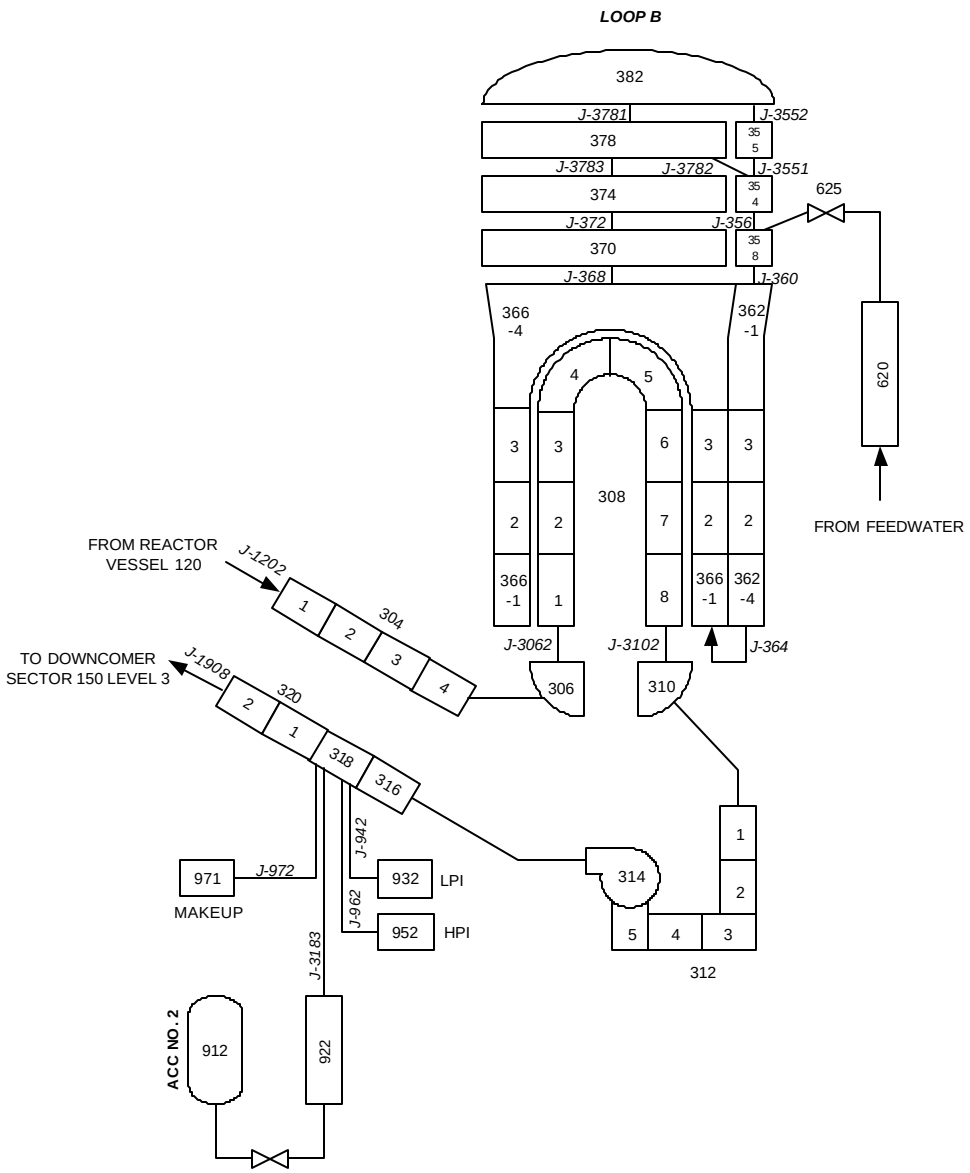


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram (continued)

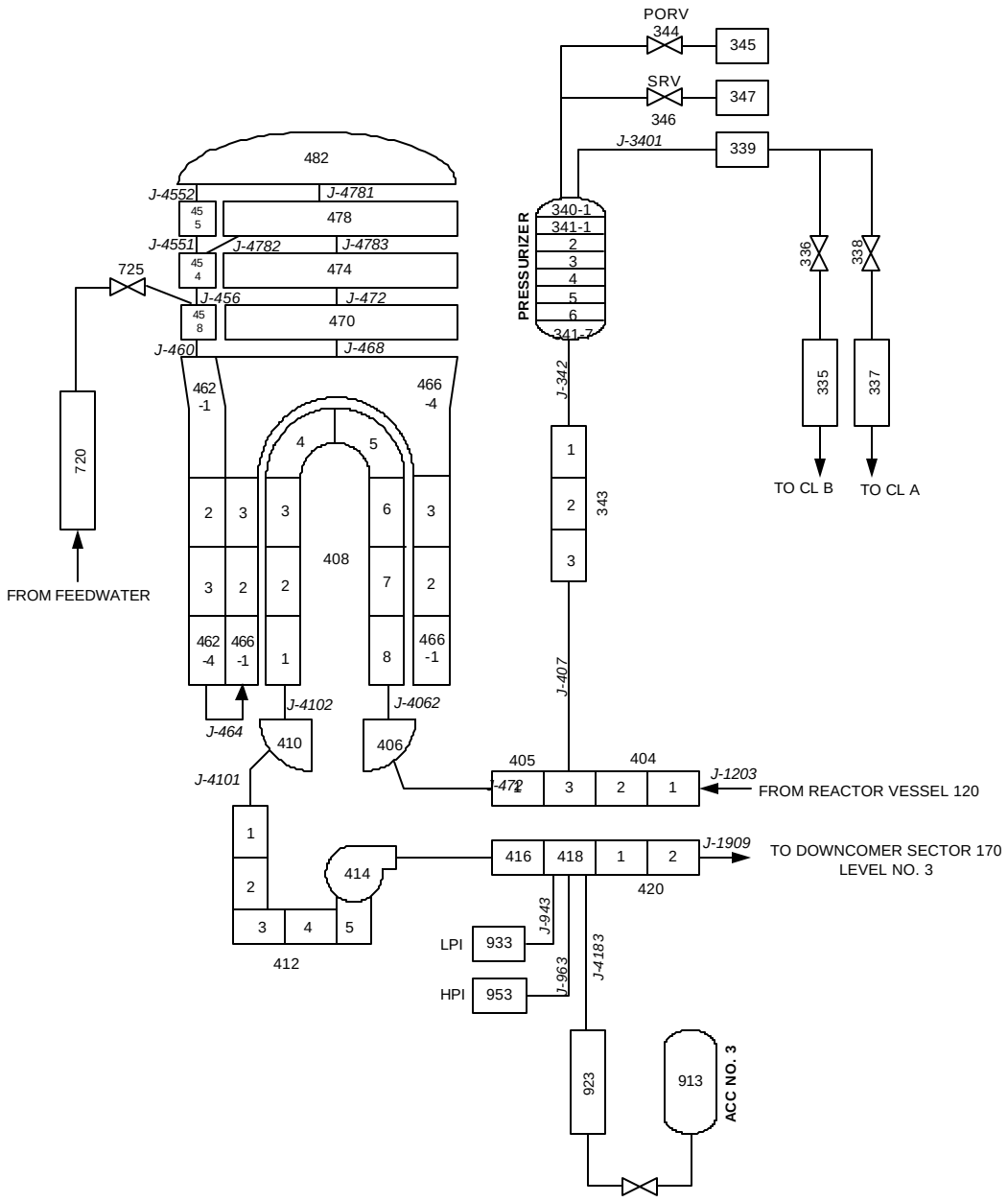


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram (continued)

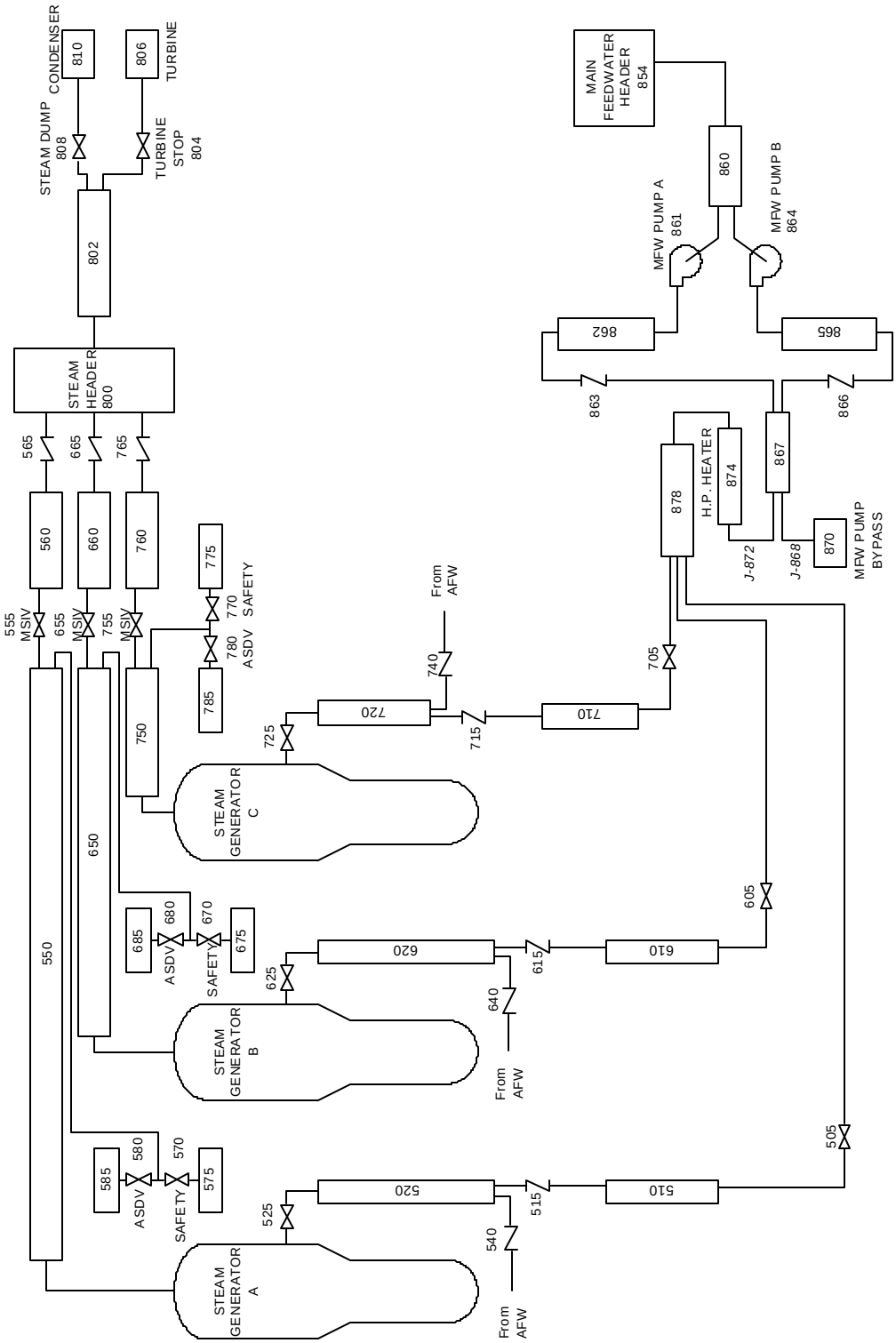


Figure B.2-1 Beaver Valley RELAP Model Noding Diagram (continued)

Case Category	LOCA
Primary Failures	2.54 cm (1.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	508.1 K (455.0°F) at 15000 s
Comments	None

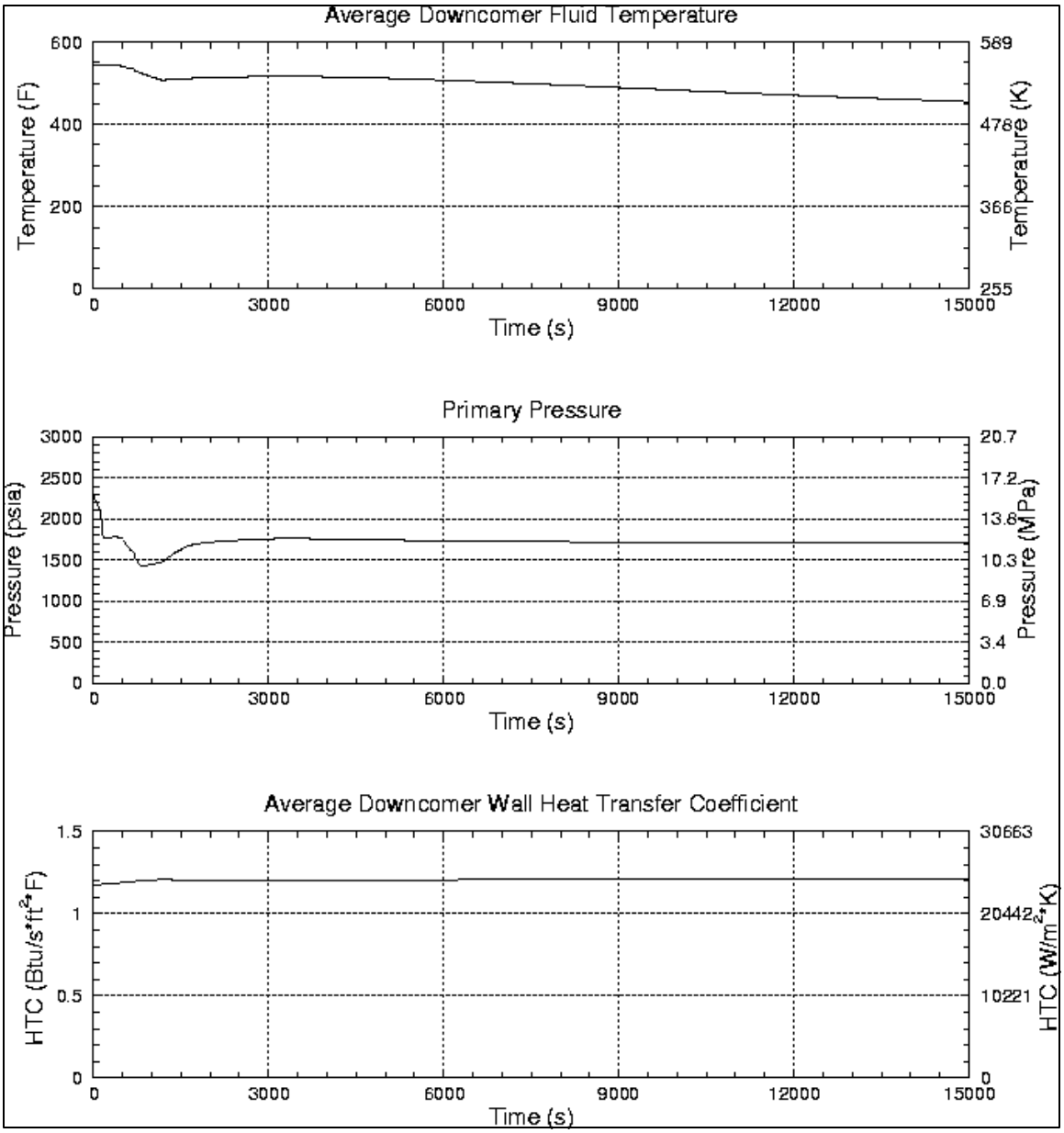


Figure B.2-2: Beaver Valley PTS Results for Case 001

Case Category	LOCA
Primary Failures	3.59 cm (1.414 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	401.6 K (263.2°F) at 12300 s
Comments	None

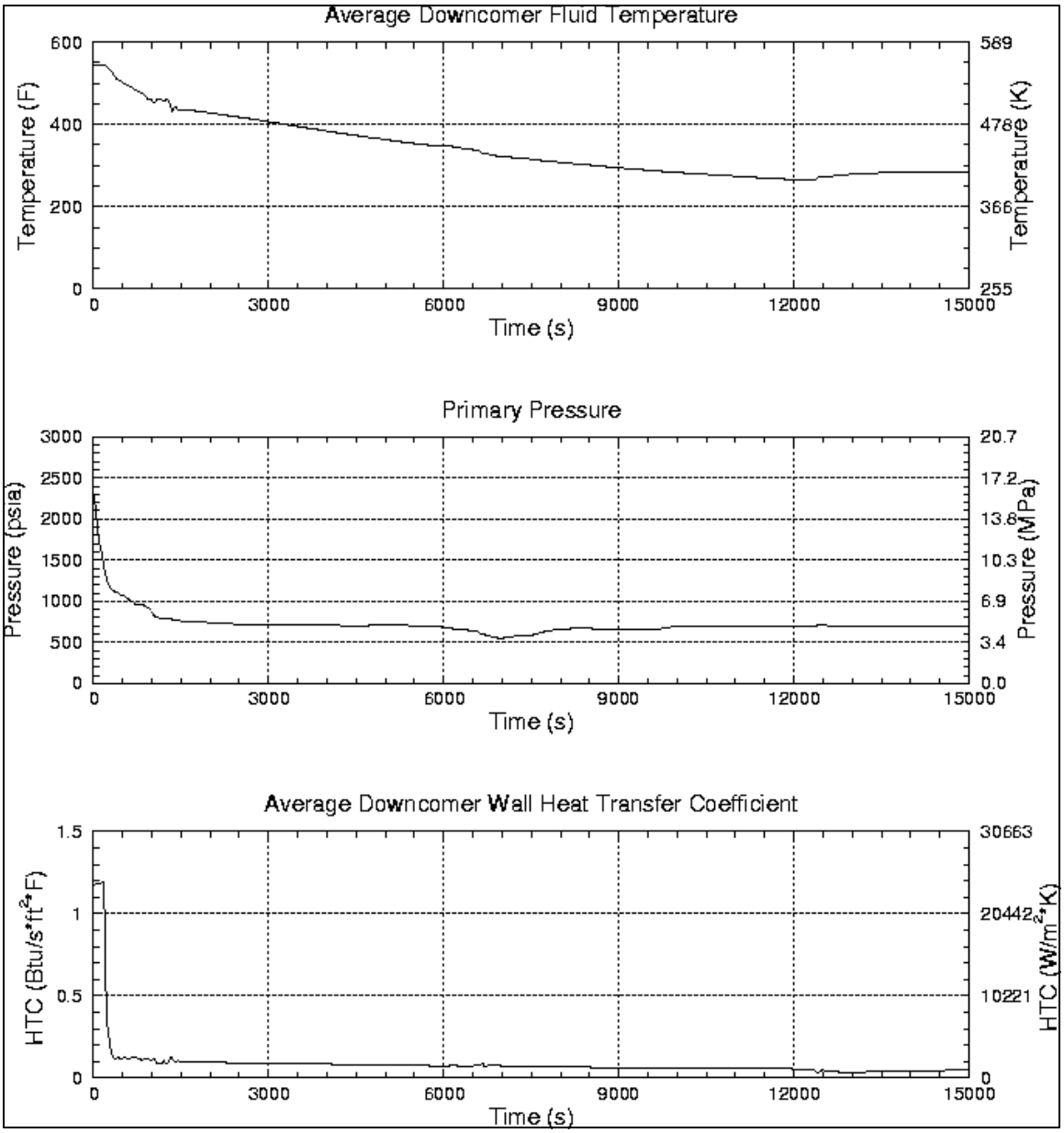


Figure B.2-3: Beaver Valley PTS Results for Case 002

Case Category	LOCA
Primary Failures	5.08 cm (2.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	310.9 K (100.0°F) at 7290 s
Comments	None

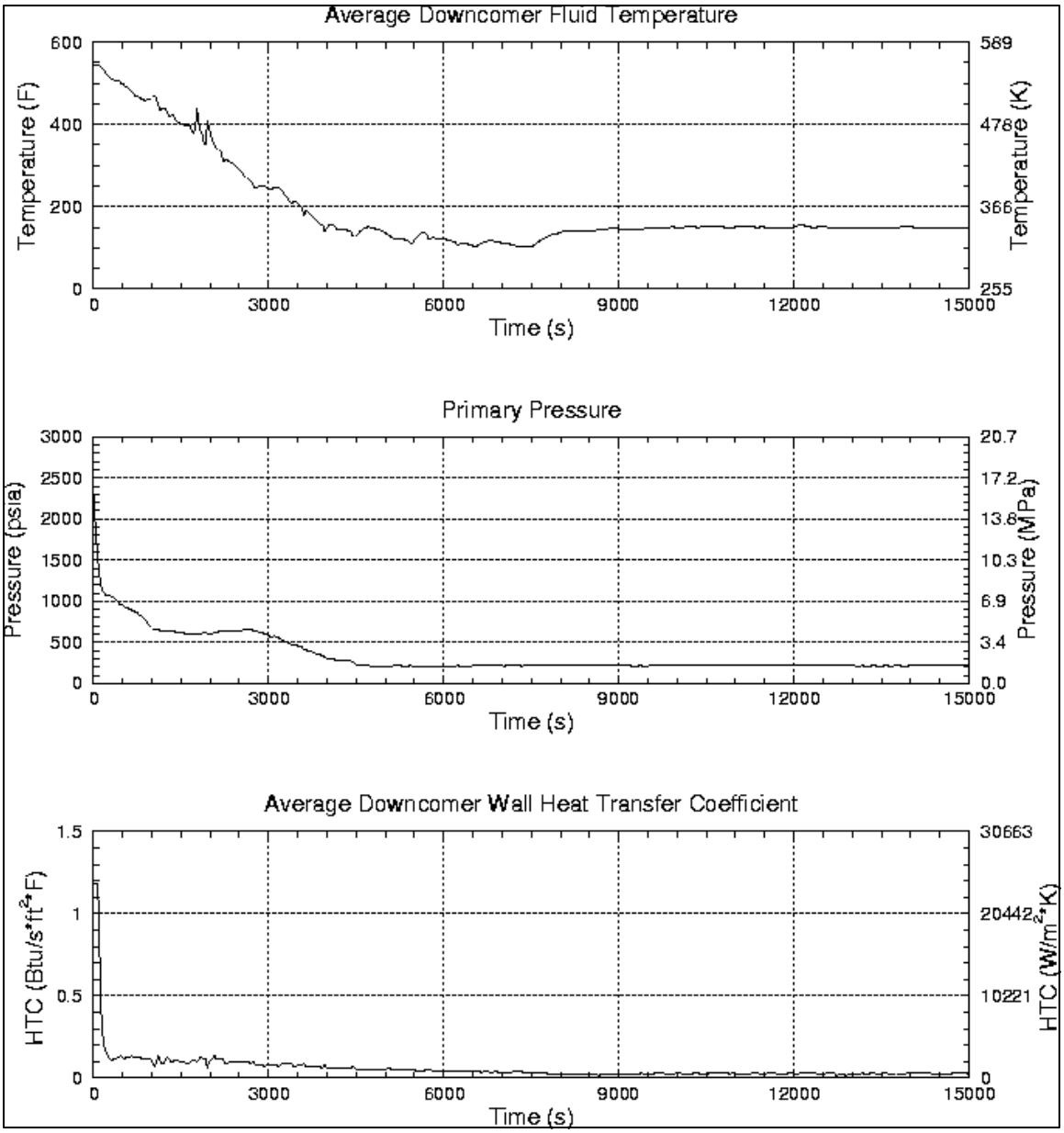


Figure B.2-4: Beaver Valley PTS Results for Case 003

Case Category	LOCA
Primary Failures	7.18 cm (2.828 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.1 K (71.6°F) at 4890 s
Comments	None

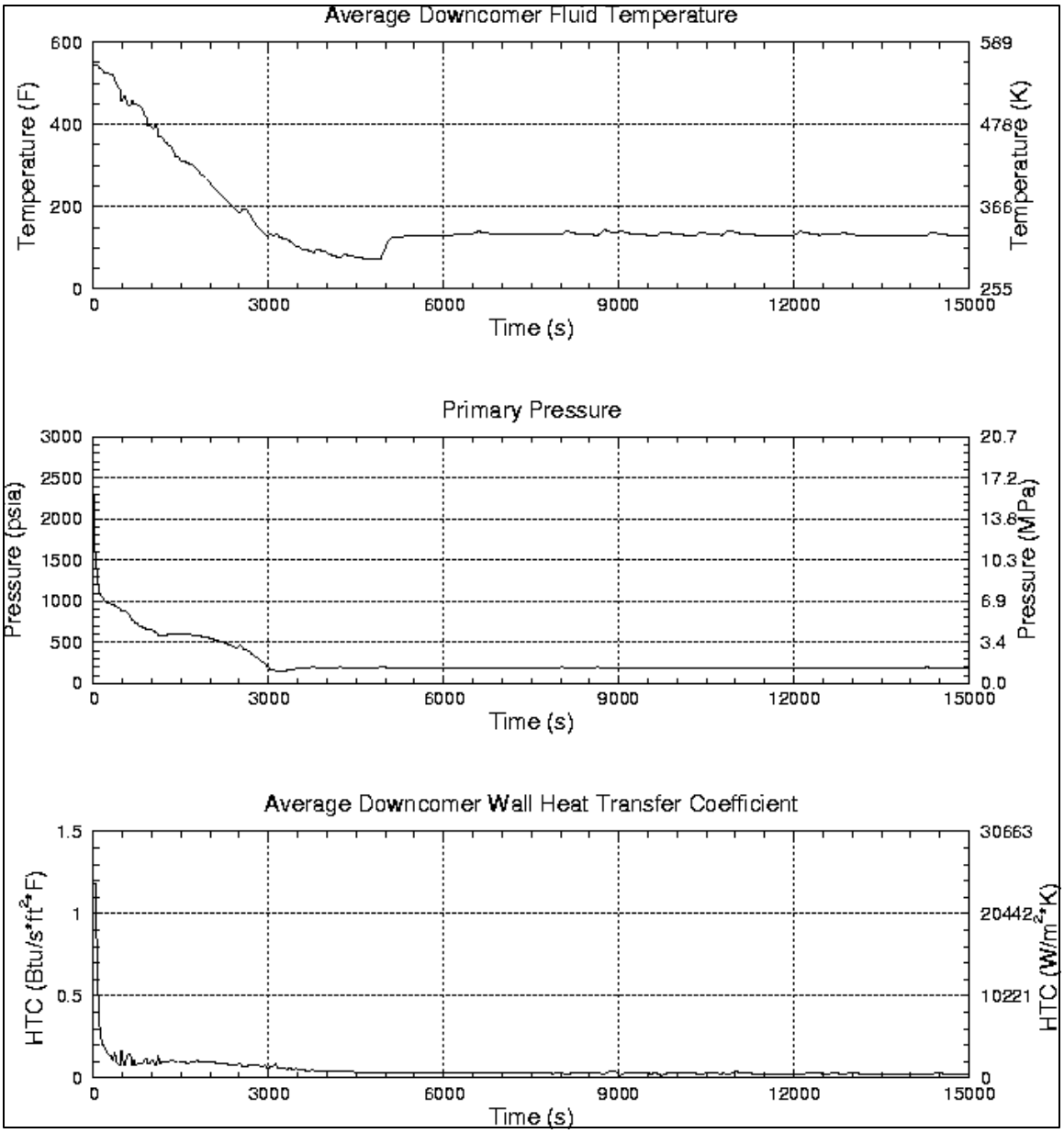


Figure B.2-5: Beaver Valley PTS Results for Case 004

Case Category	LOCA
Primary Failures	10.16 cm (4.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.5 K (72.2°F) at 2940 s
Comments	None

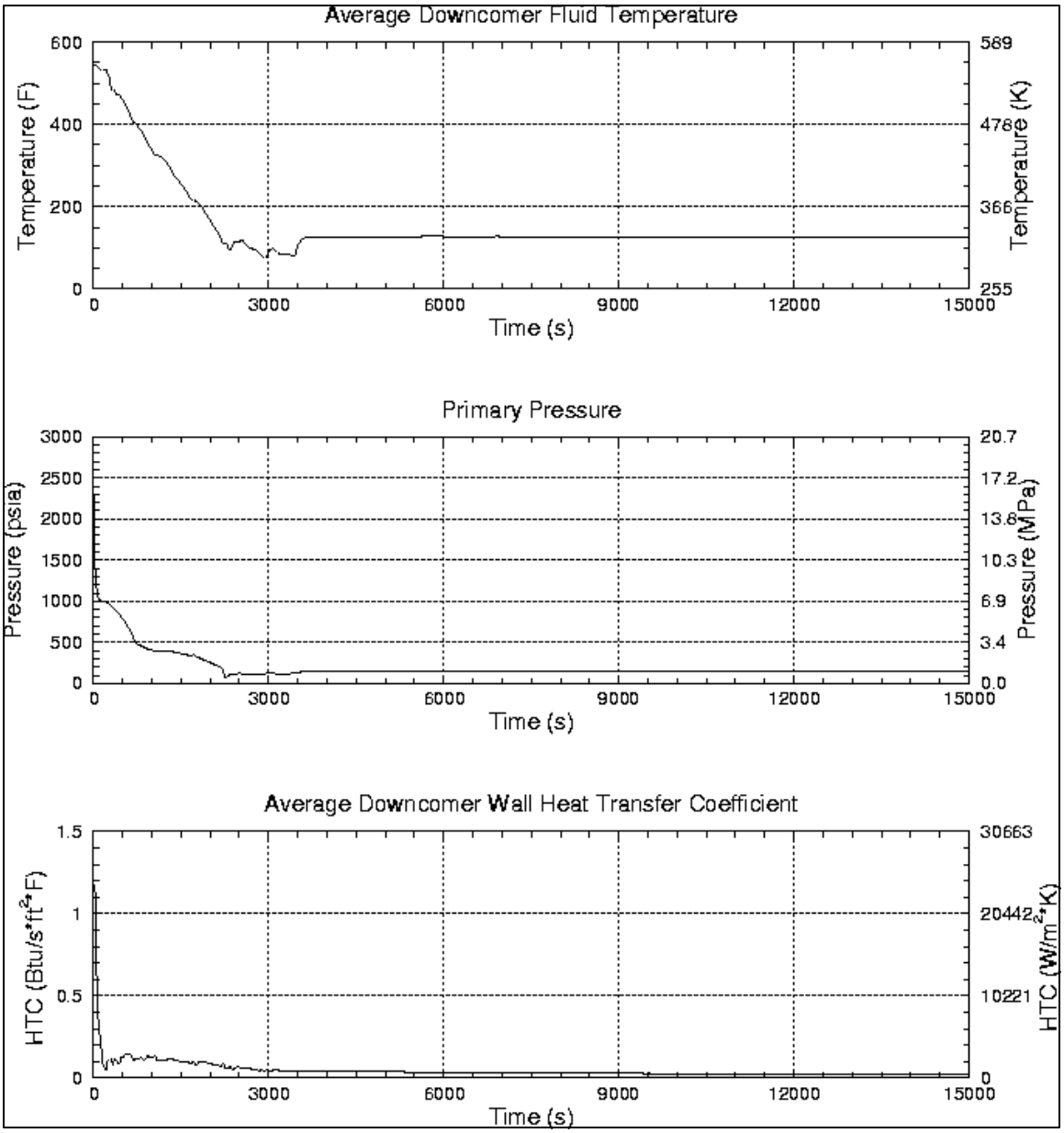


Figure B.2-6: Beaver Valley PTS Results for Case 005

Case Category	LOCA
Primary Failures	14.37 cm (5.657 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.5 K (72.2°F) at 2610 s
Comments	None

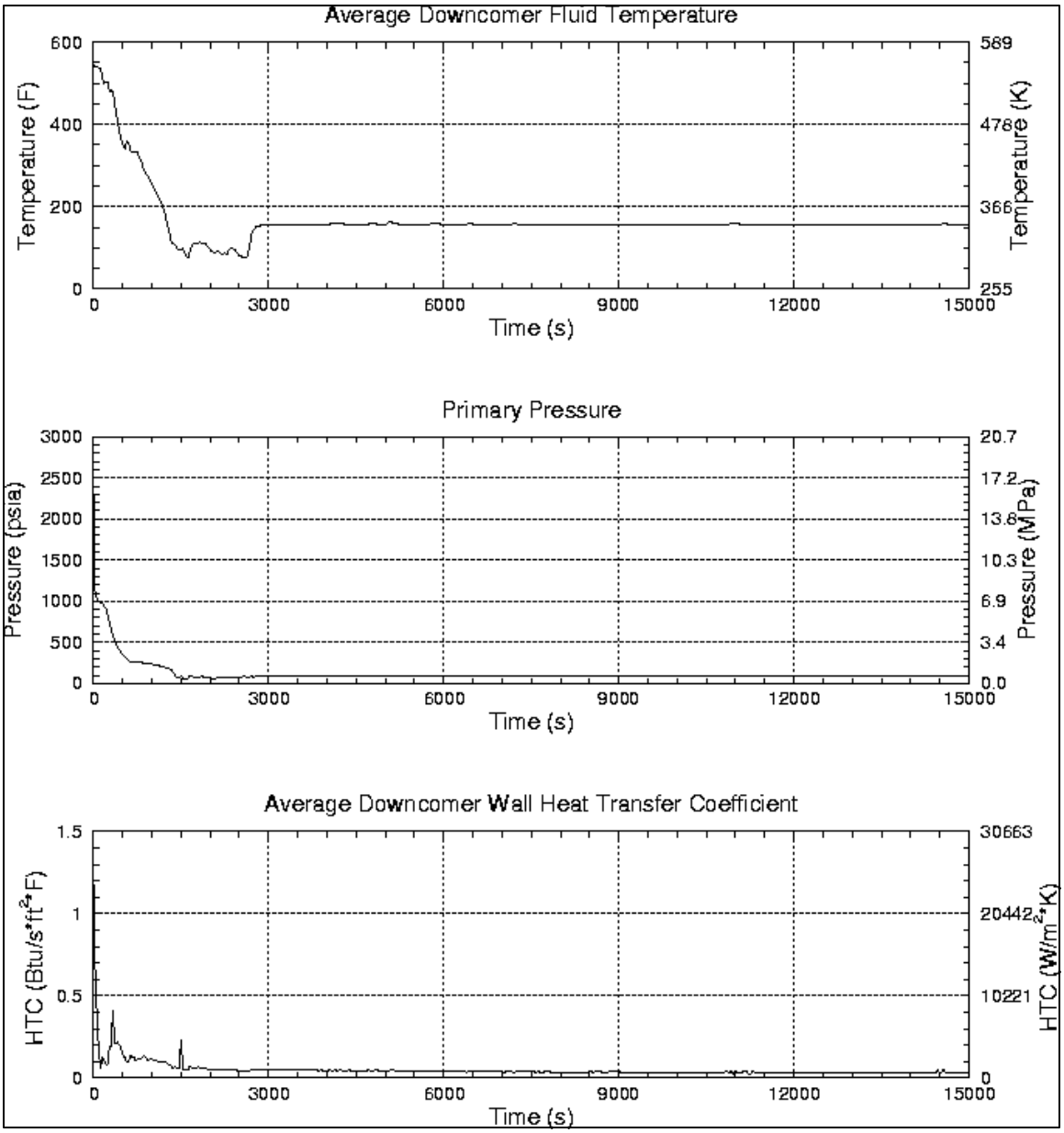


Figure B.2-7: Beaver Valley PTS Results for Case 006

Case Category	LOCA
Primary Failures	20.32 cm (8.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	291.2 K (64.5°F) at 1050 s
Comments	None

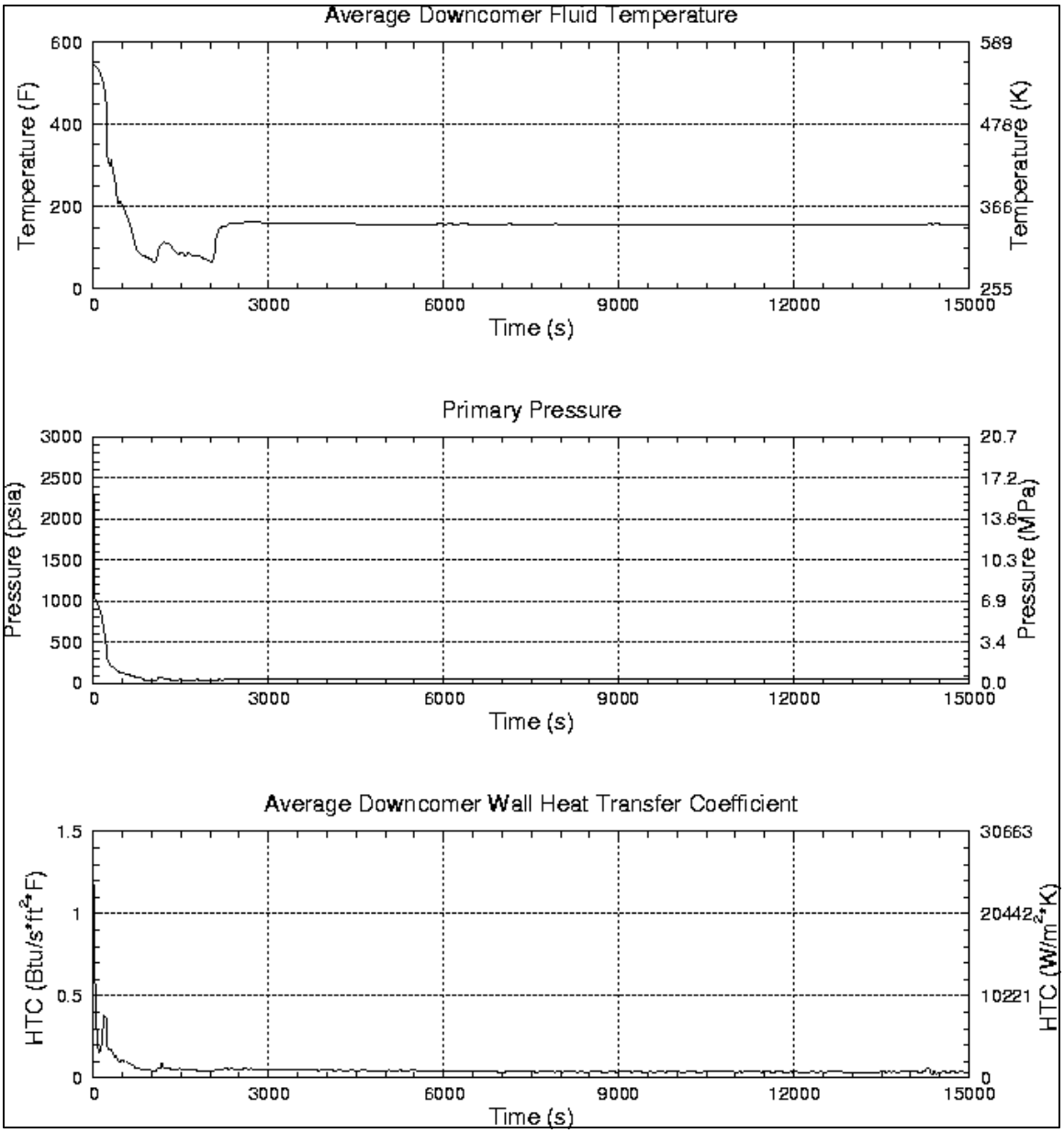


Figure B.2-8: Beaver Valley PTS Results for Case 007

Case Category	LOCA
Primary Failures	28.74 cm (11.314 in) hot leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	290.8 K (63.8°F) at 1140 s
Comments	None

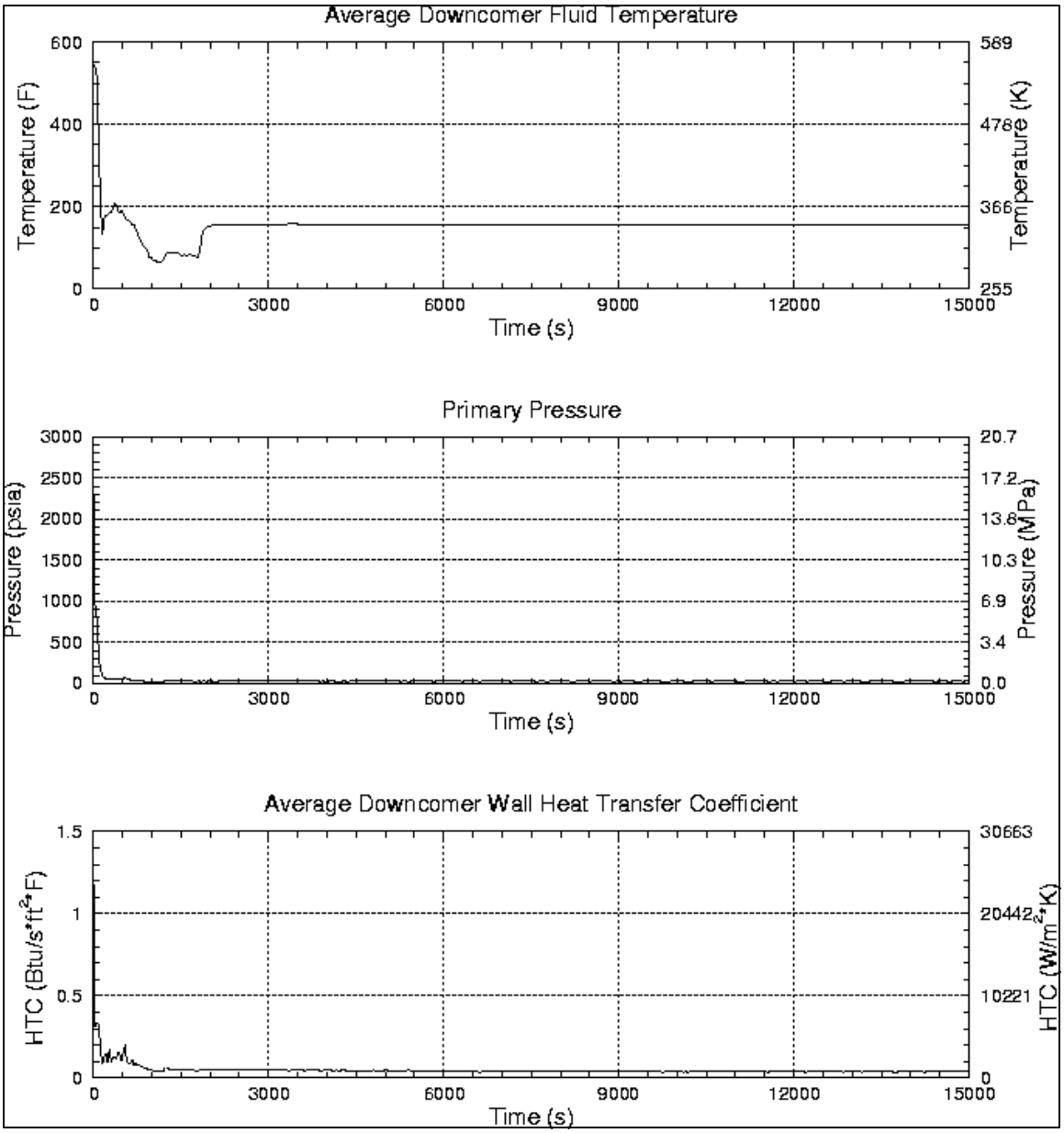


Figure B.2-9: Beaver Valley PTS Results for Case 008

Case Category	LOCA
Primary Failures	40.64 cm (16.0 in) hot leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	291.2 K (64.6°F) at 960 s
Comments	None

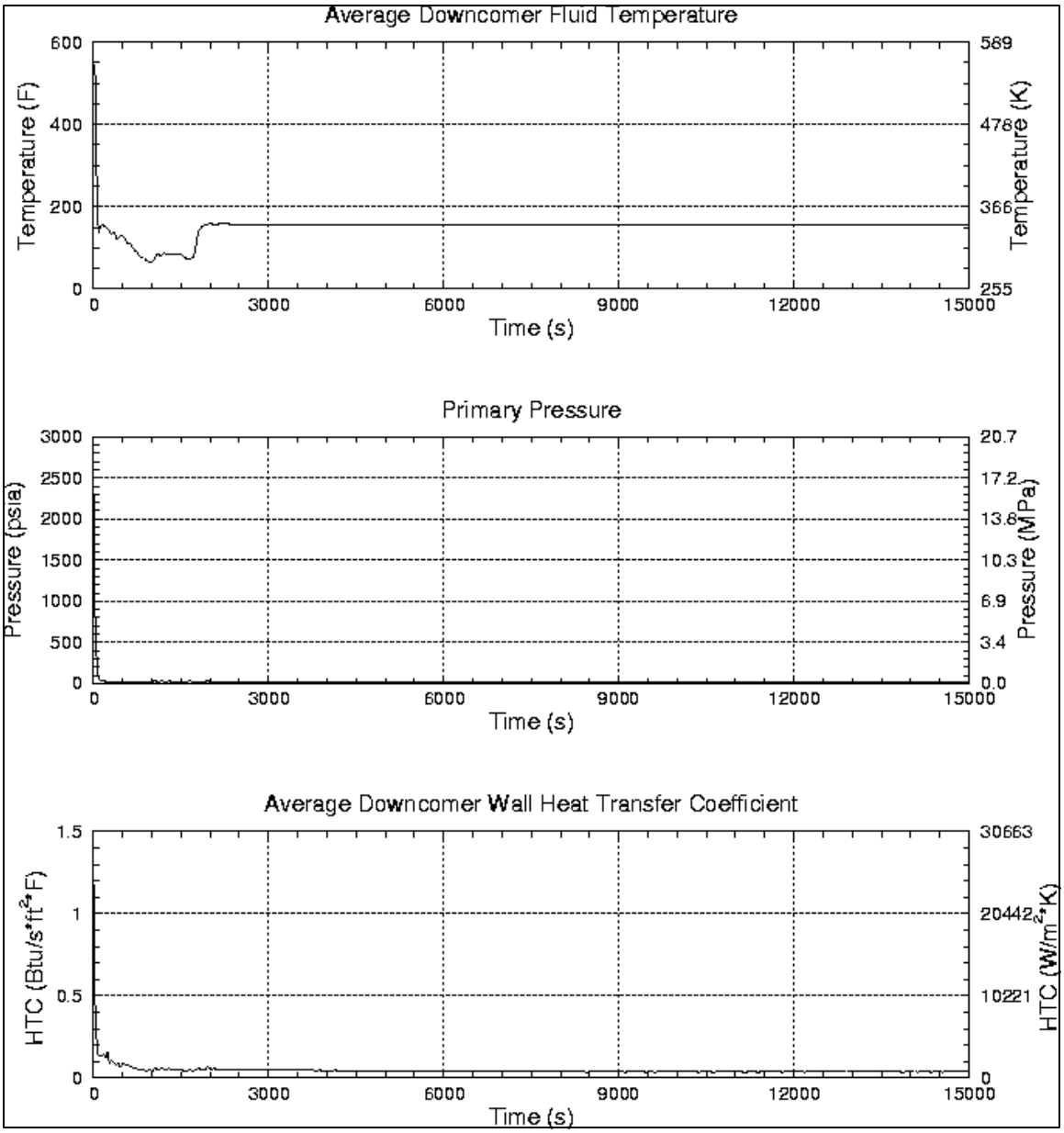


Figure B.2-10: Beaver Valley PTS Results for Case 009

Case Category	LOCA
Primary Failures	57.47 cm (22.63 in) hot leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	292.8 K (67.4°F) at 1140 s
Comments	None

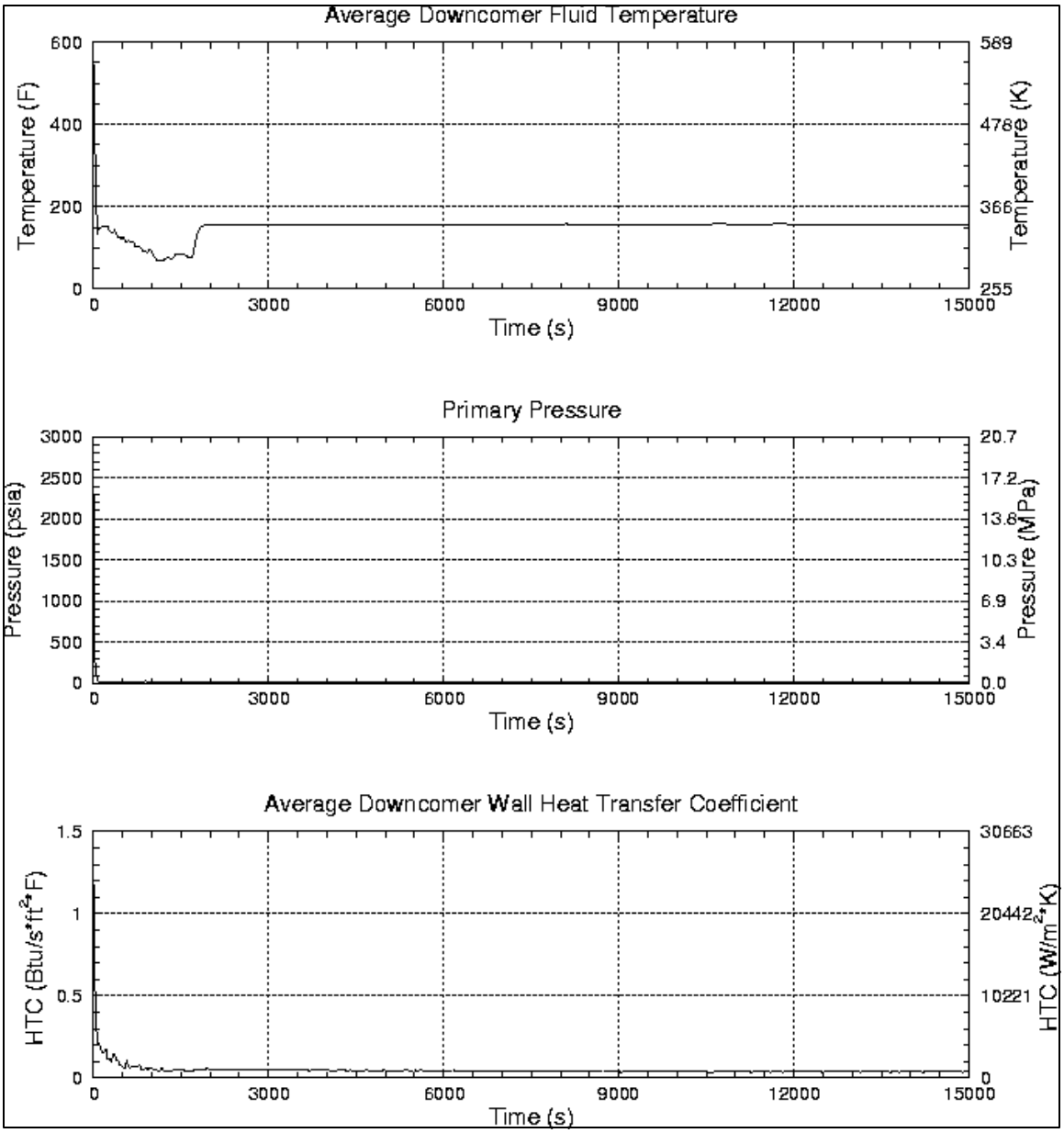


Figure B.2-11: Beaver Valley PTS Results for Case 010

Case Category	RT/TT
Primary Failures	None
Secondary Failures	None
Operator Actions	None
Min DC Temp	554.0 K (537.6°F) at 1050 s
Comments	None

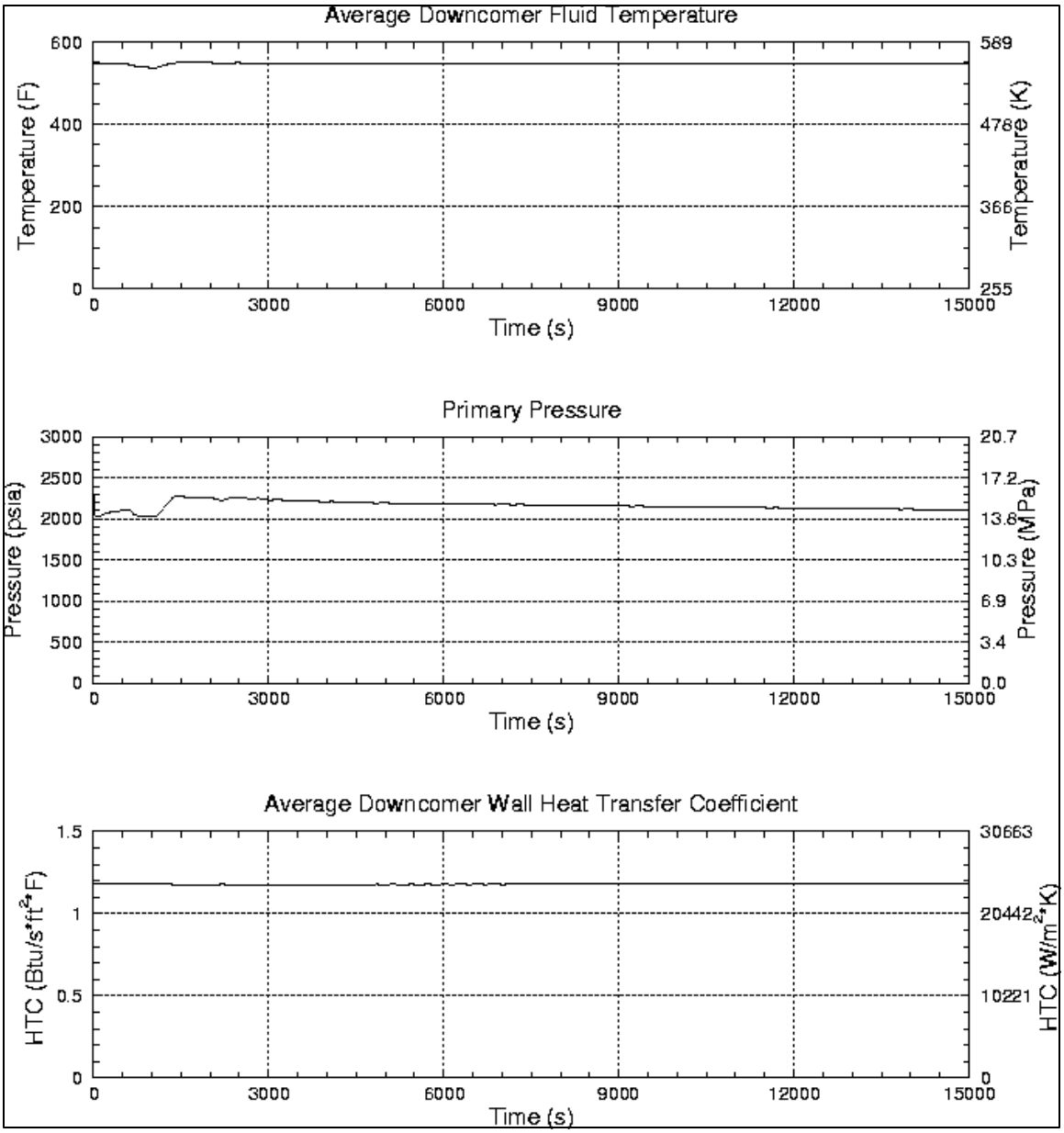


Figure B.2-12: Beaver Valley PTS Results for Case 011

Case Category	RT/TT
Primary Failures	One stuck open pressurizer PORV
Secondary Failures	None
Operator Actions	None
Min DC Temp	399.7 K (259.8°F) at 15000 s
Comments	None

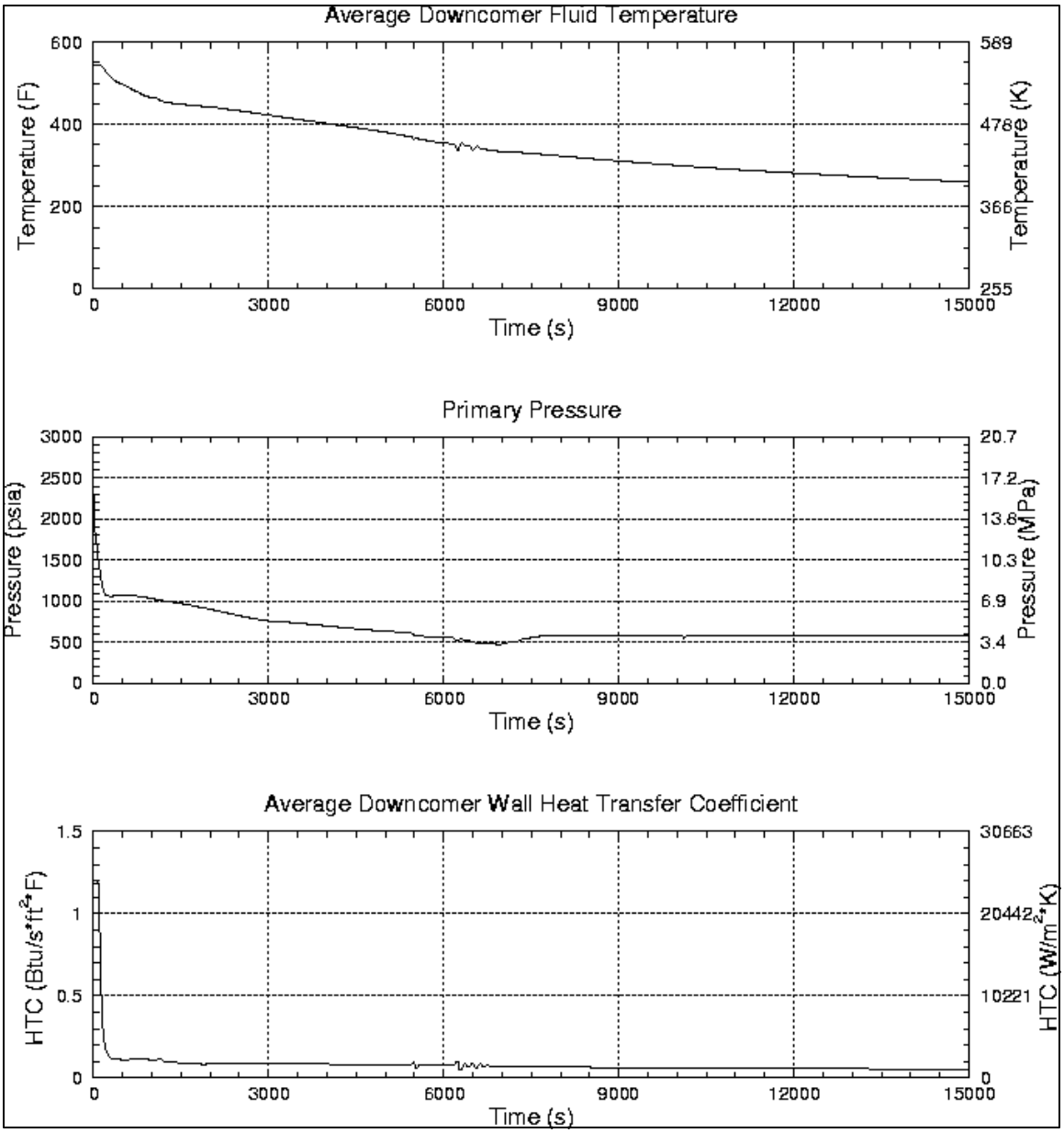


Figure B.2-13: Beaver Valley PTS Results for Case 012

Case Category	RT/TT
Primary Failures	One stuck open pressurizer PORV (isolated at 20 minutes)
Secondary Failures	None
Operator Actions	None
Min DC Temp	502.1 K (444.1°F) at 15000 s
Comments	None

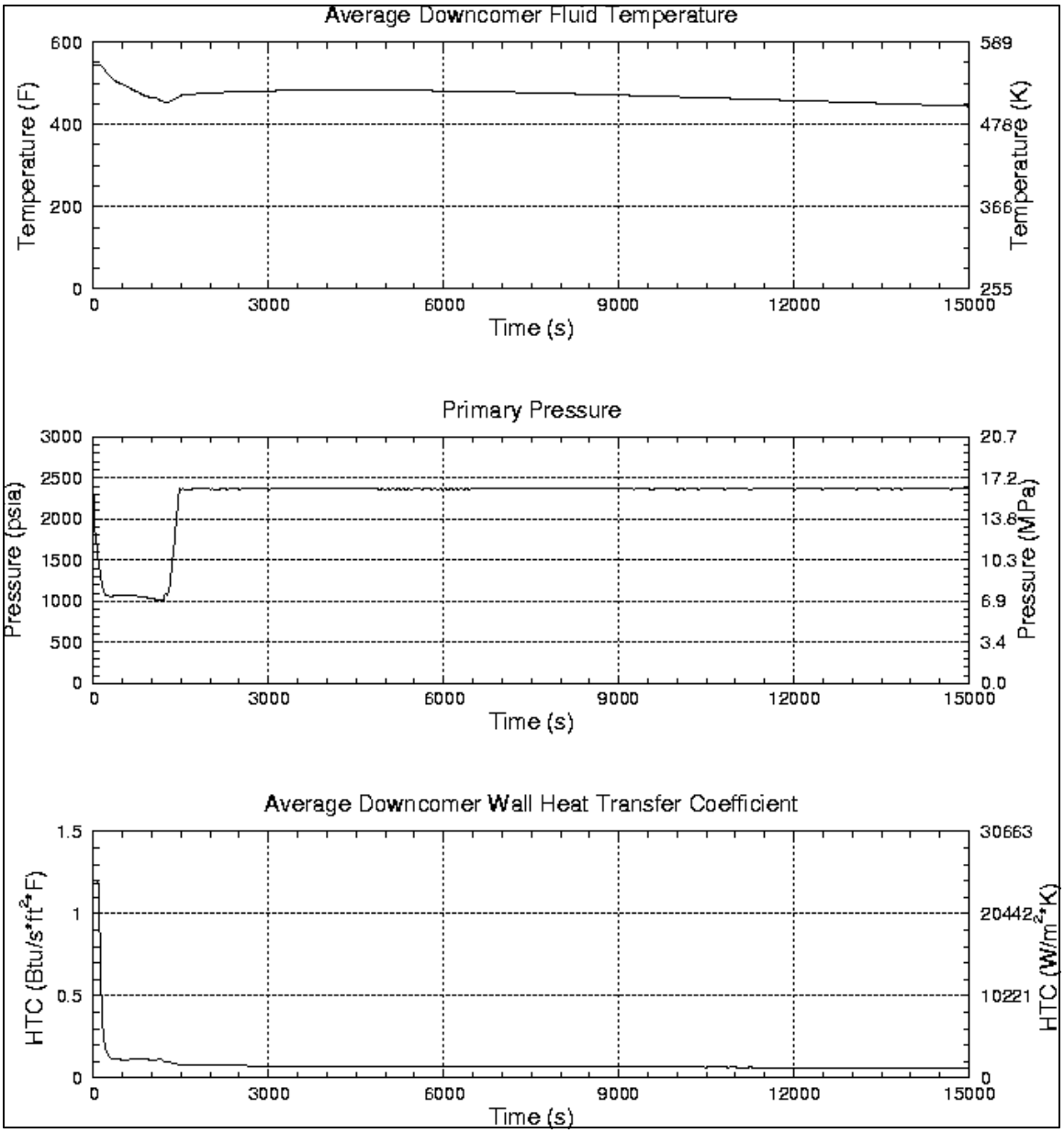


Figure B.2-14: Beaver Valley PTS Results for Case 013

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	294.8 K (70.9°F) at 14730 s
Comments	None

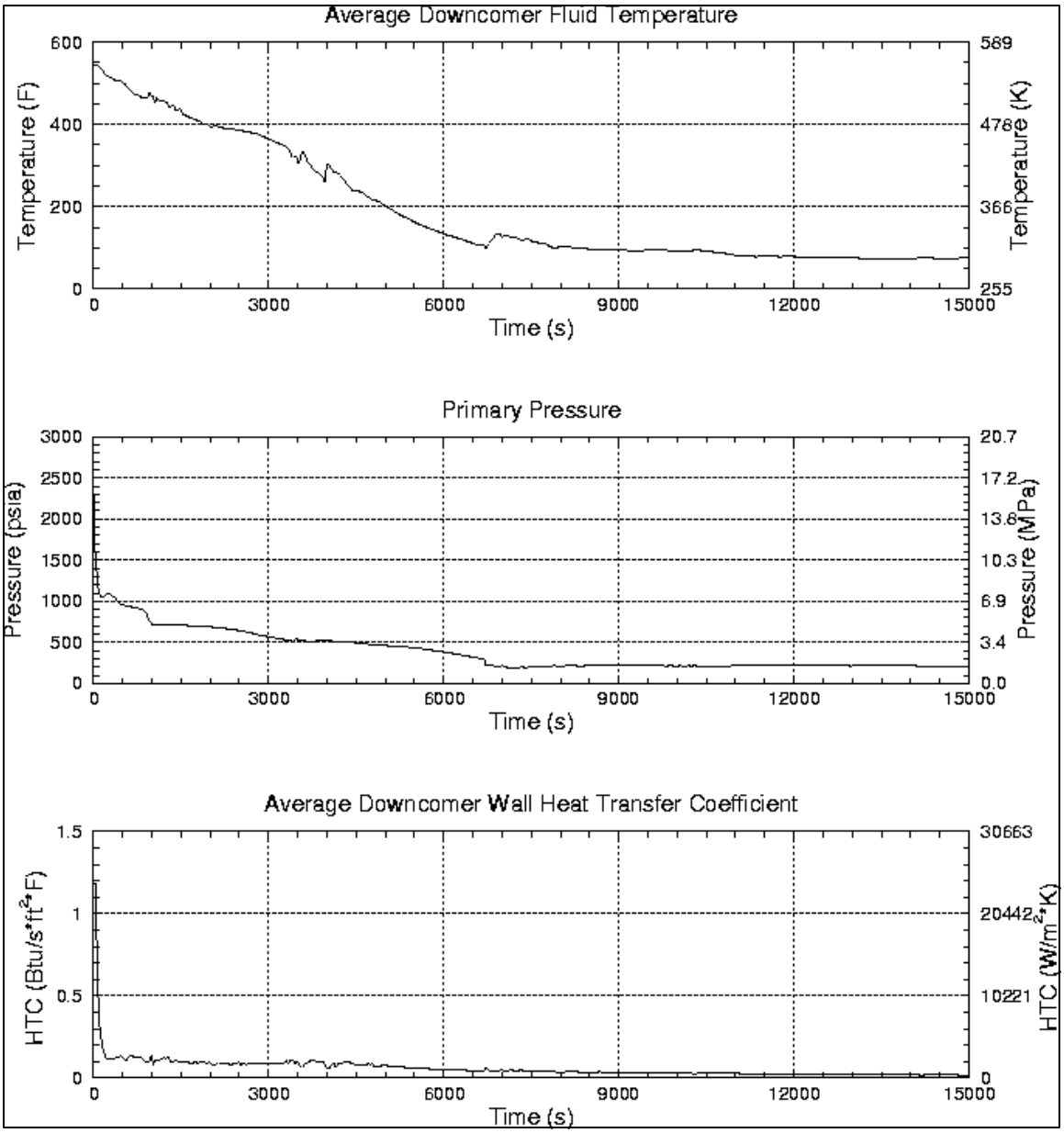


Figure B.2-15: Beaver Valley PTS Results for Case 014

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open SDV
Operator Actions	None
Min DC Temp	503.5 K (446.7°F) at 1830 s
Comments	None

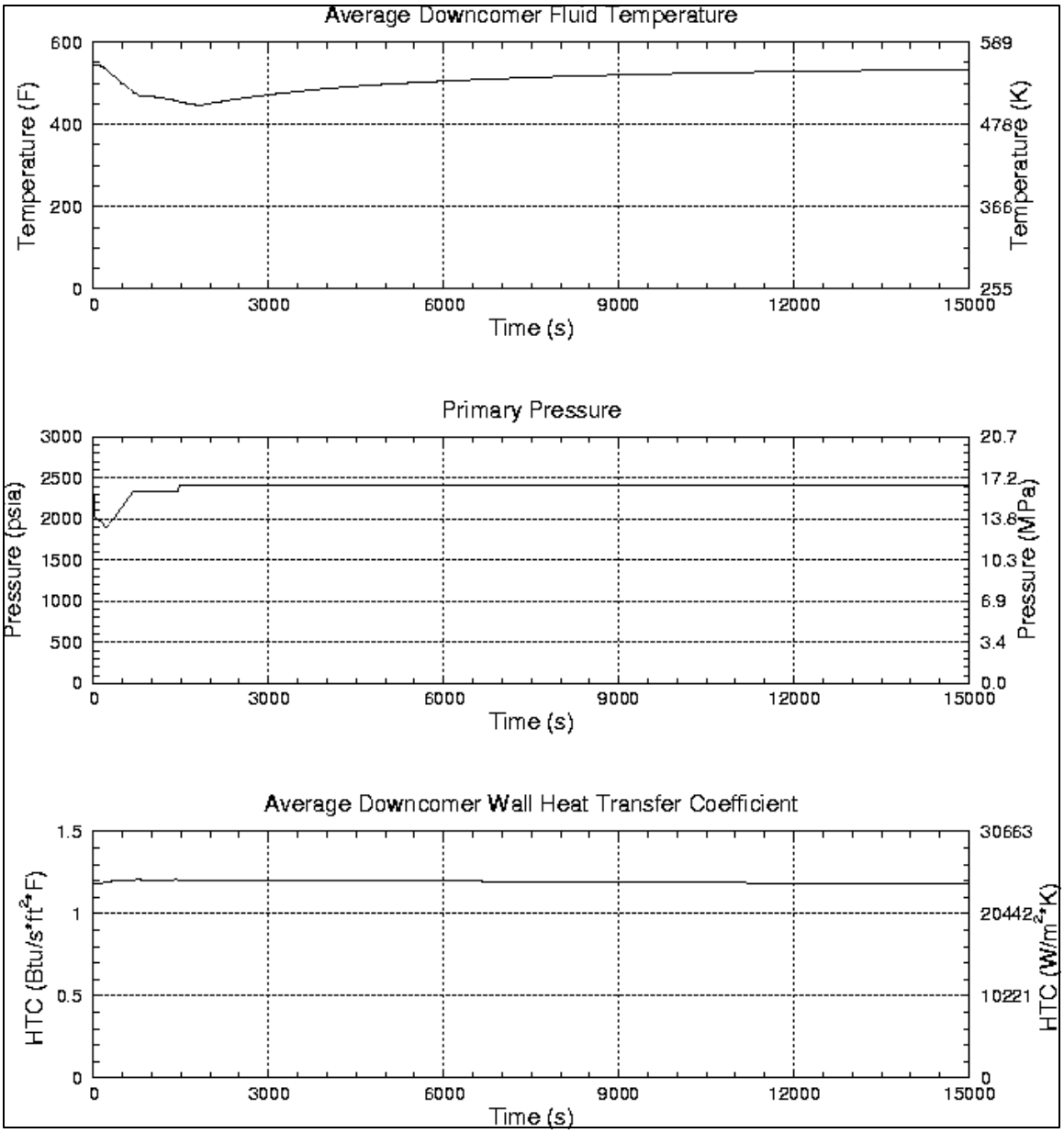


Figure B.2-16: Beaver Valley PTS Results for Case 015

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Two stuck open SDVs
Operator Actions	None
Min DC Temp	500.9 K (442.0°F) at 1860 s
Comments	None

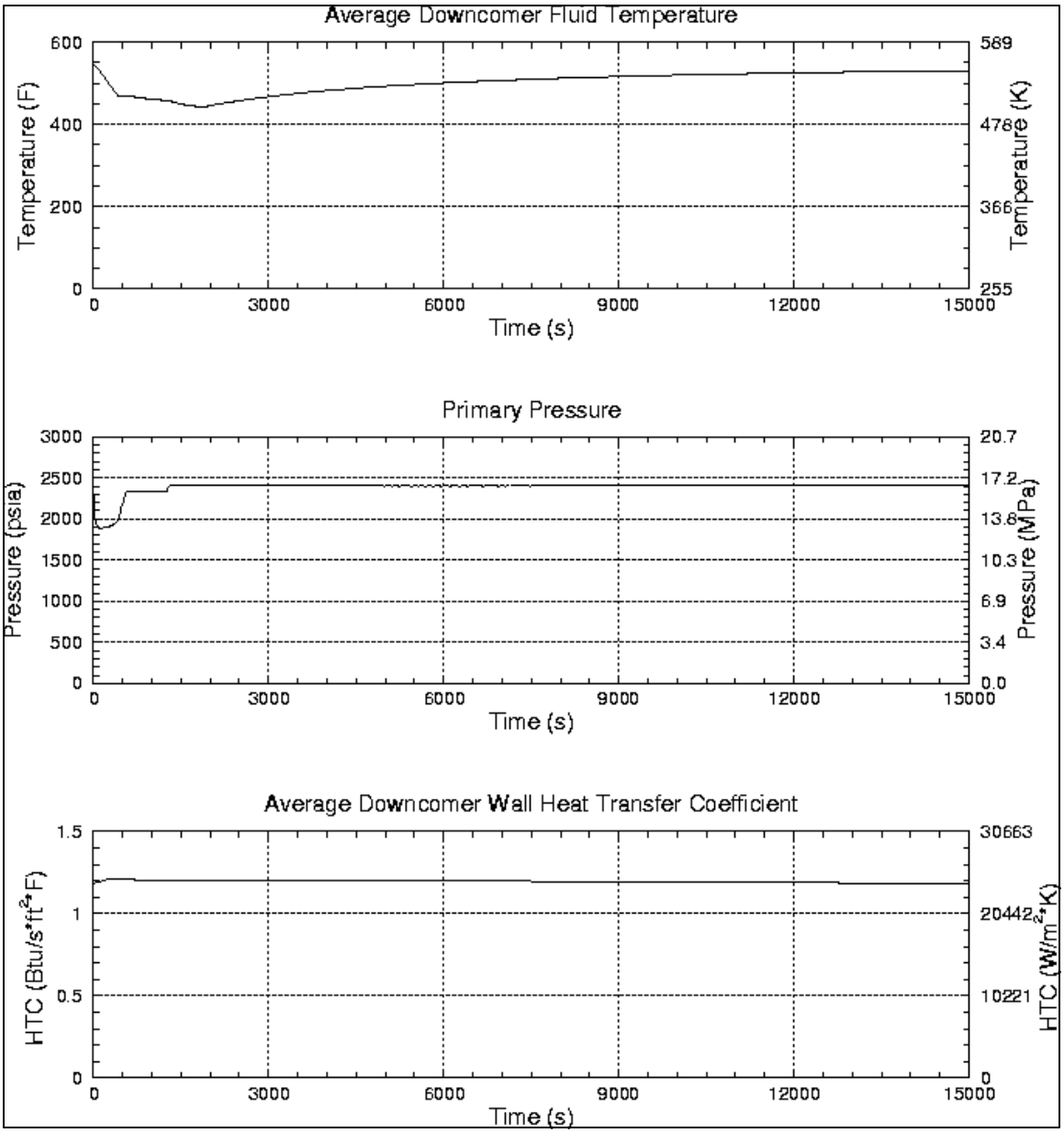


Figure B.2-17: Beaver Valley PTS Results for Case 016

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open SDV
Operator Actions	Close all MSIVs at 20 minutes
Min DC Temp	503.5 K (446.6°F) at 1830 s
Comments	None

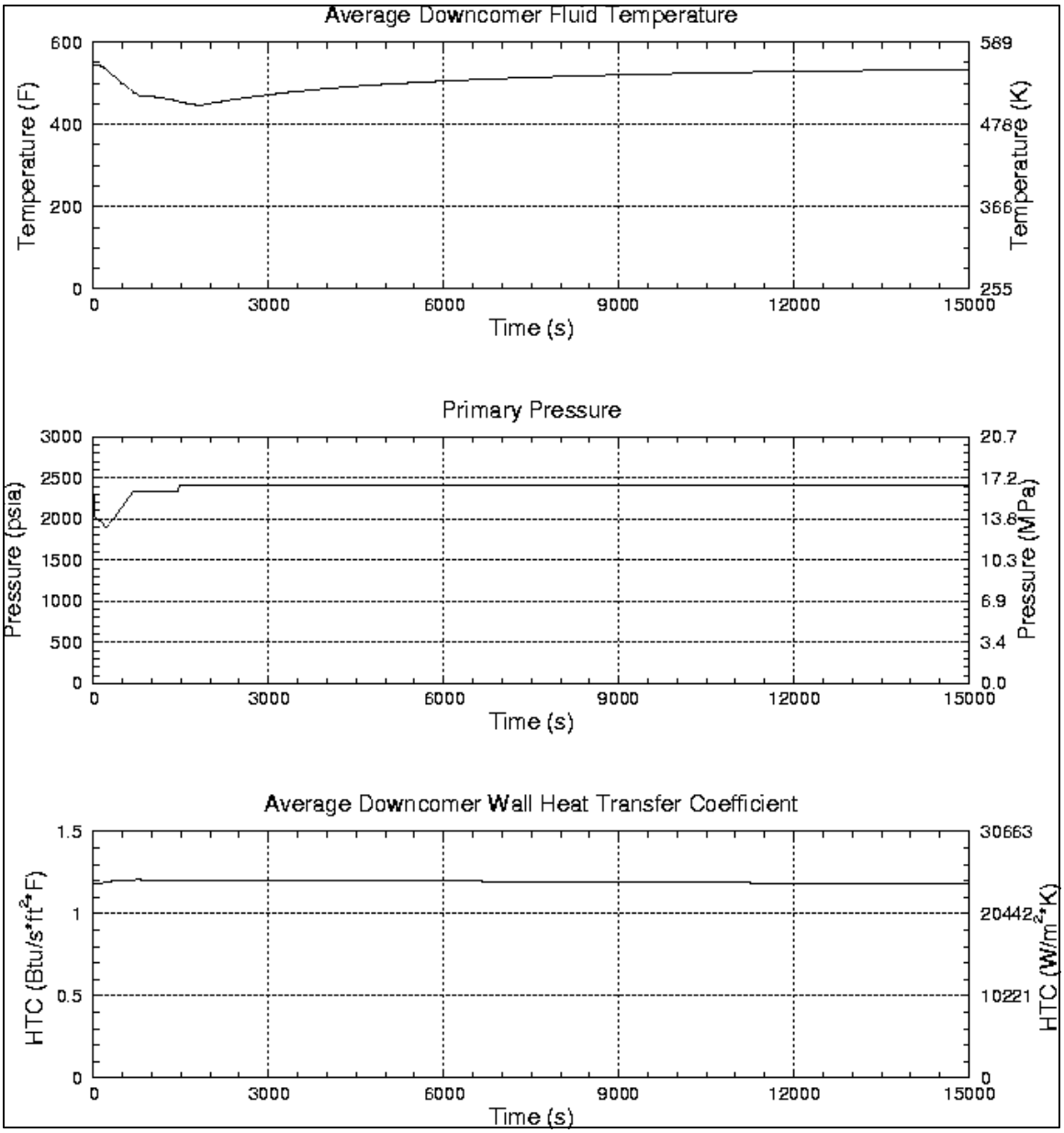


Figure B.2-18: Beaver Valley PTS Results for Case 017

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Three stuck open ASDVs (one/SG)
Operator Actions	None
Min DC Temp	418.9 K (294.3°F) at 15000 s
Comments	None

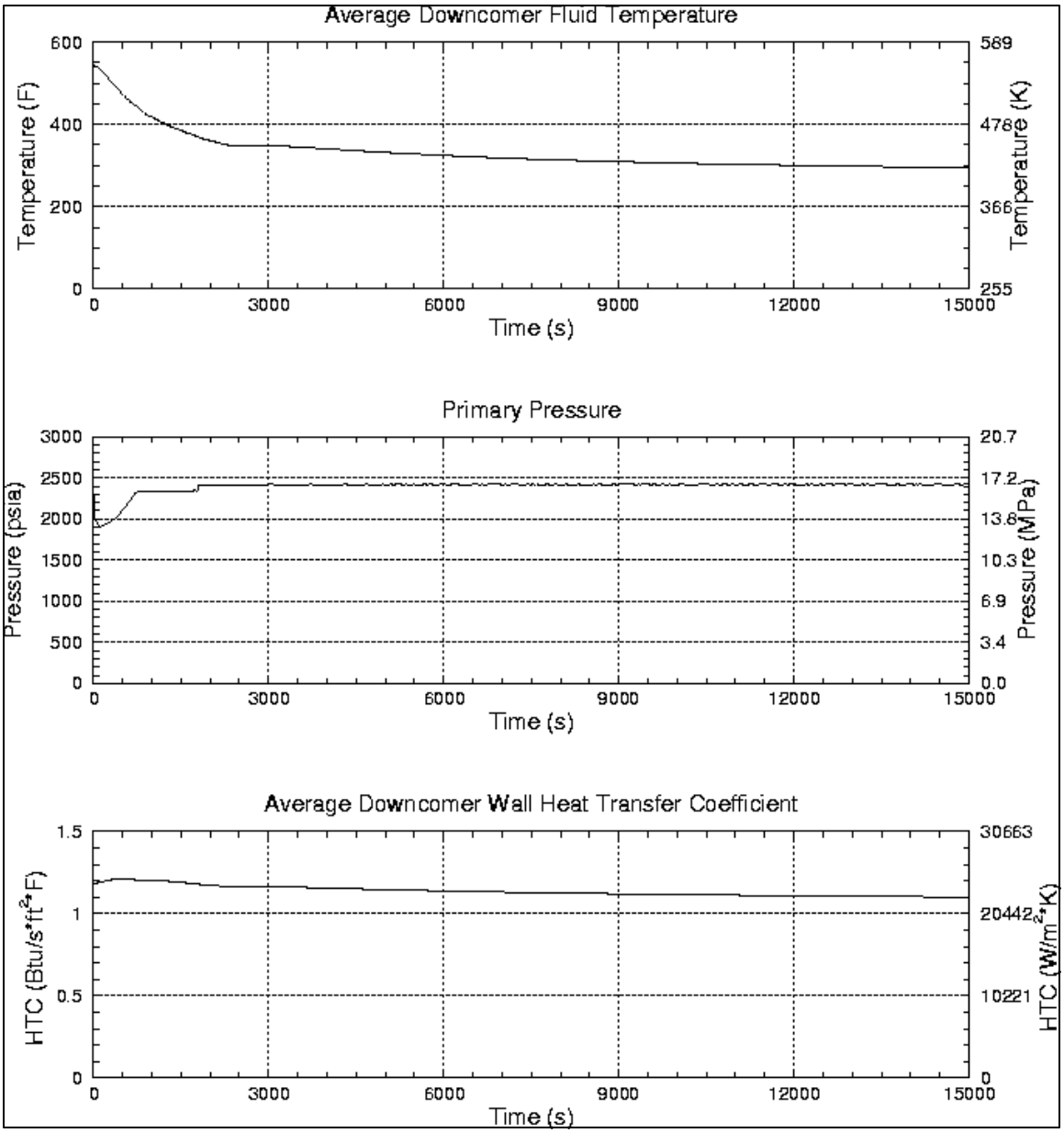


Figure B.2-19: Beaver Valley PTS Results for Case 018

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Two stuck open ASDVs (SG's A and B)
Operator Actions	None
Min DC Temp	431.8 K (317.6°F) at 15000 s
Comments	None

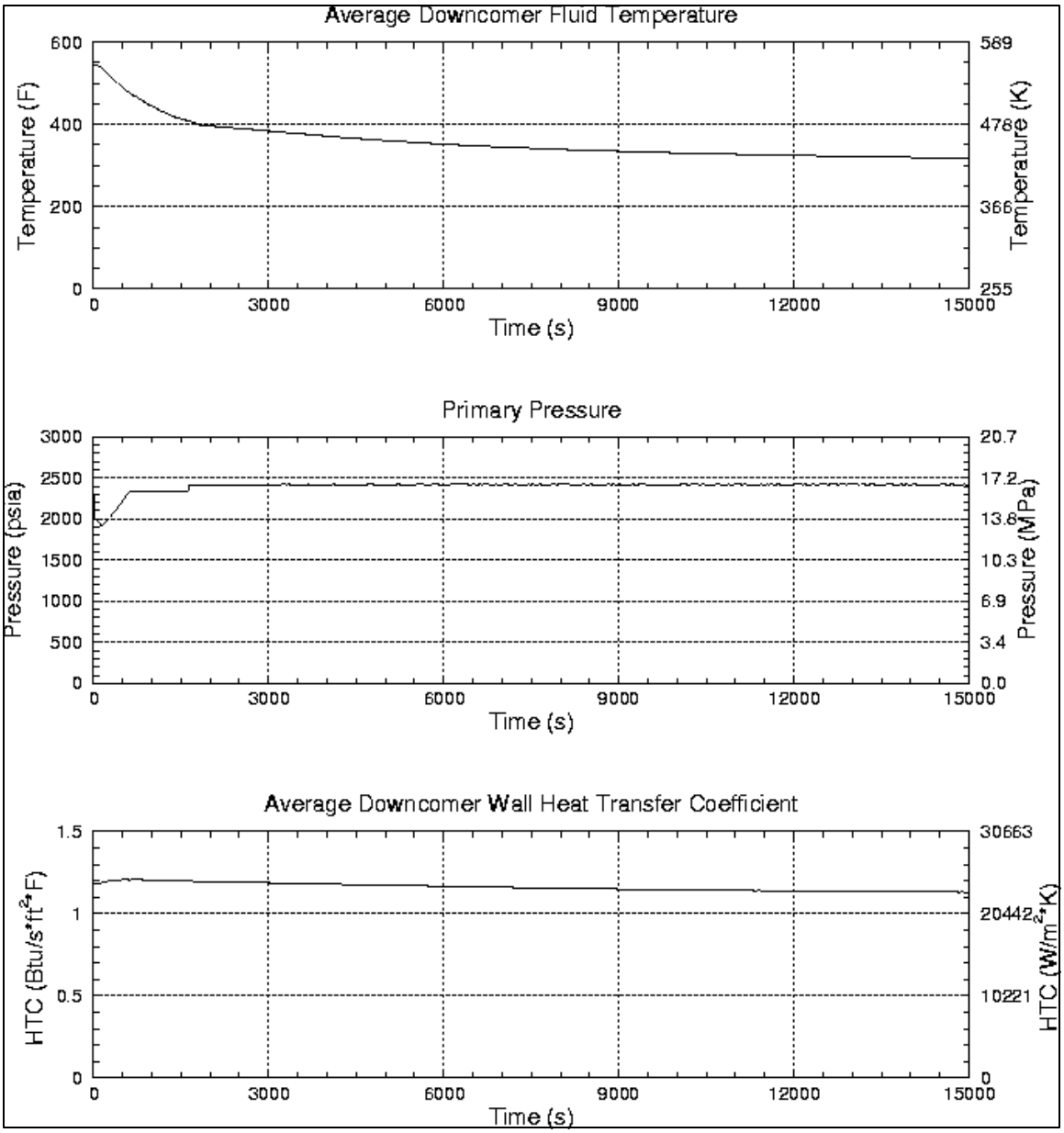


Figure B.2-20: Beaver Valley PTS Results for Case 019

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open ASDV (SG A)
Operator Actions	None
Min DC Temp	455.6 K (360.3°F) at 15000 s
Comments	None

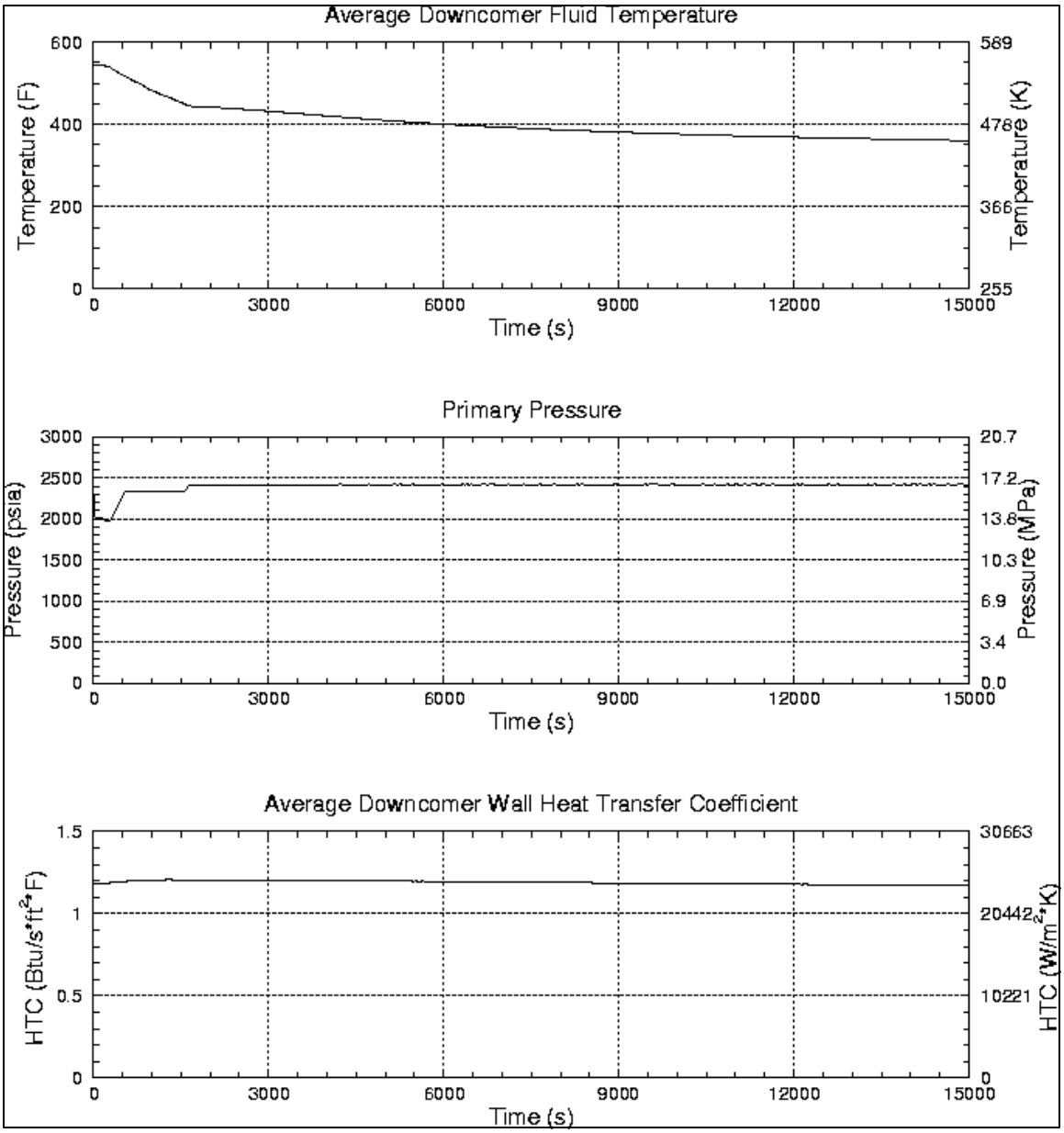


Figure B.2-21: Beaver Valley PTS Results for Case 020

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open ASDV (SG A)
Operator Actions	Close all MSIVs at 20 minutes
Min DC Temp	455.5 K (360.3°F) at 14970 s
Comments	MSIV closure will have no effect because stuck valve is upstream of MSIV. Results will be equivalent to case 020.

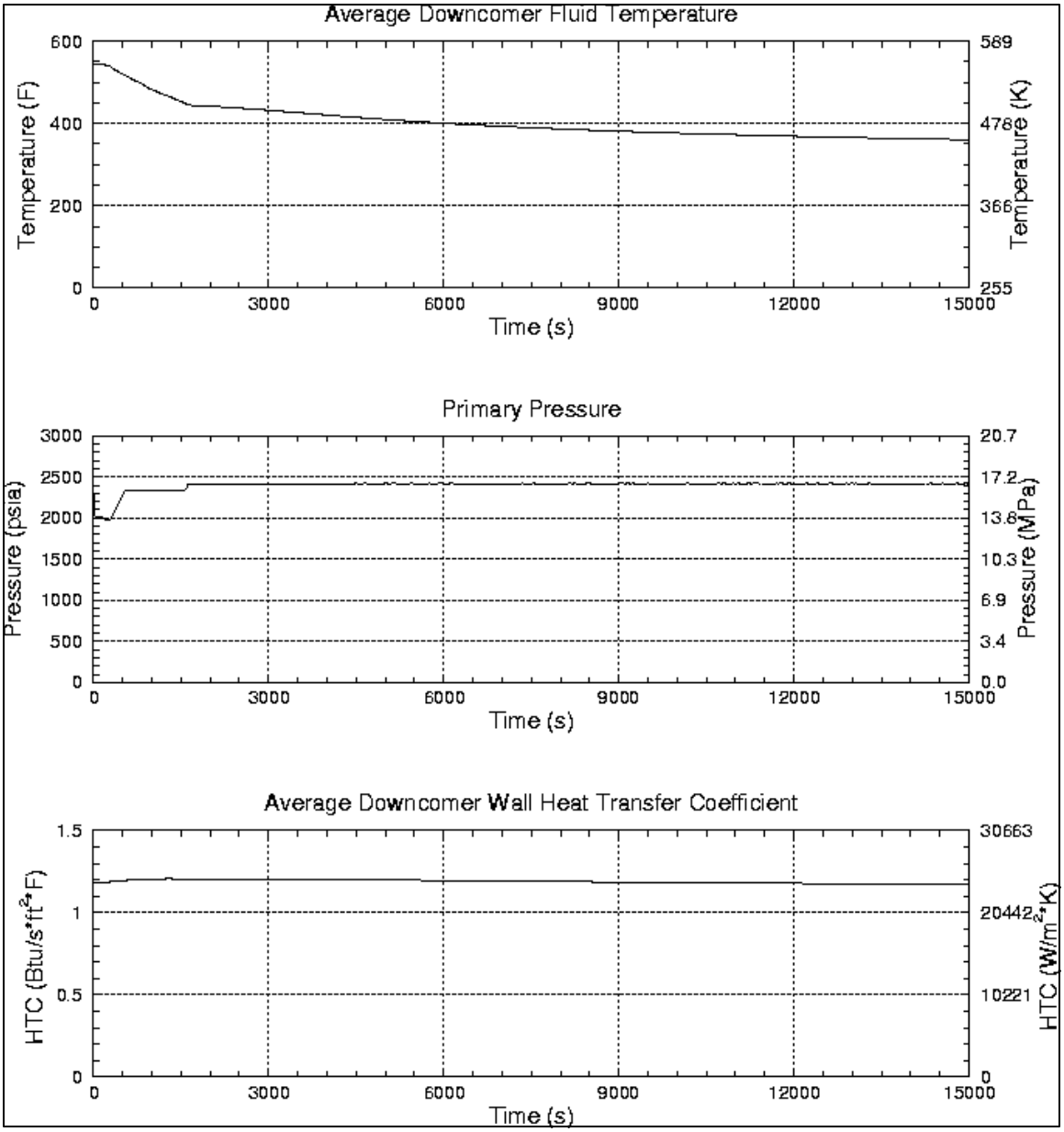


Figure B.2-22: Beaver Valley PTS Results for Case 021

Case Category	RT/TT
Primary Failures	One stuck open pressurizer PORV
Secondary Failures	One stuck open ASDV (SG A)
Operator Actions	None
Min DC Temp	352.8 K (175.3°F) at 15000 s
Comments	

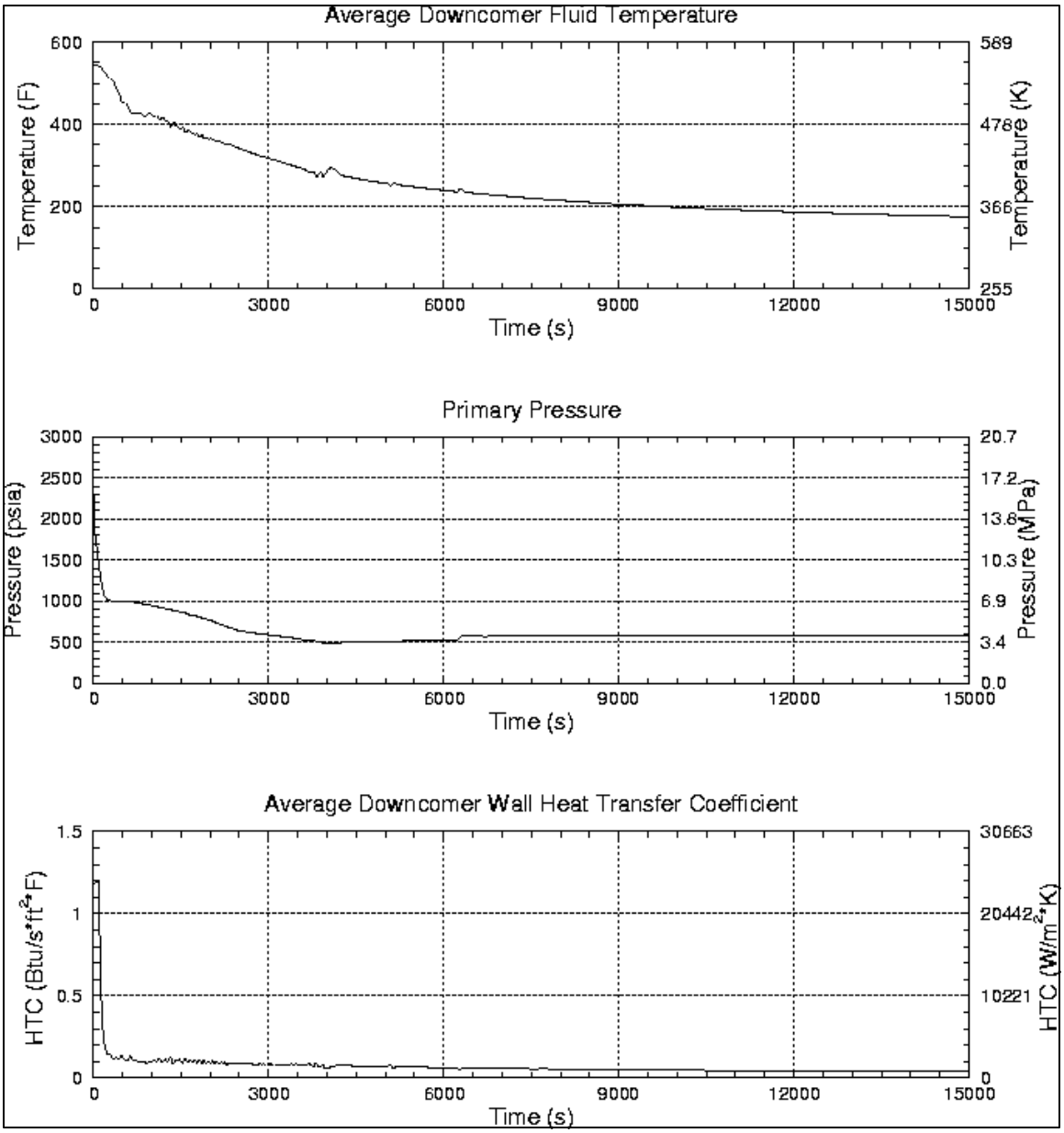


Figure B.2-23: Beaver Valley PTS Results for Case 022

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	One stuck open ASDV (SG A)
Operator Actions	None
Min DC Temp	339.1 K (150.7°F) at 15000 s
Comments	

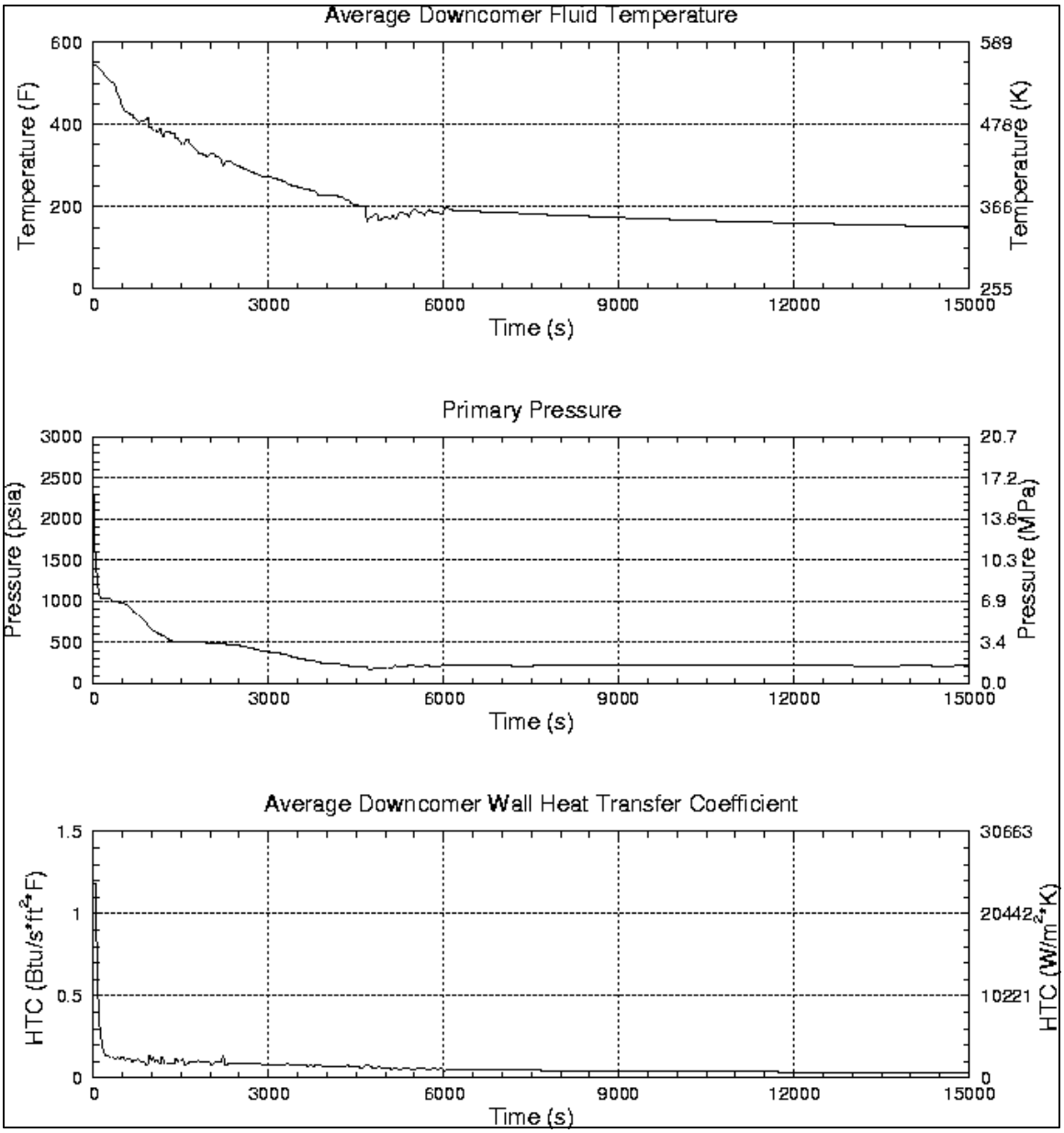


Figure B.2-24: Beaver Valley PTS Results for Case 023

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Three stuck open MS-SRVs (one/SG)
Operator Actions	None
Min DC Temp	402.0 K (263.8°F) at 14970 s
Comments	

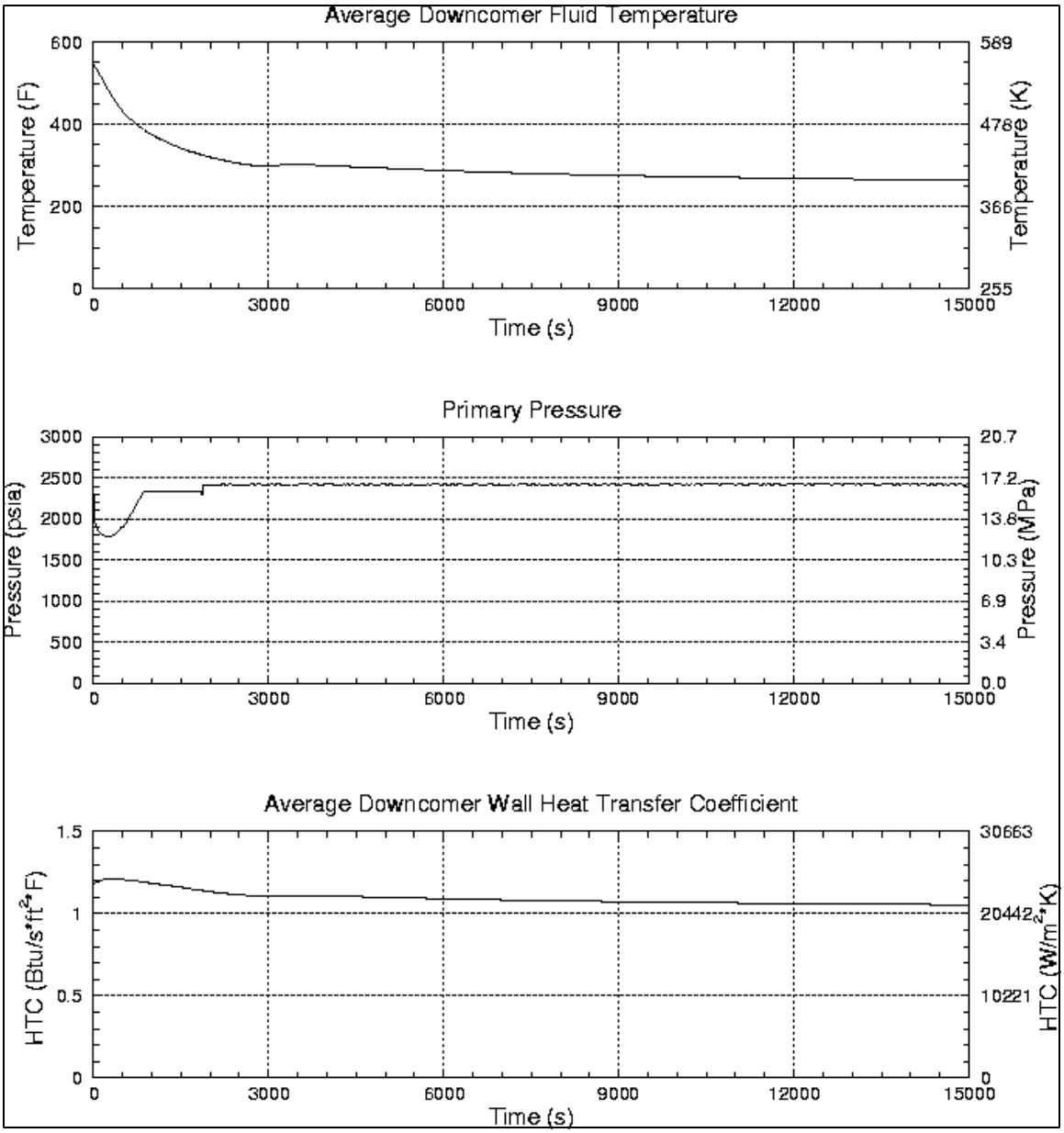


Figure B.2-25: Beaver Valley PTS Results for Case 024

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Two stuck open MS-SRVs (SG's A and B)
Operator Actions	None
Min DC Temp	414.3 K (286.1°F) at 15000 s
Comments	

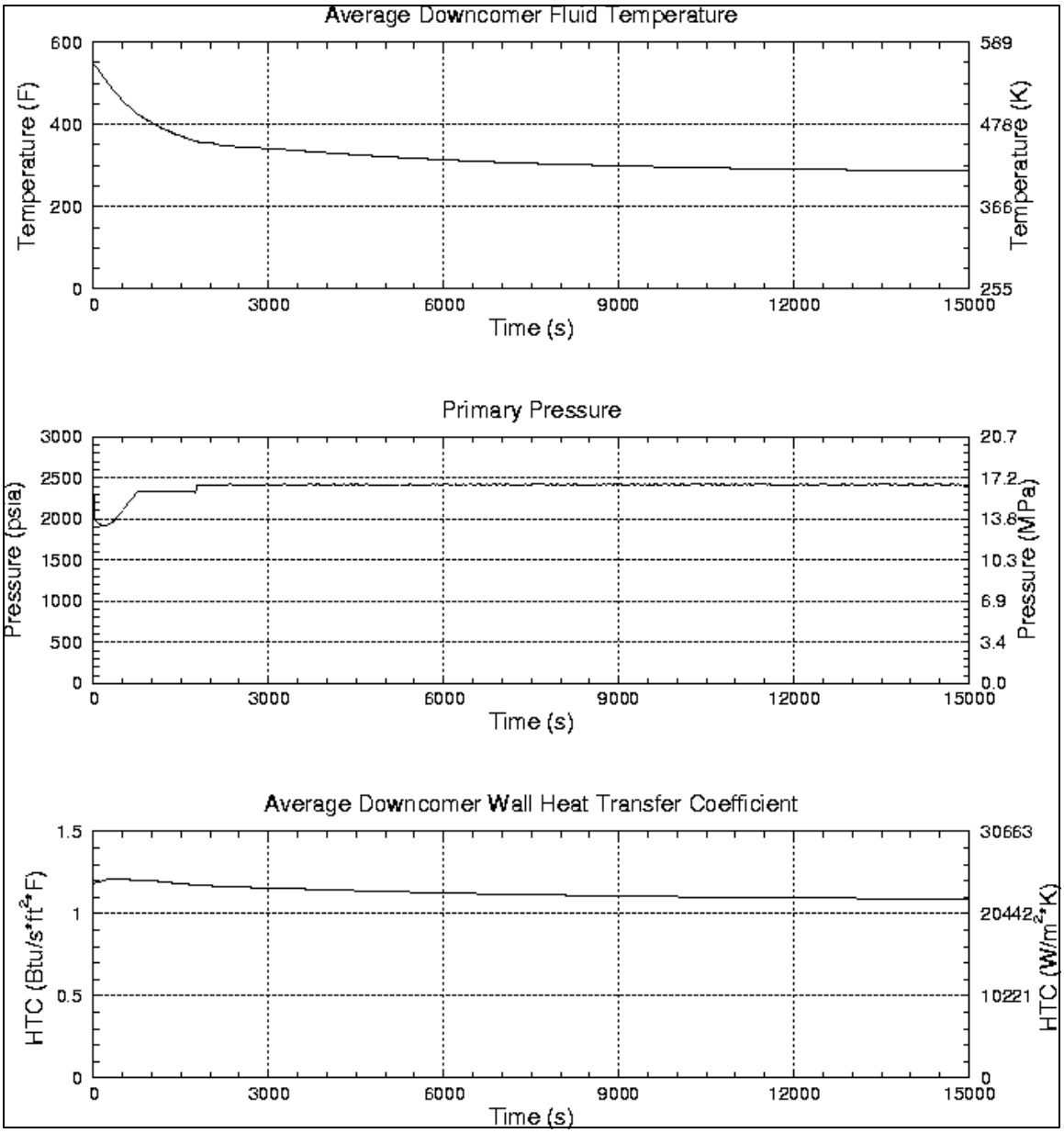


Figure B.2-26: Beaver Valley PTS Results for Case 025

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open MS-SRV (SG A)
Operator Actions	None
Min DC Temp	436.2 K (325.5°F) at 15000 s
Comments	

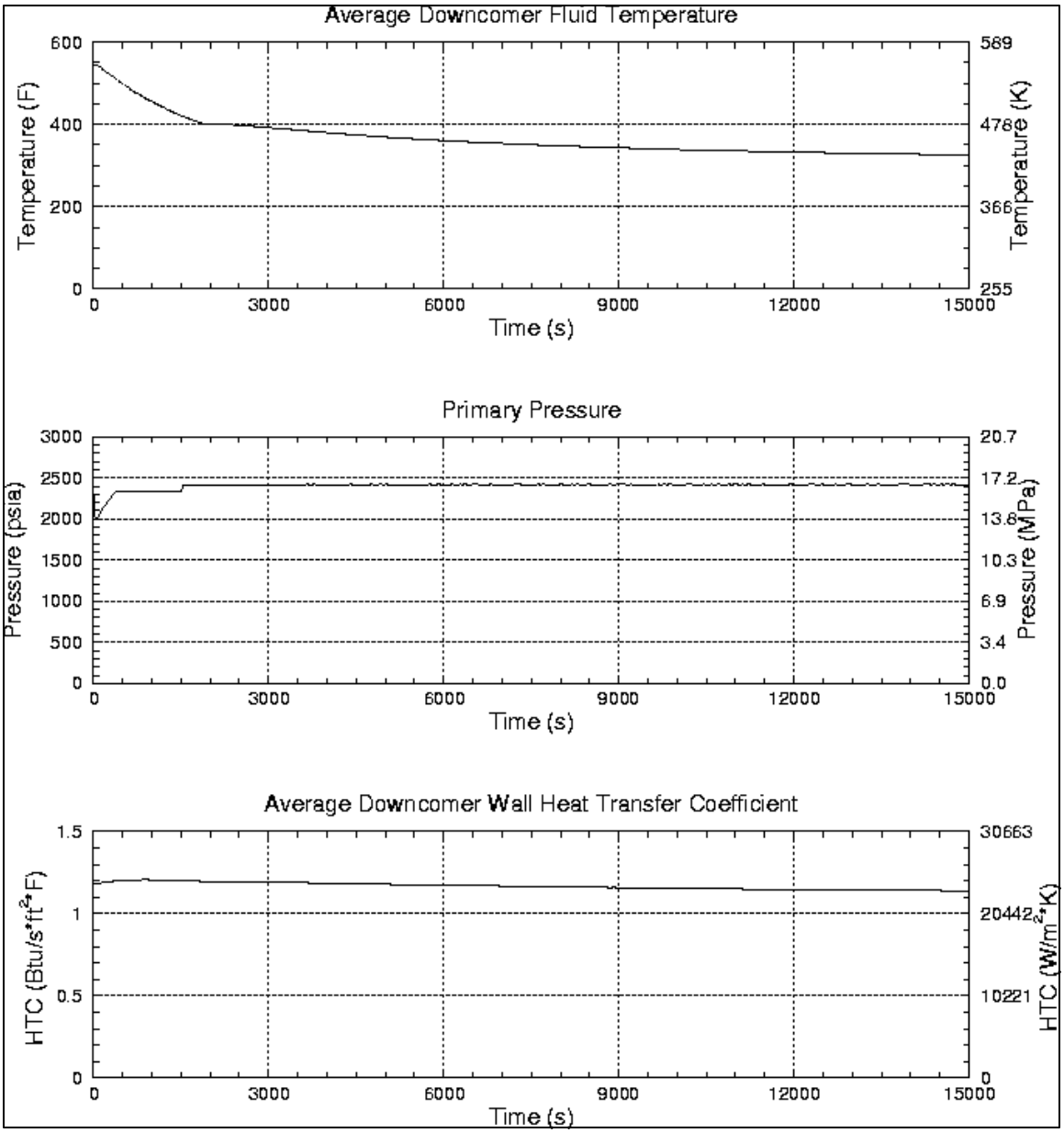


Figure B.2-27: Beaver Valley PTS Results for Case 026

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open MS-SRV (SG A)
Operator Actions	Close all MSIVs at 20 minutes
Min DC Temp	436.2 K (325.5°F) at 15000 s
Comments	MSIV closure will have no effect because stuck valve is upstream of MSIV. Results will be equivalent to case 026.

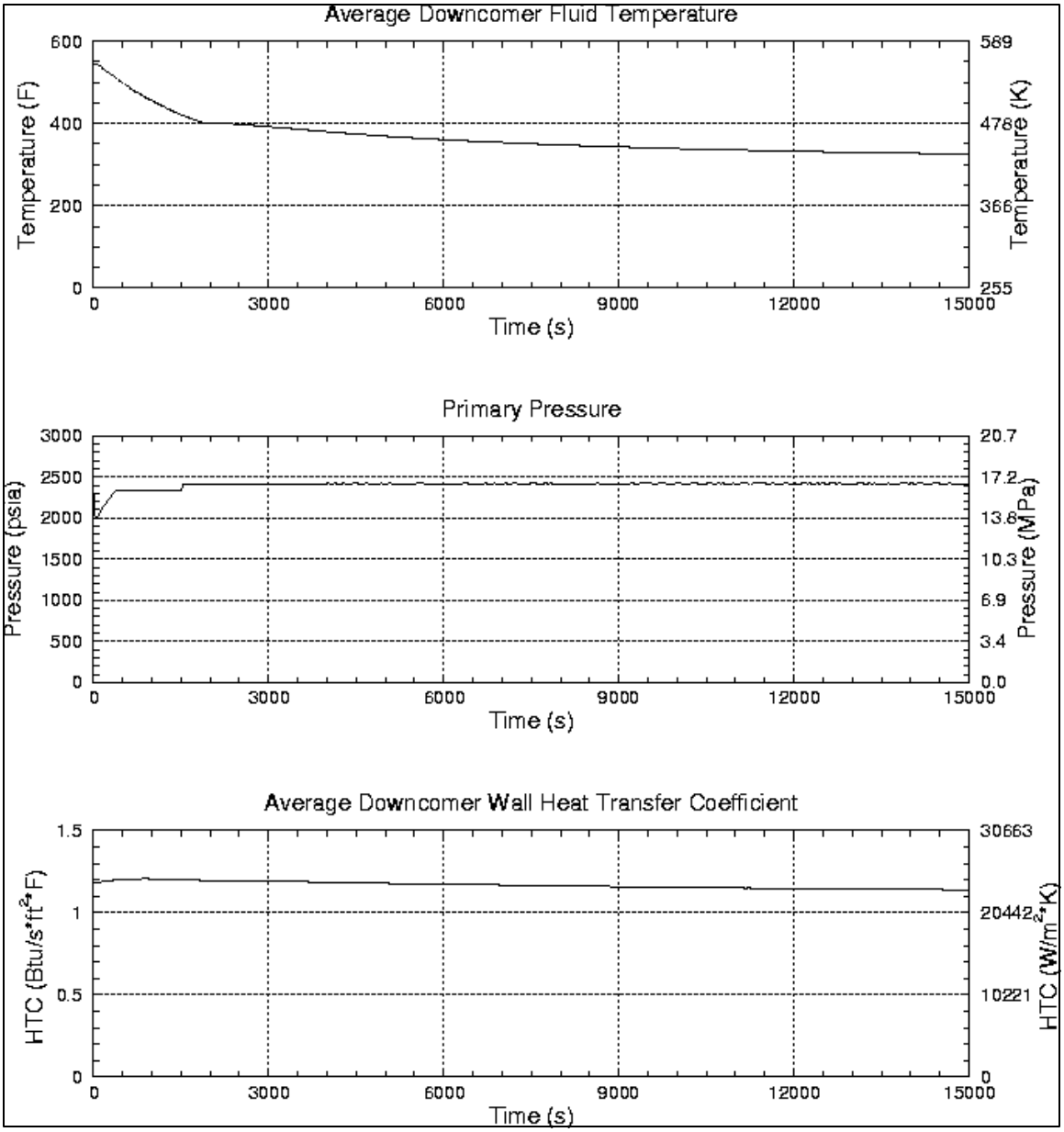


Figure B.2-28: Beaver Valley PTS Results for Case 027

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of all SGs
Operator Actions	Trips MFW when water enters steam line
Min DC Temp	538.7 K (509.9°F) at 240 s
Comments	After MFW is tripped, AFW works as normal.

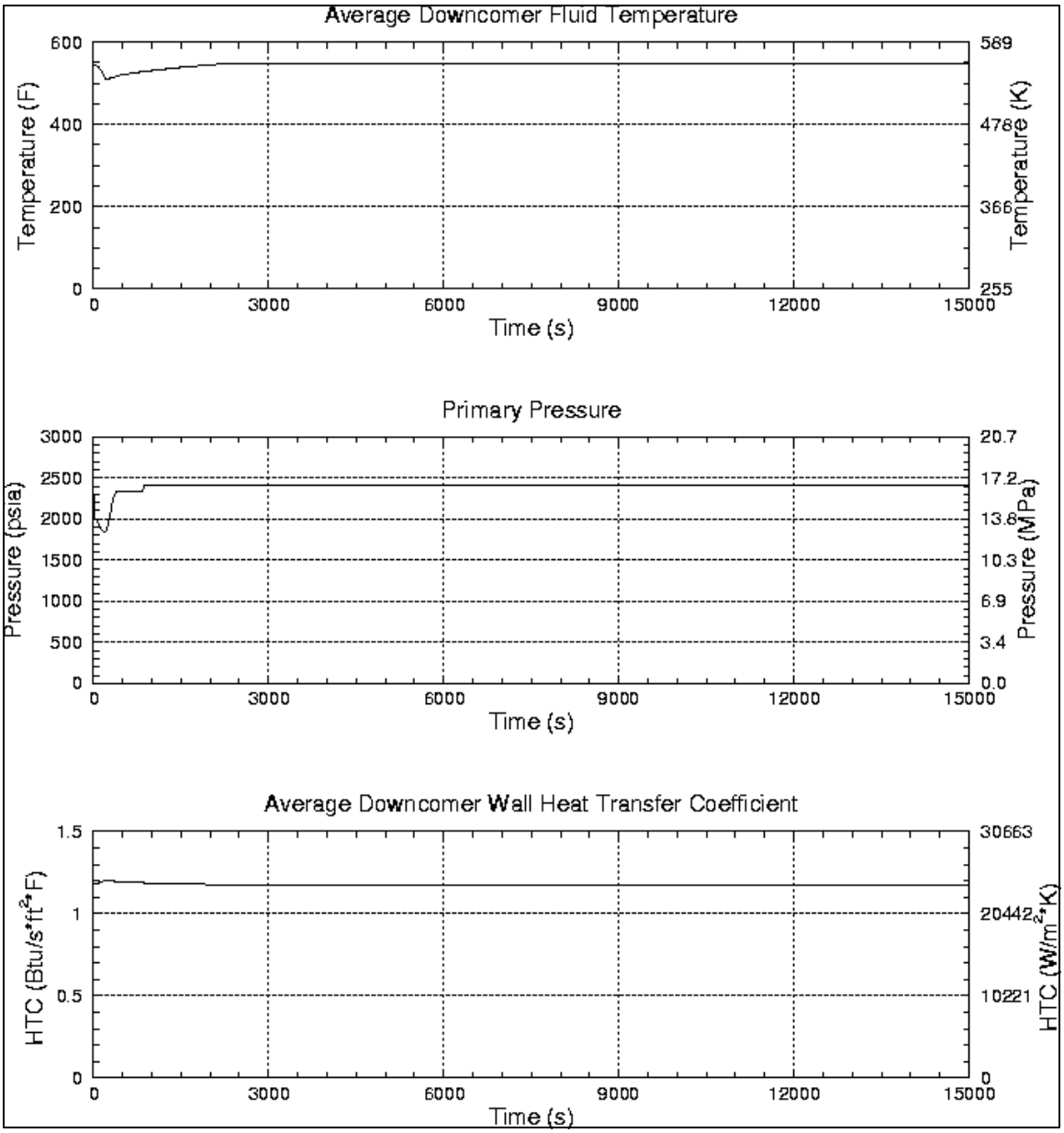


Figure B.2-29: Beaver Valley PTS Results for Case 028

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of SGs A and B
Operator Actions	Trips MFW when water enters steam line
Min DC Temp	544.3 K (520.1°F) at 480 s
Comments	After MFW is tripped, AFW works as normal.

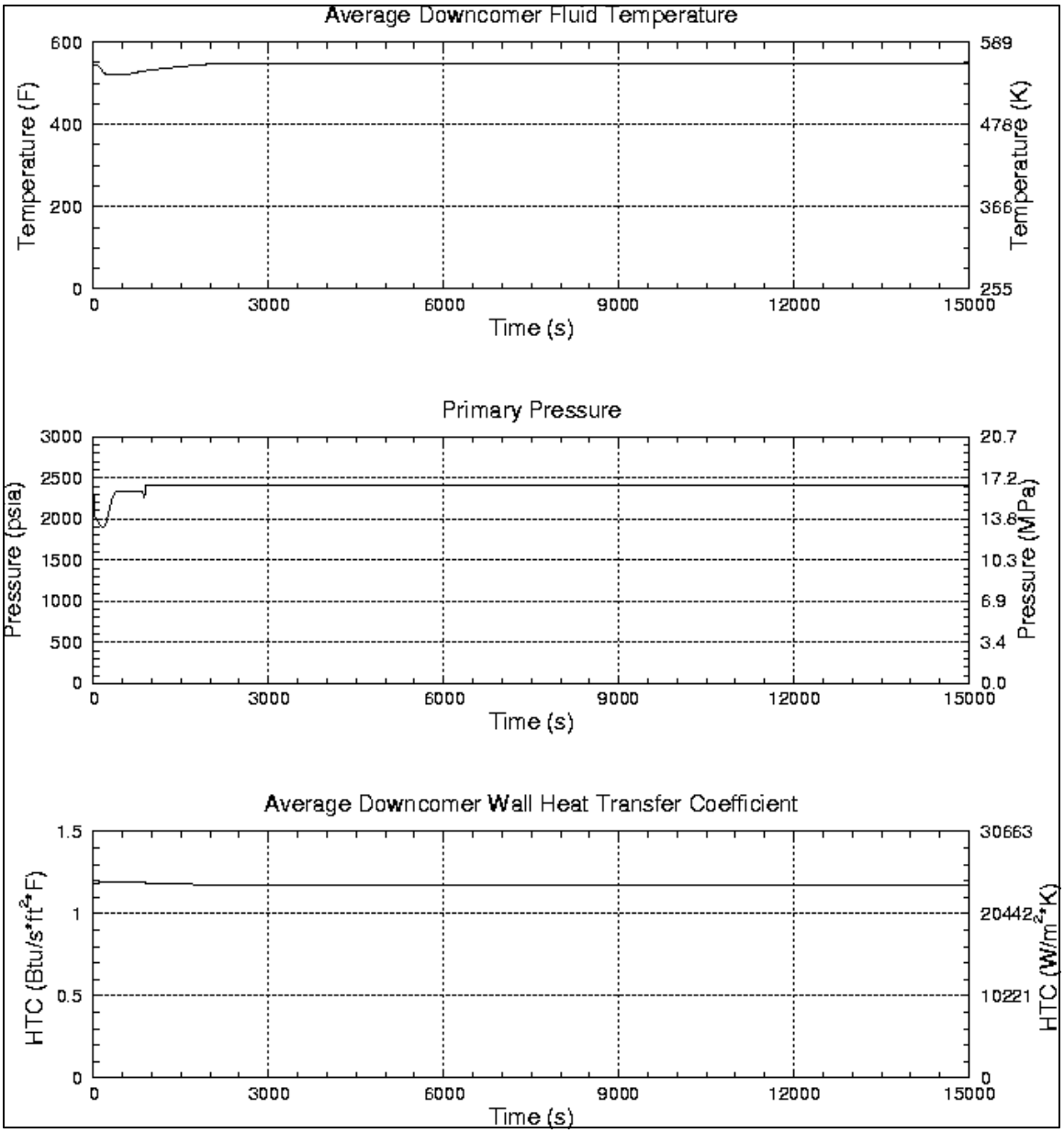


Figure B.2-30: Beaver Valley PTS Results for Case 029

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of SG A
Operator Actions	Trips MFW when water enters steam line
Min DC Temp	547.2 K (525.2°F) at 690 s
Comments	After MFW is tripped, AFW works as normal.

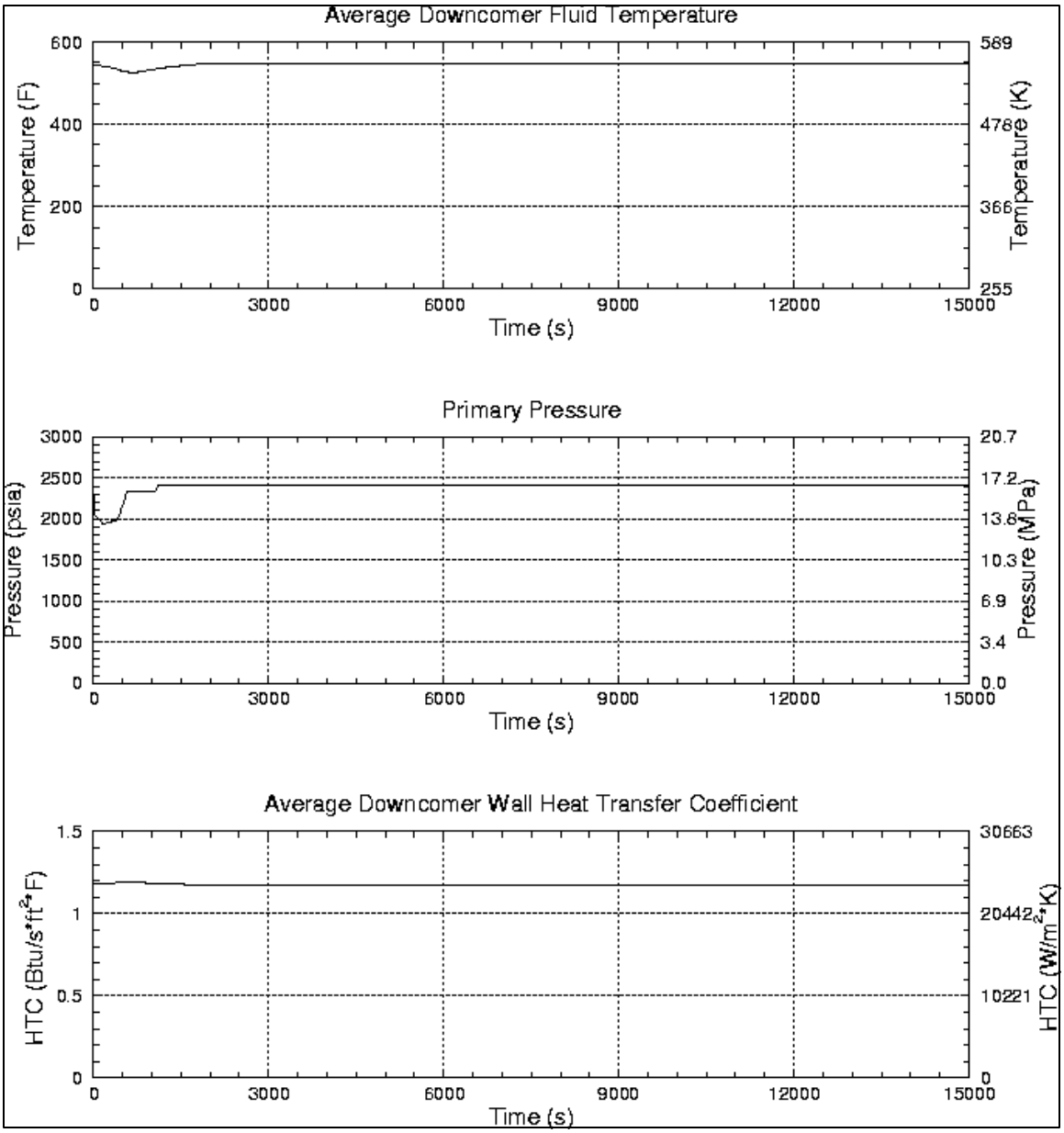


Figure B.2-31: Beaver Valley PTS Results for Case 030

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Loss of all feedwater
Operator Actions	Opens all pressurizer PORVs and uses all HPI pumps
Min DC Temp	287.7 K (58.2°F) at 15000 s
Comments	Feed and bleed started upon high pressurizer pressure or low SG level.

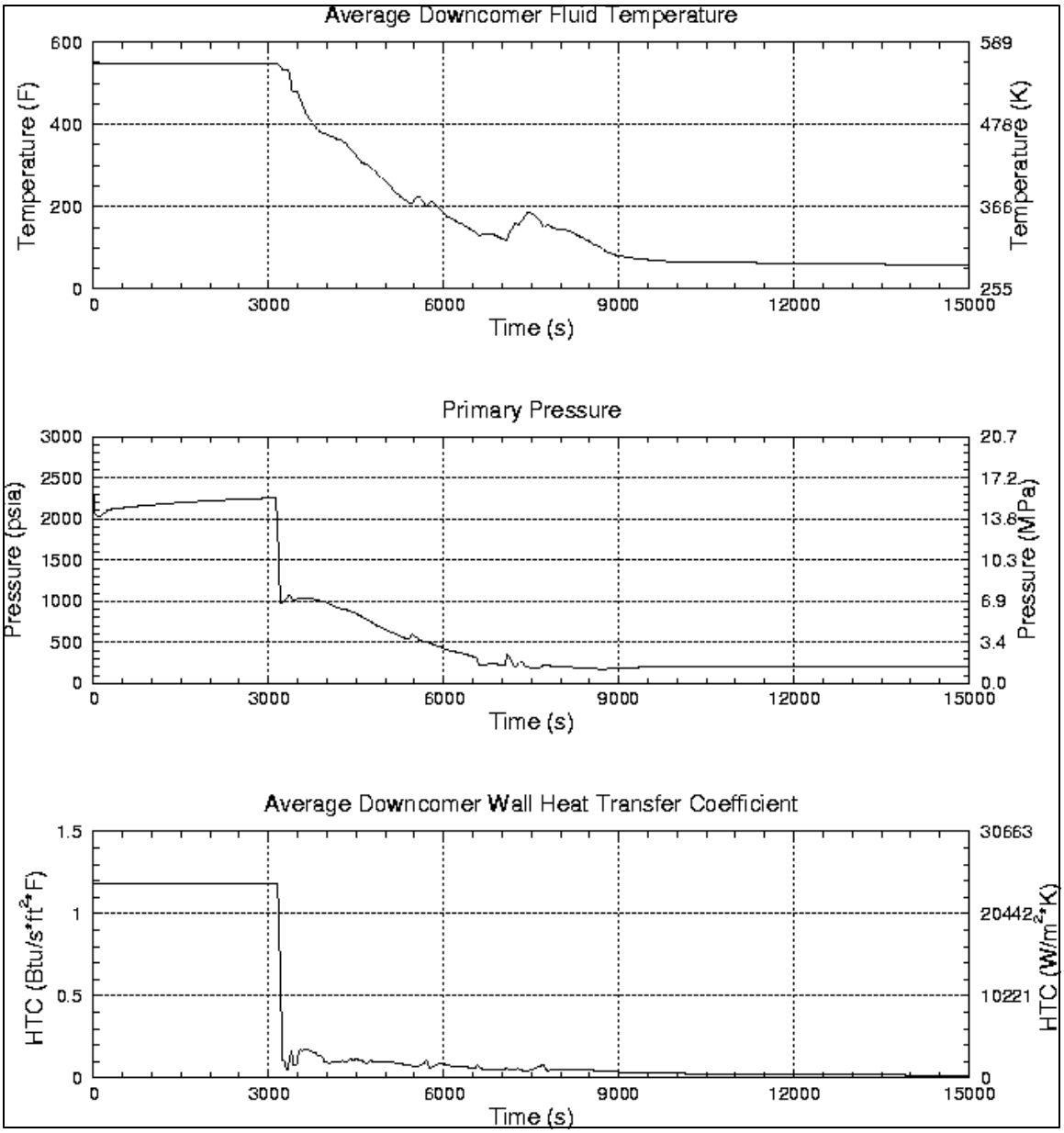


Figure B.2-32: Beaver Valley PTS Results for Case 031

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	Operator terminates feedwater to SG A upon break
Min DC Temp	533.7 K (500.9°F) at 1200 s
Comments	Break is assumed to occur upstream of MSIV.

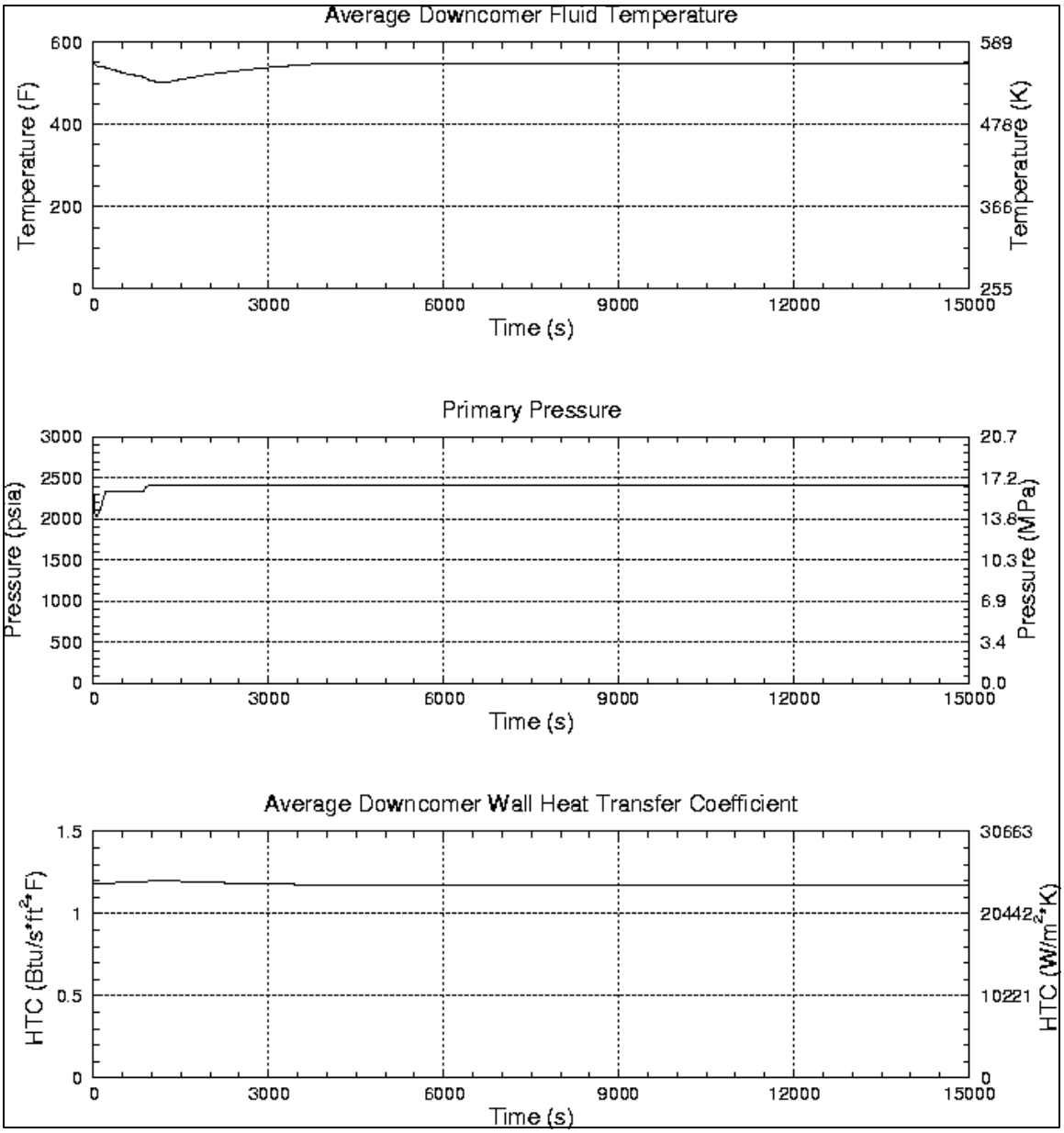


Figure B.2-33: Beaver Valley PTS Results for Case 032

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer PORVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	337.2 K (147.4°F) at 8130 s
Comments	None

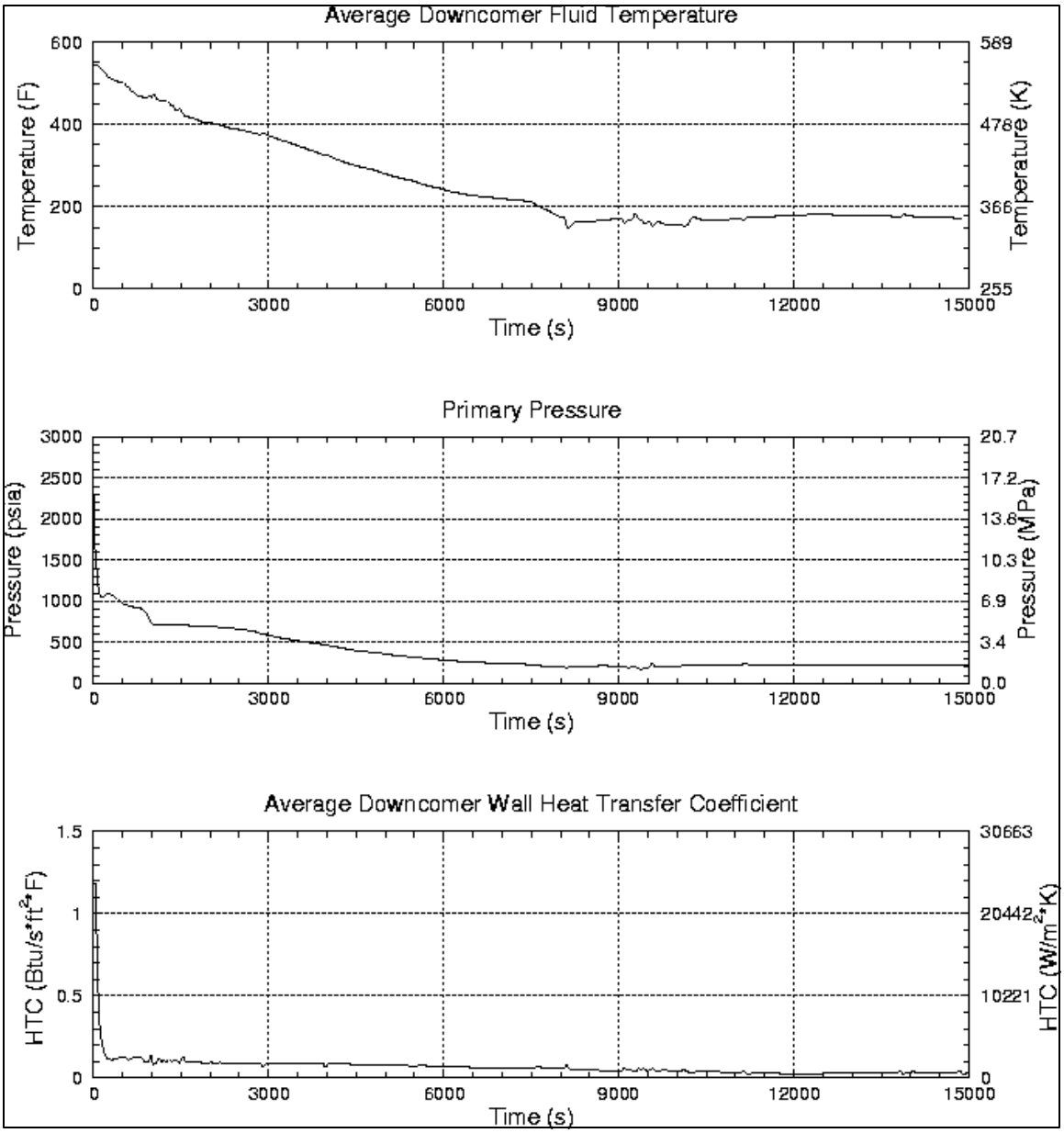


Figure B.2-34: Beaver Valley PTS Results for Case 033

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	287.5 K (57.9°F) at 9930 s
Comments	None

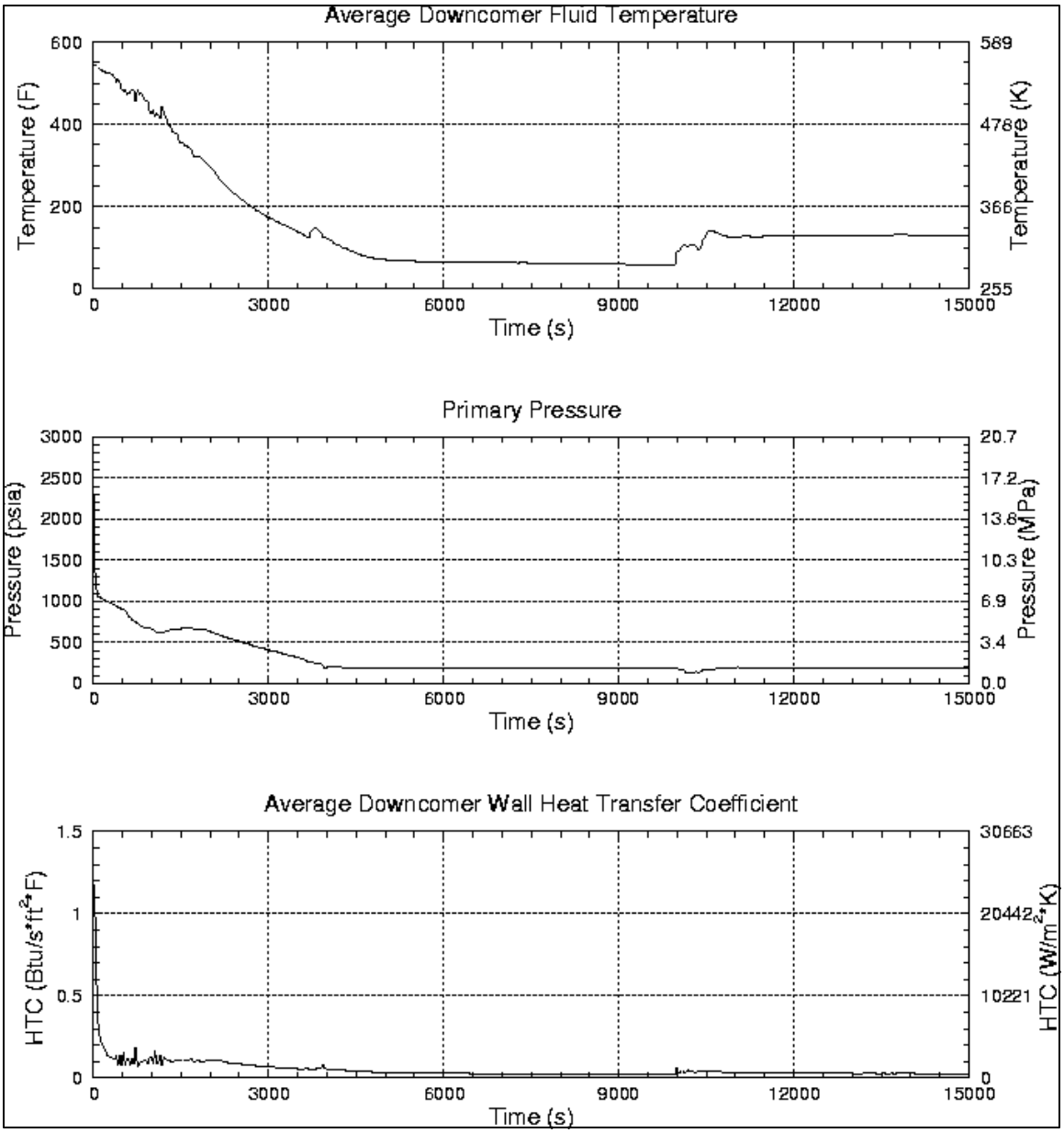


Figure B.2-35: Beaver Valley PTS Results for Case 034

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	462.5 K (372.7°F) at 1530 s
Comments	SRV recloses at 1,200 seconds.

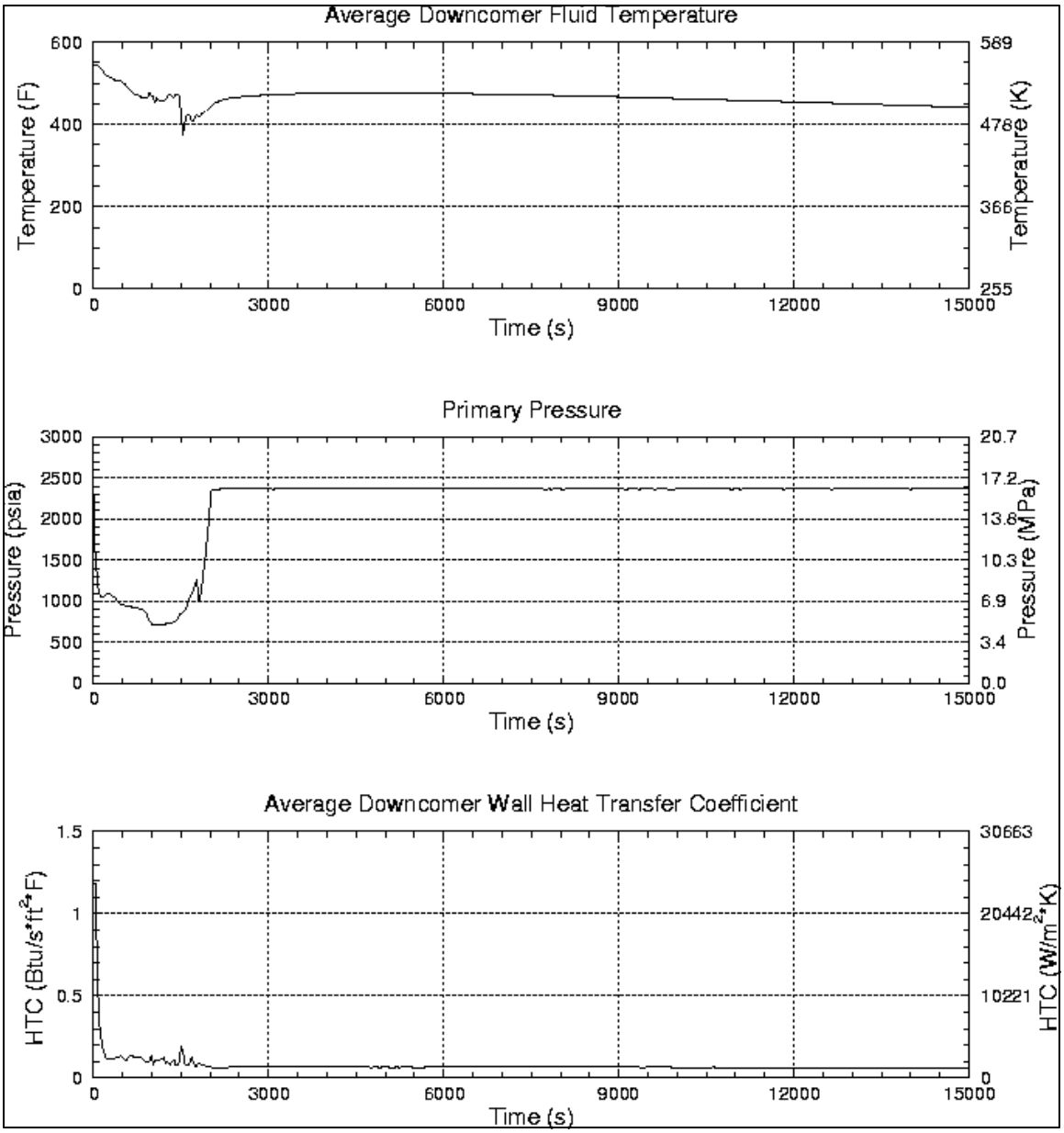


Figure B.2-36: Beaver Valley PTS Results for Case 035

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Three stuck open SDVs
Operator Actions	None
Min DC Temp	500.9 K (441.9°F) at 1860 s
Comments	None

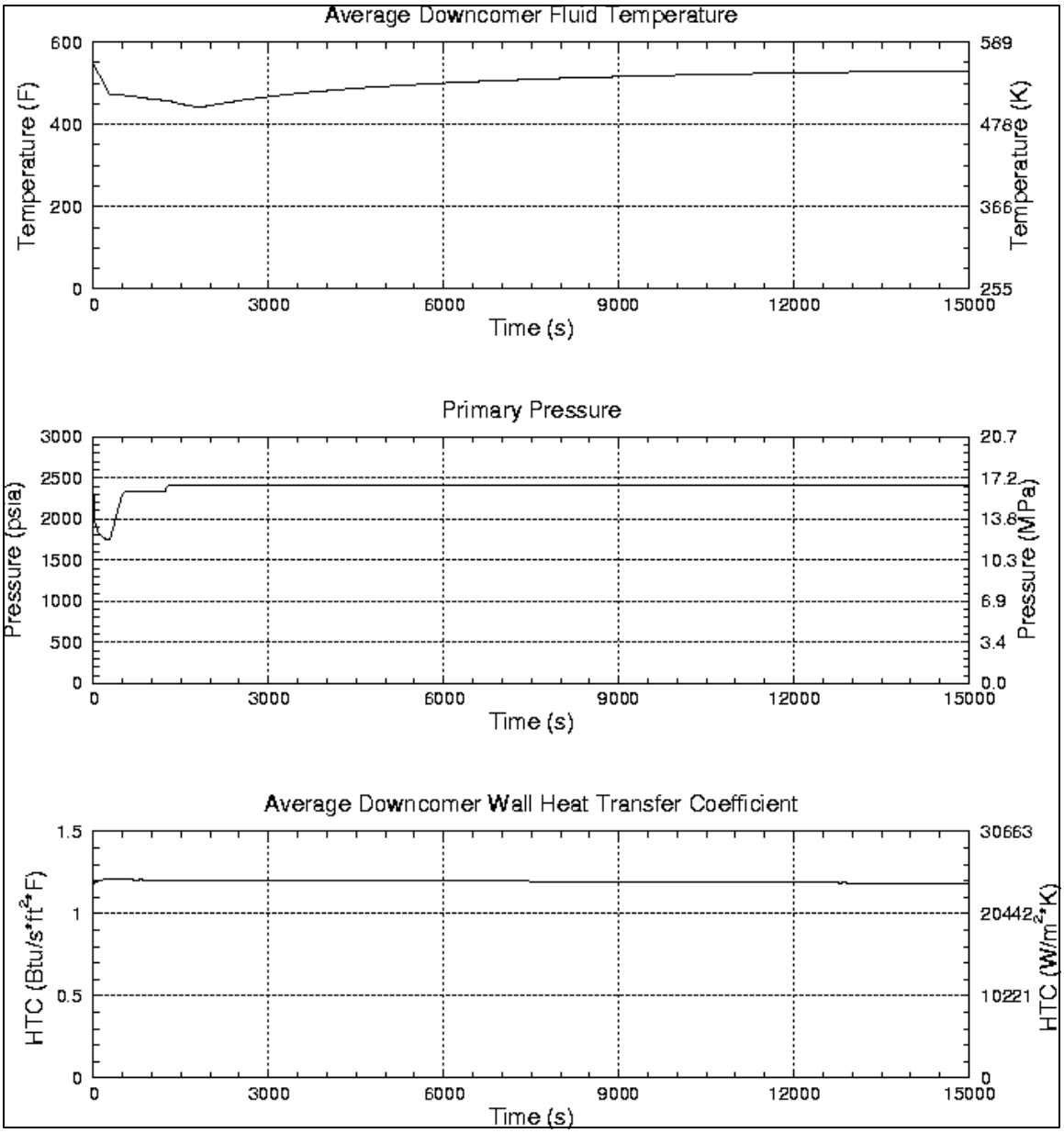


Figure B.2-37: Beaver Valley PTS Results for Case 036

Case Category	SGTR
Primary Failures	Steam generator tube rupture (SG A)
Secondary Failures	None
Operator Actions	None
Min DC Temp	545.6 K (522.4°F) at 900 s
Comments	None

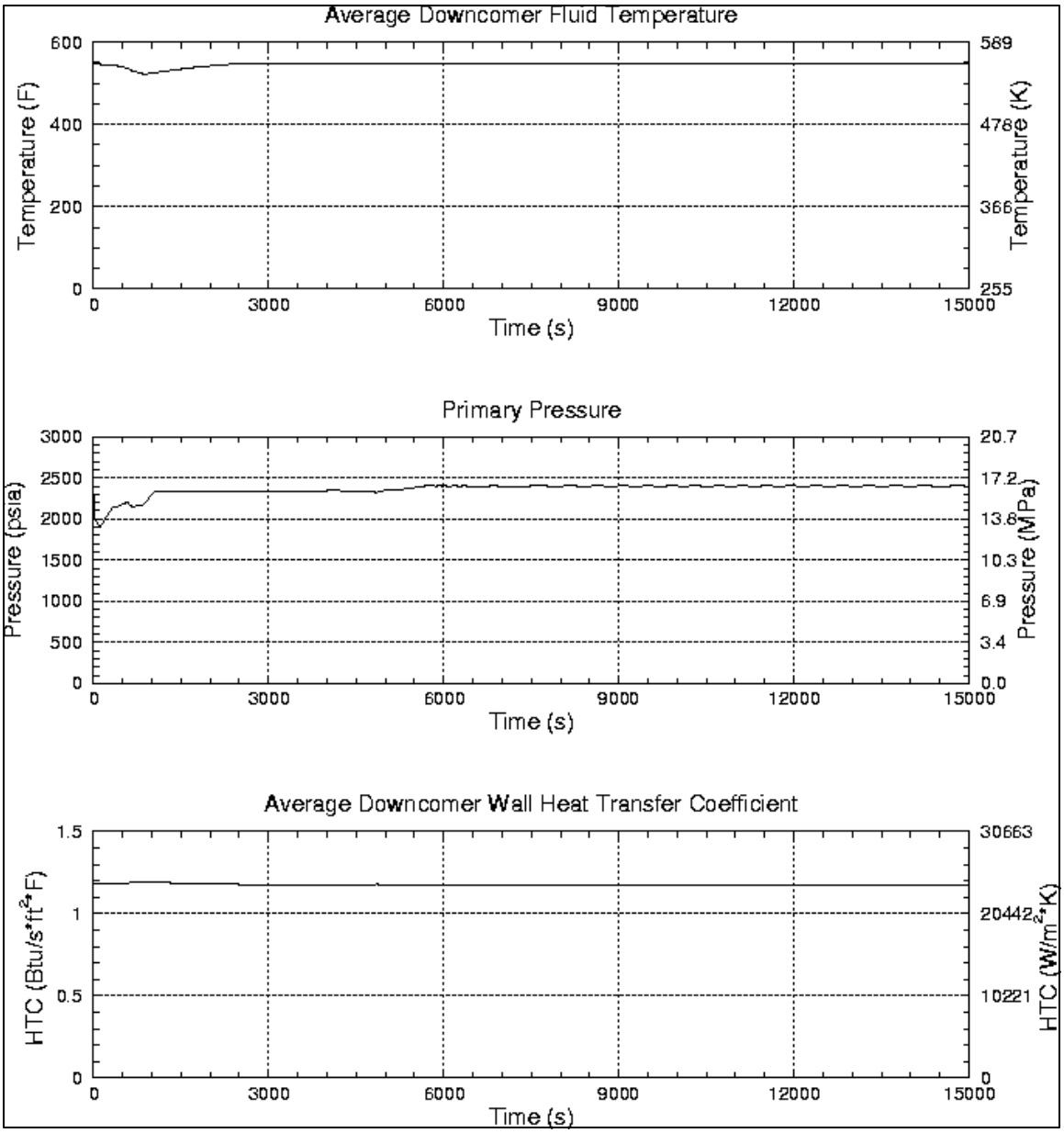


Figure B.2-38: Beaver Valley PTS Results for Case 037

Case Category	SGTR
Primary Failures	Steam generator tube rupture (SG A)
Secondary Failures	Stuck open SDV
Operator Actions	None
Min DC Temp	503.9 K (447.3°F) at 1500 s
Comments	None

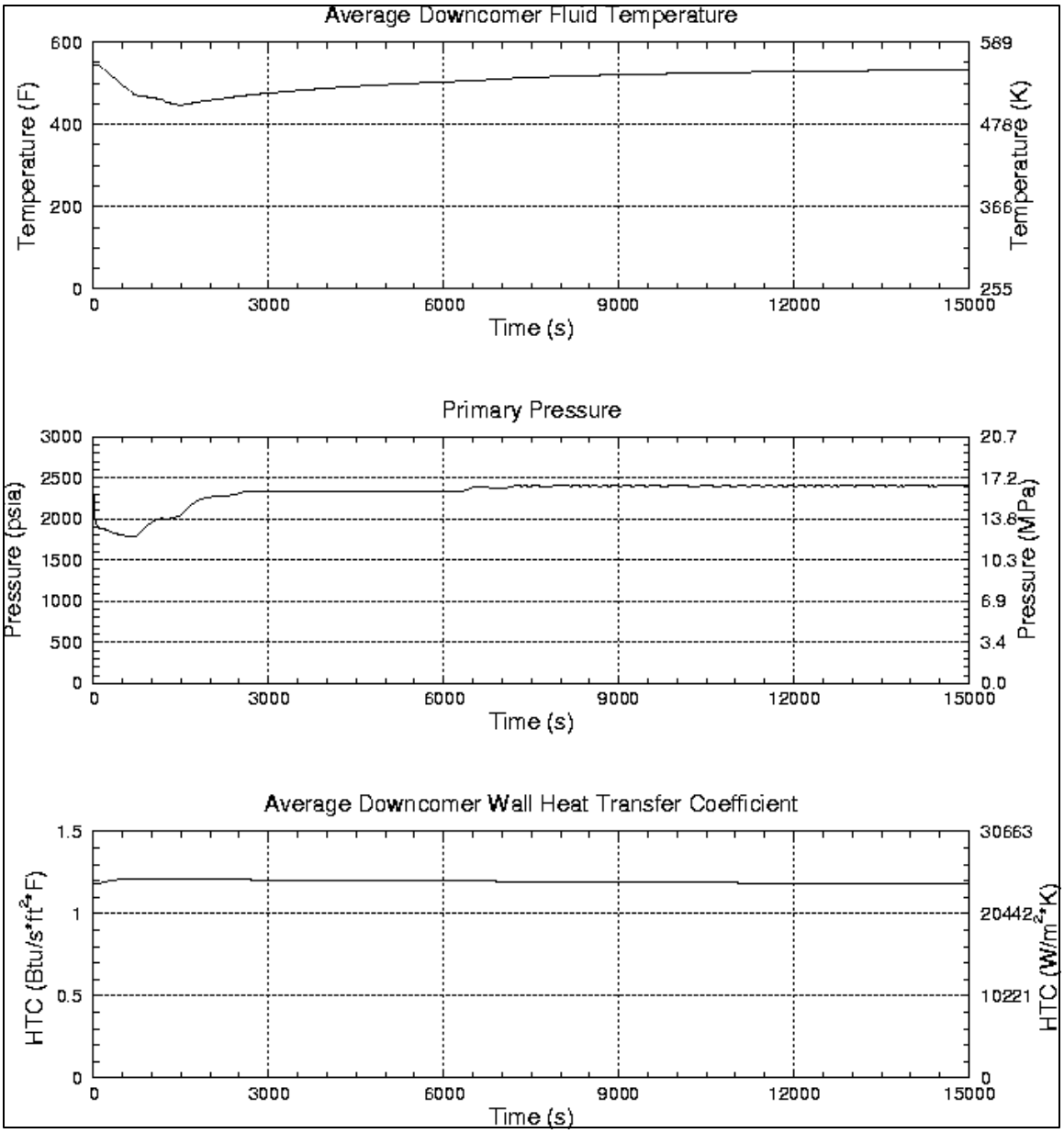


Figure B.2-39: Beaver Valley PTS Results for Case 038

Case Category	RT/TT
Primary Failures	One stuck open pressurizer PORV
Secondary Failures	One stuck open SDV
Operator Actions	None
Min DC Temp	395.7 K (252.6°F) at 15000 s
Comments	None

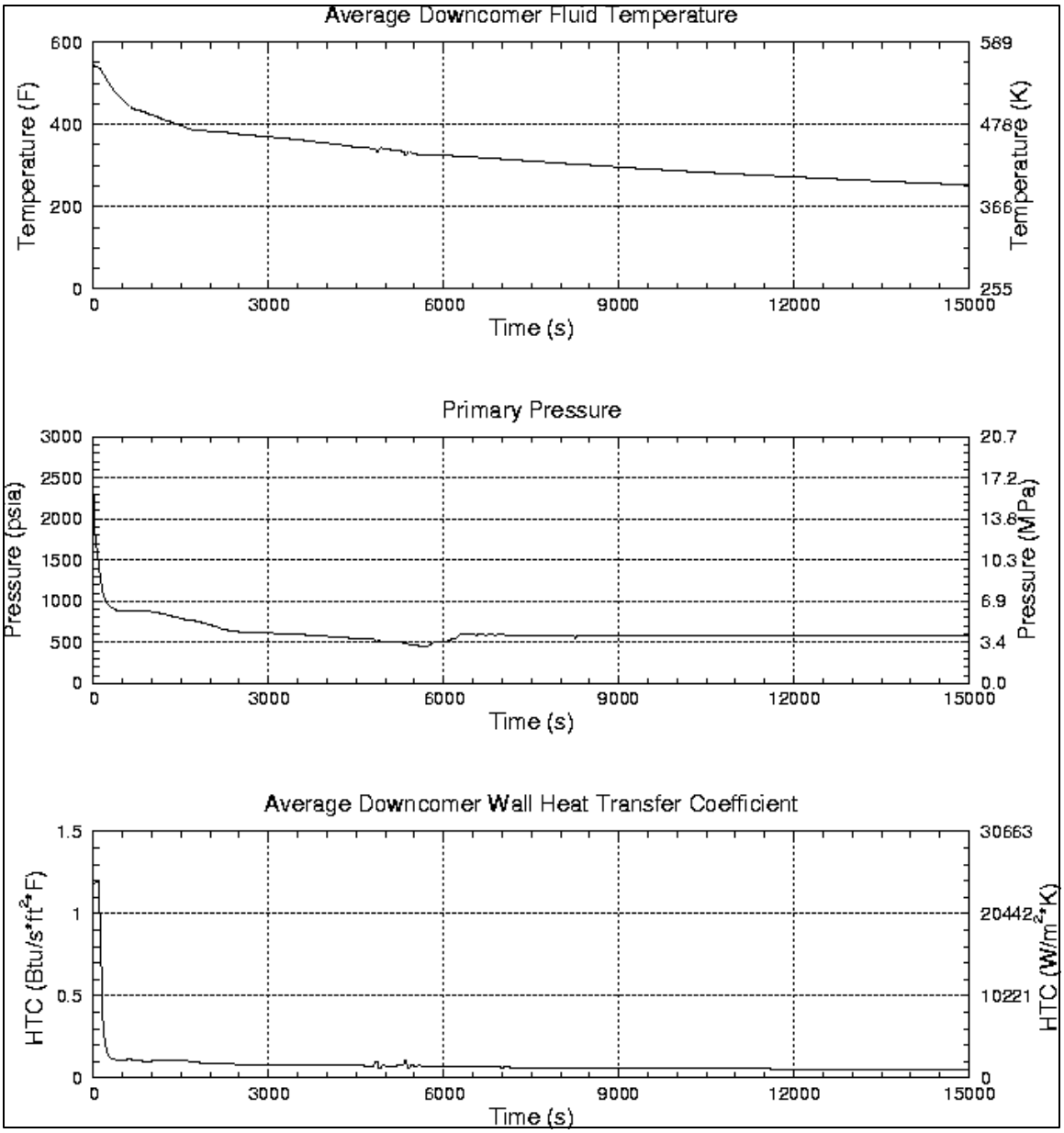


Figure B.2-40: Beaver Valley PTS Results for Case 039

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	One stuck open SDV
Operator Actions	None
Min DC Temp	360.9 K (189.9°F) at 15000 s
Comments	None

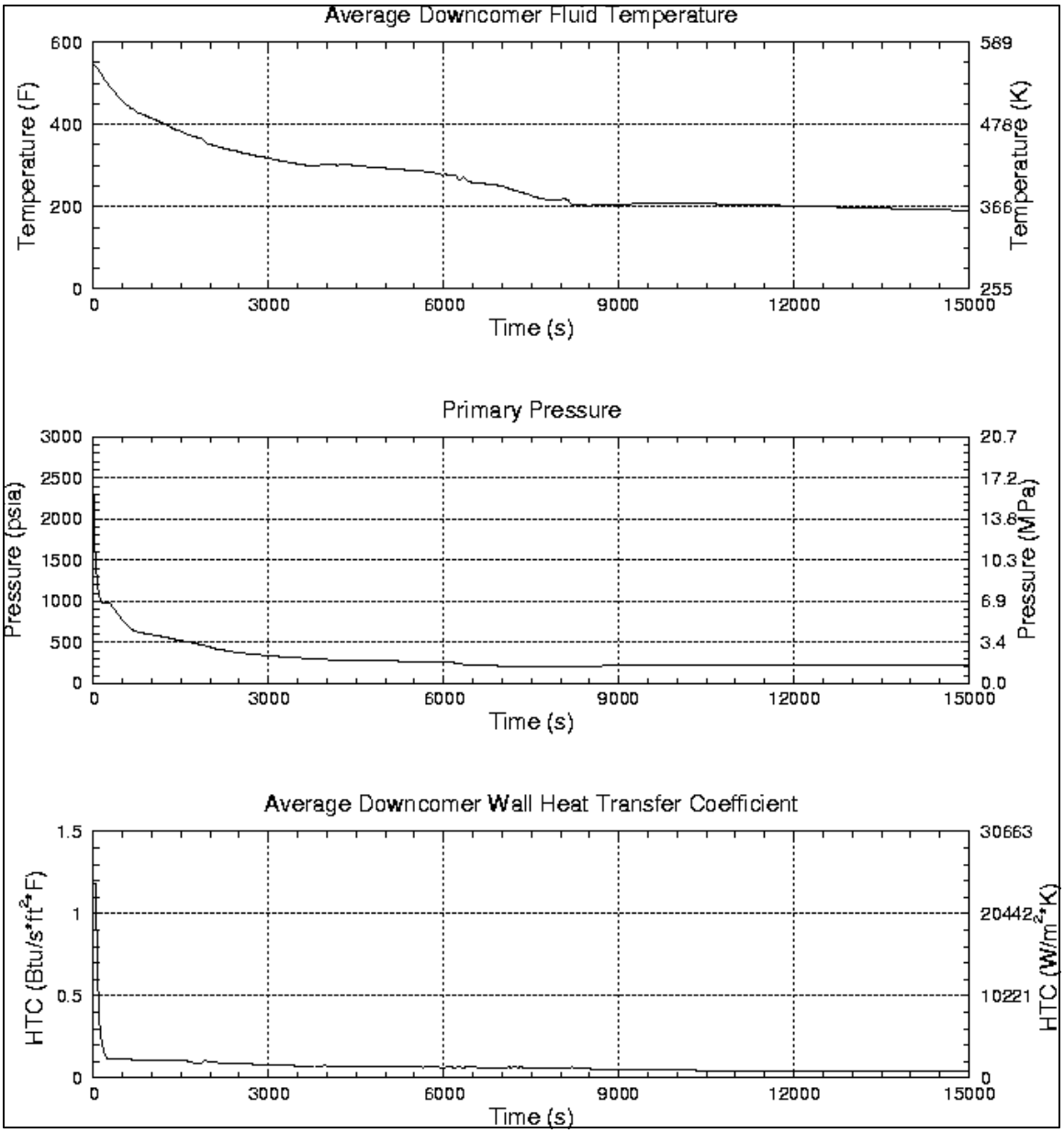


Figure B.2-41: Beaver Valley PTS Results for Case 040

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	One stuck open MS-SRV (SG A)
Operator Actions	None
Min DC Temp	333.3 K (140.2°F) at 14310 s
Comments	None

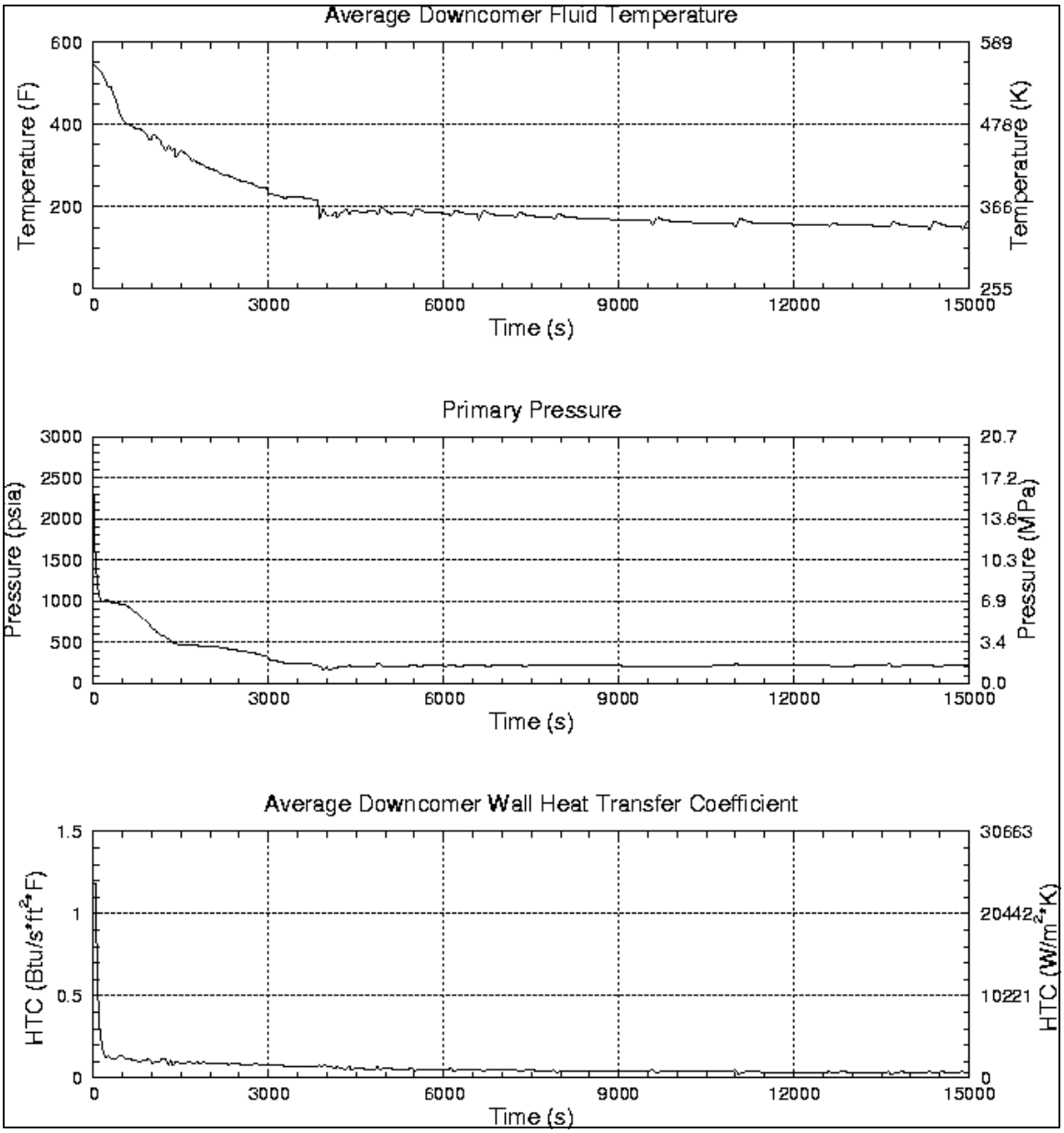


Figure B.2-42: Beaver Valley PTS Results for Case 041

Case Category	RT/TT
Primary Failures	None
Secondary Failures	One stuck open MS-SRV (SG A)
Operator Actions	MS-SRV isolated at 7000 seconds
Min DC Temp	451.1 K (352.4°F) at 7110 s
Comments	None

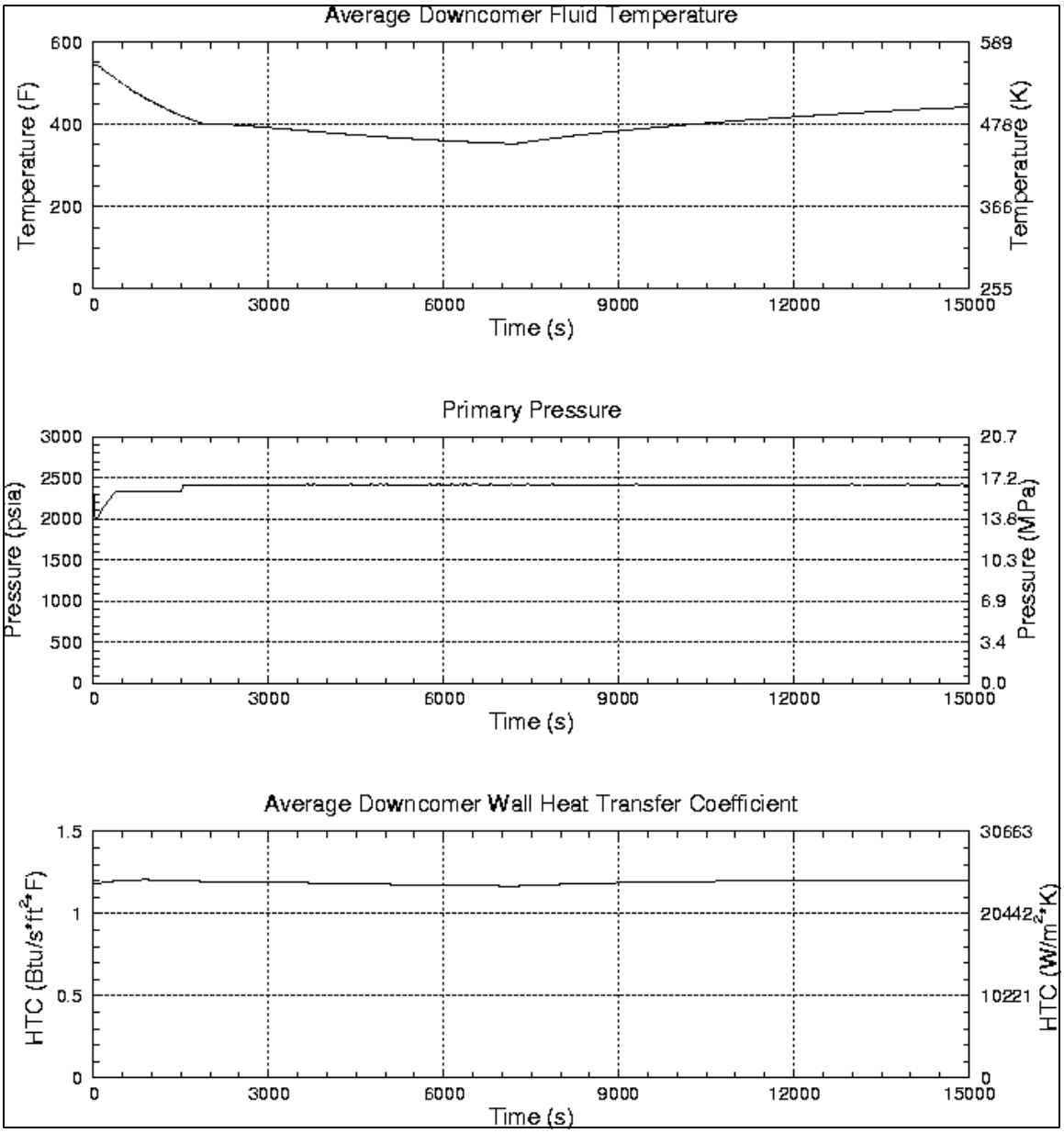


Figure B.2-43: Beaver Valley PTS Results for Case 042

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	399.6 K (259.5°F) at 3960 s
Comments	SRV recloses at 4,000 seconds.

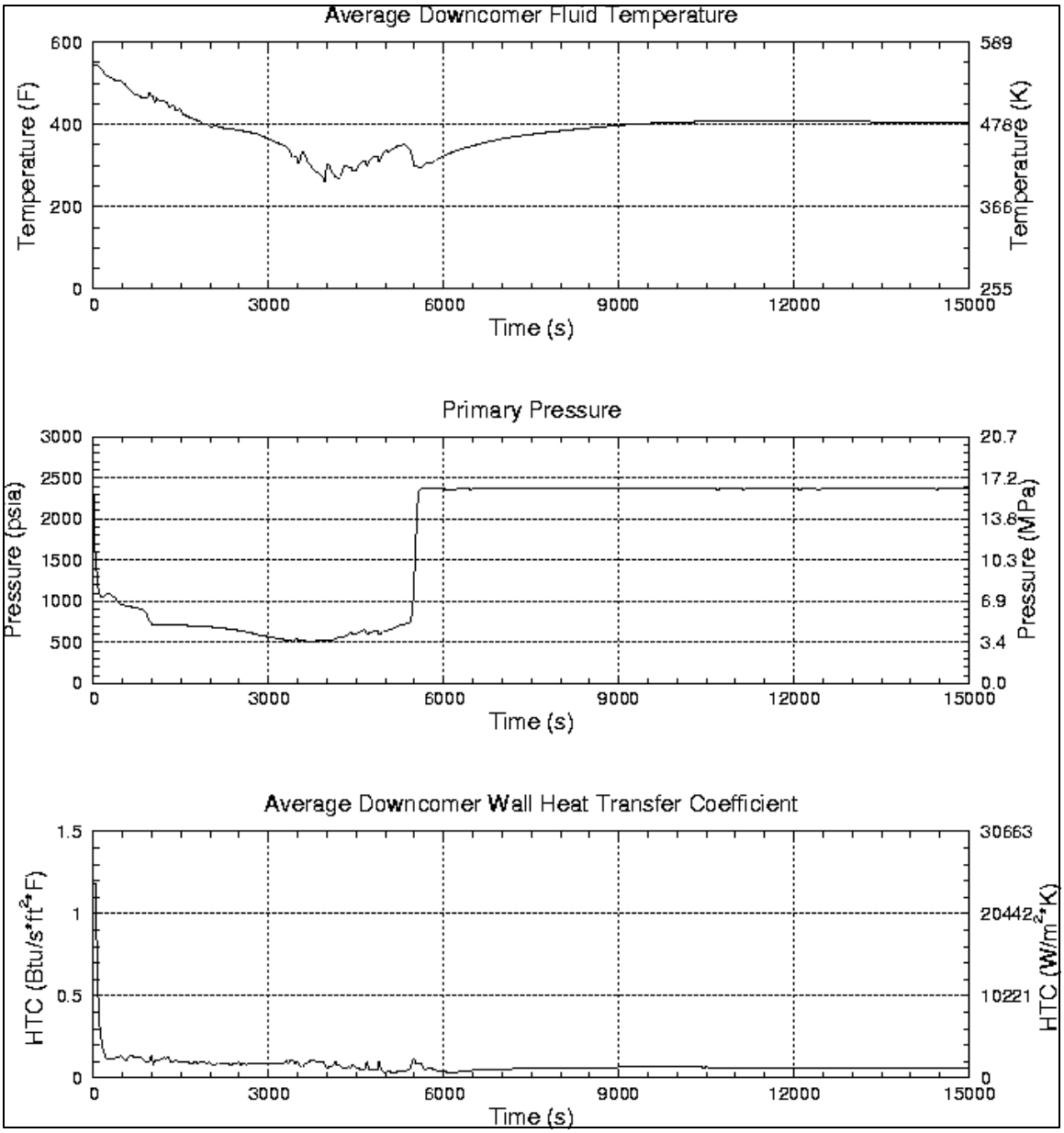


Figure B.2-44: Beaver Valley PTS Results for Case 043

Case Category	RT/TT, HZP
Primary Failures	None
Secondary Failures	MFW overfeed of all SGs
Operator Actions	MFW tripped when water in steamline
Min DC Temp	330.5 K (135.3°F) at 14580 s
Comments	After MFW is tripped, AFW works as normal. Case 028 @ HZP.

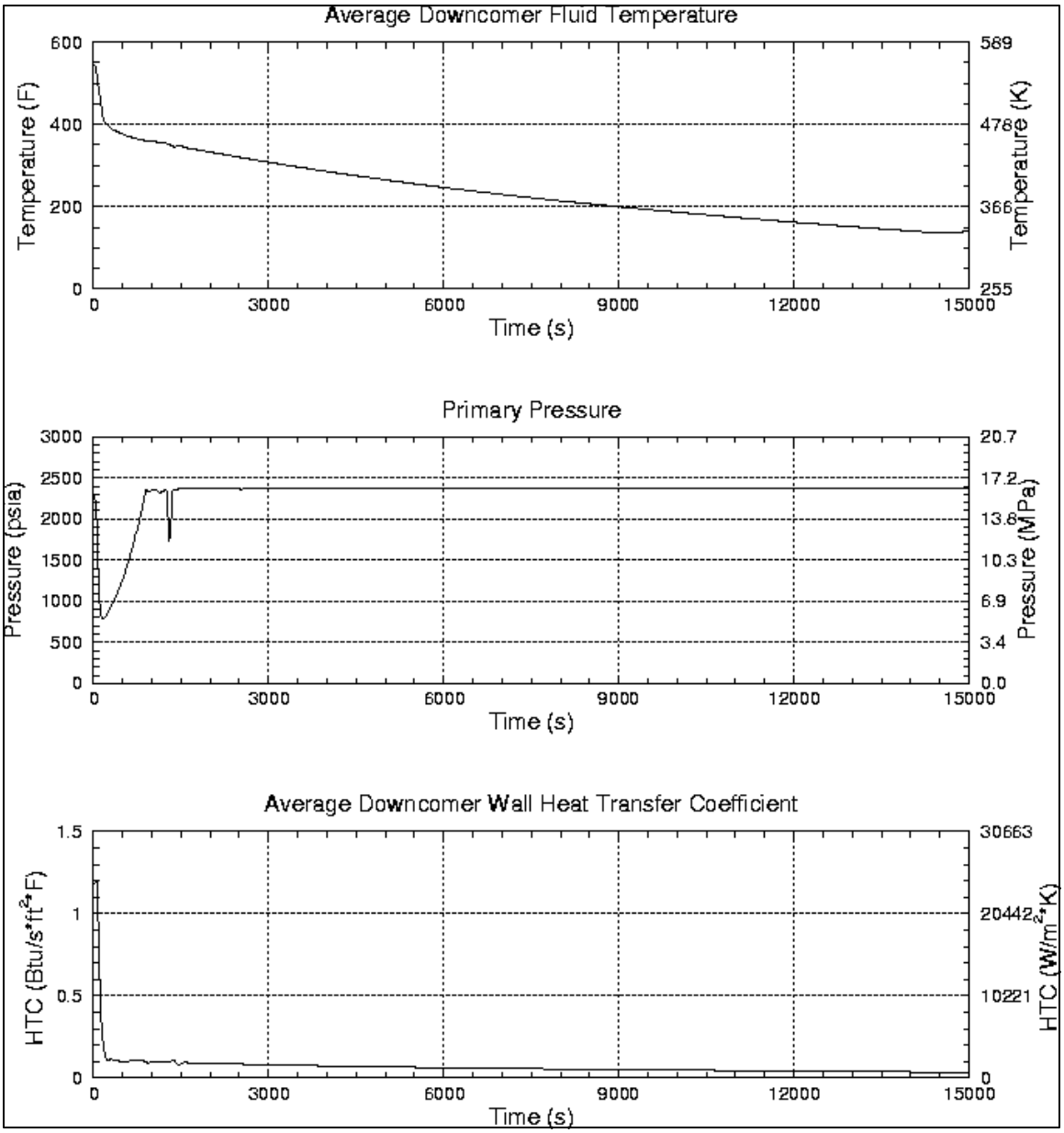


Figure B.2-45: Beaver Valley PTS Results for Case 044

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of all SGs
Operator Actions	None
Min DC Temp	534.1 K (501.6°F) at 240 s
Comments	MFW keeps SGs filled to top.

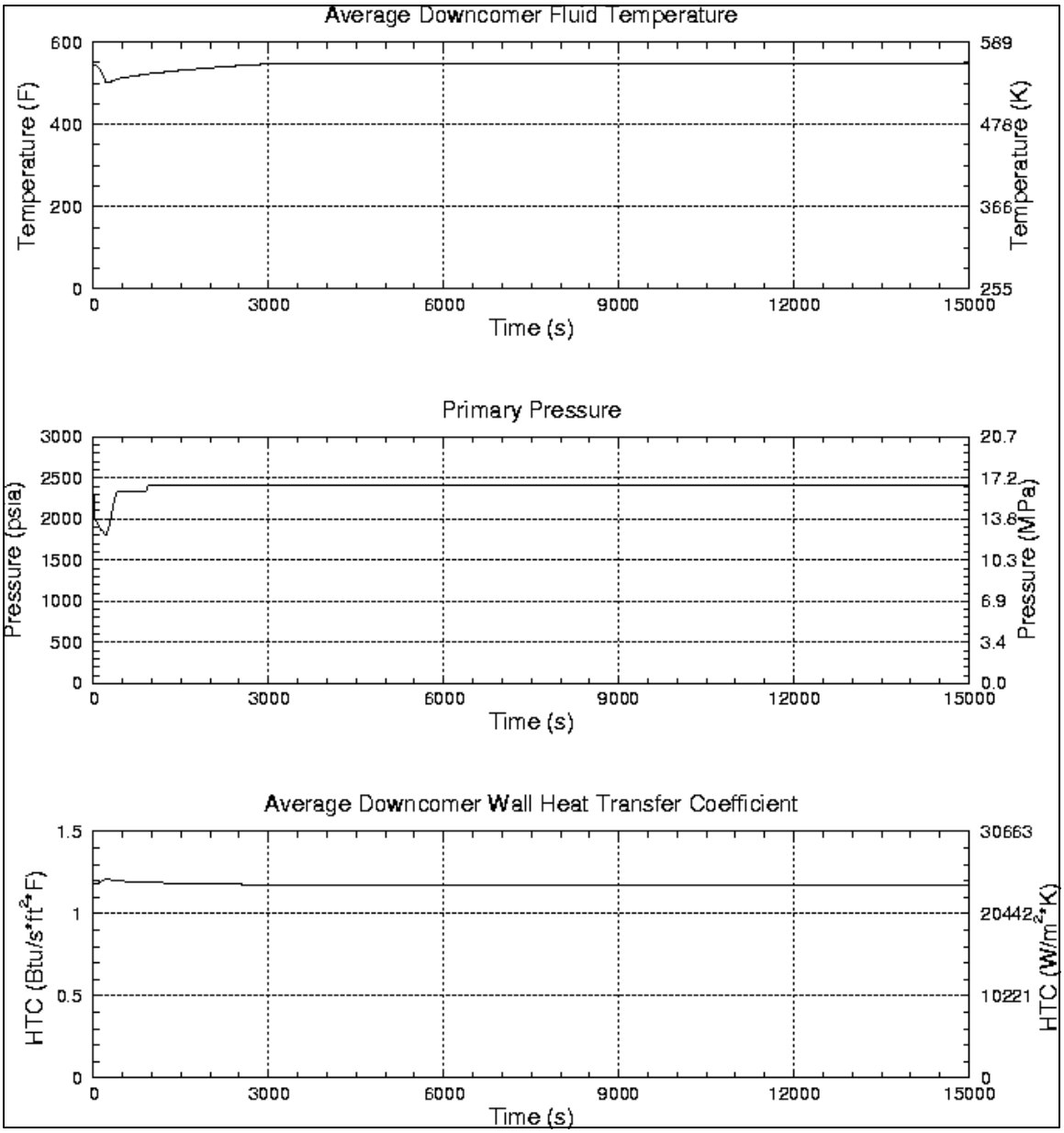


Figure B.2-46: Beaver Valley PTS Results for Case 045

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of SG's A and B
Operator Actions	None
Min DC Temp	538.4 K (509.5°F) at 450 s
Comments	MFW keeps SGs A and B filled to top.

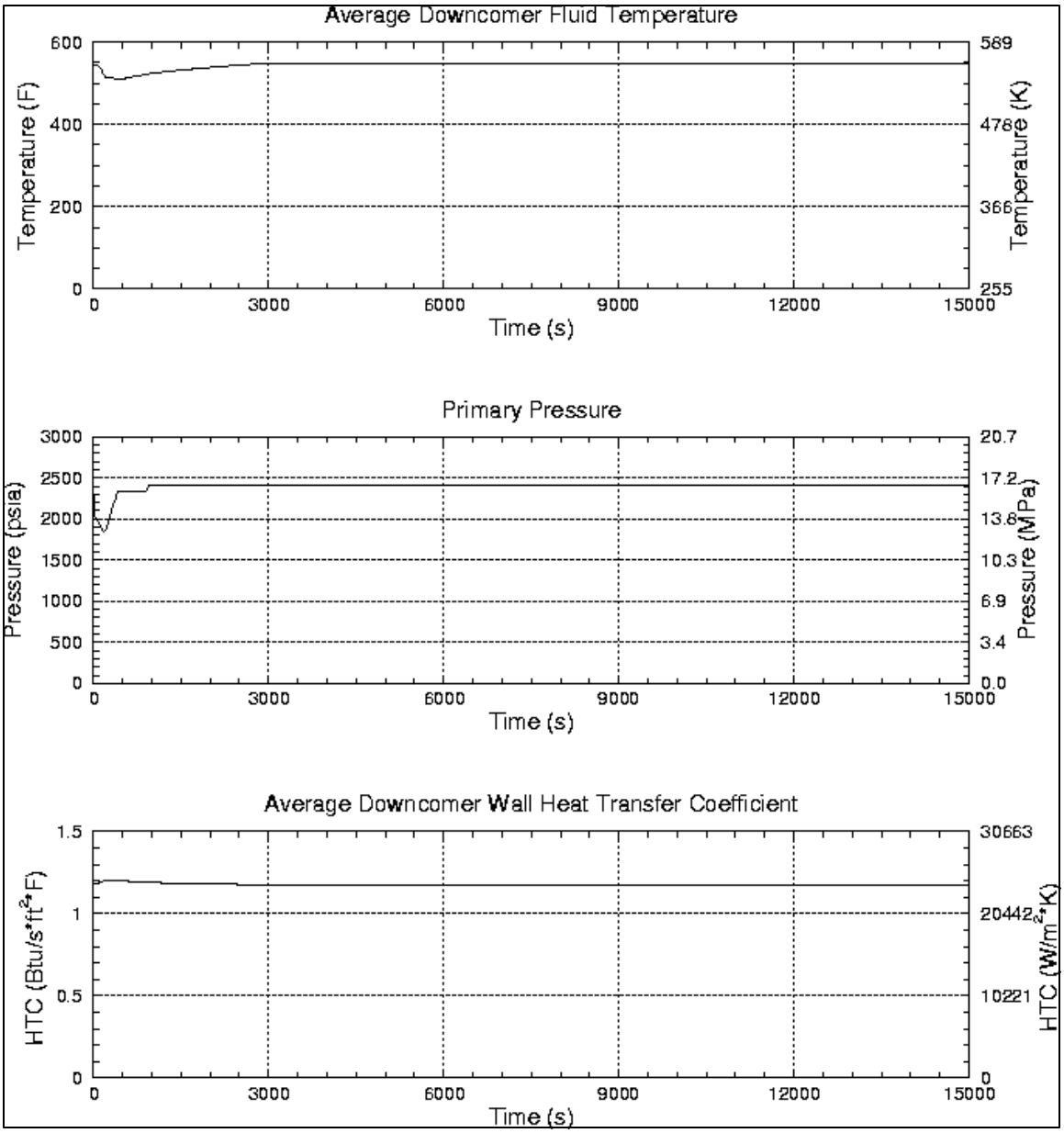


Figure B.2-47: Beaver Valley PTS Results for Case 046

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of SG A
Operator Actions	None
Min DC Temp	541.8 K (515.7°F) at 660 s
Comments	MFW keeps SG A filled to top.

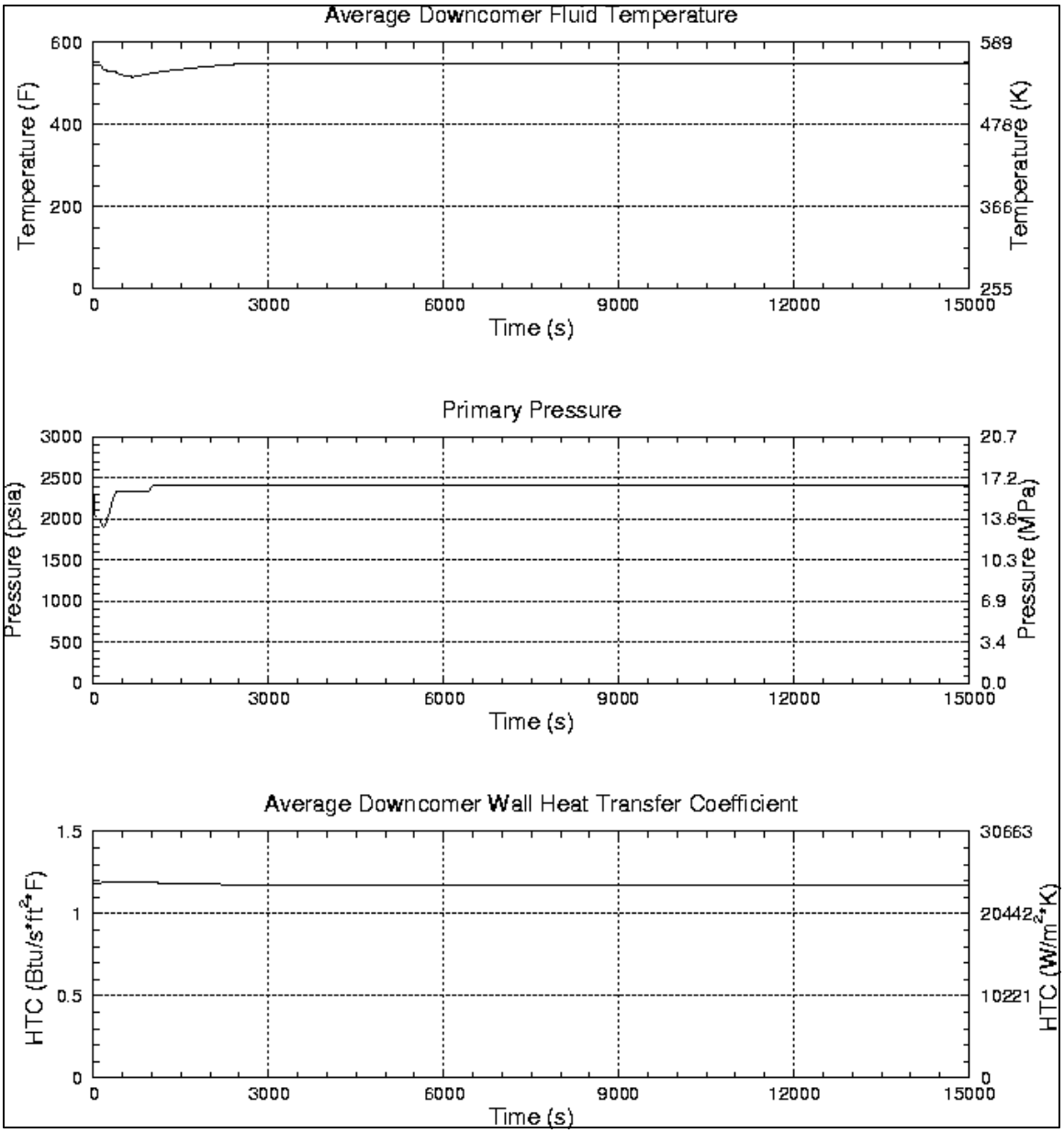


Figure B.2-48: Beaver Valley PTS Results for Case 047

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of all SGs
Operator Actions	None
Min DC Temp	467.6 K (382.1°F) at 15000 s
Comments	Once MFW fills generators, AFW maintains high level.

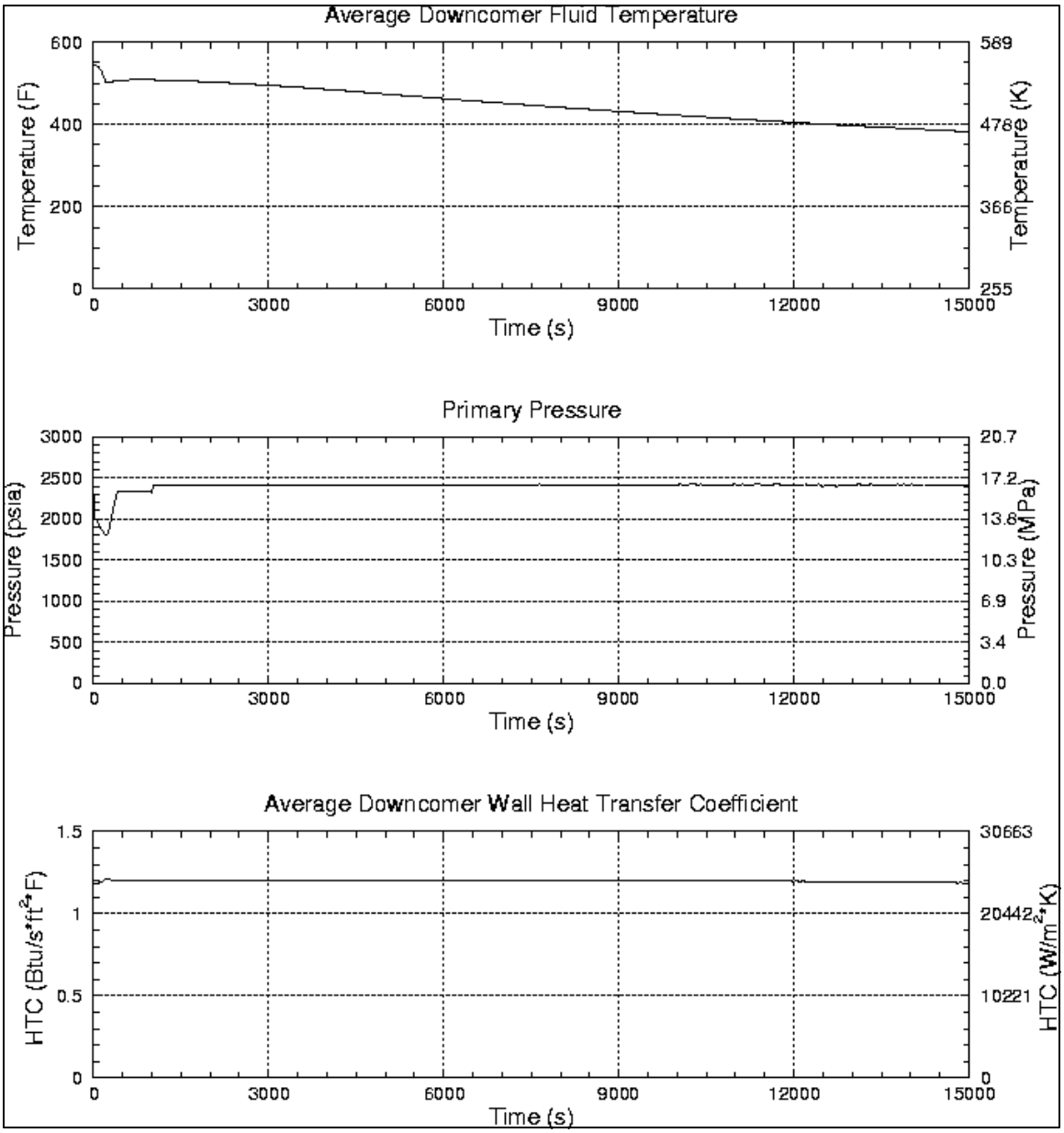


Figure B.2-49: Beaver Valley PTS Results for Case 048

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A, no MSIV closure
Operator Actions	None
Min DC Temp	378.9 K (222.4°F) at 14970 s
Comments	Break is assumed to occur upstream of MSIV, so MSIV closure has no effect. This case is the same as case 074.

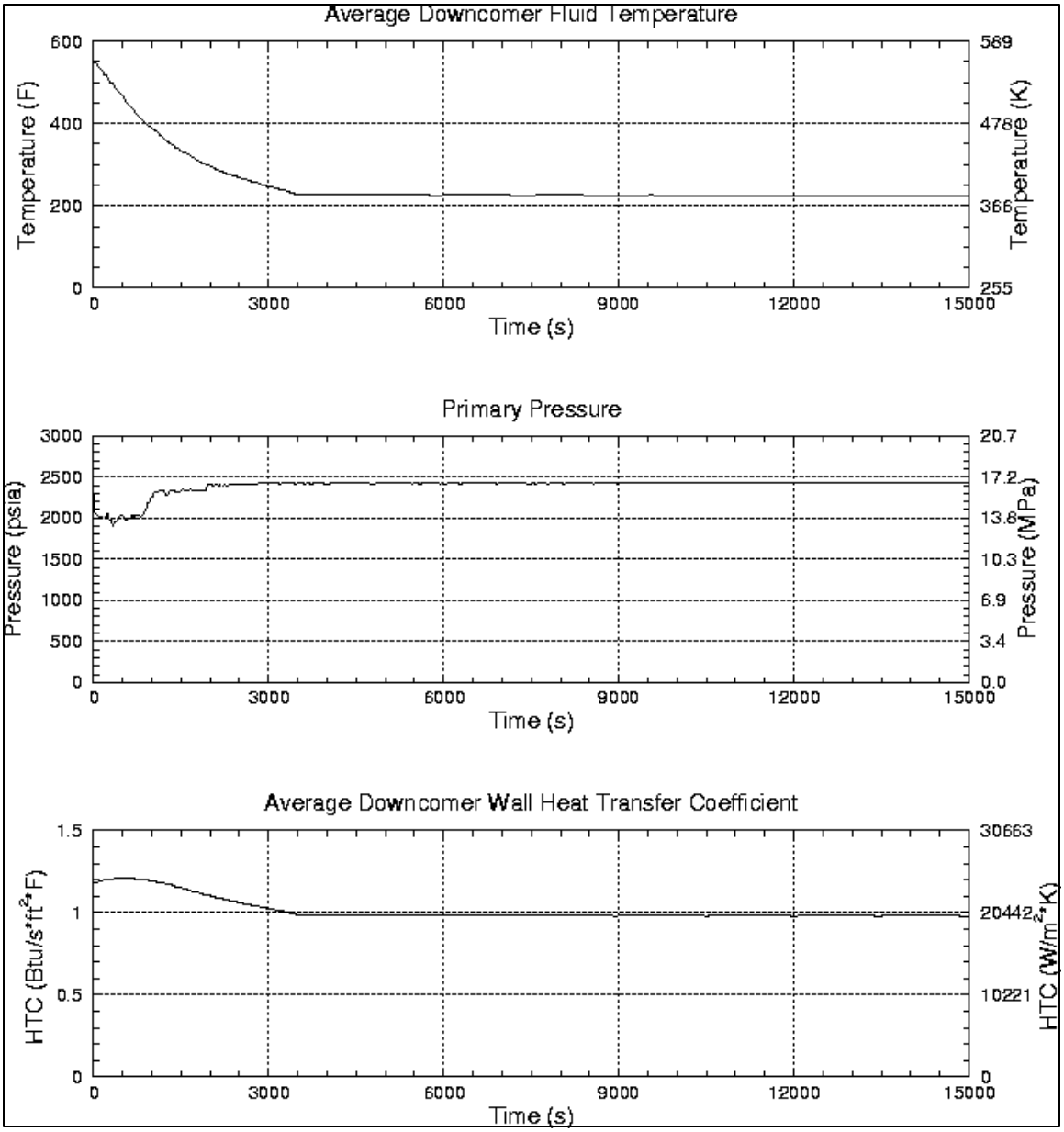


Figure B.2-50: Beaver Valley PTS Results for Case 049

Case Category	SGTR
Primary Failures	Steam generator tube rupture (SG A)
Secondary Failures	None
Operator Actions	RCP's are tripped
Min DC Temp	503.7 K (447.0°F) at 15000 s
Comments	None

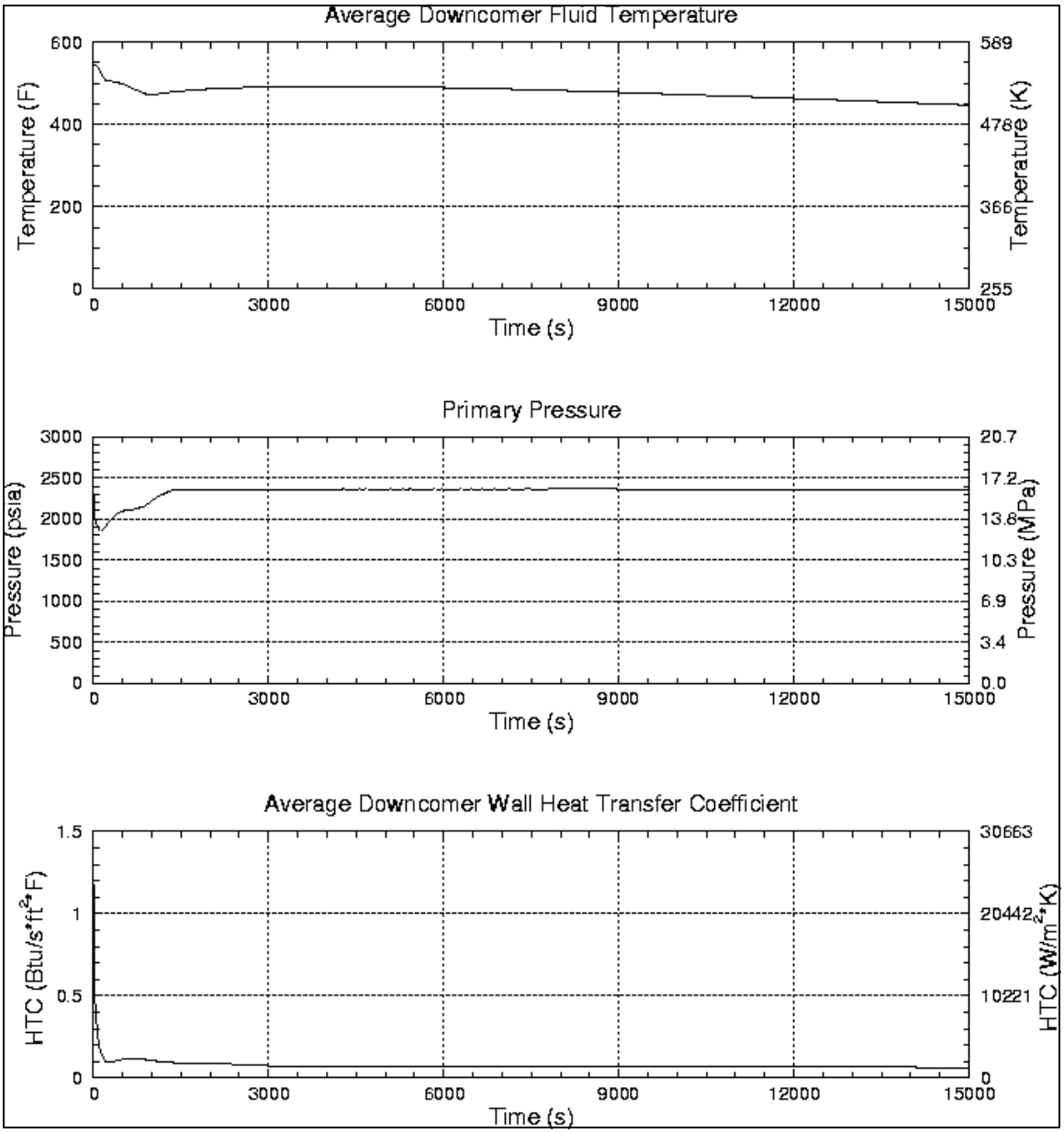


Figure B.2-51: Beaver Valley PTS Results for Case 050

Case Category	SGTR
Primary Failures	Steam generator tube rupture (SG A), one stuck open pressurizer PORV
Secondary Failures	One stuck open ASDV (SG A)
Operator Actions	RCP's are tripped
Min DC Temp	355.5 K (180.3°F) at 15000 s
Comments	AFW continues to feed SG A

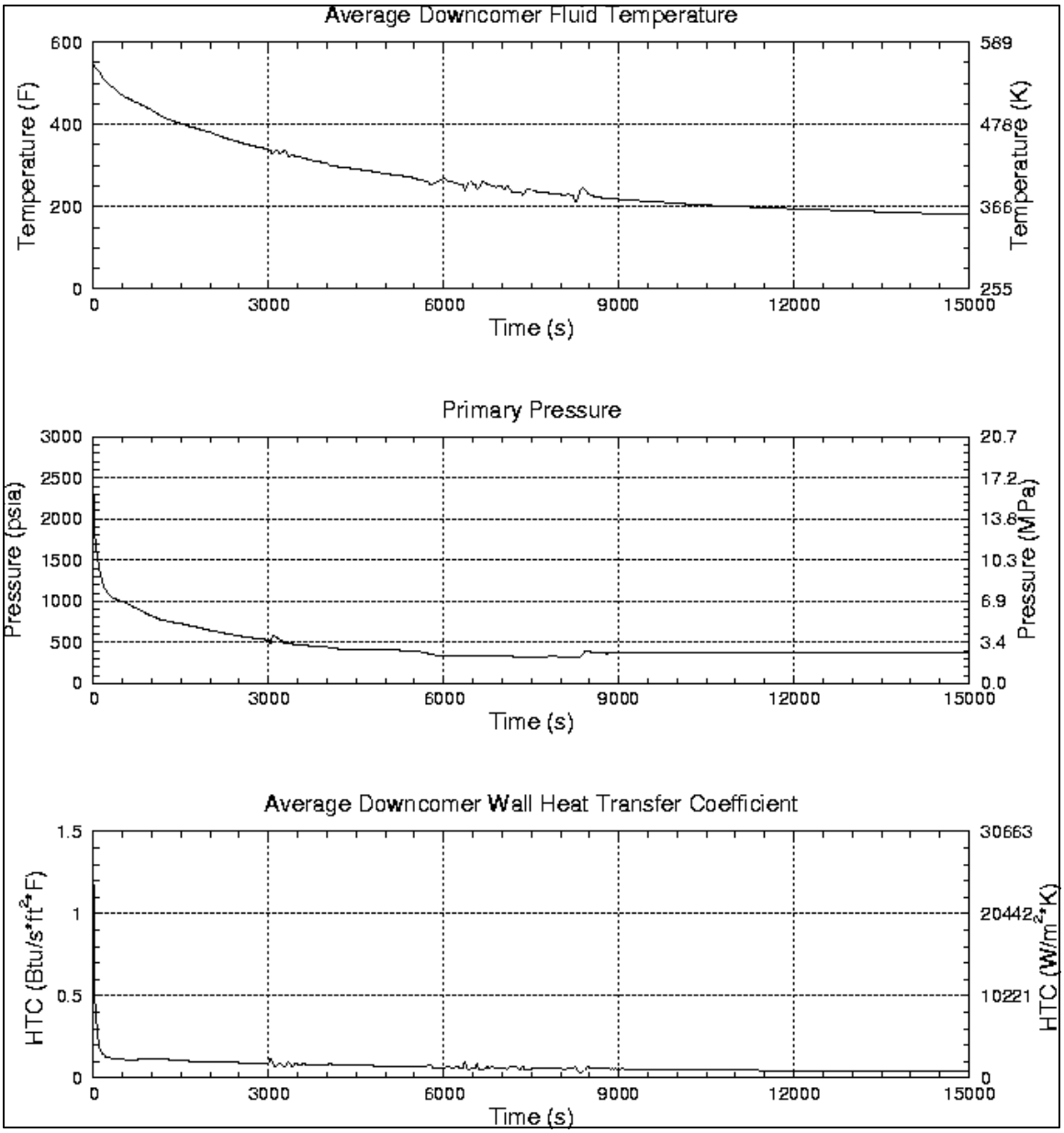


Figure B.2-52: Beaver Valley PTS Results for Case 051

Case Category	LOCA, HZP
Primary Failures	2.54 cm (1.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	432.1 K (318.0°F) at 15000 s
Comments	Case 001 @ HZP

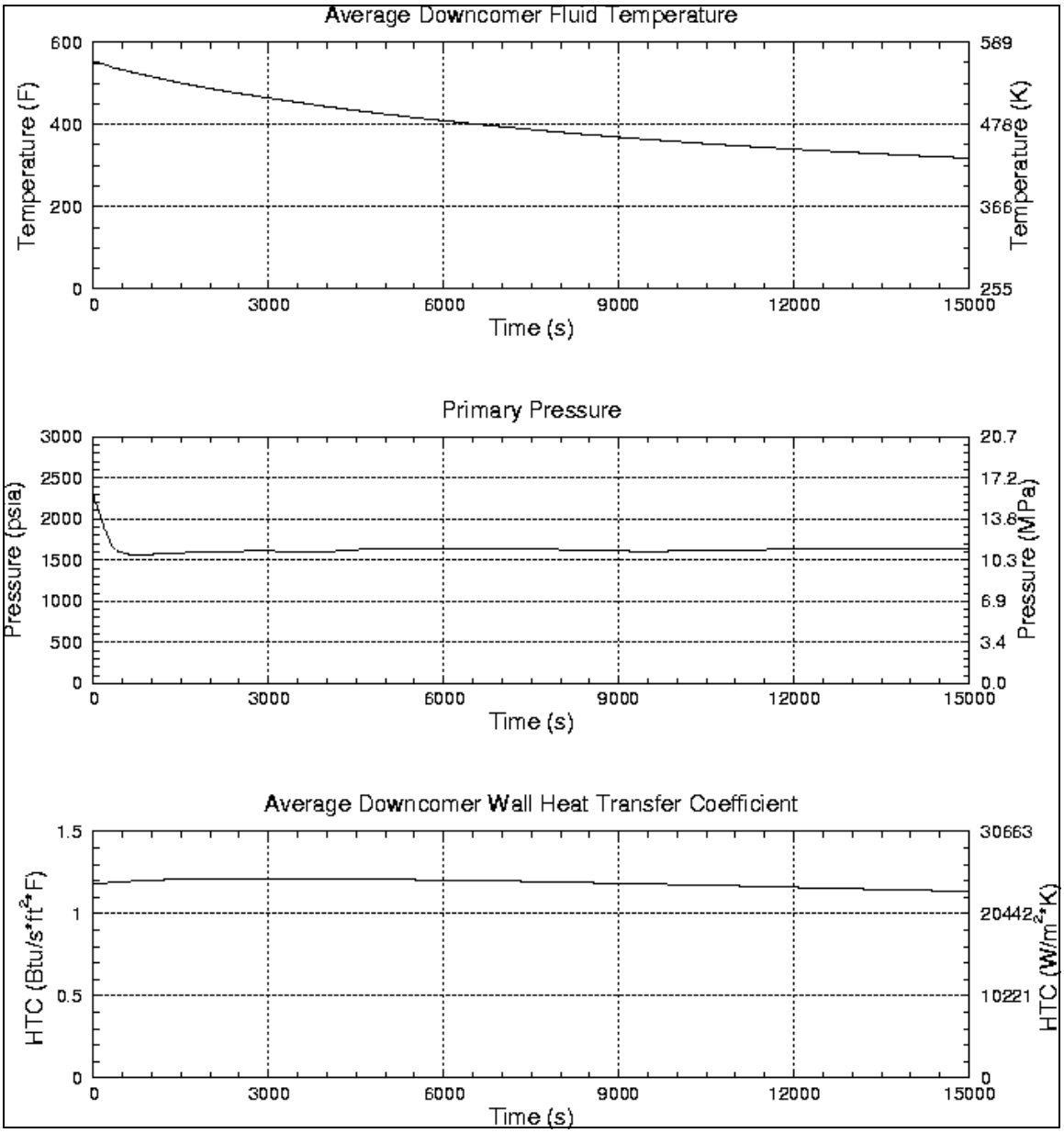


Figure B.2-53: Beaver Valley PTS Results for Case 052

Case Category	LOCA, HZP
Primary Failures	3.59 cm (1.414 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	291.0 K (64.1°F) at 12090 s
Comments	Case 002 @ HZP

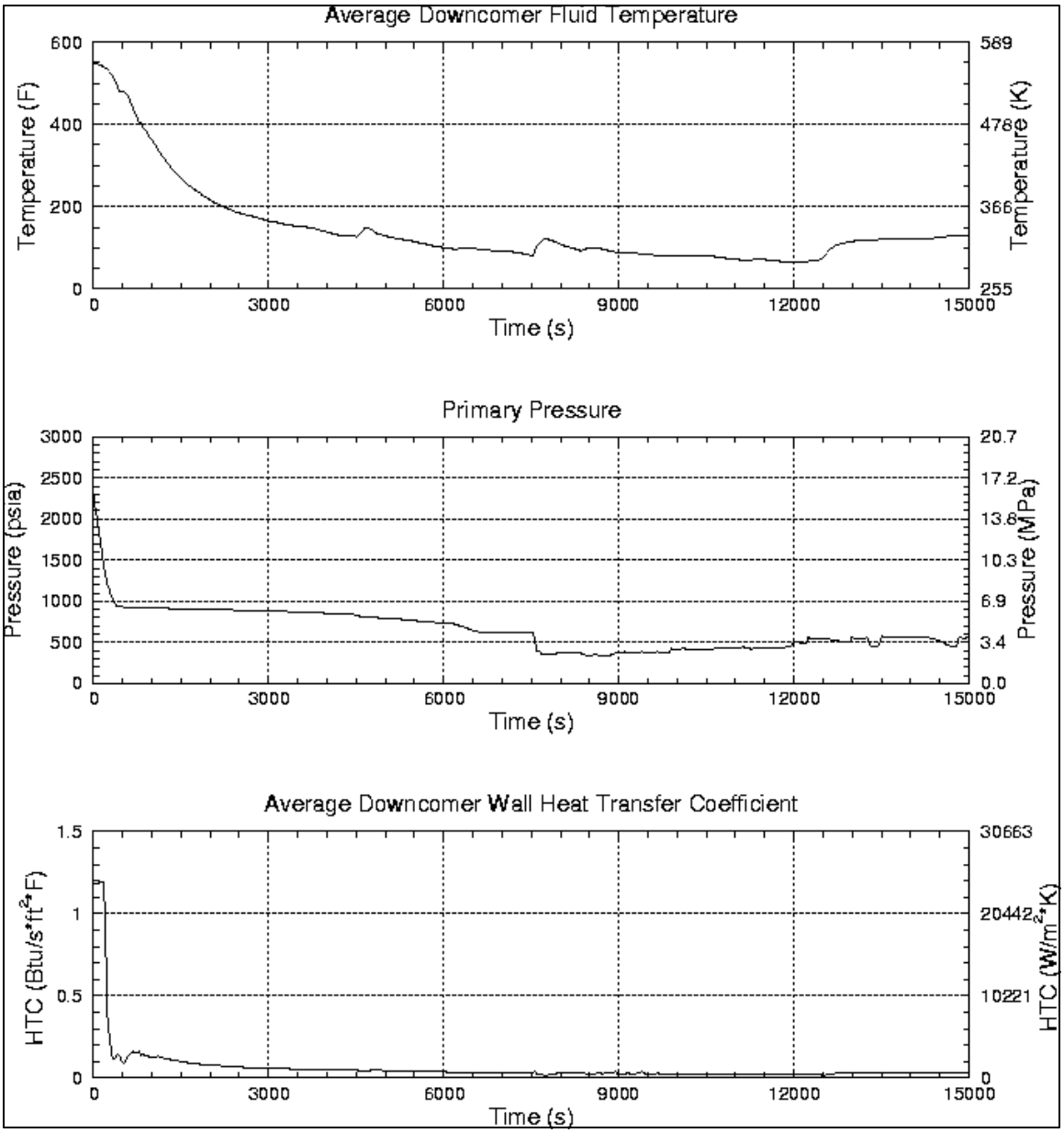


Figure B.2-54: Beaver Valley PTS Results for Case 053

Case Category	LOCA, HZP
Primary Failures	5.08 cm (2.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.3 K (71.9°F) at 7410 s
Comments	Case 003 @ HZP

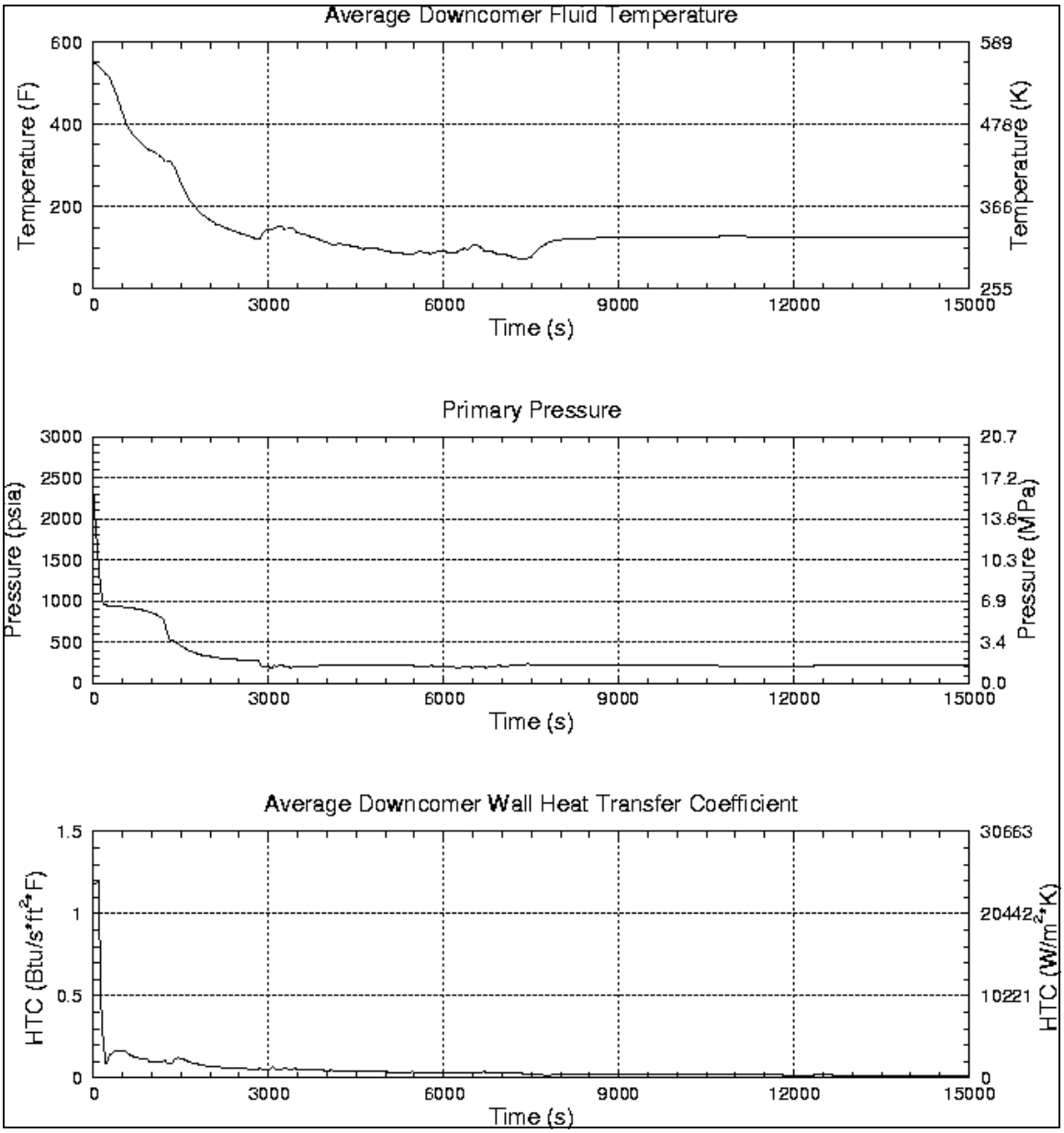


Figure B.2-55: Beaver Valley PTS Results for Case 054

Case Category	LOCA, HZP
Primary Failures	7.18 cm (2.828 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	289.4 K (61.3°F) at 4290 s
Comments	Case 004 @ HZP

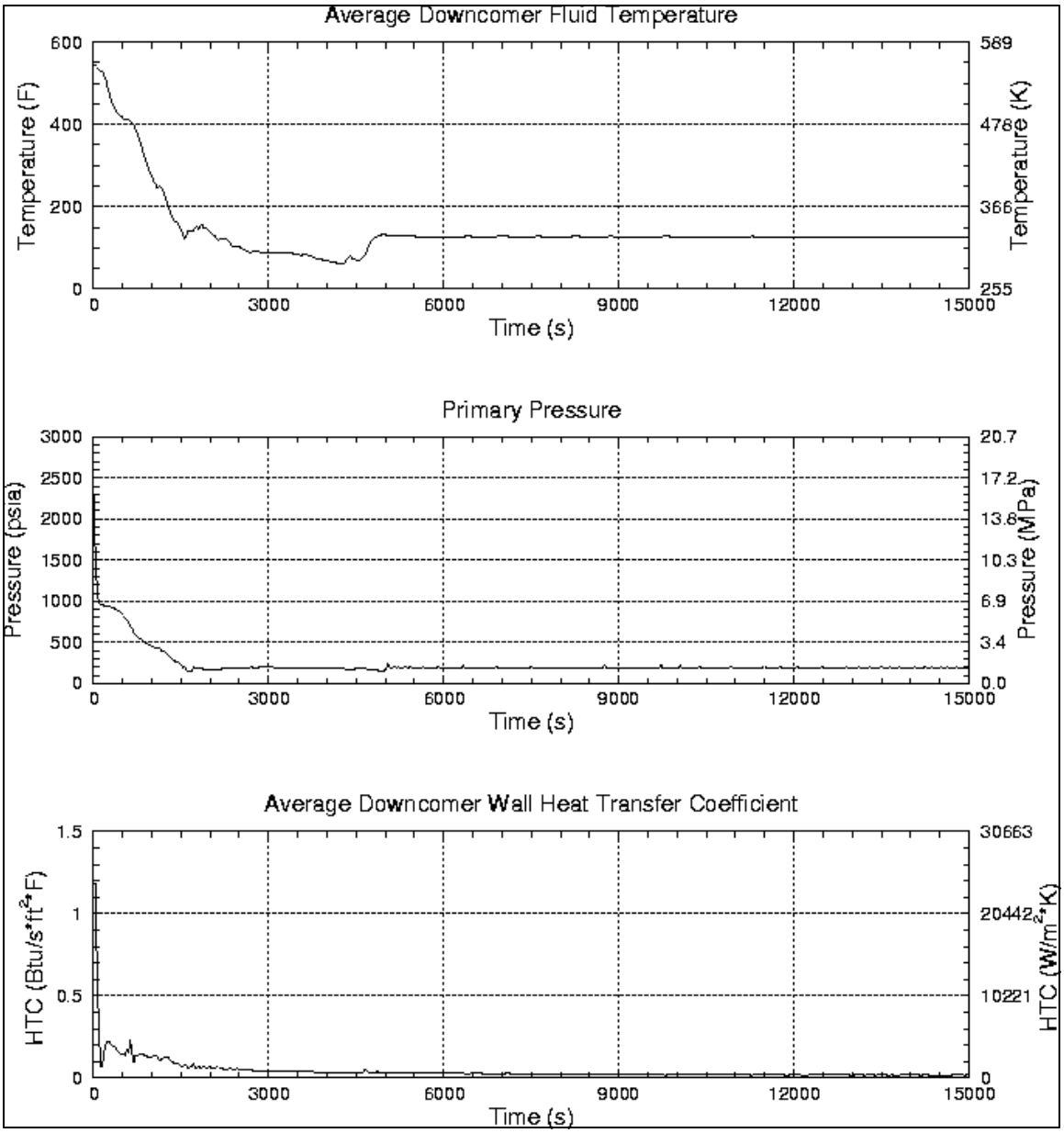


Figure B.2-56: Beaver Valley PTS Results for Case 055

Case Category	LOCA, HZP
Primary Failures	10.16 cm (4.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	288.4 K (59.5°F) at 2970 s
Comments	Case 005 @ HZP

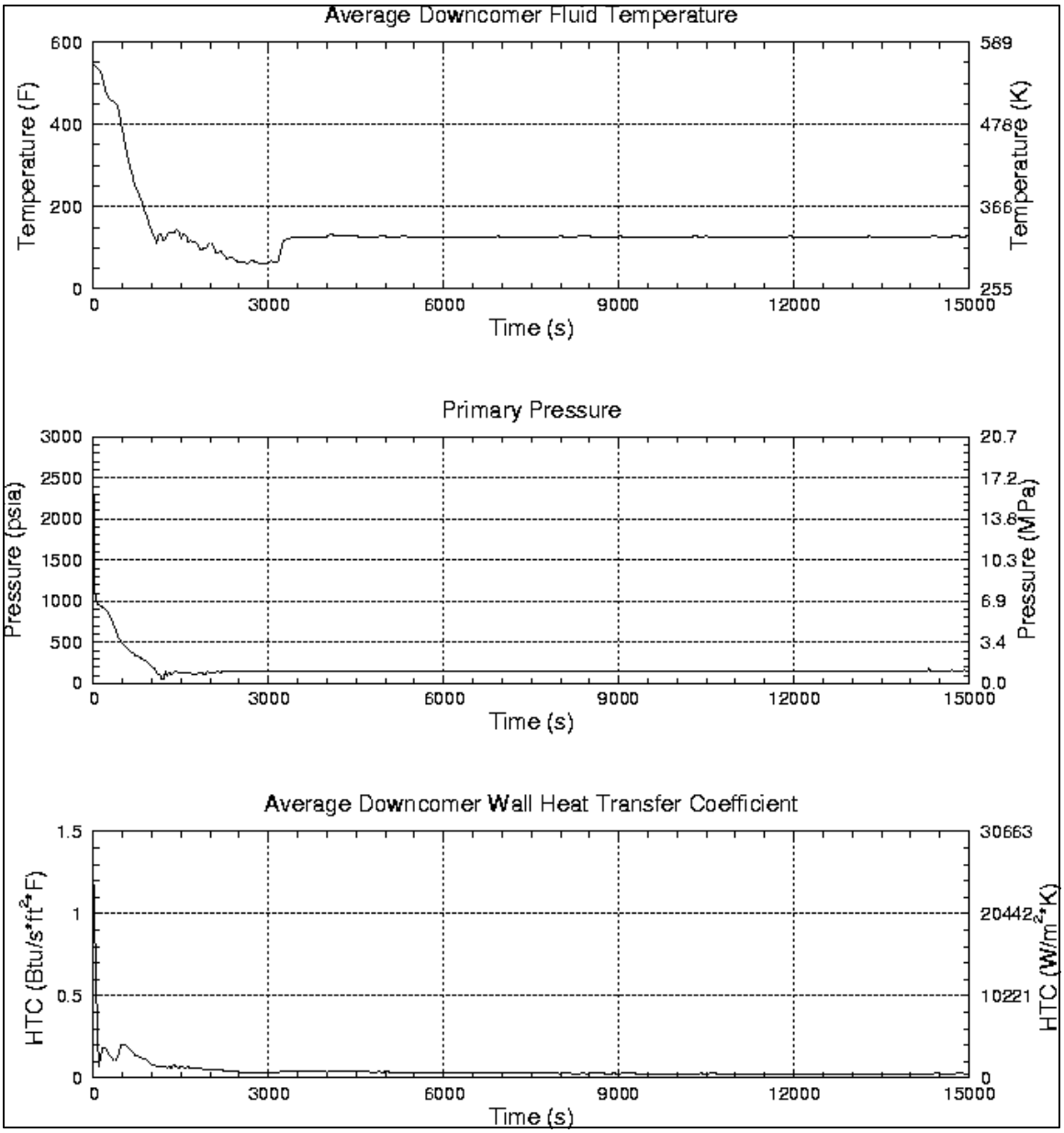


Figure B.2-57: Beaver Valley PTS Results for Case 056

Case Category	LOCA, HZP
Primary Failures	14.37 cm (5.657 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	291.1 K (64.4°F) at 2340 s
Comments	Case 006 @ HZP

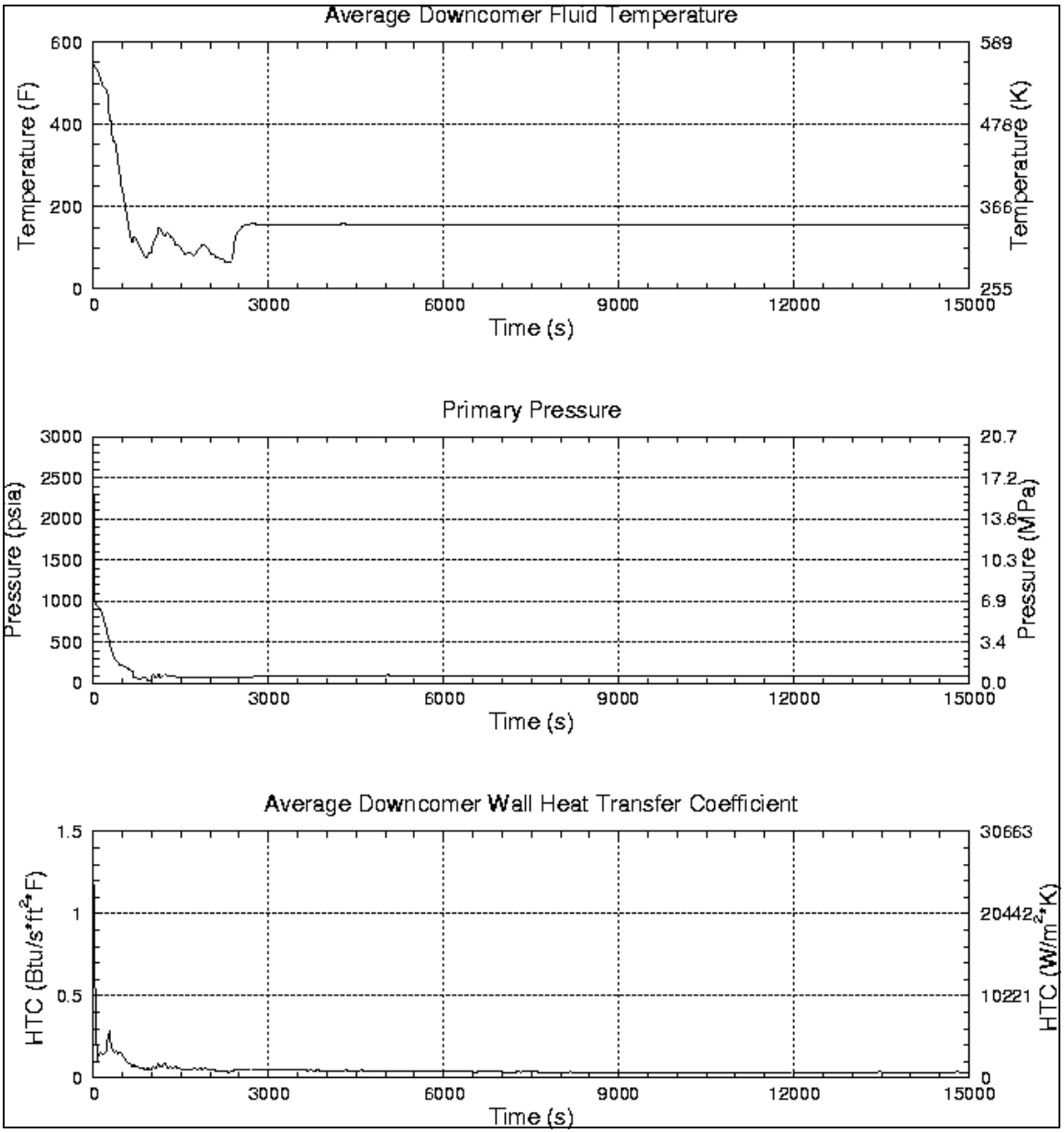


Figure B.2-58: Beaver Valley PTS Results for Case 057

Case Category	LOCA, HZP
Primary Failures	20.32 cm (8.0 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	290.6 K (63.4°F) at 1920 s
Comments	Case 007 @ HZP

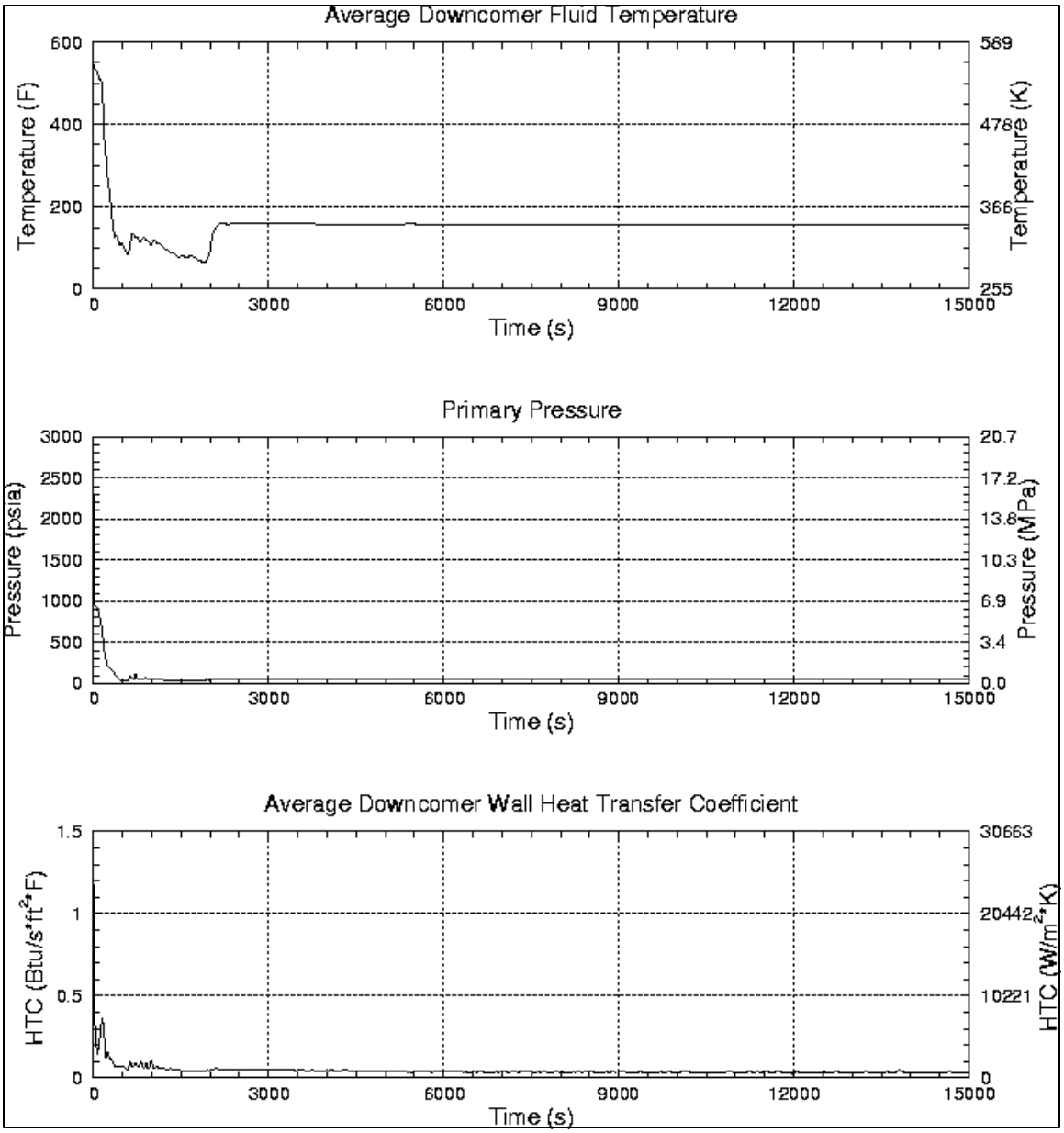


Figure B.2-59: Beaver Valley PTS Results for Case 058

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	429.6 K (313.7°F) at 4410 s
Comments	SRV recloses at 3,000 seconds

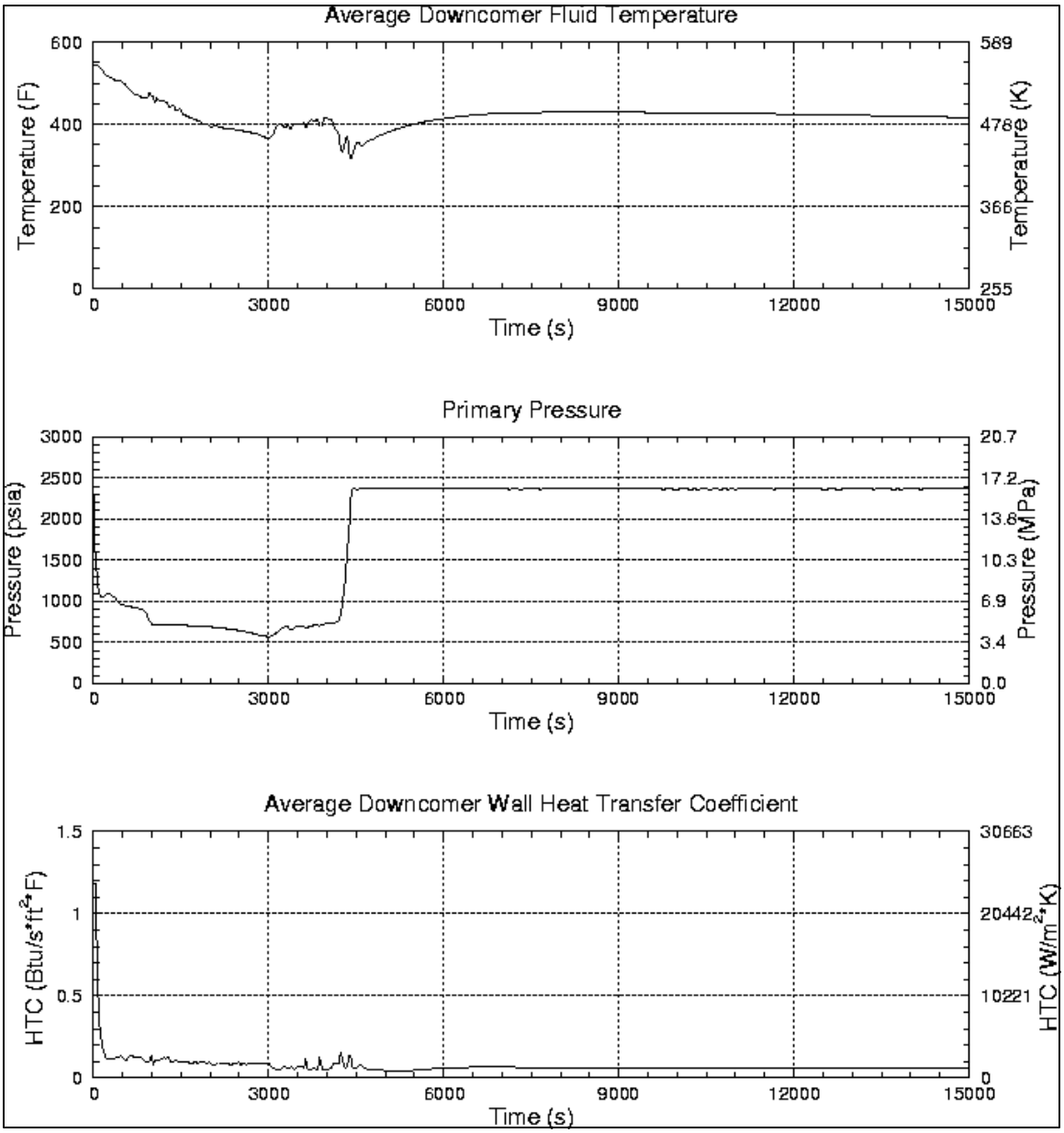


Figure B.2-60: Beaver Valley PTS Results for Case 059

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	329.8 K (133.9°F) at 6000 s
Comments	SRV recloses at 6,000 seconds

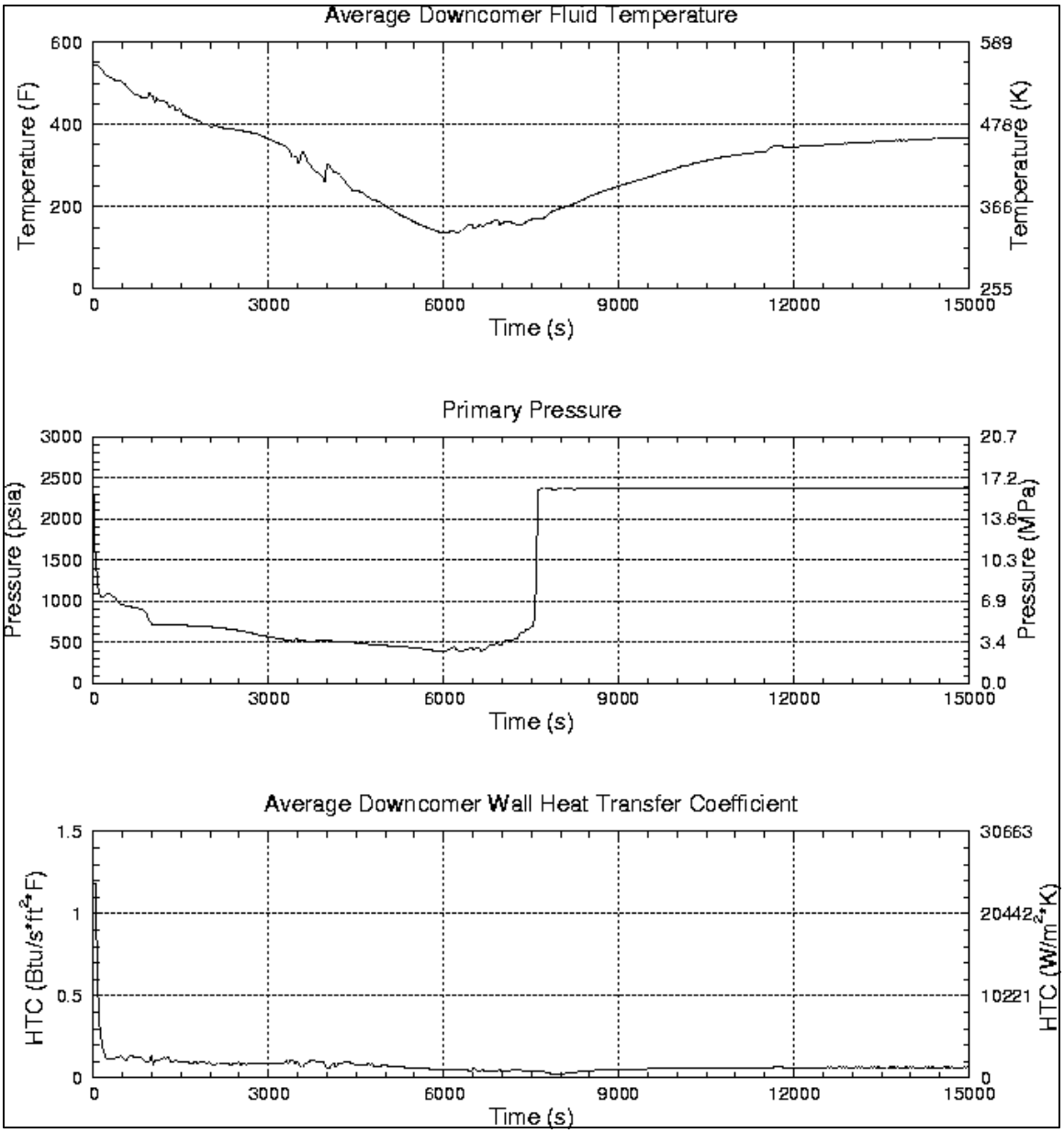


Figure B.2-61: Beaver Valley PTS Results for Case 060

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	357.1 K (183.2°F) at 3450 s
Comments	SRV recloses at 3,000 seconds

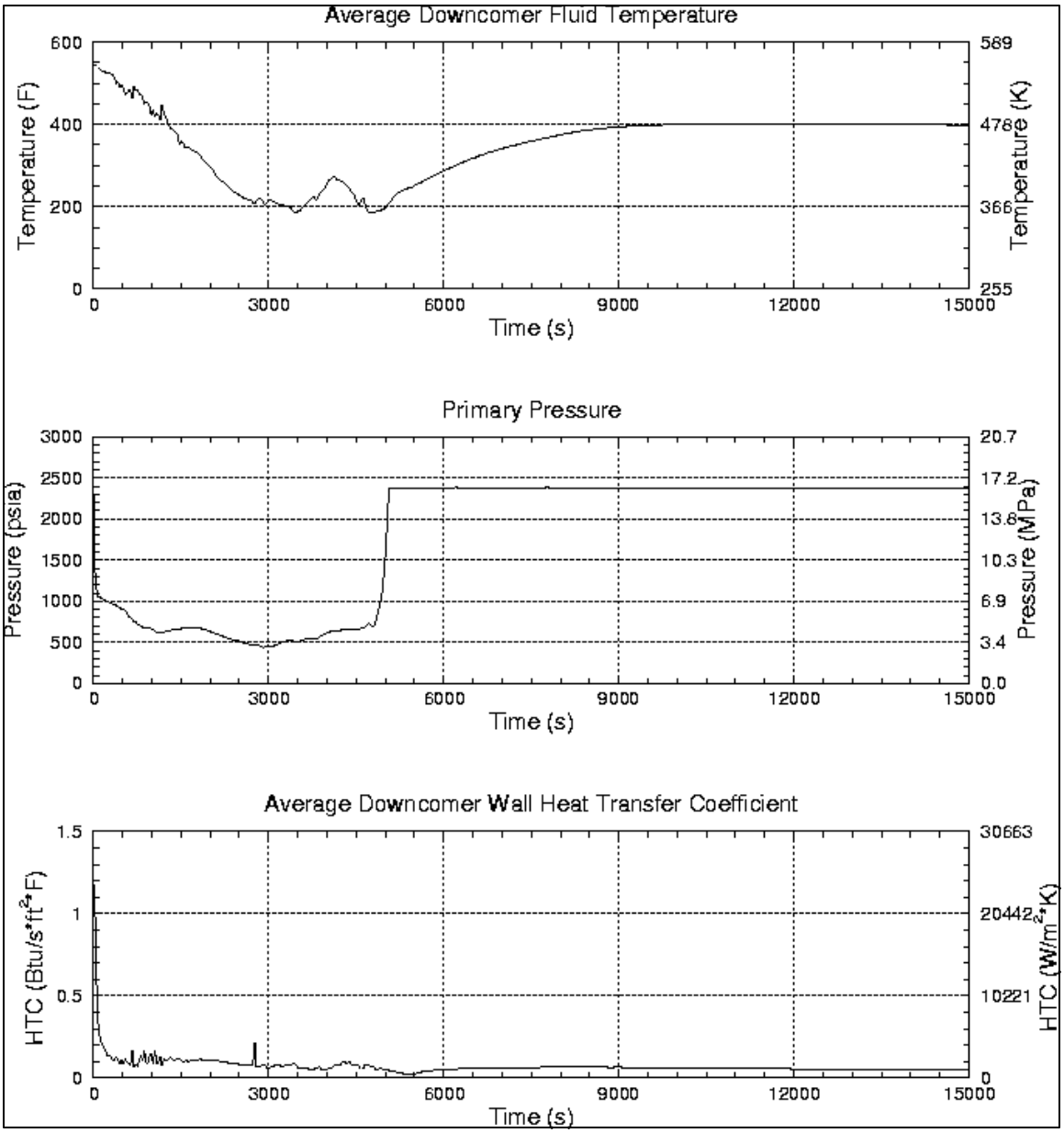


Figure B.2-62: Beaver Valley PTS Results for Case 061

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	292.0 K (66.0°F) at 5700 s
Comments	SRV recloses at 6,000 seconds

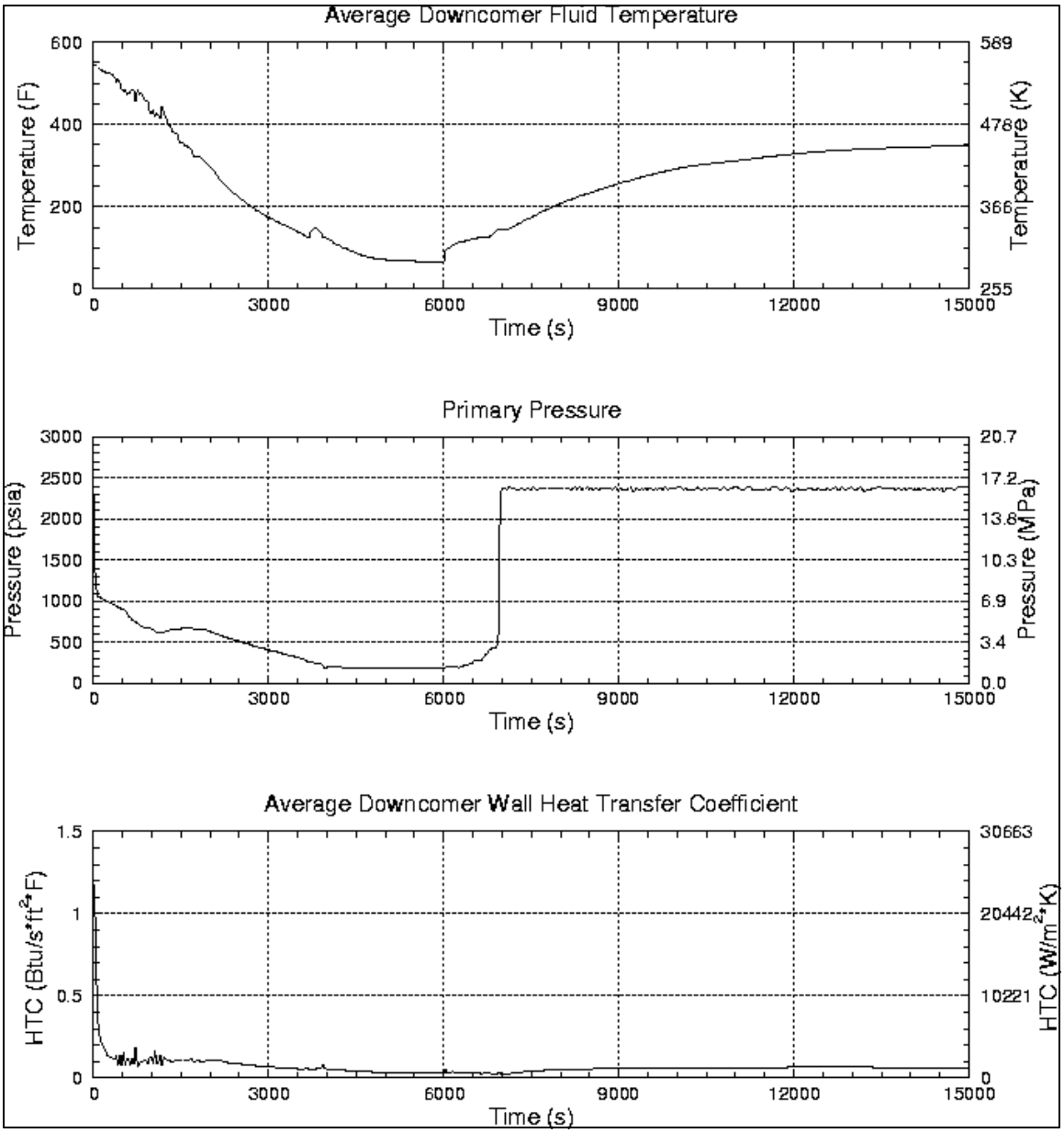


Figure B.2-63: Beaver Valley PTS Results for Case 062

Case Category	LOCA
Primary Failures	40.64 cm (16.0 in) cold leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	350.3 K (170.8°F) at 60 s
Comments	None

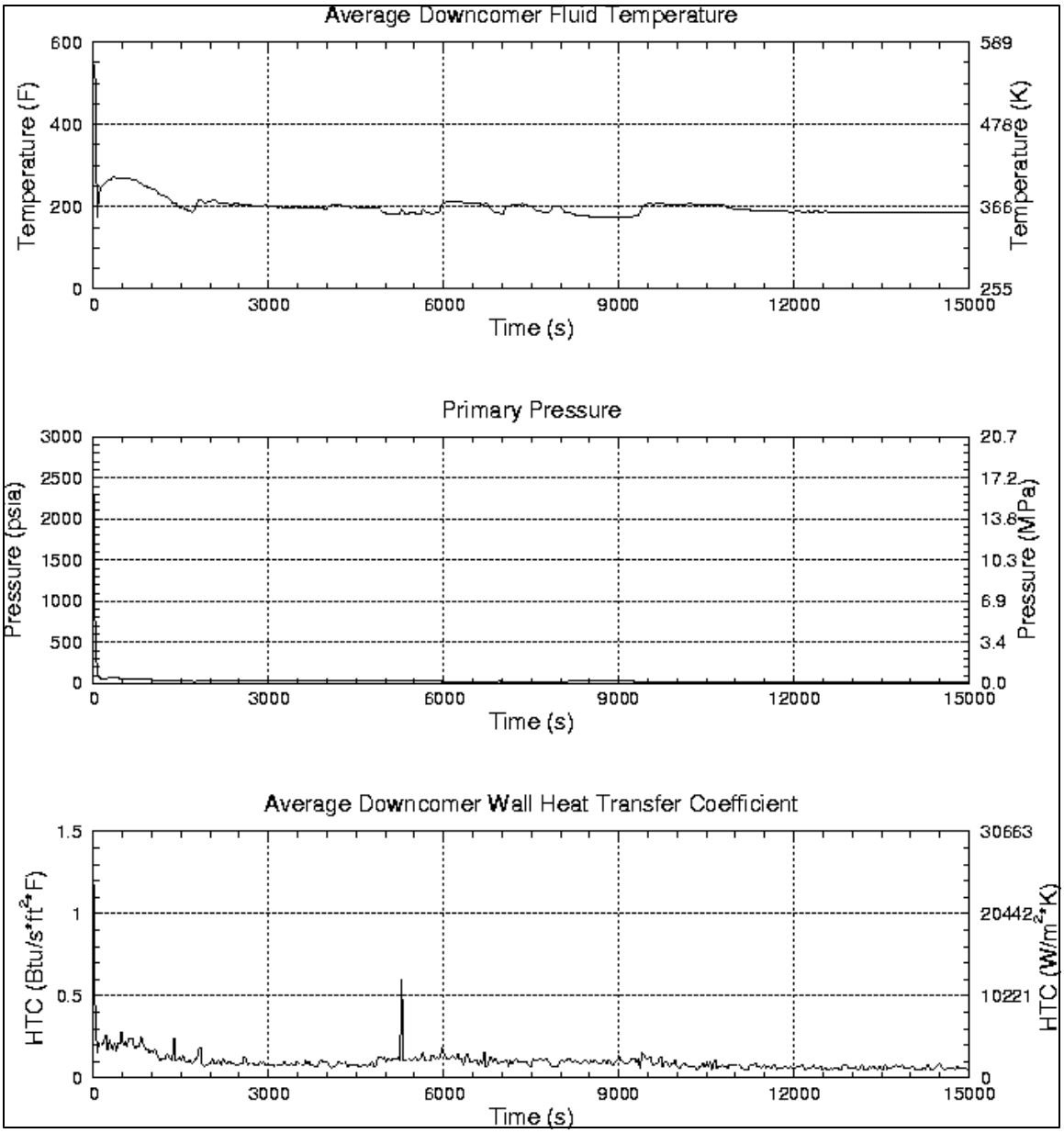


Figure B.2-64: Beaver Valley PTS Results for Case 063

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	284.4 K (52.2°F) at 8880 s
Comments	Case 034 @ HZP

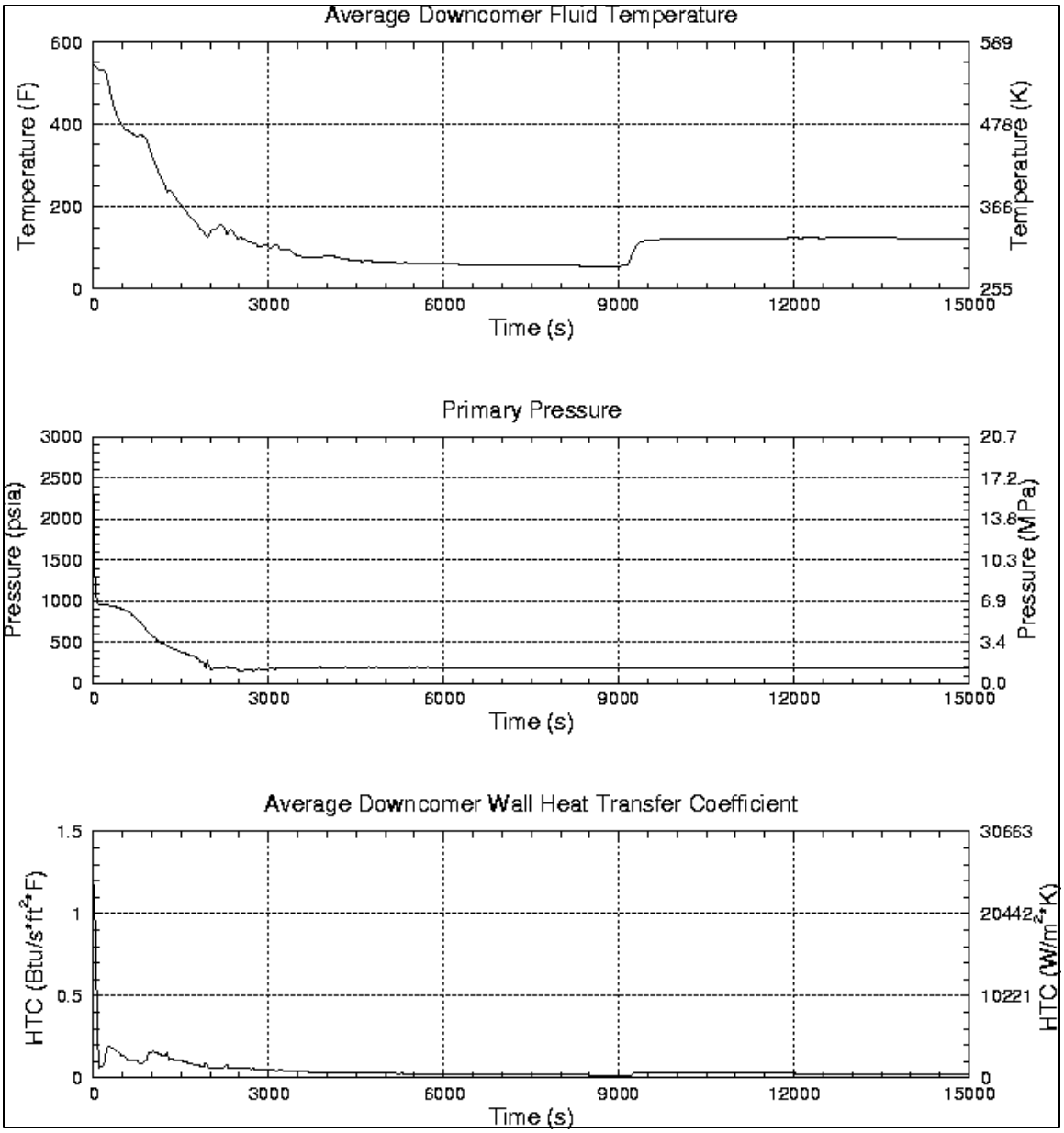


Figure B.2-65: Beaver Valley PTS Results for Case 064

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs, no HPI
Secondary Failures	None
Operator Actions	Open all ASDVs 5 minutes after HPI would have come on
Min DC Temp	327.3 K (129.5°F) at 10350 s
Comments	None

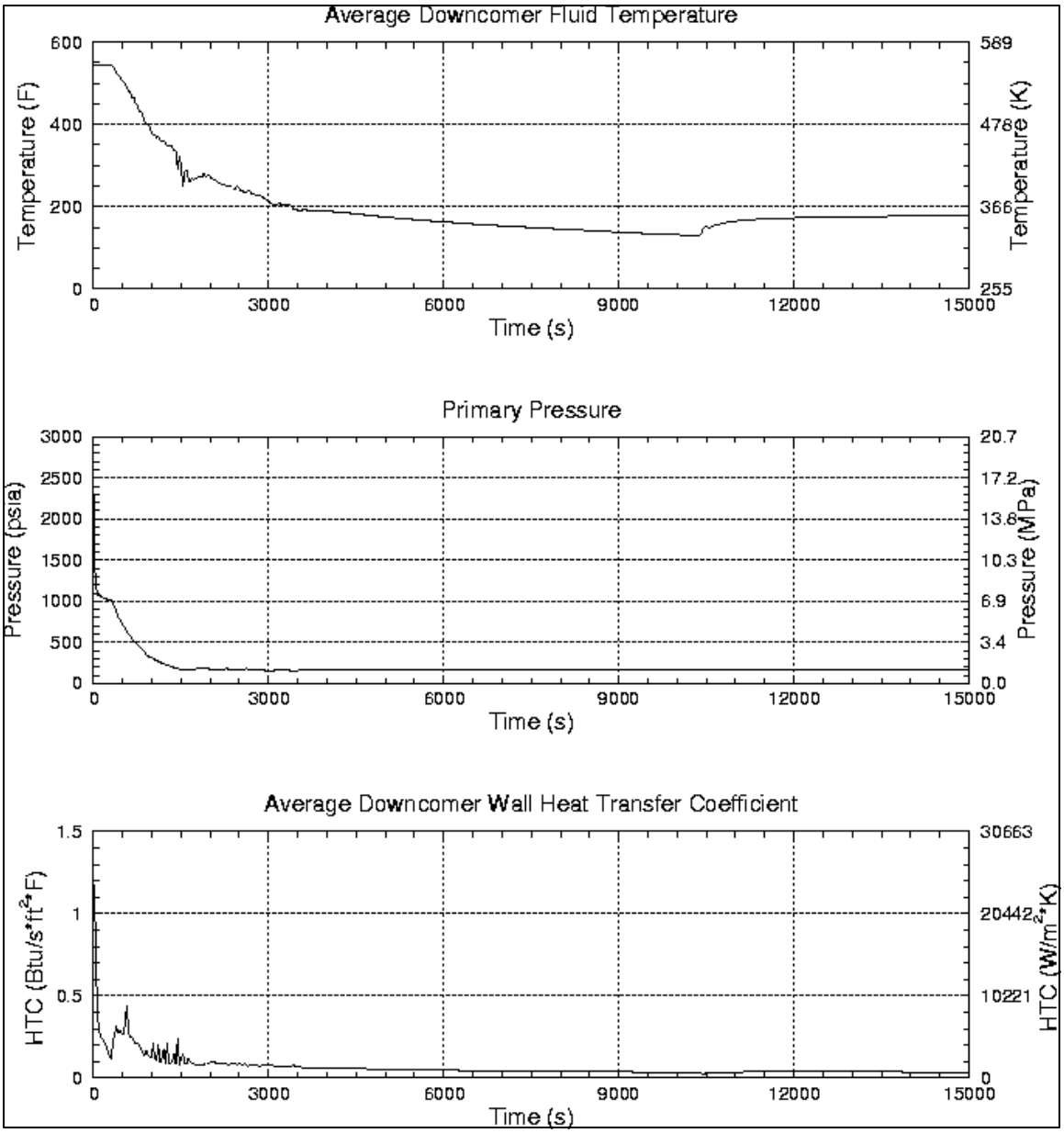


Figure B.2-66: Beaver Valley PTS Results for Case 065

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.4 K (72.1°F) at 13800 s
Comments	One SRV recloses at 3,000 seconds

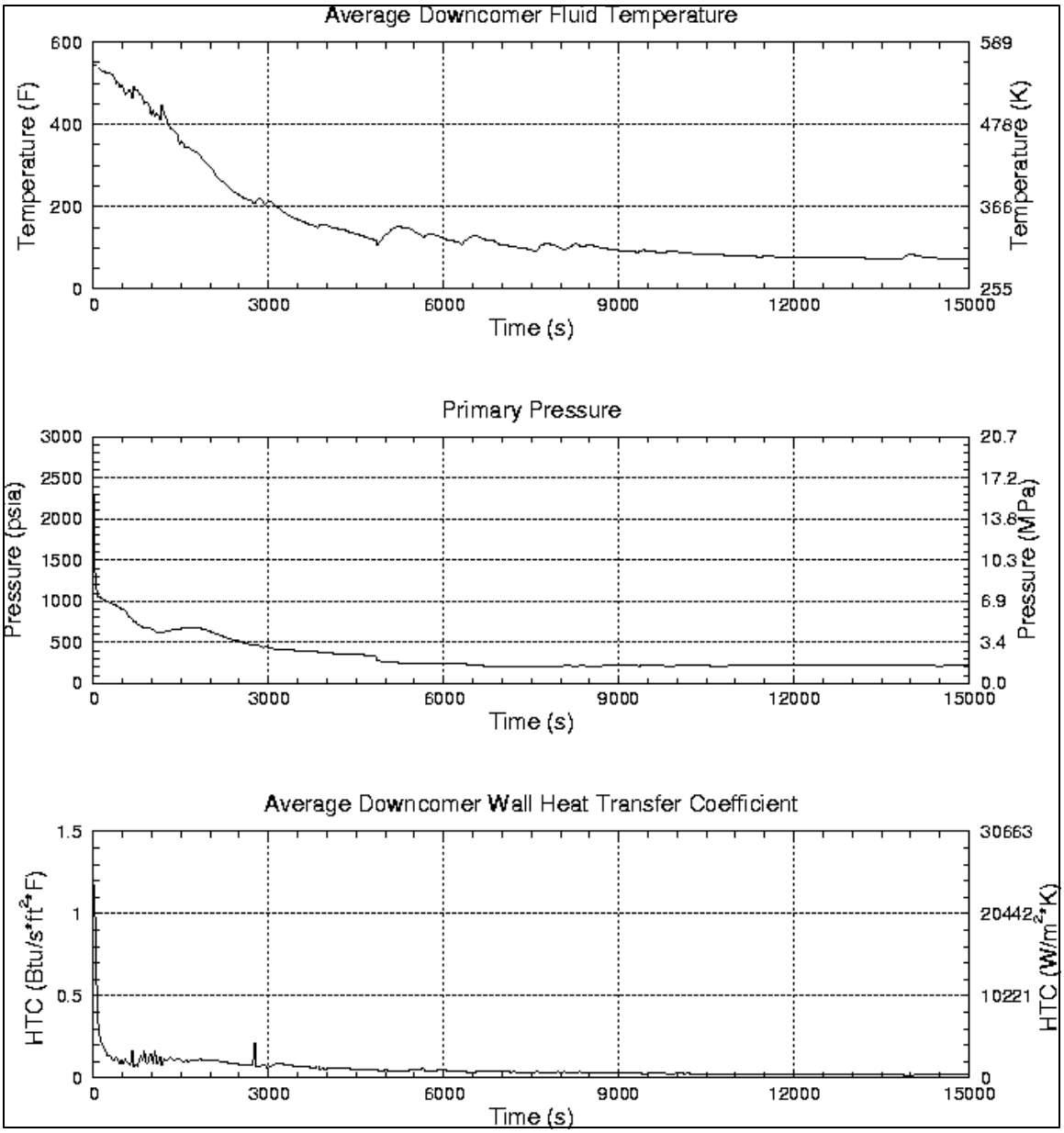


Figure B.2-67: Beaver Valley PTS Results for Case 066

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	294.4 K (70.3°F) at 12960 s
Comments	One SRV recloses at 6,000 seconds

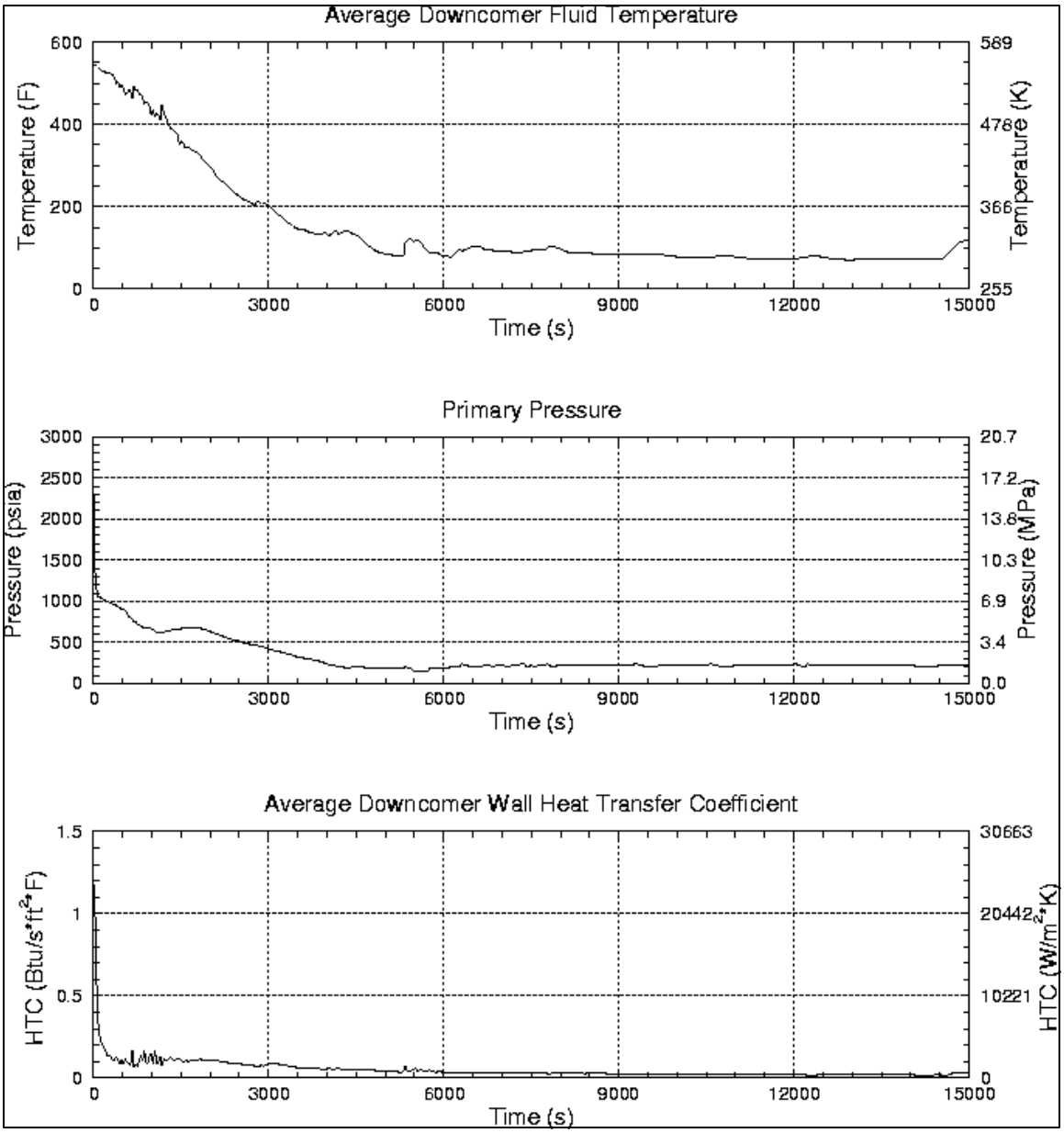


Figure B.2-68: Beaver Valley PTS Results for Case 067

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs, no HPI
Secondary Failures	None
Operator Actions	Open all ASDVs 5 minutes after HPI would have come on
Min DC Temp	345.7 K (162.6°F) at 6000 s
Comments	SRVs reclose at 6,000 seconds.

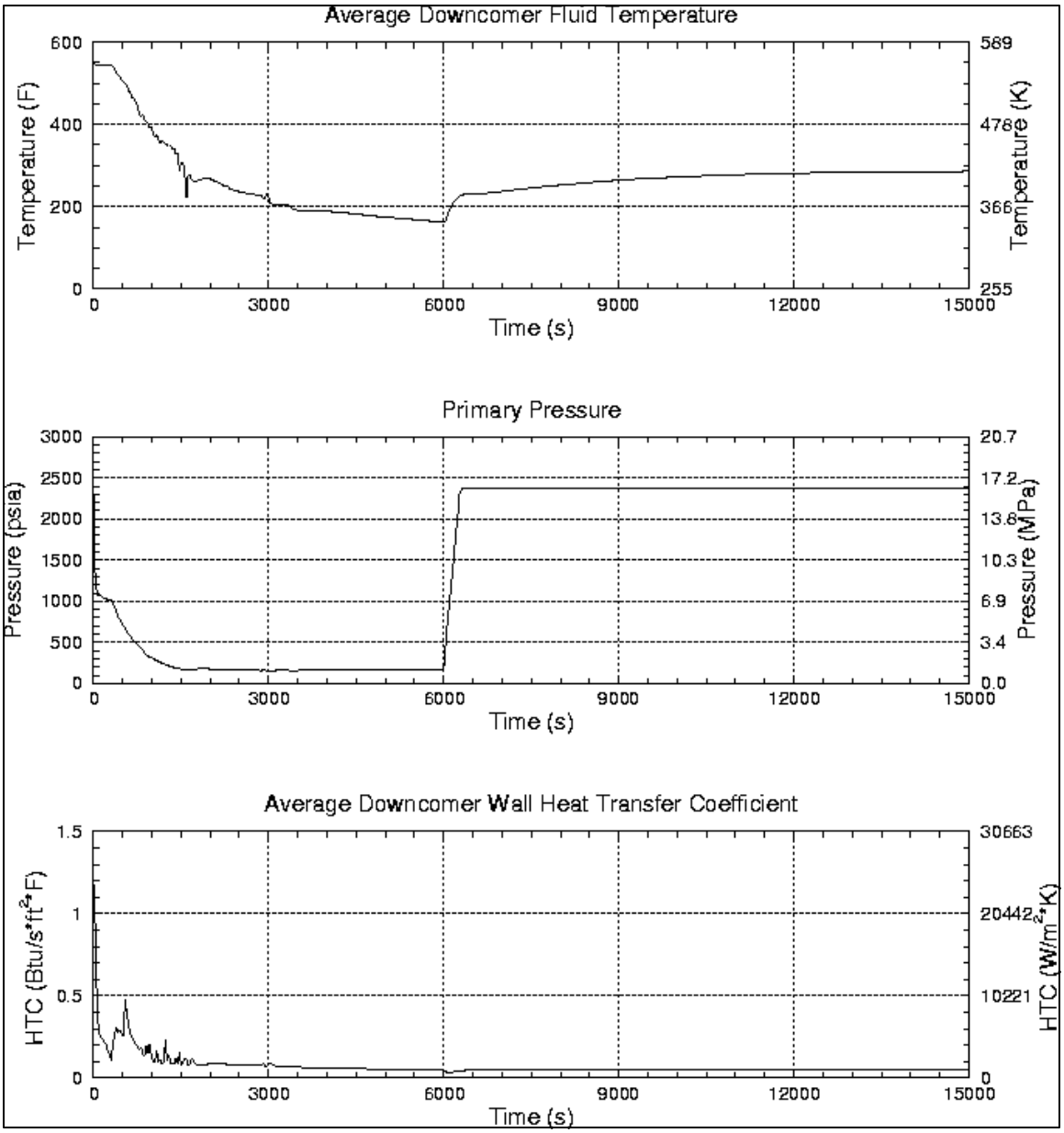


Figure B.2-69: Beaver Valley PTS Results for Case 068

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.4 K (72.1°F) at 15000 s
Comments	SRVs reclose at 3,000 seconds. Case 061 @ HZP

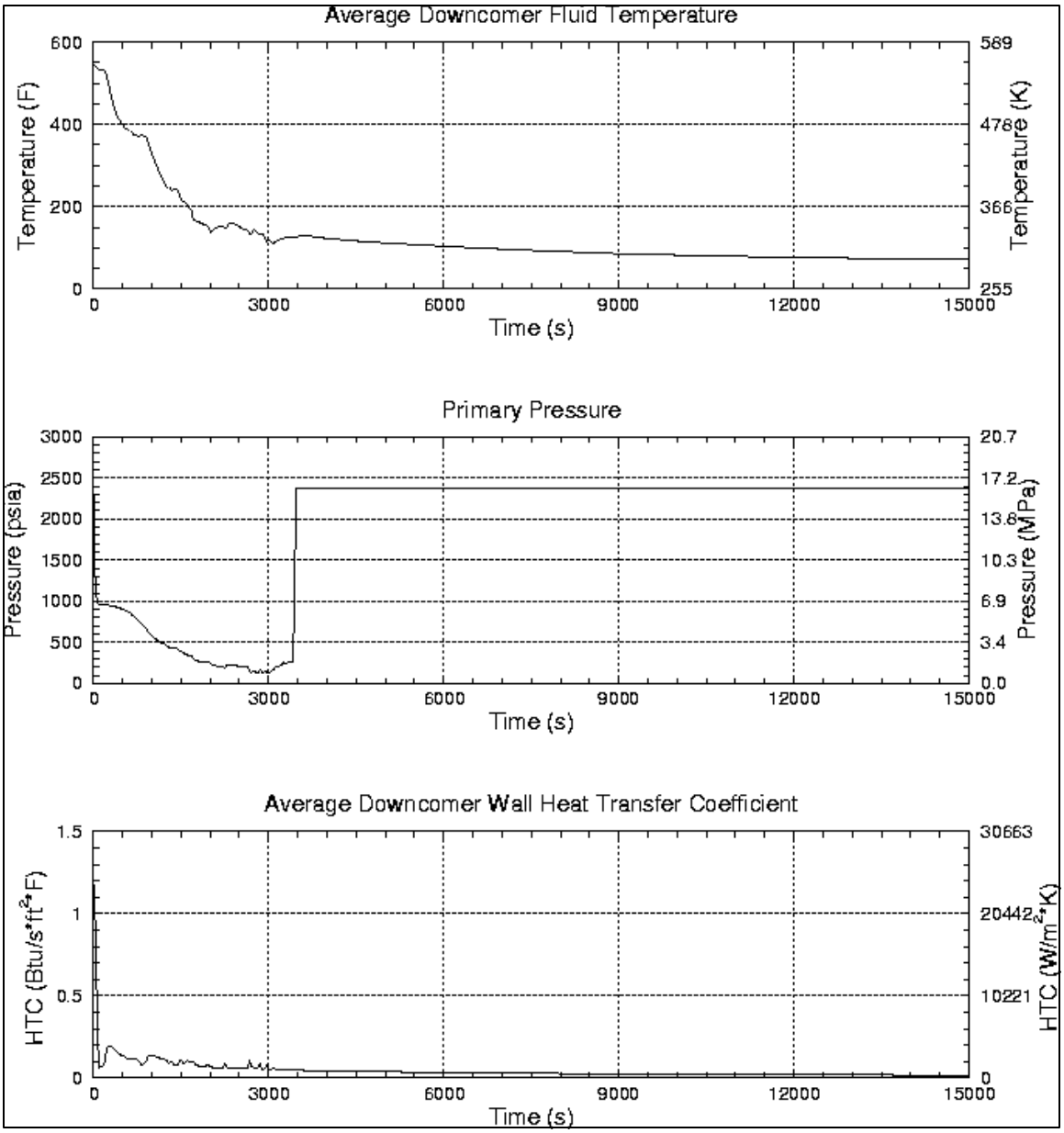


Figure B.2-70: Beaver Valley PTS Results for Case 069

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	288.6 K (59.7°F) at 5790 s
Comments	SRVs reclose at 6,000 seconds. Case 062 @ HZP

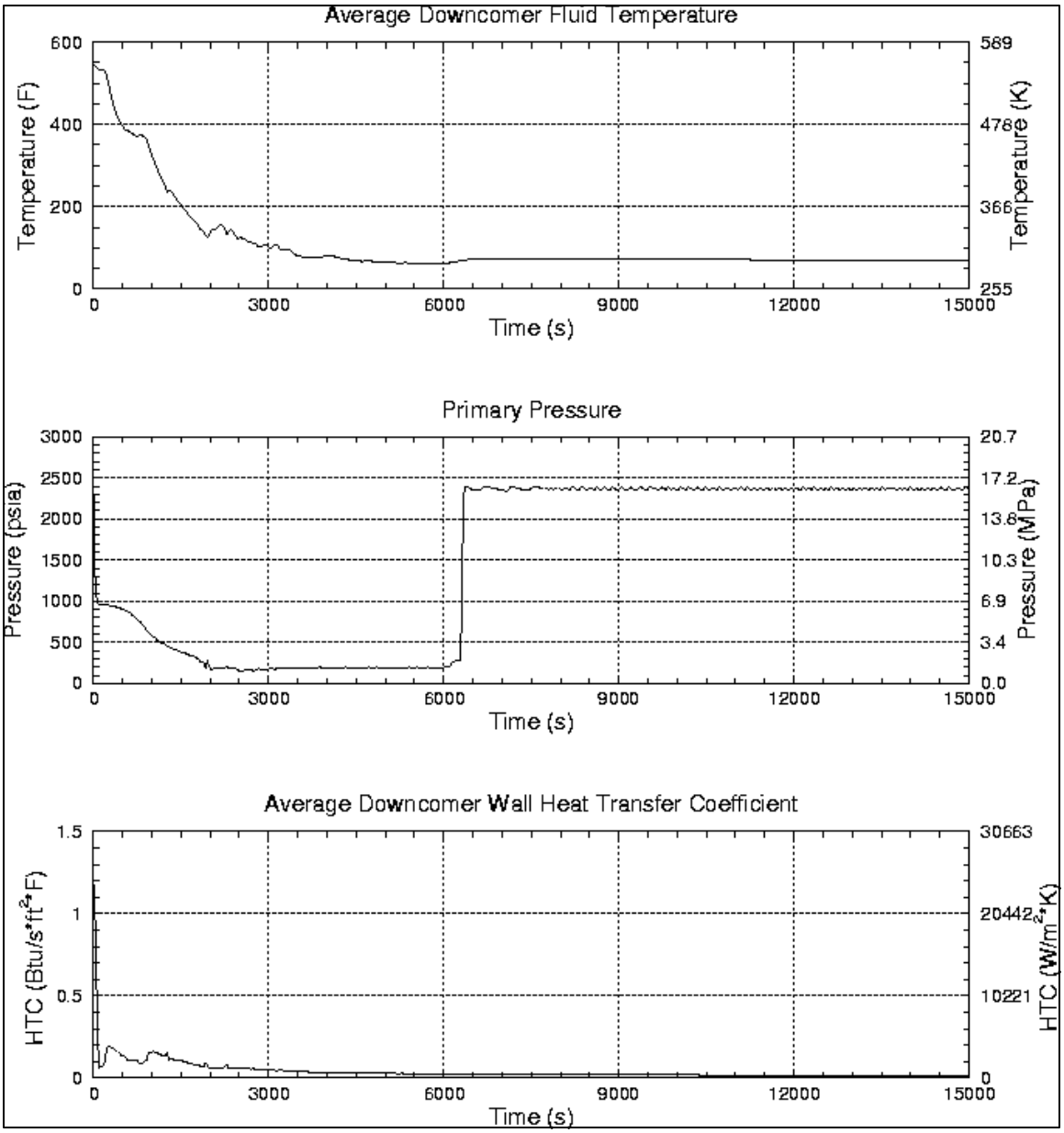


Figure B.2-71: Beaver Valley PTS Results for Case 070

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	295.0 K (71.2°F) at 15000 s
Comments	SRV recloses at 6,000 seconds. Case 060 @ HZP

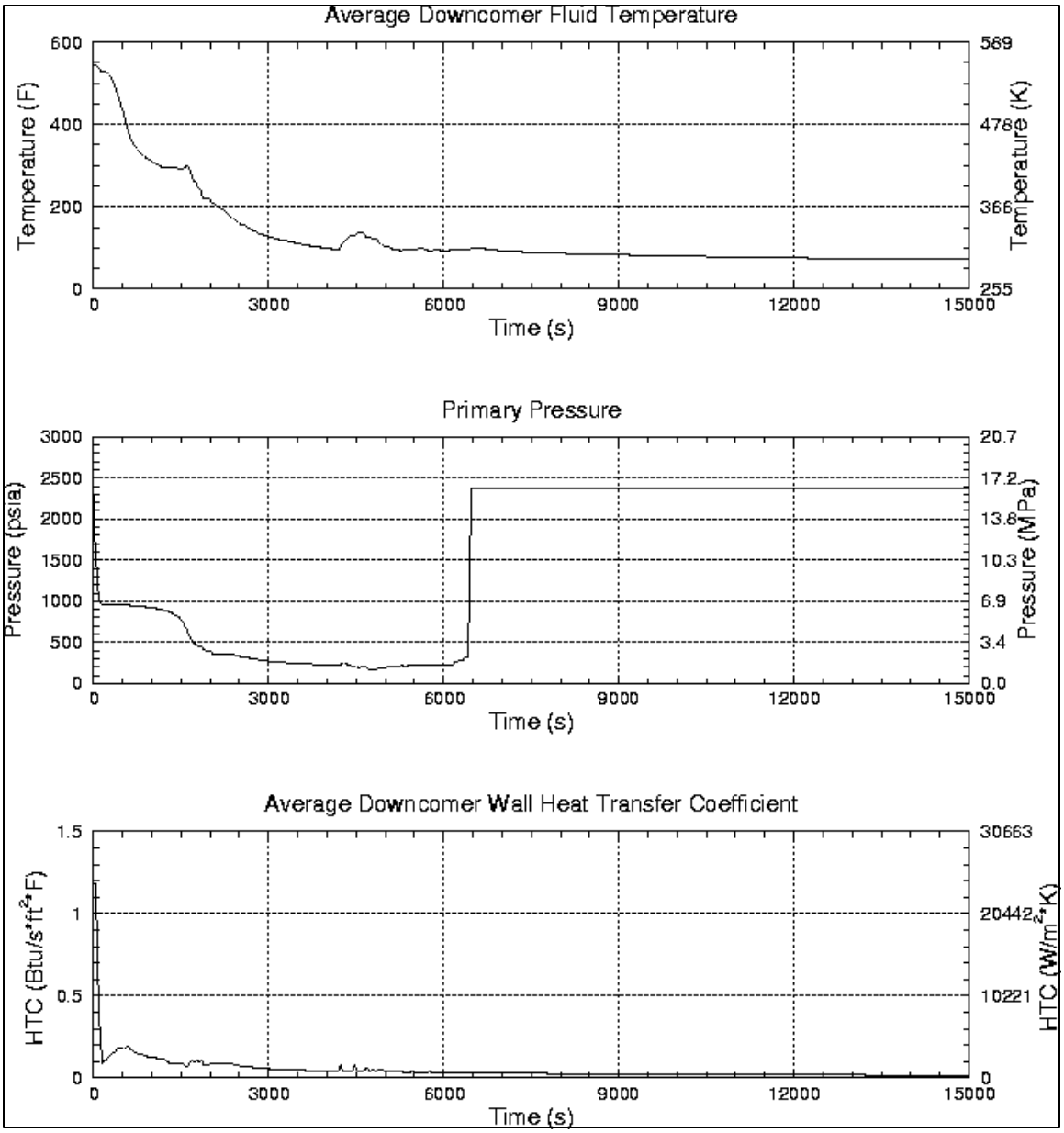


Figure B.2-72: Beaver Valley PTS Results for Case 071

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV, no HPI
Secondary Failures	None
Operator Actions	Open all ASDVs 5 minutes after HPI would have come on
Min DC Temp	358.3 K (185.2°F) at 15000 s
Comments	None

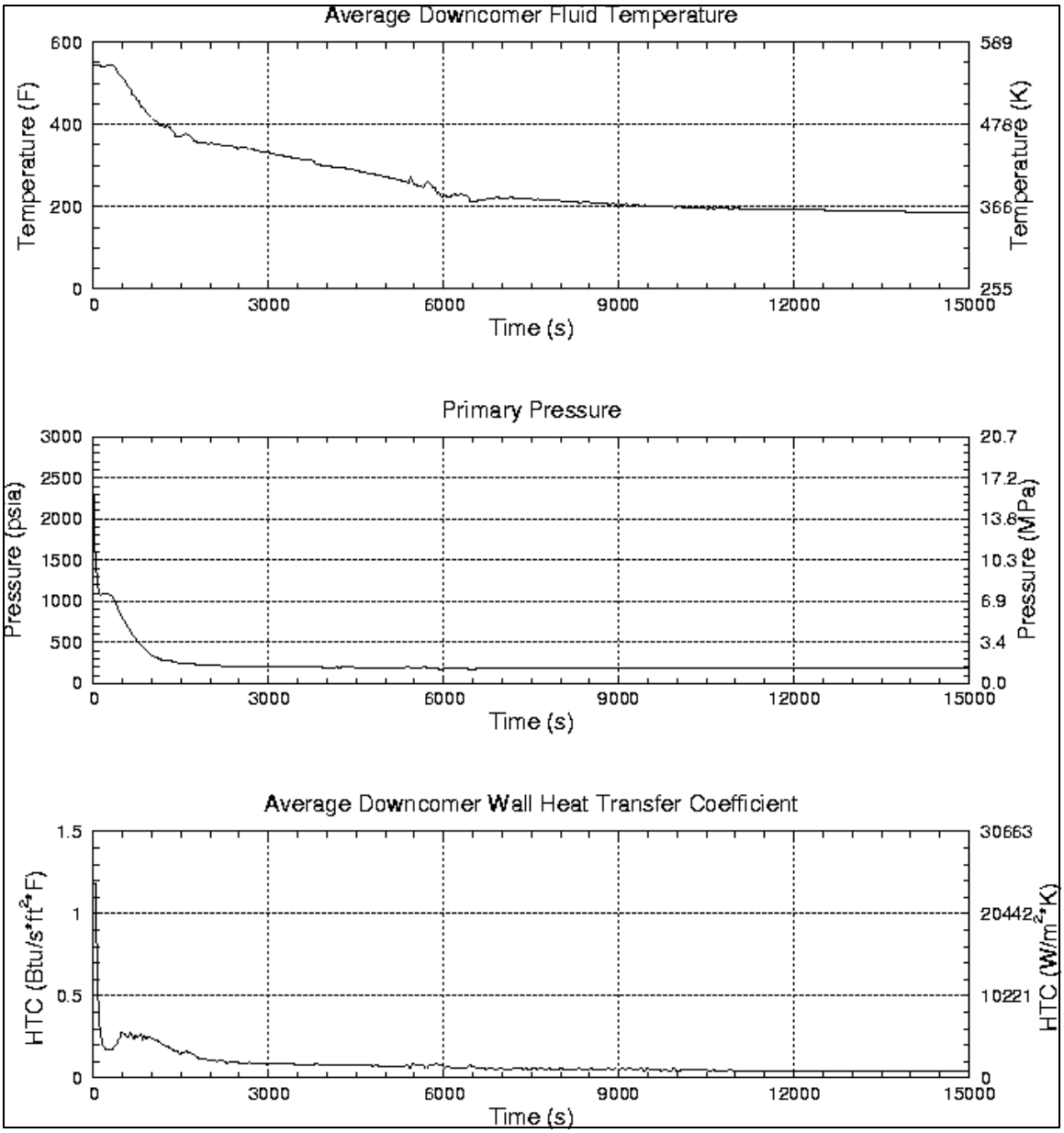


Figure B.2-73: Beaver Valley PTS Results for Case 072

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV, no HPI
Secondary Failures	None
Operator Actions	Open all ASDVs 5 minutes after HPI would have come on
Min DC Temp	285.0 K (53.3°F) at 15000 s
Comments	Case 072 @ HZP

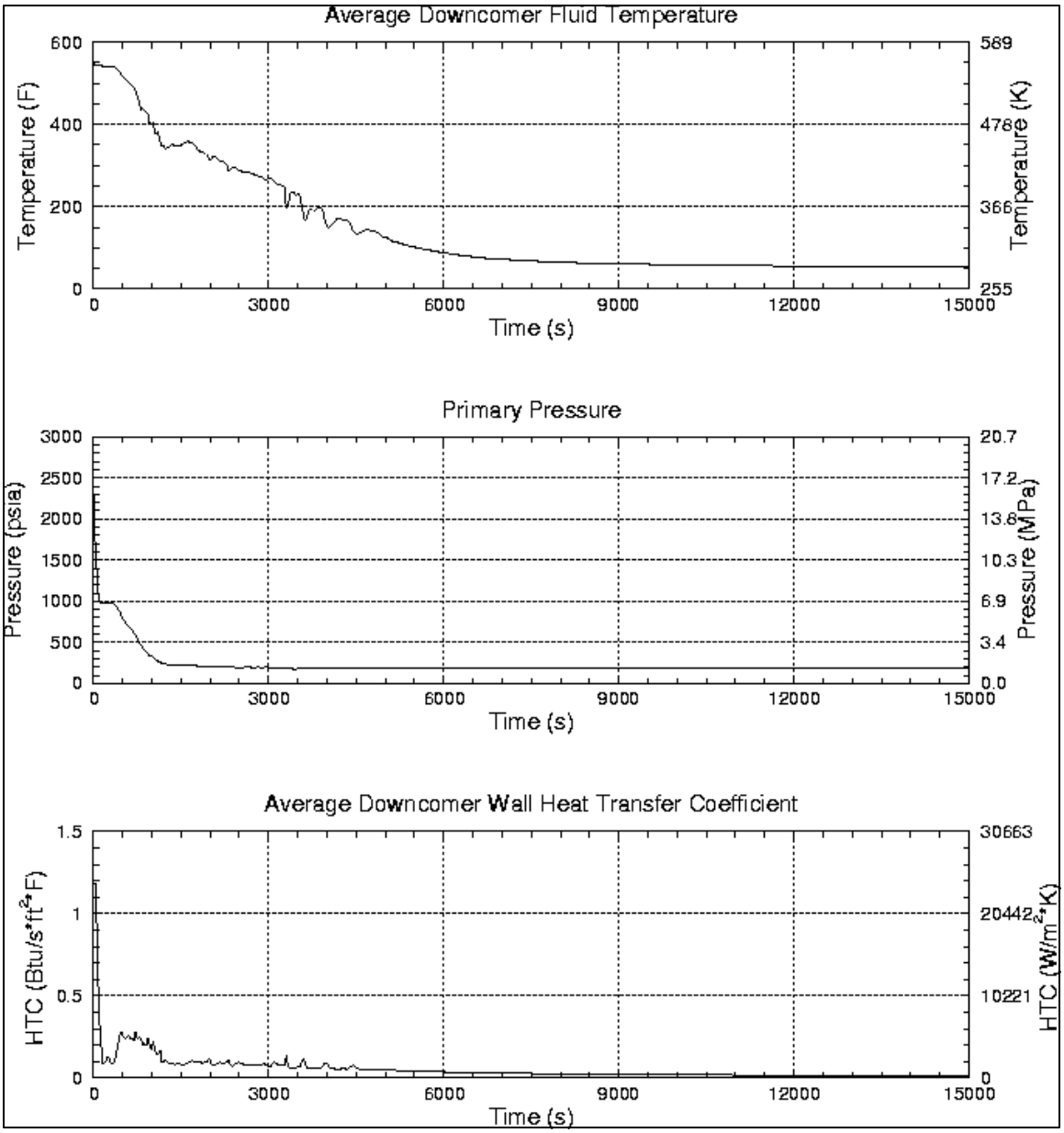


Figure B.2-74: Beaver Valley PTS Results for Case 073

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	None
Min DC Temp	378.9 K (222.4°F) at 13710 s
Comments	AFW continues to feed SG A

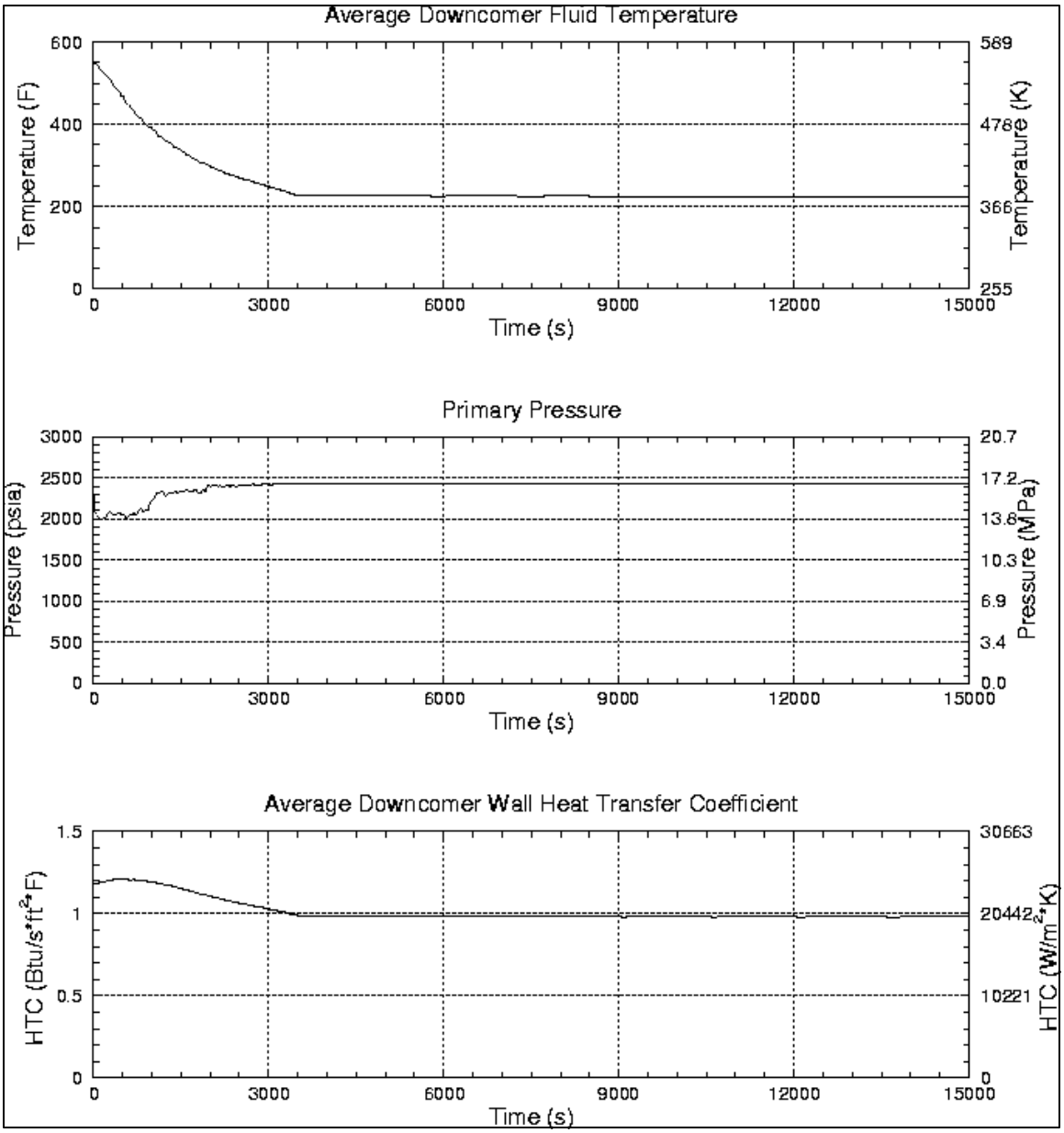


Figure B.2-75: Beaver Valley PTS Results for Case 074

Case Category	RT/TT
Primary Failures	None
Secondary Failures	MFW overfeed of all SGs
Operator Actions	RCP's are tripped
Min DC Temp	507.8 K (454.4°F) at 15000 s
Comments	MFW keeps SGs filled to top.

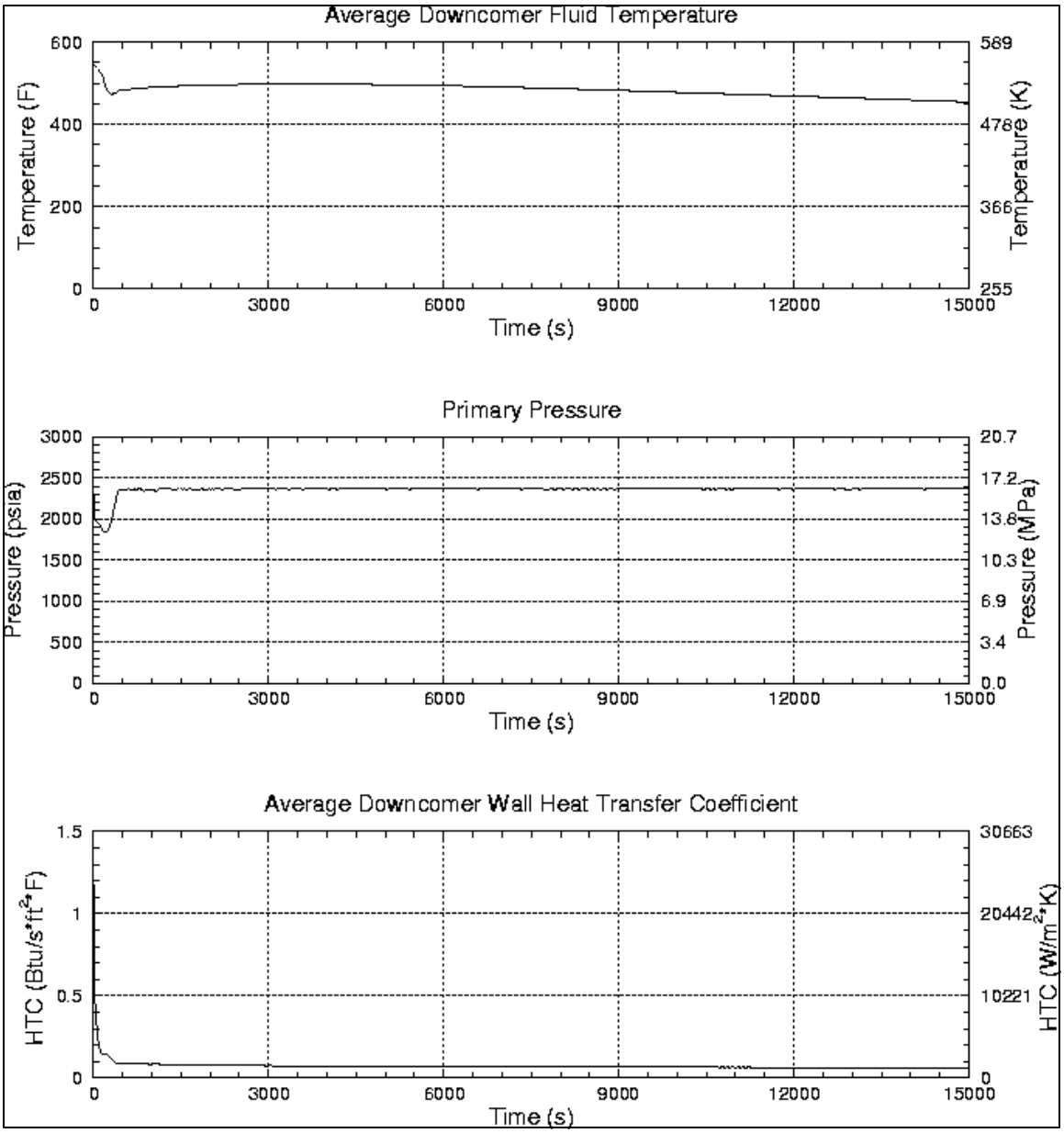


Figure B.2-76: Beaver Valley PTS Results for Case 075

Case Category	RT/TT, HZP
Primary Failures	None
Secondary Failures	MFW overfeed of all SGs
Operator Actions	RCP's are tripped
Min DC Temp	335.0 K (143.4°F) at 14610 s
Comments	MFW keeps SGs filled to top. Case 075 @ HZP

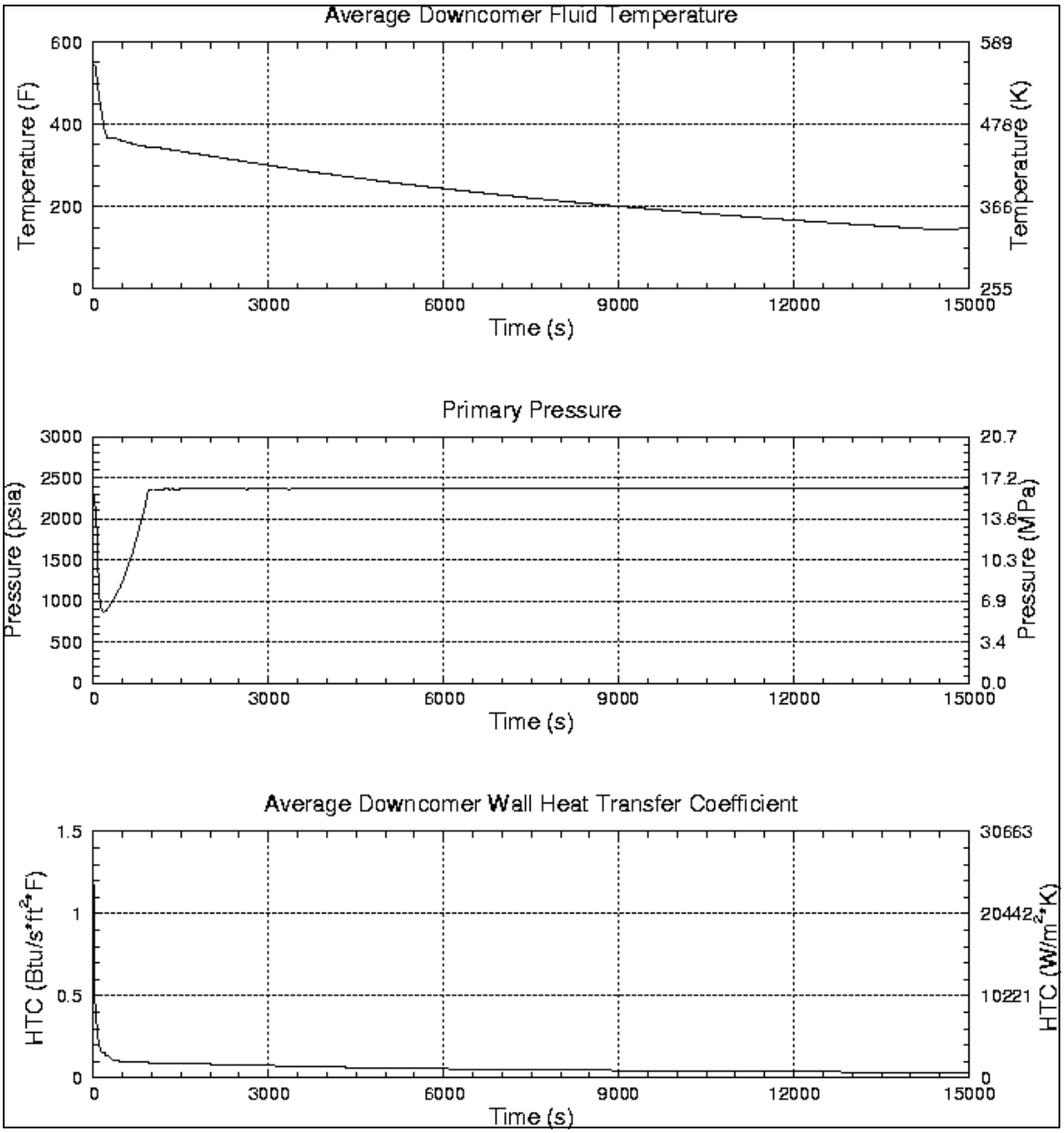


Figure B.2-77: Beaver Valley PTS Results for Case 076

Case Category	RT/TT, HZP
Primary Failures	None
Secondary Failures	Loss of all feedwater
Operator Actions	Opens all pressurizer PORVs and uses all HPI pumps
Min DC Temp	559.2 K (547.0°F) at 10140 s
Comments	Feed and bleed started upon high pressurizer pressure or low SG level. Case 031 @ HZP

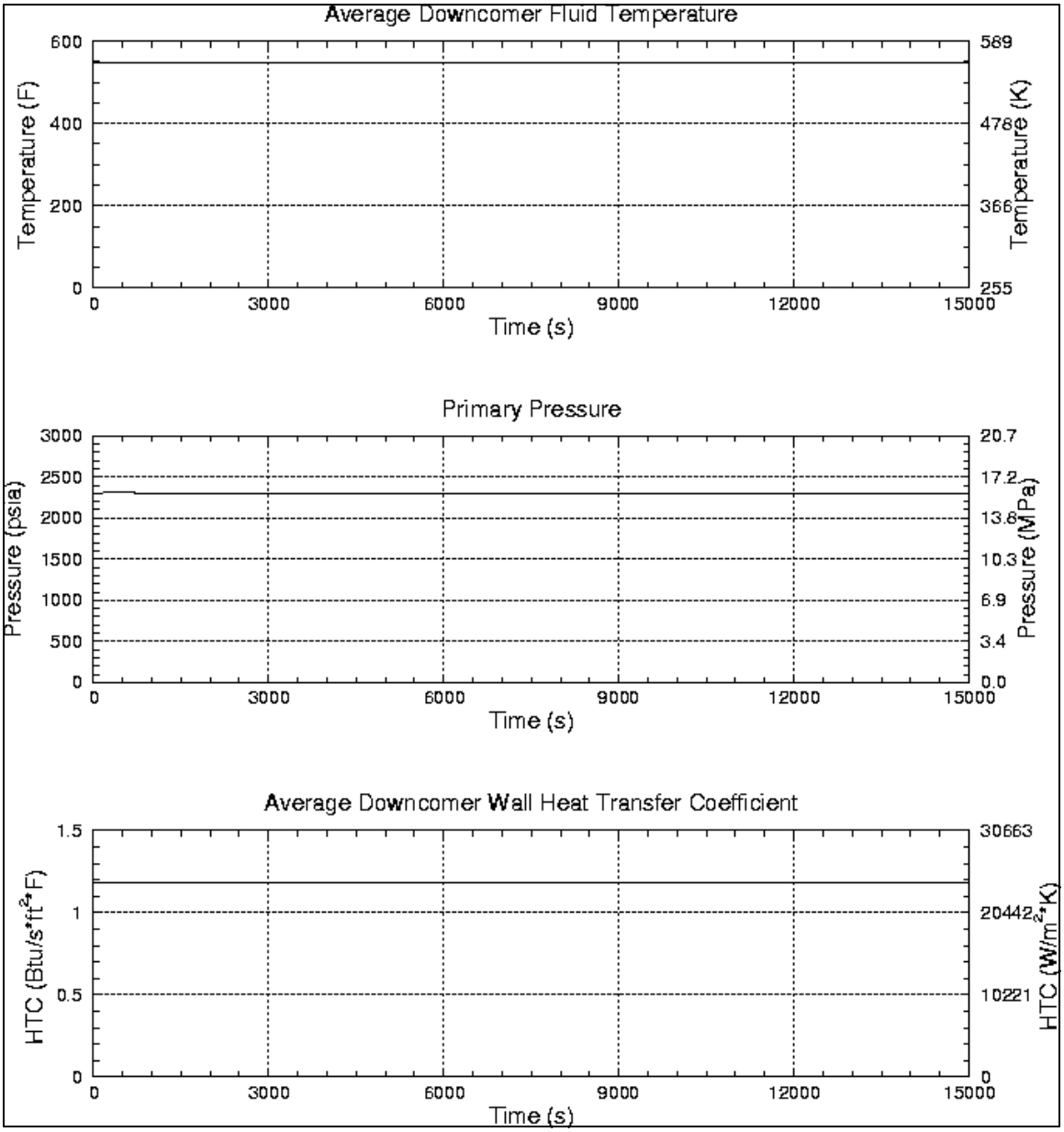


Figure B.2-78: Beaver Valley PTS Results for Case 077

Case Category	RT/TT
Primary Failures	None
Secondary Failures	Loss of MFW and AFW
Operator Actions	Open all ASDVs
Min DC Temp	429.8 K (313.9°F) at 15000 s
Comments	Condensate pumps used to supply feedwater.

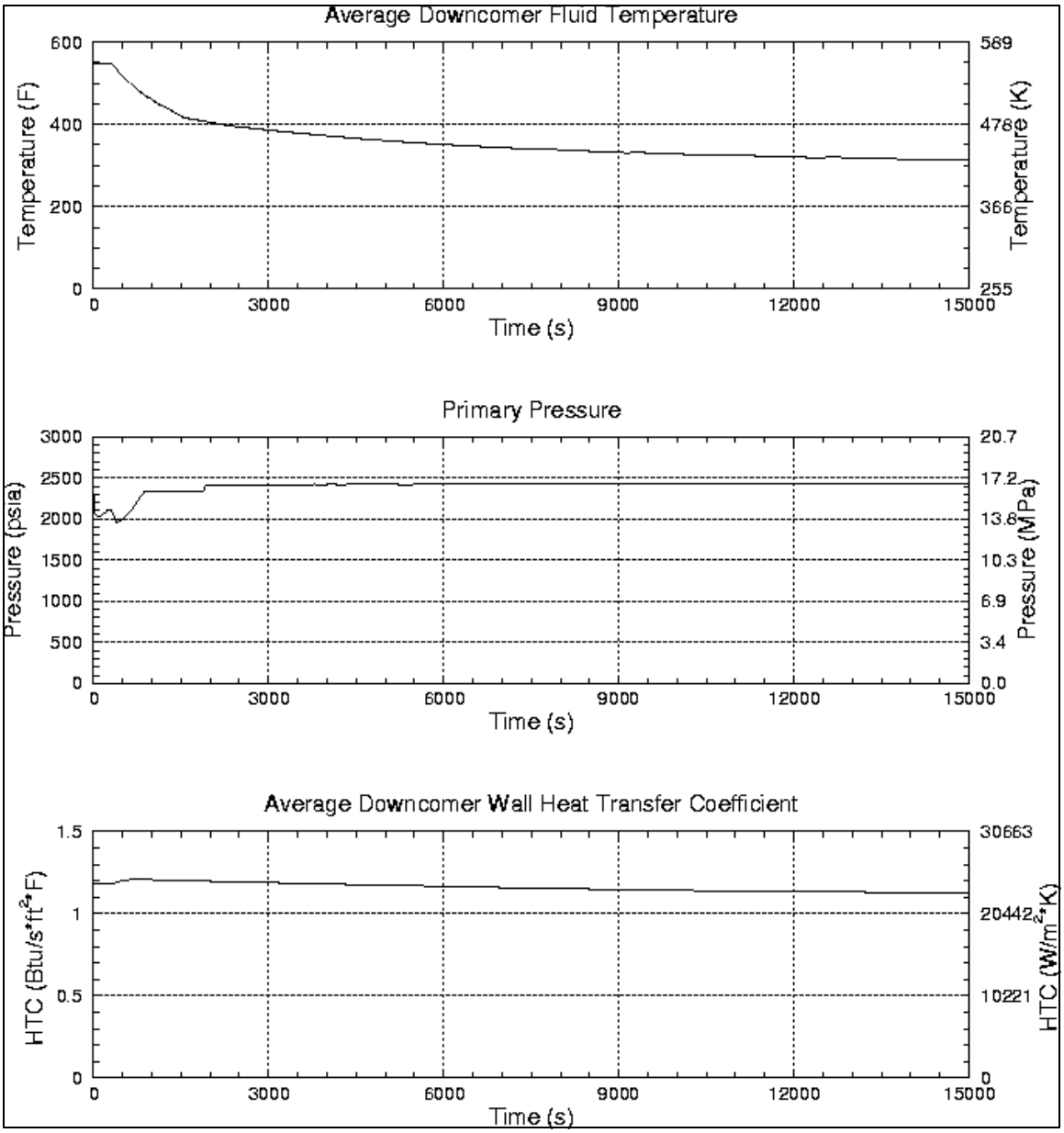


Figure B.2-79: Beaver Valley PTS Results for Case 078

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped
Min DC Temp	363.3 K (194.3°F) at 13380 s
Comments	AFW continues to feed SG A

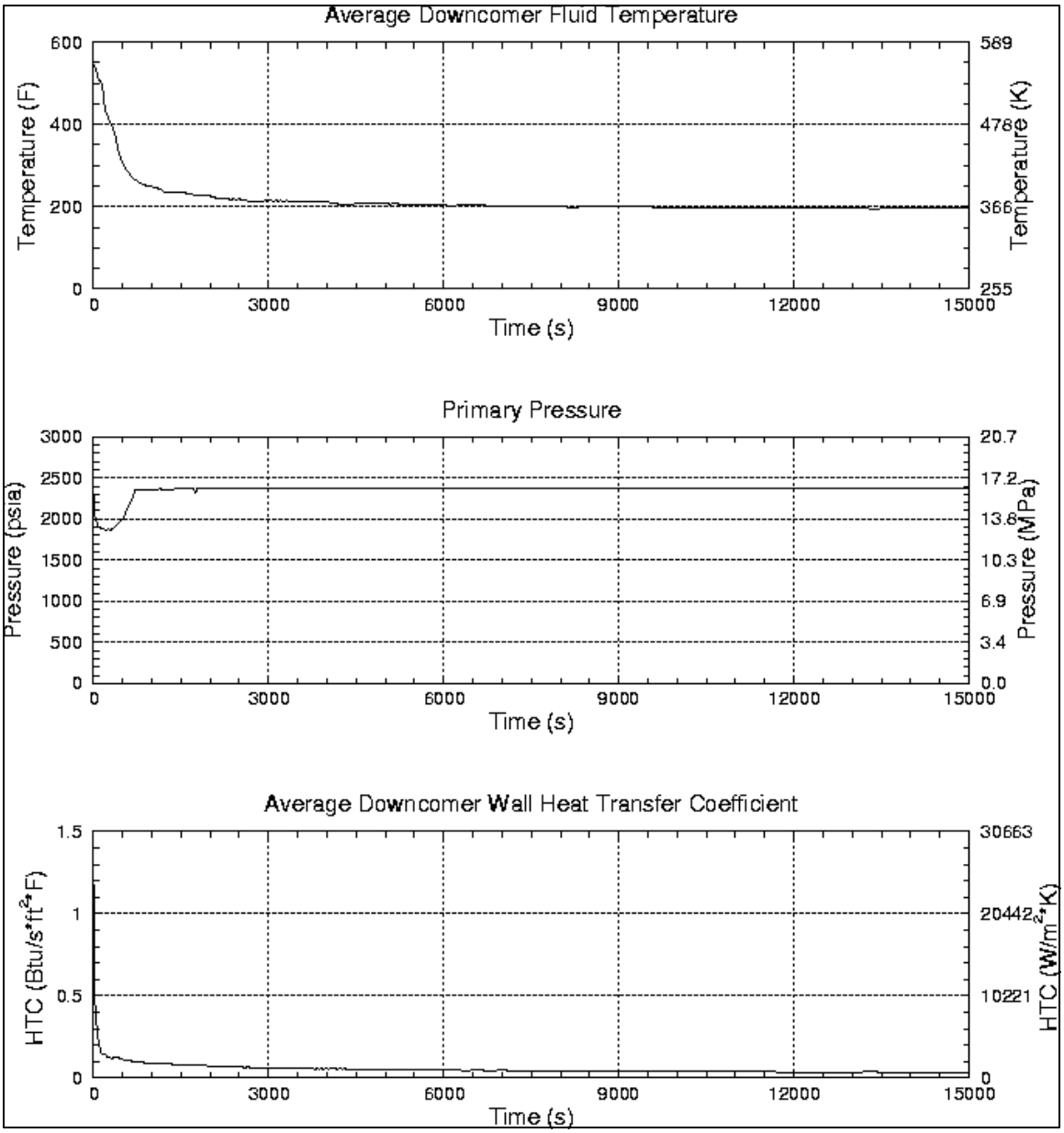


Figure B.2-80: Beaver Valley PTS Results for Case 079

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped
Min DC Temp	335.5 K (144.3°F) at 15000 s
Comments	AFW continues to feed SG A Case 079 @ HZP.

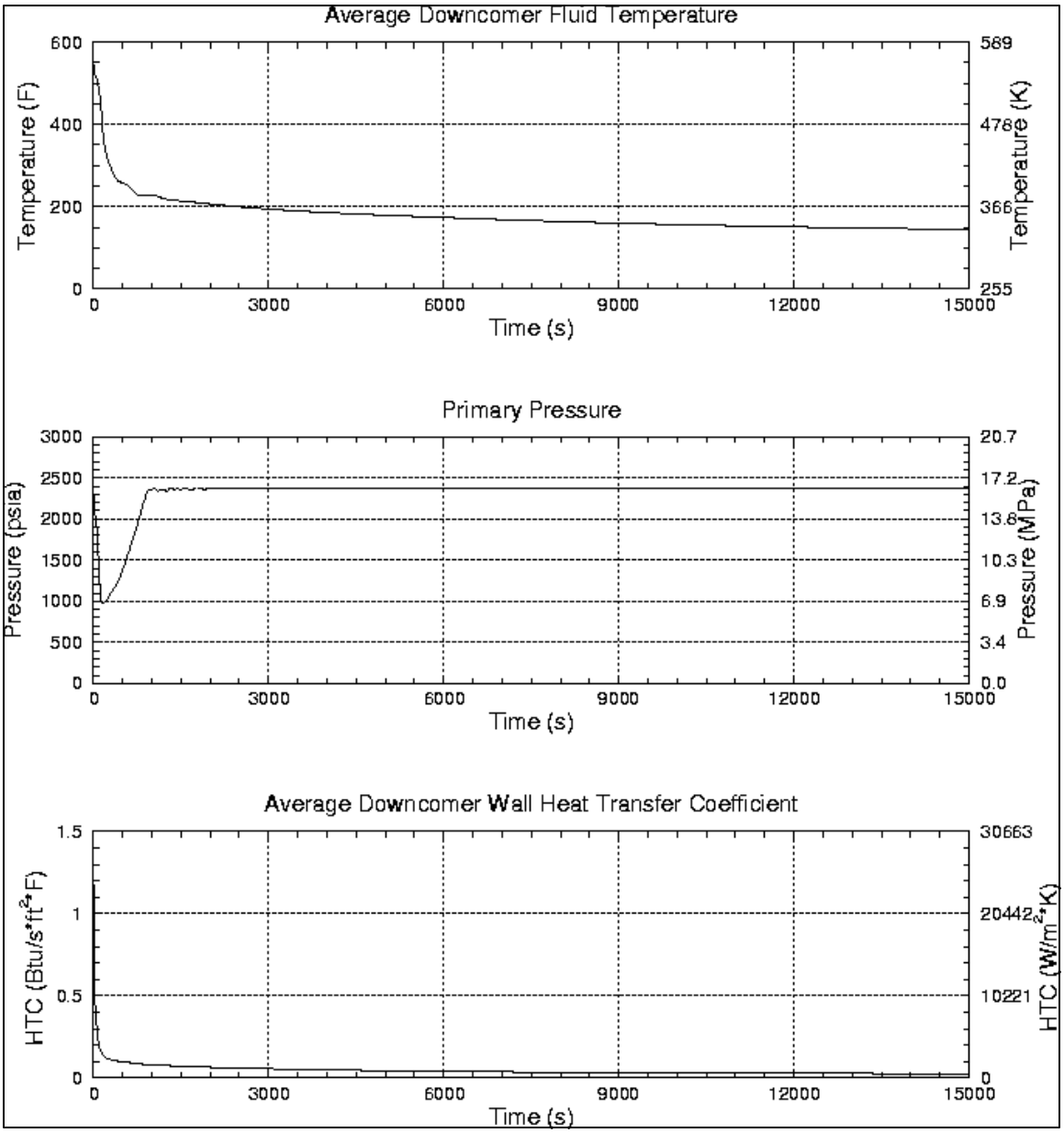


Figure B.2-81: Beaver Valley PTS Results for Case 080

Case Category	MSLB
Primary Failures	Initial HPI failure
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	Open ASDVs on SG A
Min DC Temp	388.5 K (239.6°F) at 3120 s
Comments	AFW continues to feed SG A. HPI is available after CFTs discharge 50%.

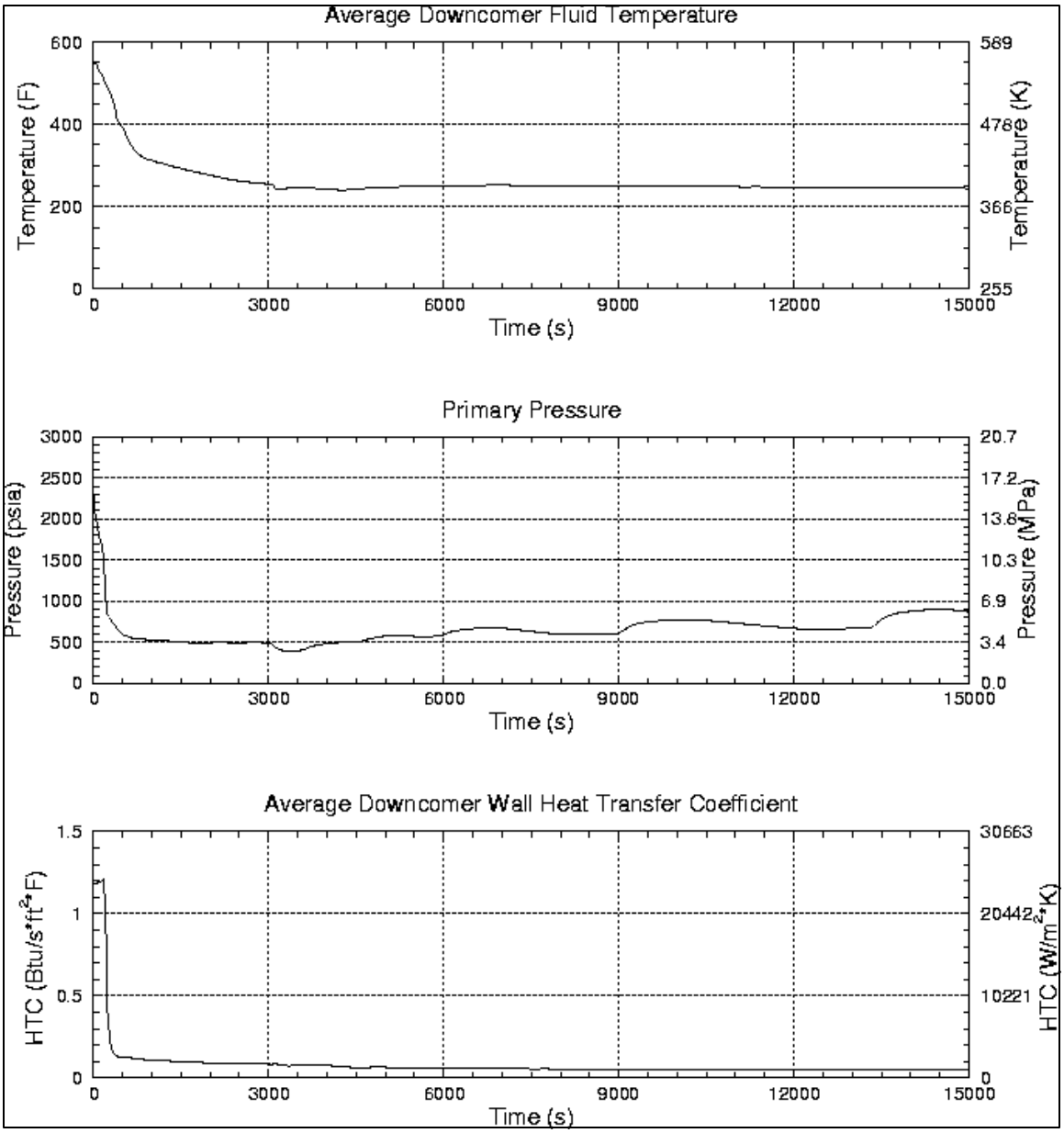


Figure B.2-82: Beaver Valley PTS Results for Case 081

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV, no HPI
Secondary Failures	None
Operator Actions	Open all ASDVs 5 minutes after HPI would have come on
Min DC Temp	379.0 K (222.6°F) at 5970 s
Comments	SRV recloses at 6,000 seconds.

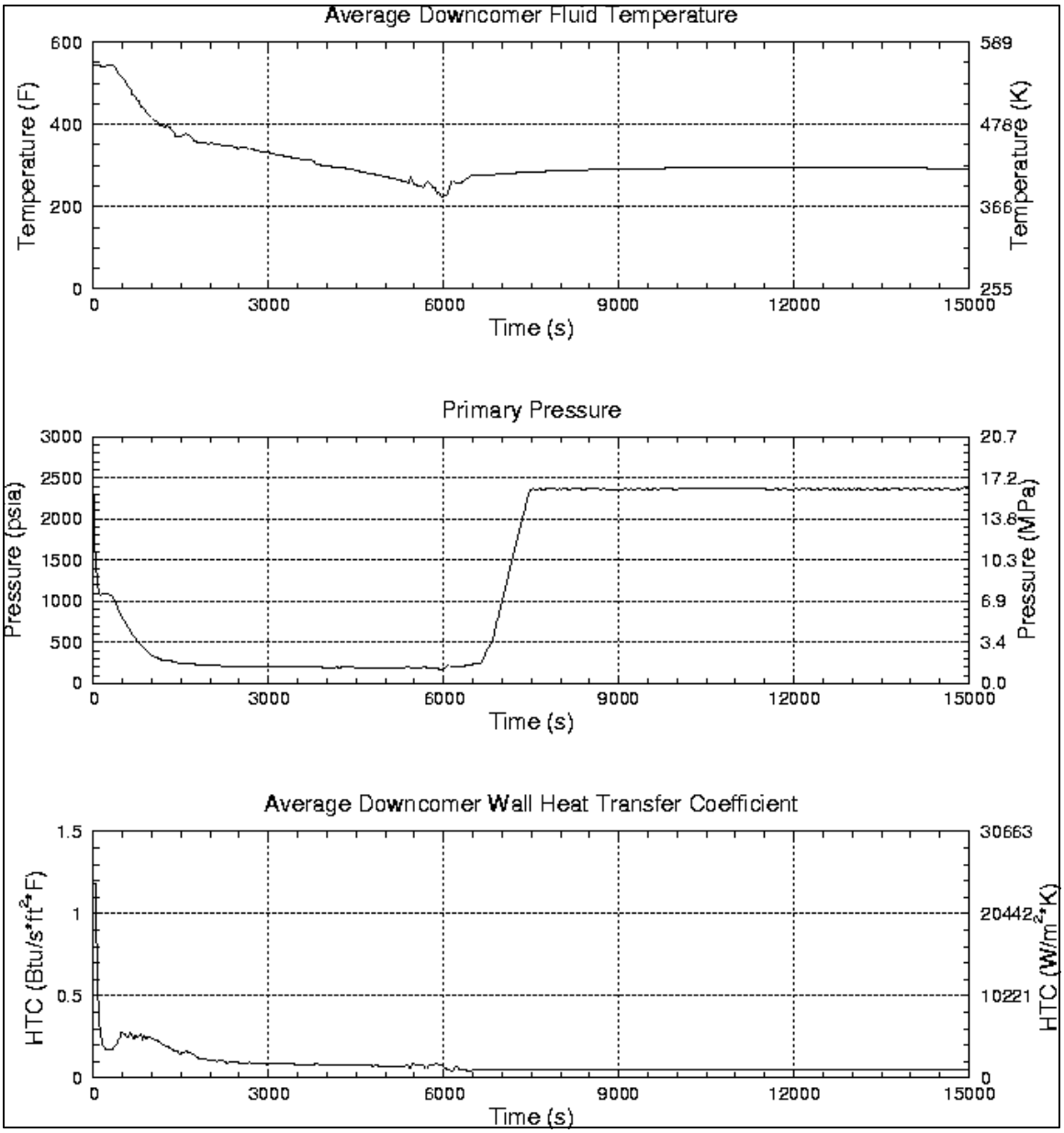


Figure B.2-83: Beaver Valley PTS Results for Case 082

Case Category	LOCA
Primary Failures	2.54 cm (1.0 in) surge line break, no HPI
Secondary Failures	no motor AFW, overfeed of SGs with turbine AFW
Operator Actions	RCP's are tripped, MFW tripped, open all ASDVs 5 minutes after HPI would have come on
Min DC Temp	392.8 K (247.3°F) at 14400 s
Comments	None

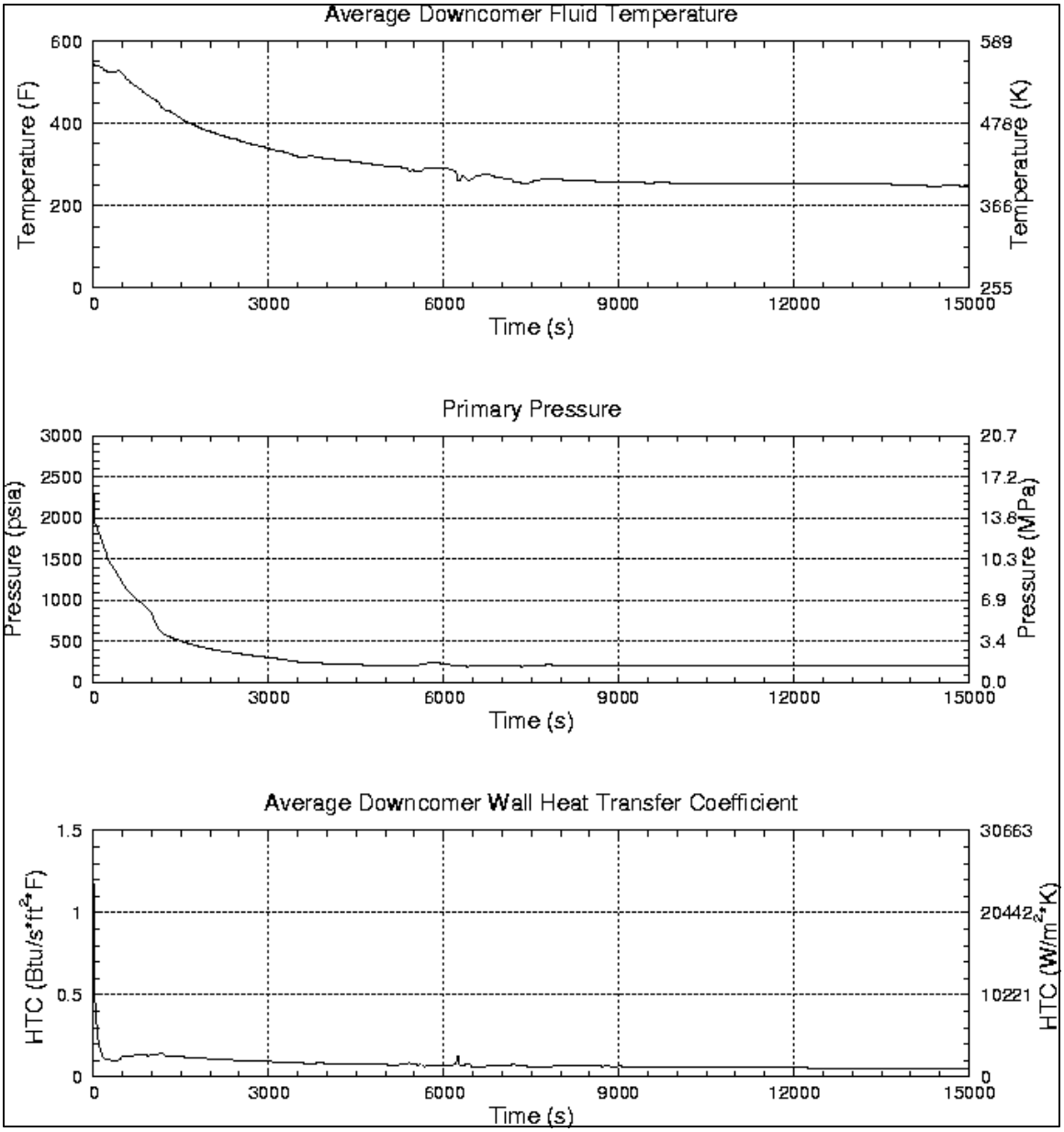


Figure B.2-84: Beaver Valley PTS Results for Case 083

Case Category	LOCA, HZP
Primary Failures	14.37 cm (5.657 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	289.0 K (60.5°F) at 2160 s
Comments	Accumulators allowed to fully discharge.

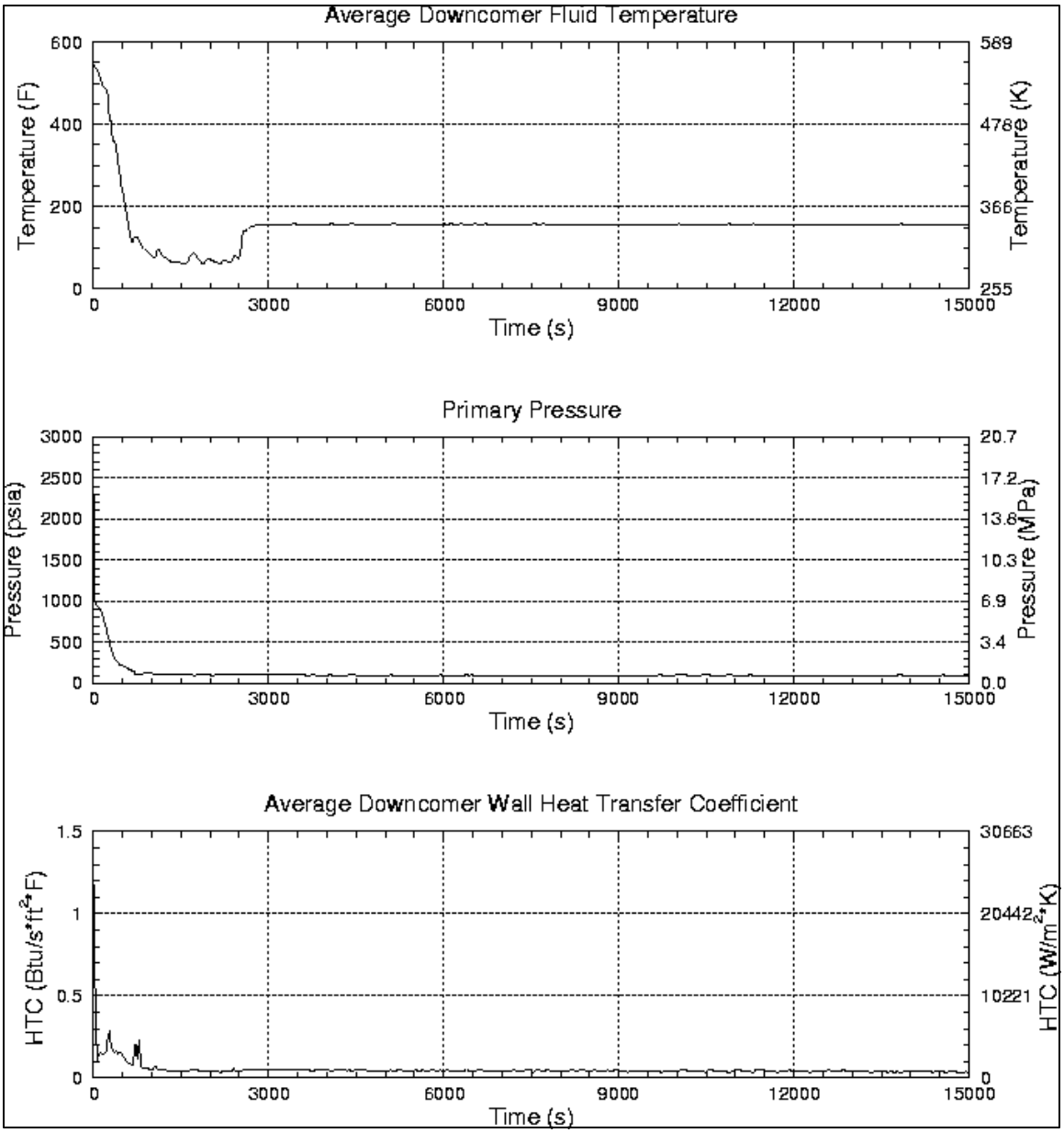


Figure B.2-85: Beaver Valley PTS Results for Case 084

Case Category	LOCA
Primary Failures	14.37 cm (5.657 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	287.7 K (58.2°F) at 2310 s
Comments	Accumulators allowed to fully discharge.

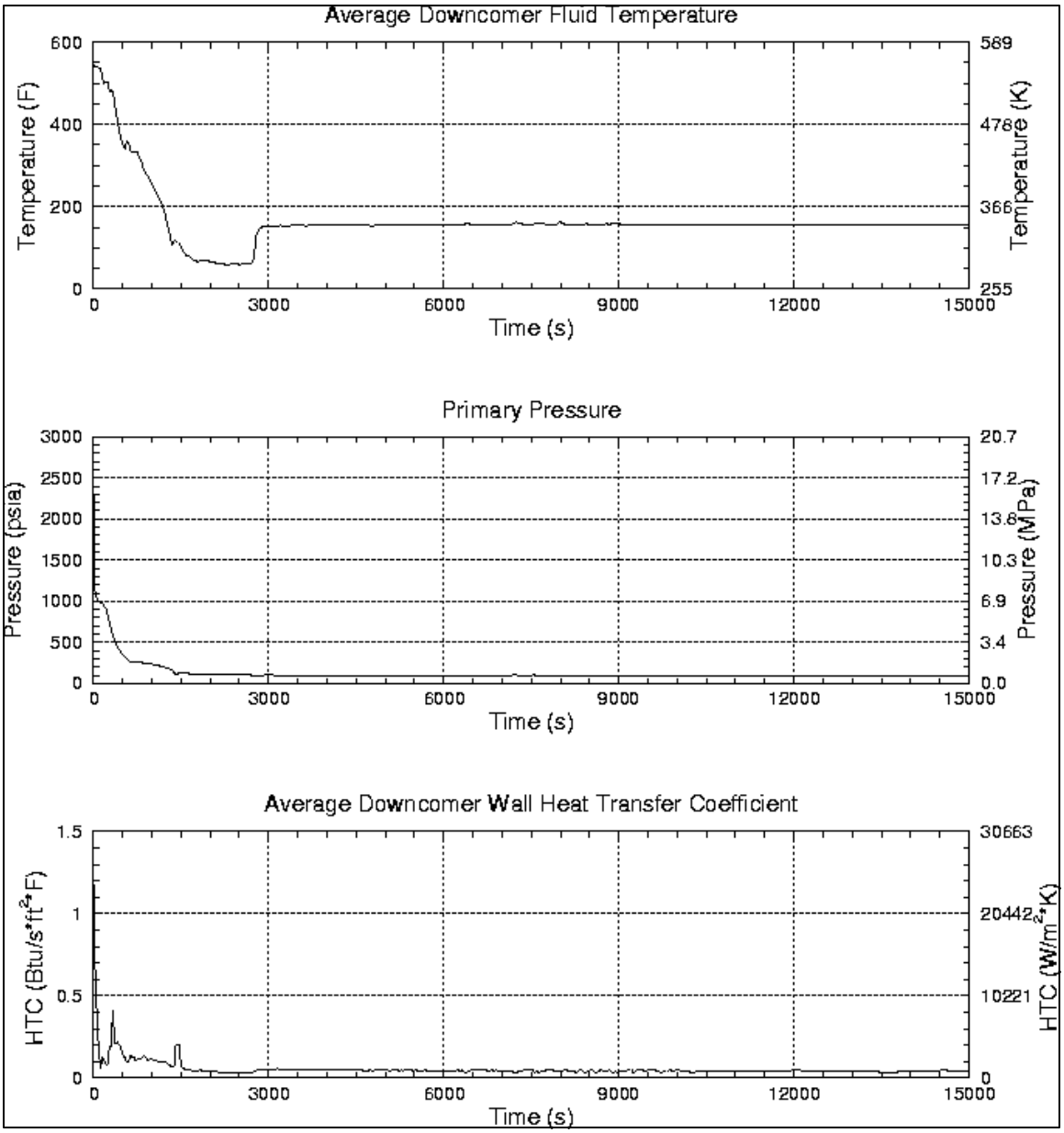


Figure B.2-86: Beaver Valley PTS Results for Case 085

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	Controls HPI 1 minute after allowed
Min DC Temp	298.6 K (77.8°F) at 5070 s
Comments	SRVs reclose at 6,000 seconds.

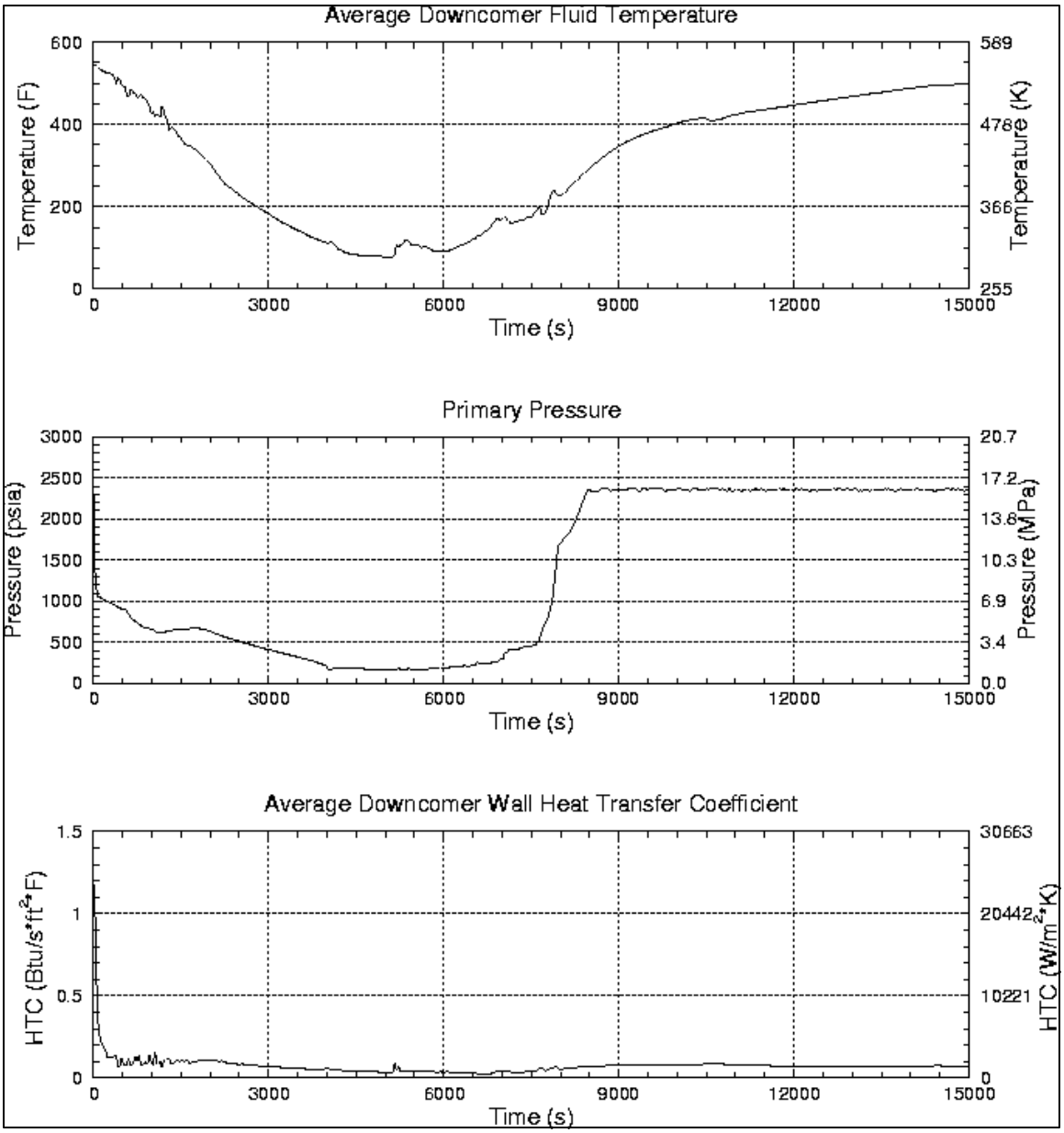


Figure B.2-87: Beaver Valley PTS Results for Case 086

Case Category	RT/TT
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	Controls HPI 10 minutes after allowed
Min DC Temp	300.1 K (80.6°F) at 4470 s
Comments	SRVs reclose at 6,000 seconds.

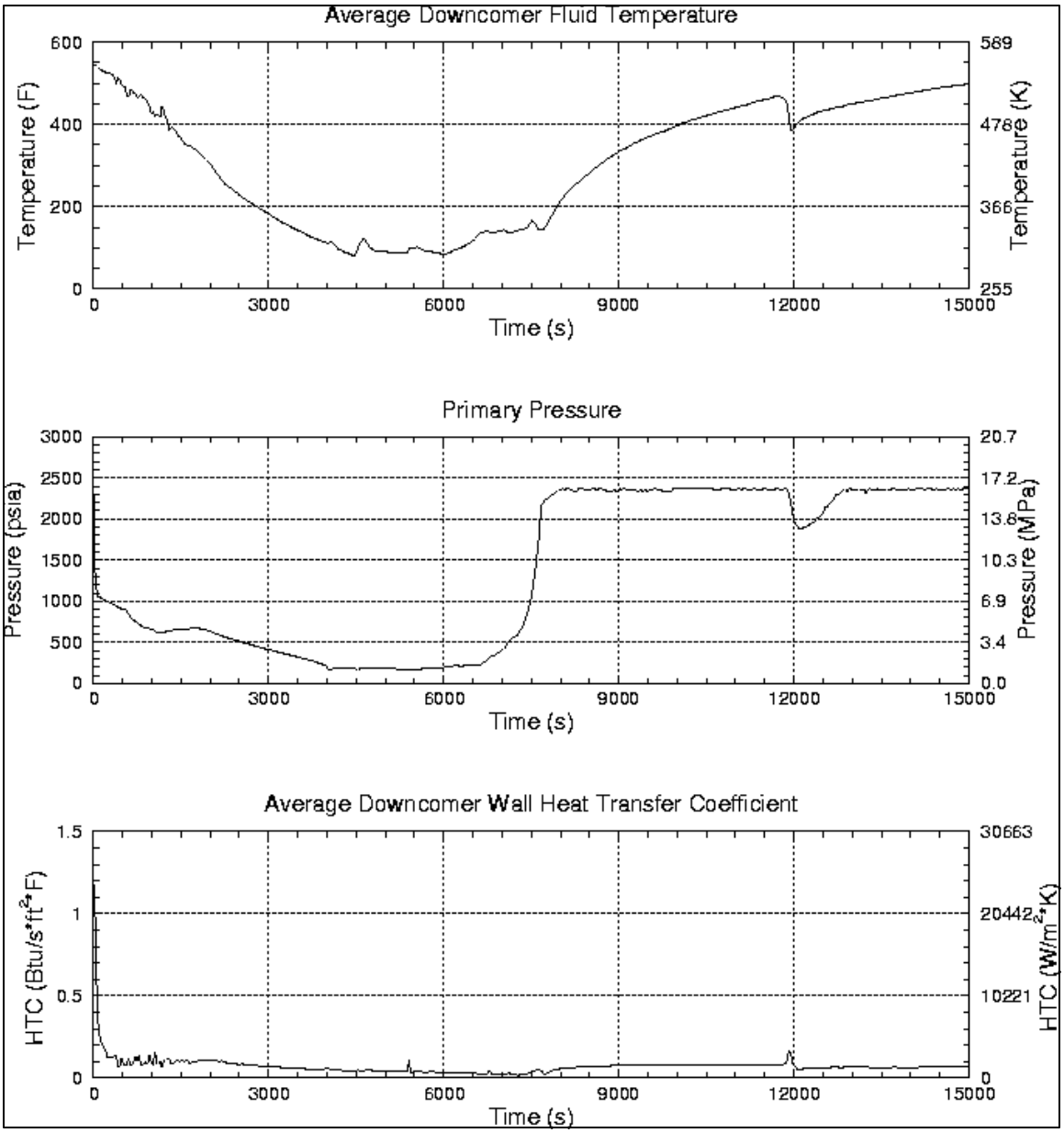


Figure B.2-88: Beaver Valley PTS Results for Case 087

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	Controls HPI 1 minutes after allowed
Min DC Temp	320.9 K (117.9°F) at 2940 s
Comments	SRVs reclose at 3,000 seconds.

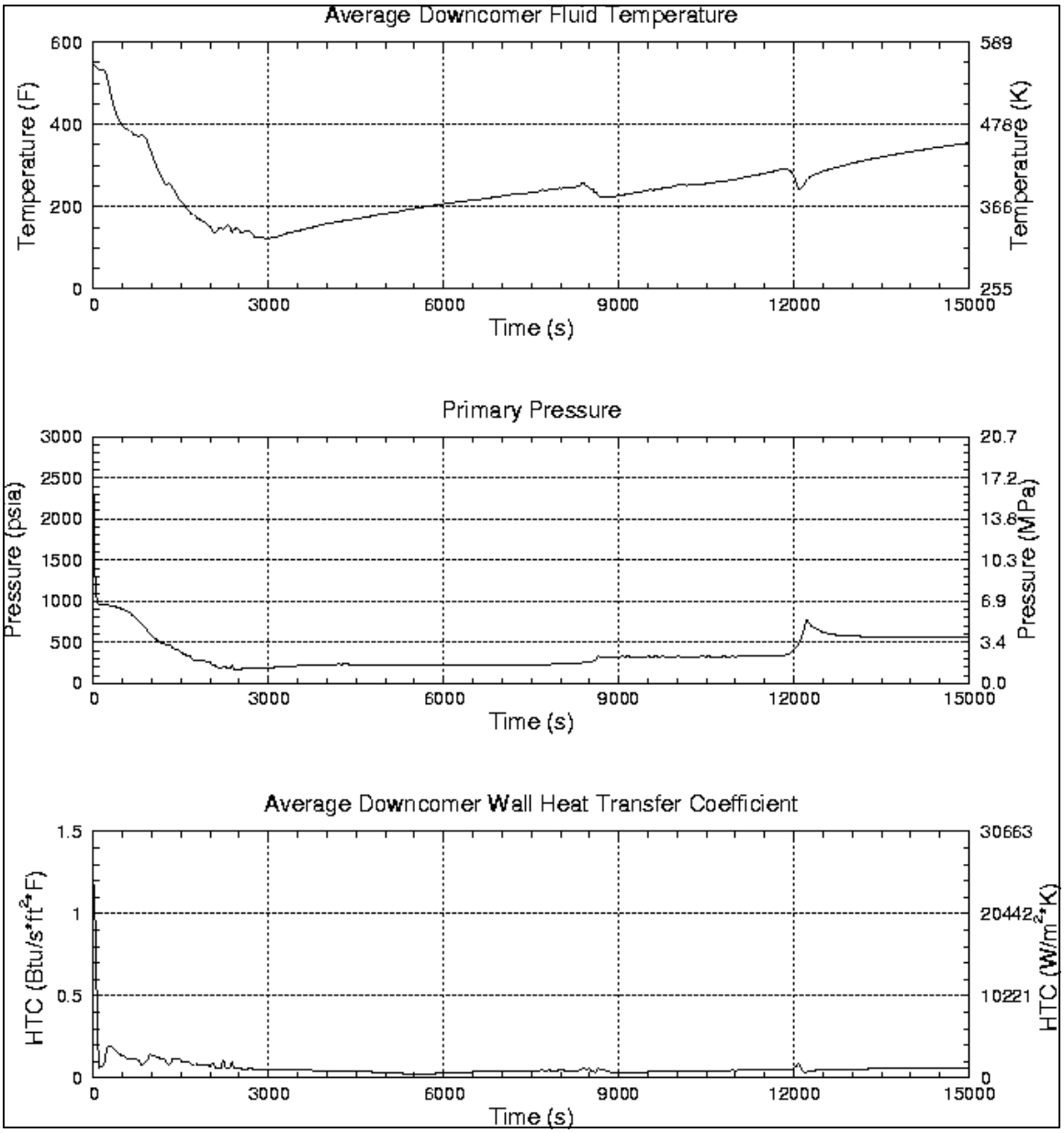


Figure B.2-89: Beaver Valley PTS Results for Case 088

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	Controls HPI 1 minutes after allowed
Min DC Temp	299.7 K (79.9°F) at 6030 s
Comments	SRVs reclose at 6,000 seconds.

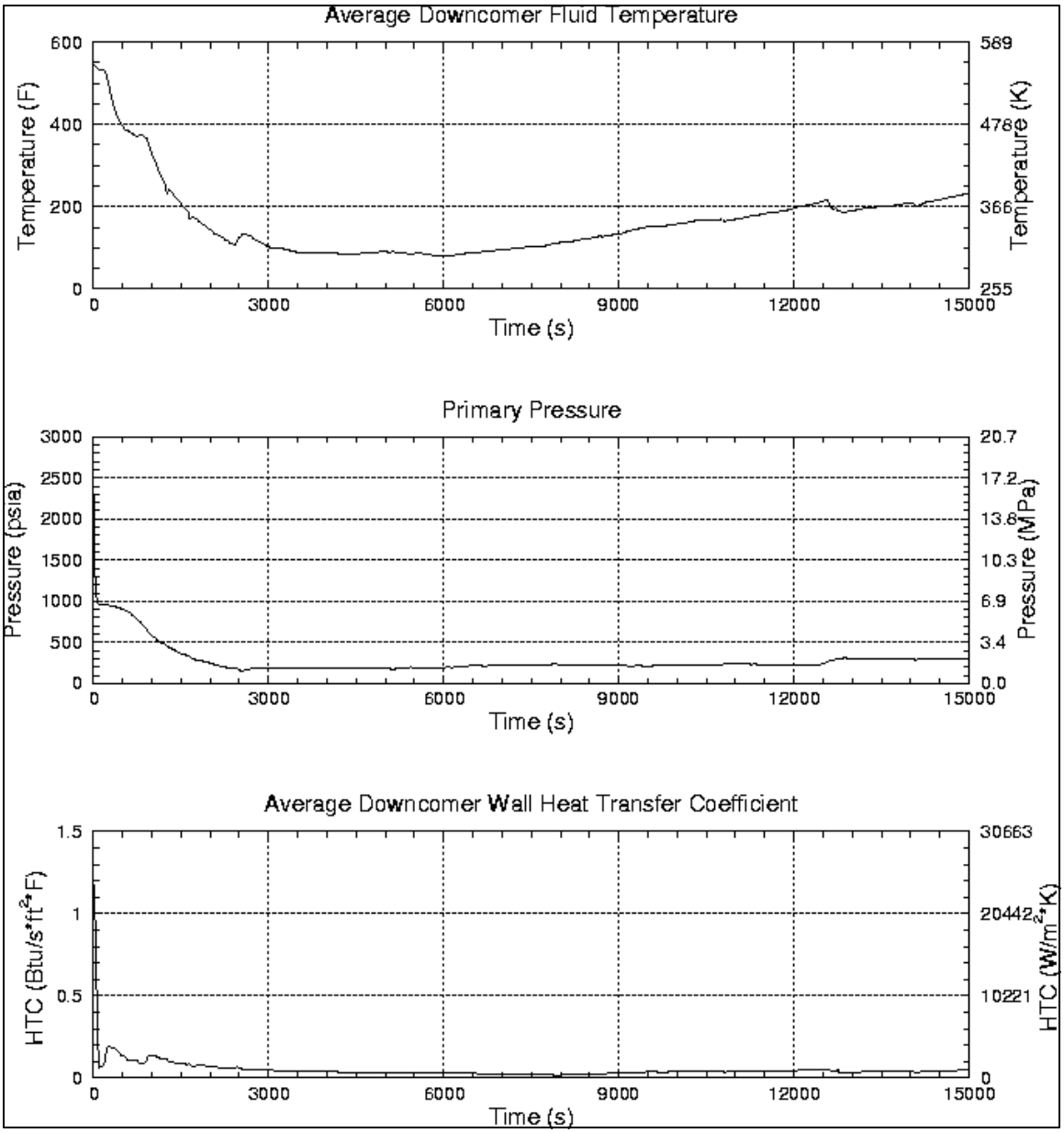


Figure B.2-90: Beaver Valley PTS Results for Case 089

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	Controls HPI 10 minutes after allowed
Min DC Temp	311.9 K (101.8°F) at 2880 s
Comments	SRVs reclose at 3,000 seconds.

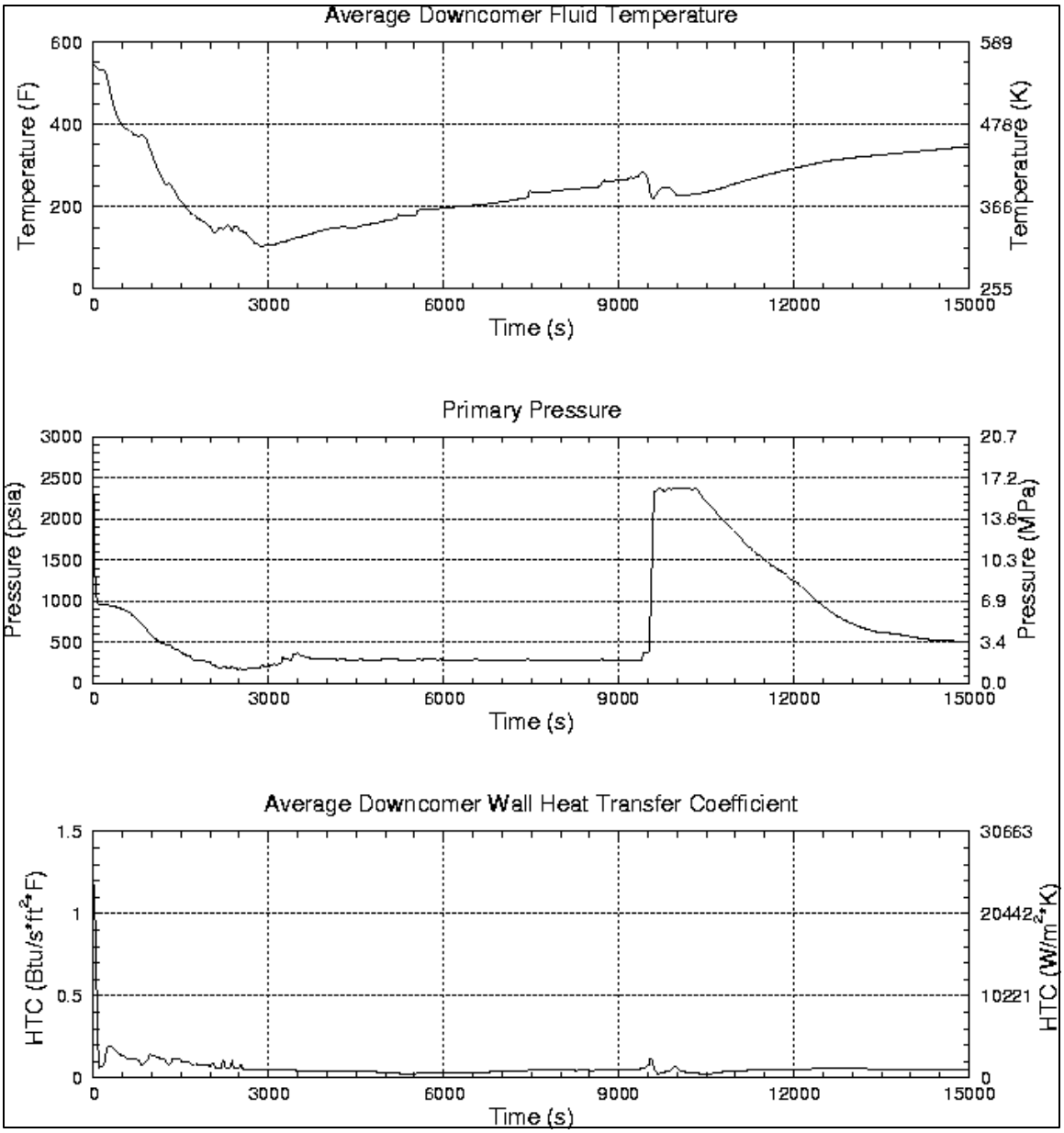


Figure B.2-91: Beaver Valley PTS Results for Case 090

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	Controls HPI 10 minutes after allowed
Min DC Temp	302.3 K (84.5°F) at 6090 s
Comments	SRVs reclose at 6,000 seconds.

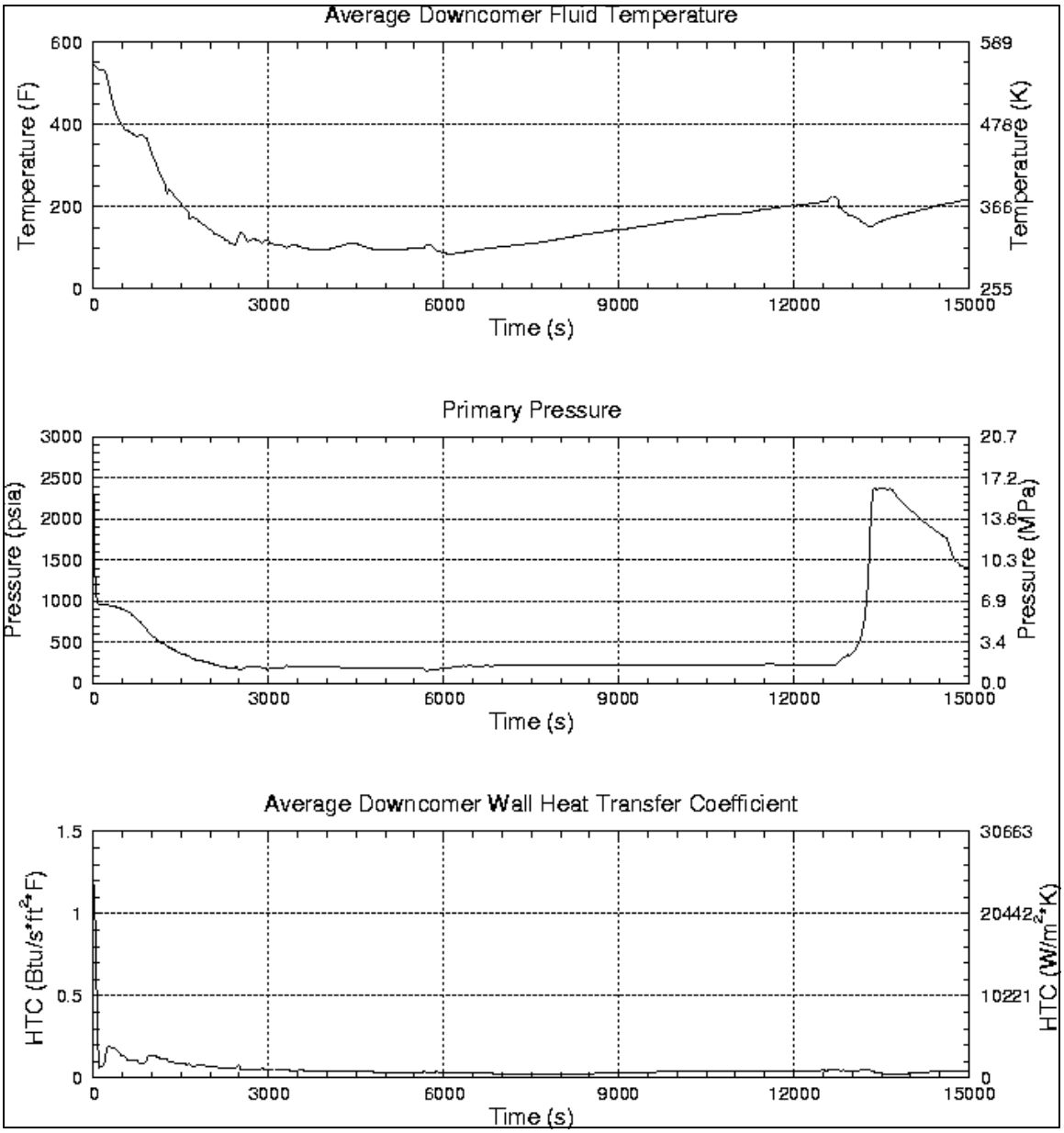


Figure B.2-92: Beaver Valley PTS Results for Case 091

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	288.9 K (60.3°F) at 14610 s
Comments	One SRV recloses at 3,000 seconds. Case 066 @ HZP.

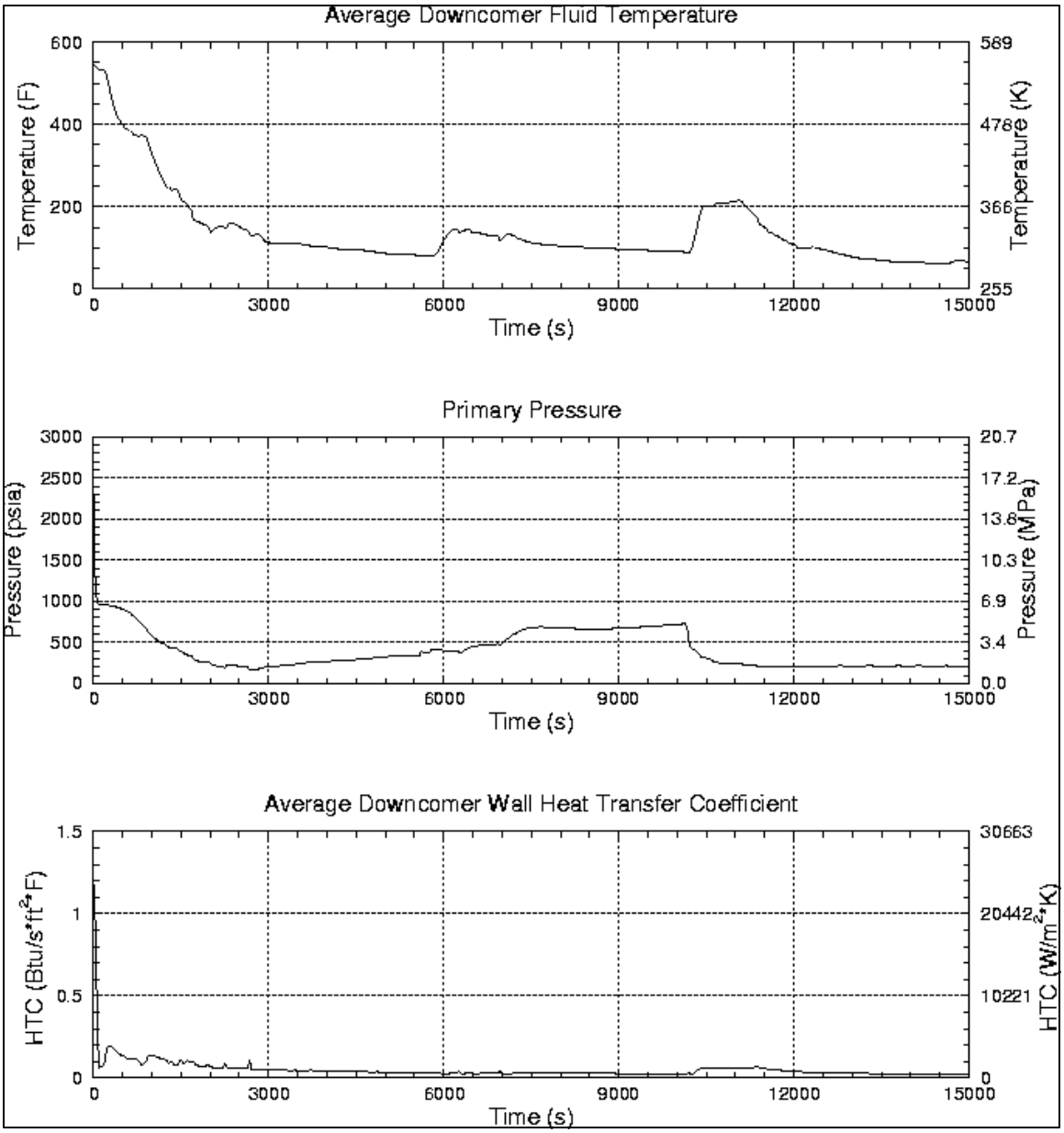


Figure B.2-93: Beaver Valley PTS Results for Case 092

Case Category	RT/TT, HZP
Primary Failures	Two stuck open pressurizer SRVs
Secondary Failures	None
Operator Actions	None
Min DC Temp	291.5 K (65.0°F) at 15000 s
Comments	One SRV recloses at 6,000 seconds. Case 067 @ HZP

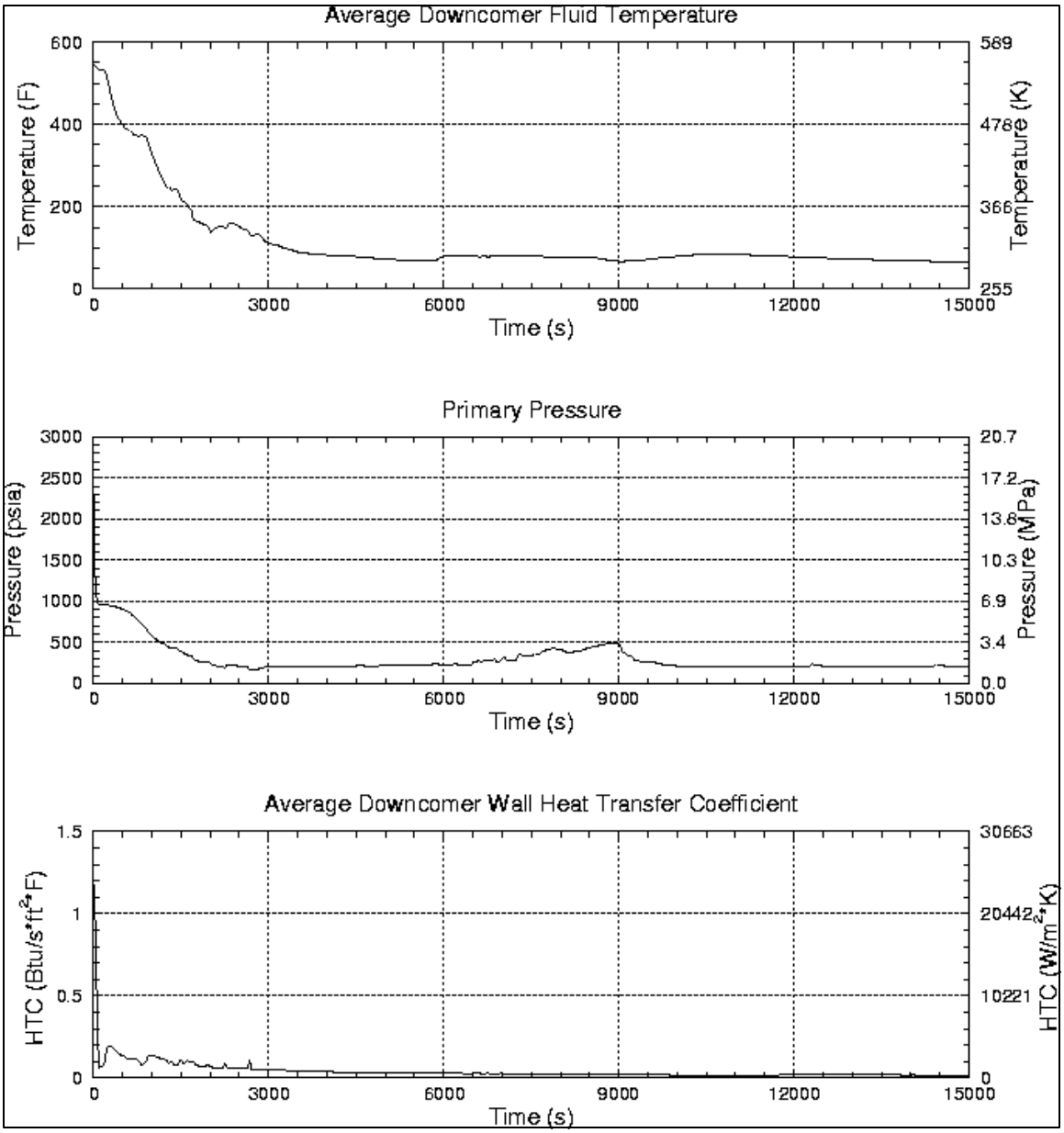


Figure B.2-94: Beaver Valley PTS Results for Case 093

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	285.4 K (54.1°F) at 15000 s
Comments	Case 014 @ HZP.

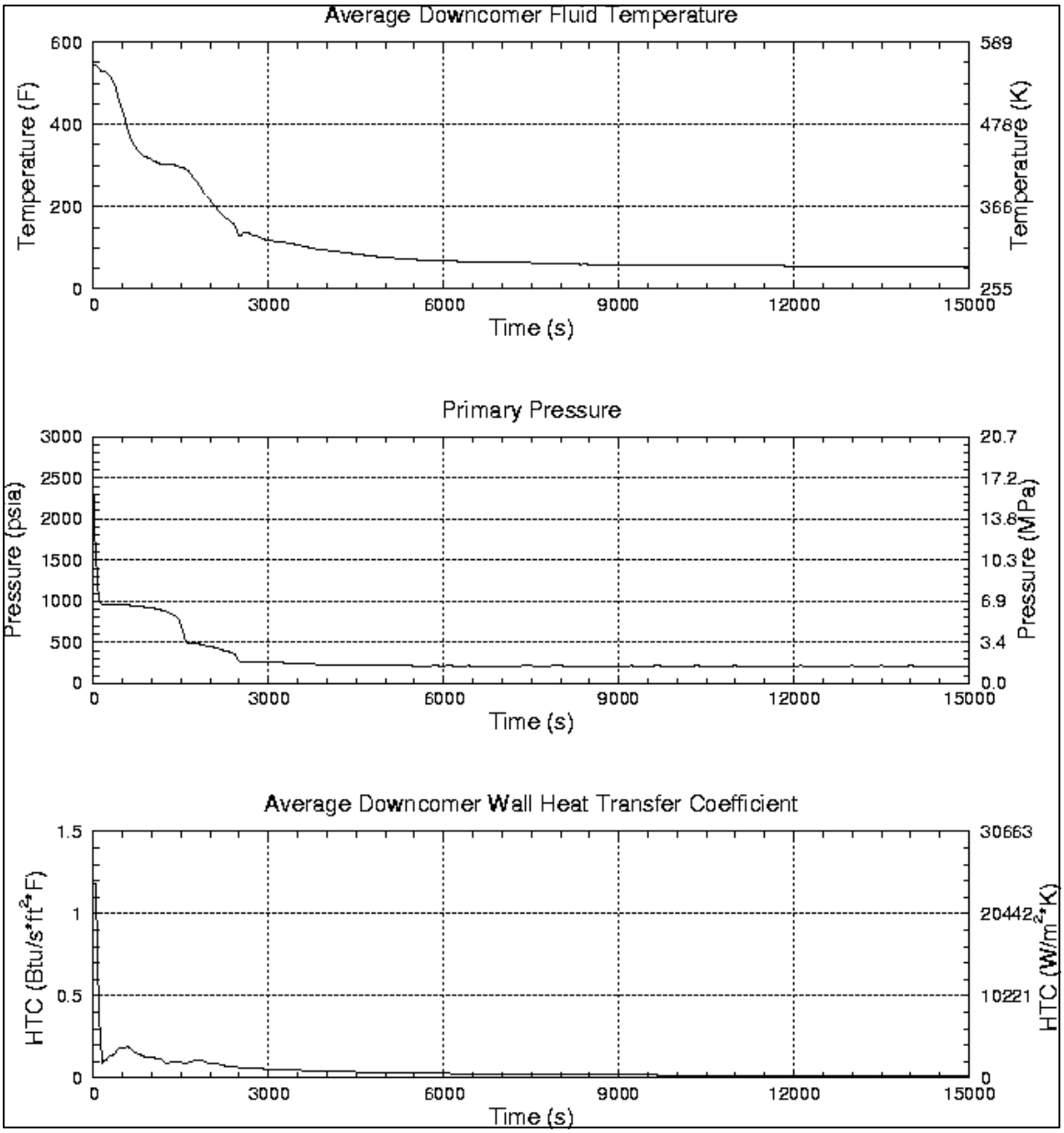


Figure B.2-95: Beaver Valley PTS Results for Case 094

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	Controls HPI 1 minutes after allowed
Min DC Temp	345.2 K (161.8°F) at 6000 s
Comments	SRV recloses at 6,000 seconds.

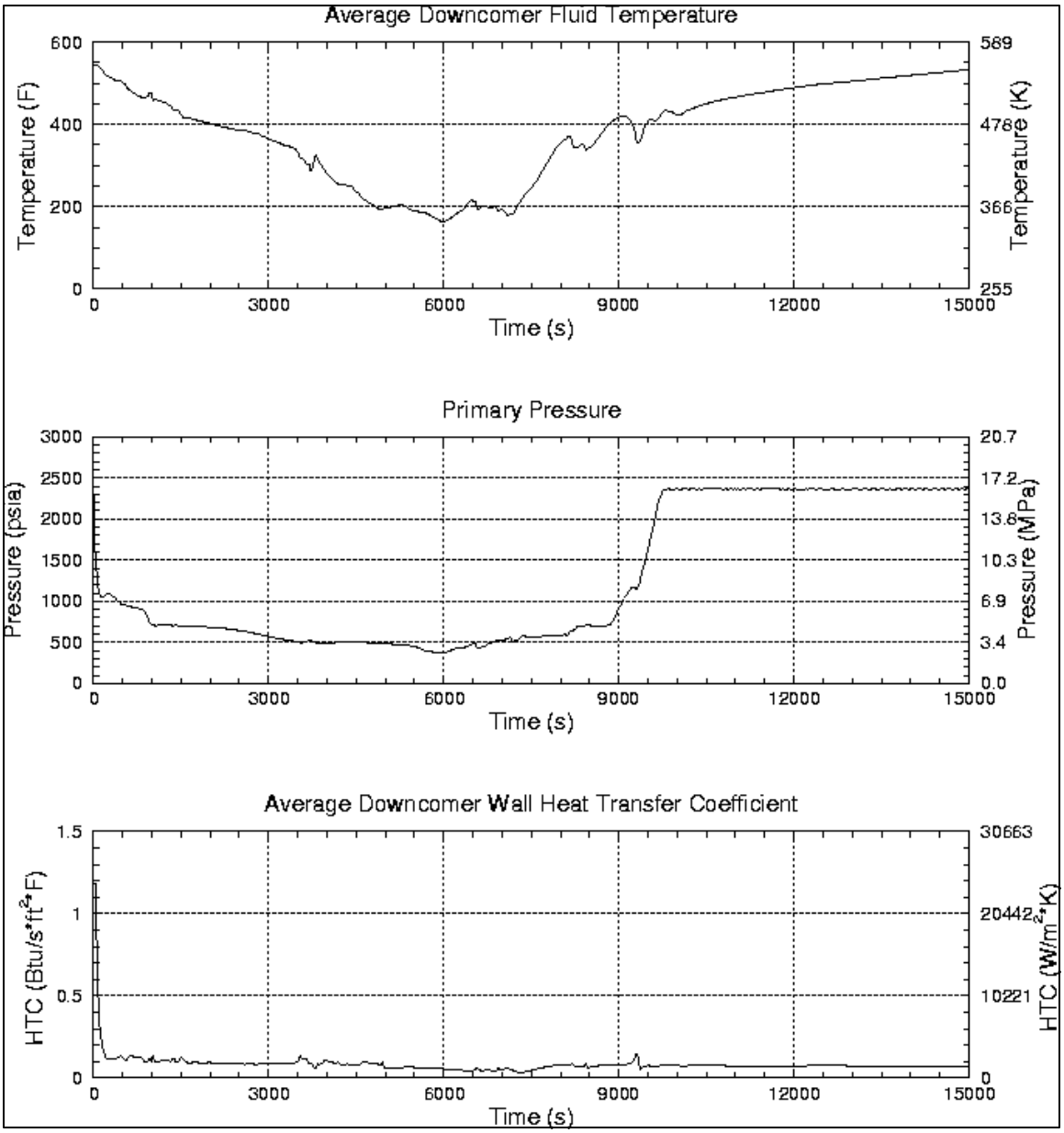


Figure B.2-96: Beaver Valley PTS Results for Case 095

Case Category	RT/TT
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	Controls HPI 10 minutes after allowed
Min DC Temp	331.6 K (137.2°F) at 6030 s
Comments	SRV recloses at 6,000 seconds.

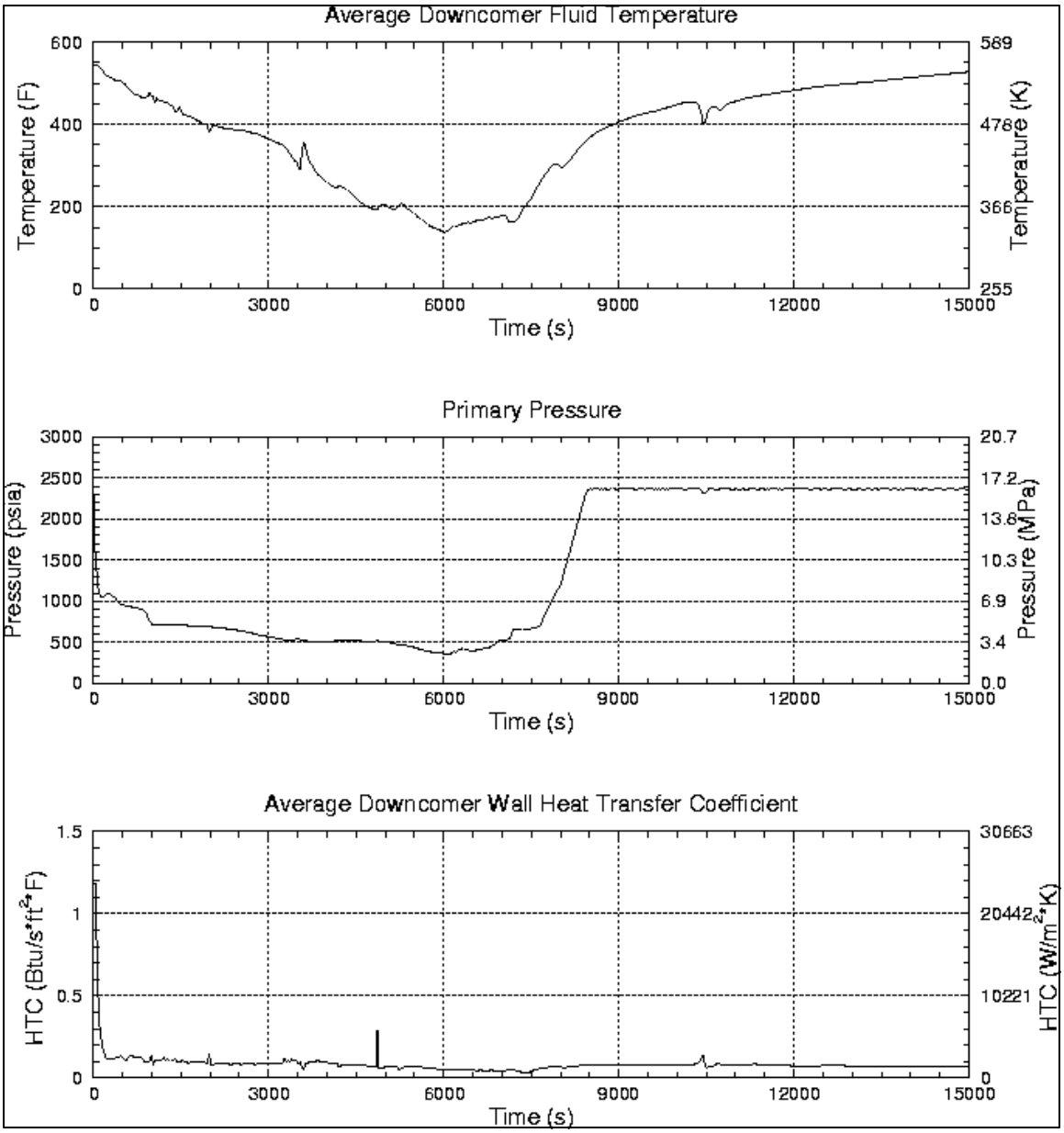


Figure B.2-97: Beaver Valley PTS Results for Case 096

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	None
Min DC Temp	296.8 K (74.6°F) at 15000 s
Comments	SRV recloses at 3,000 seconds.

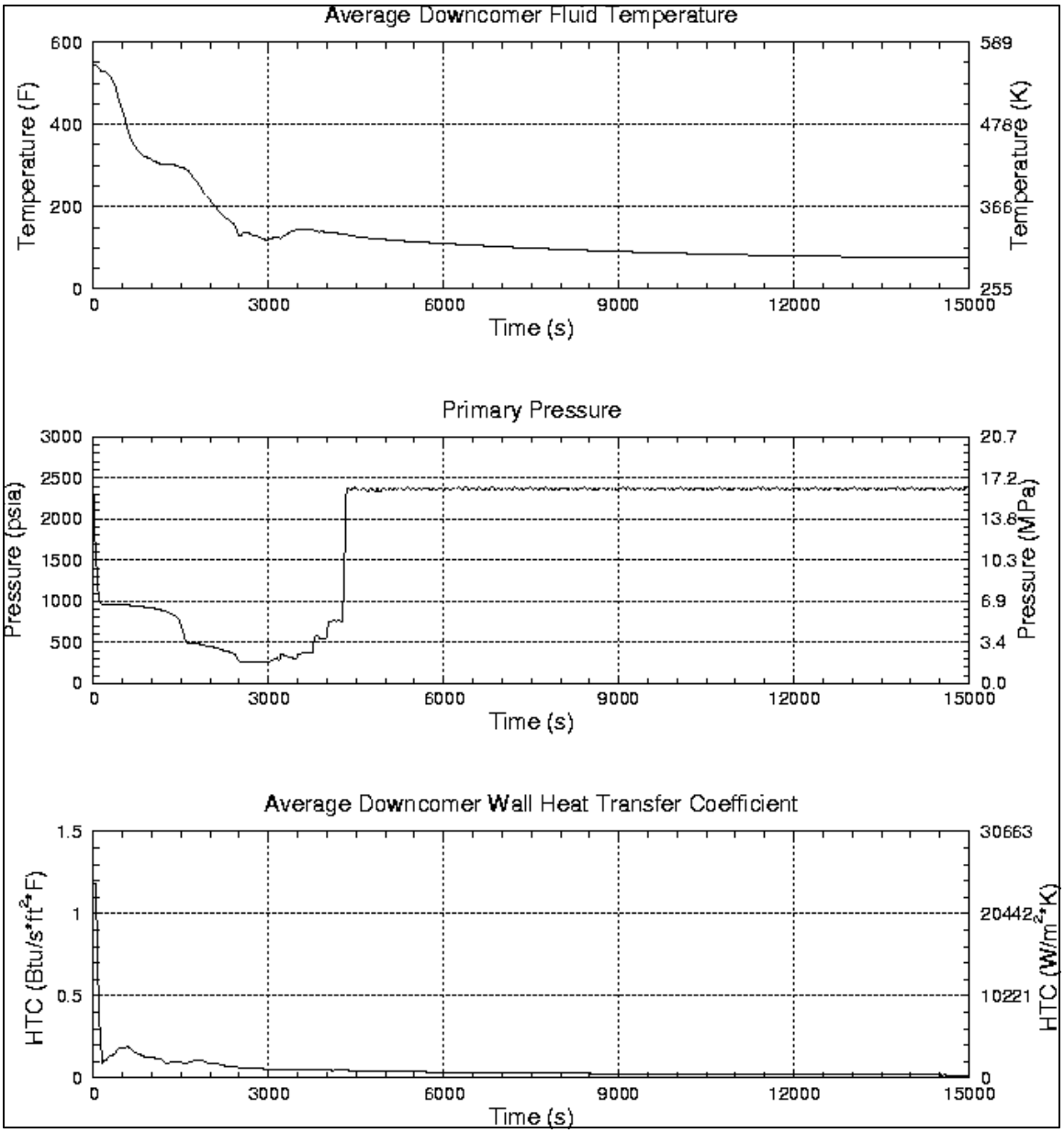


Figure B.2-98: Beaver Valley PTS Results for Case 097

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	Controls HPI 1 minutes after allowed
Min DC Temp	320.0 K (116.4°F) at 6030 s
Comments	SRV recloses at 6,000 seconds.

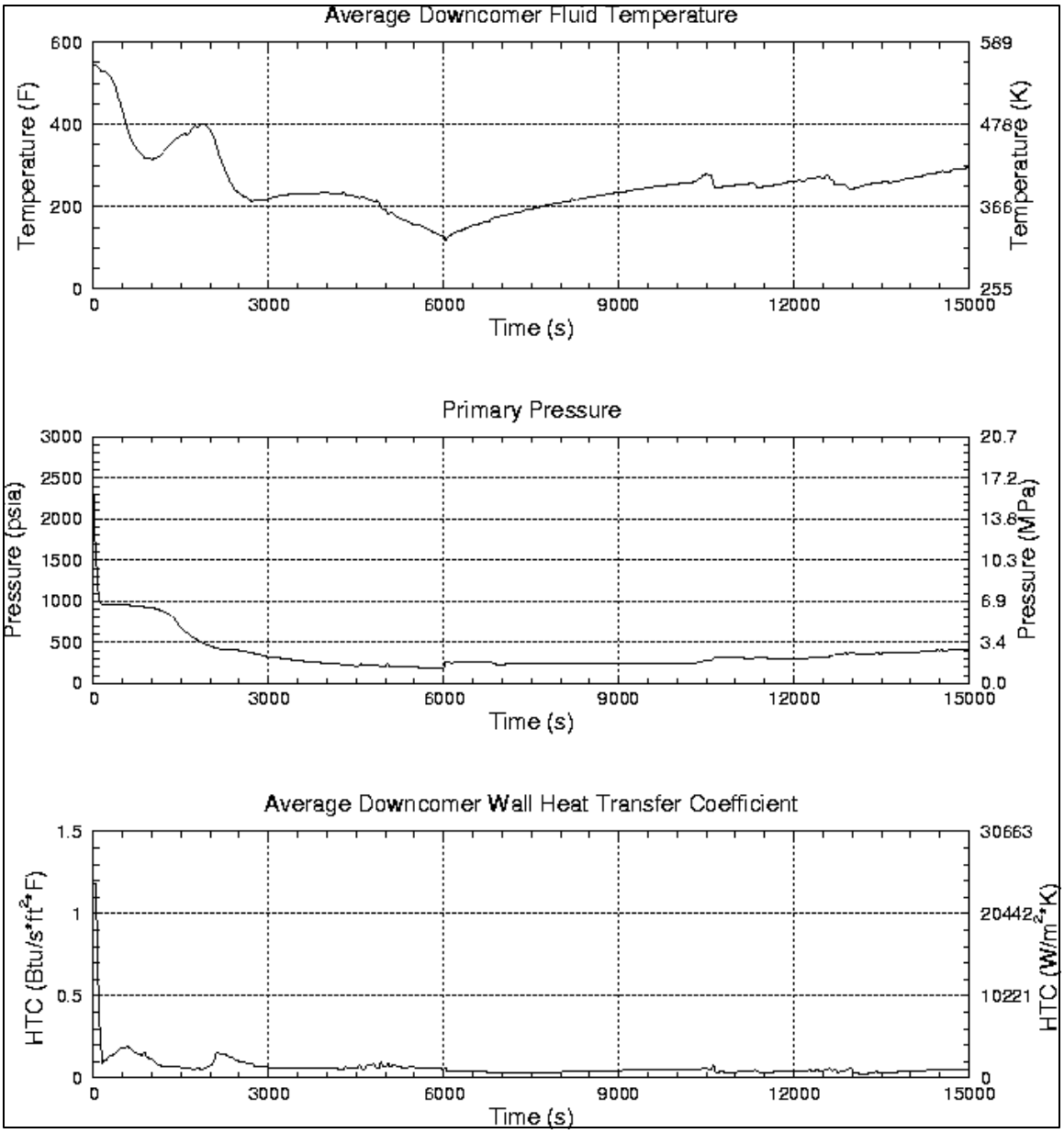


Figure B.2-99: Beaver Valley PTS Results for Case 098

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	Controls HPI 1 minutes after allowed
Min DC Temp	373.4 K (212.4°F) at 2730 s
Comments	SRV recloses at 3,000 seconds.

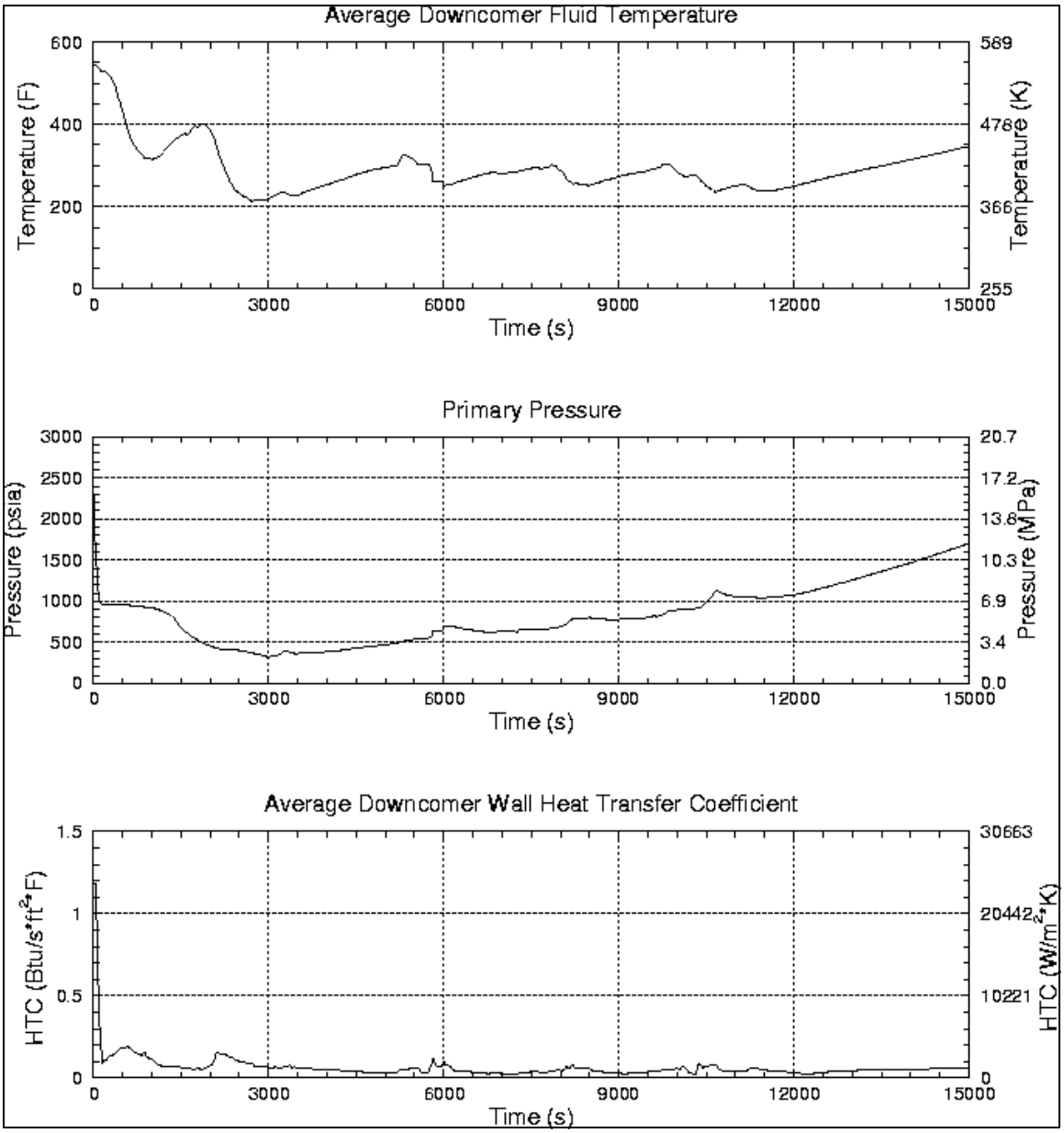


Figure B.2-100: Beaver Valley PTS Results for Case 099

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	Controls HPI 10 minutes after allowed
Min DC Temp	310.7 K (99.6°F) at 4470 s
Comments	SRV recloses at 6,000 seconds.

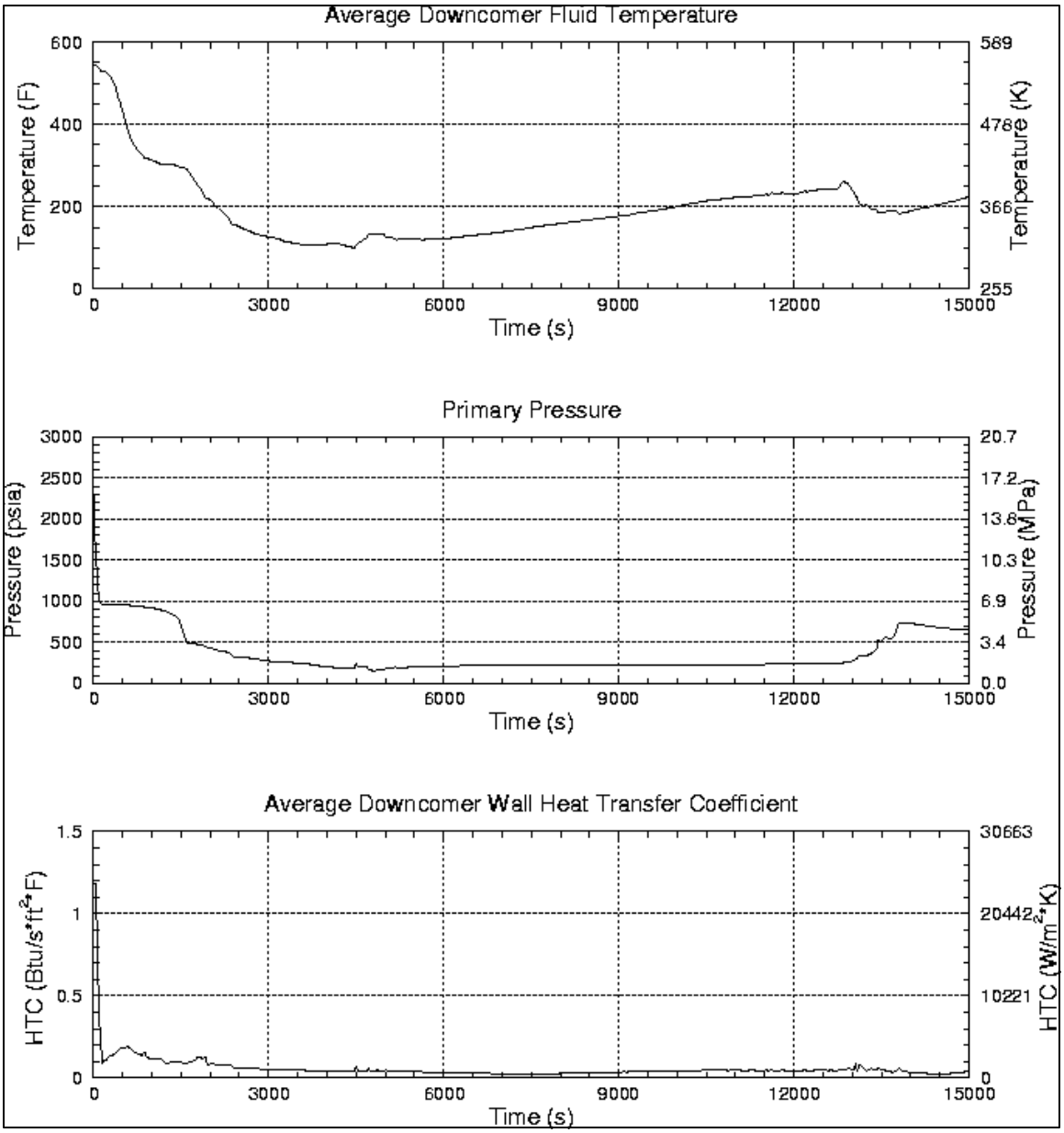


Figure B.2-101: Beaver Valley PTS Results for Case 100

Case Category	RT/TT, HZP
Primary Failures	One stuck open pressurizer SRV
Secondary Failures	None
Operator Actions	Controls HPI 10 minutes after allowed
Min DC Temp	320.4 K (117.1°F) at 3030 s
Comments	SRV recloses at 3,000 seconds.

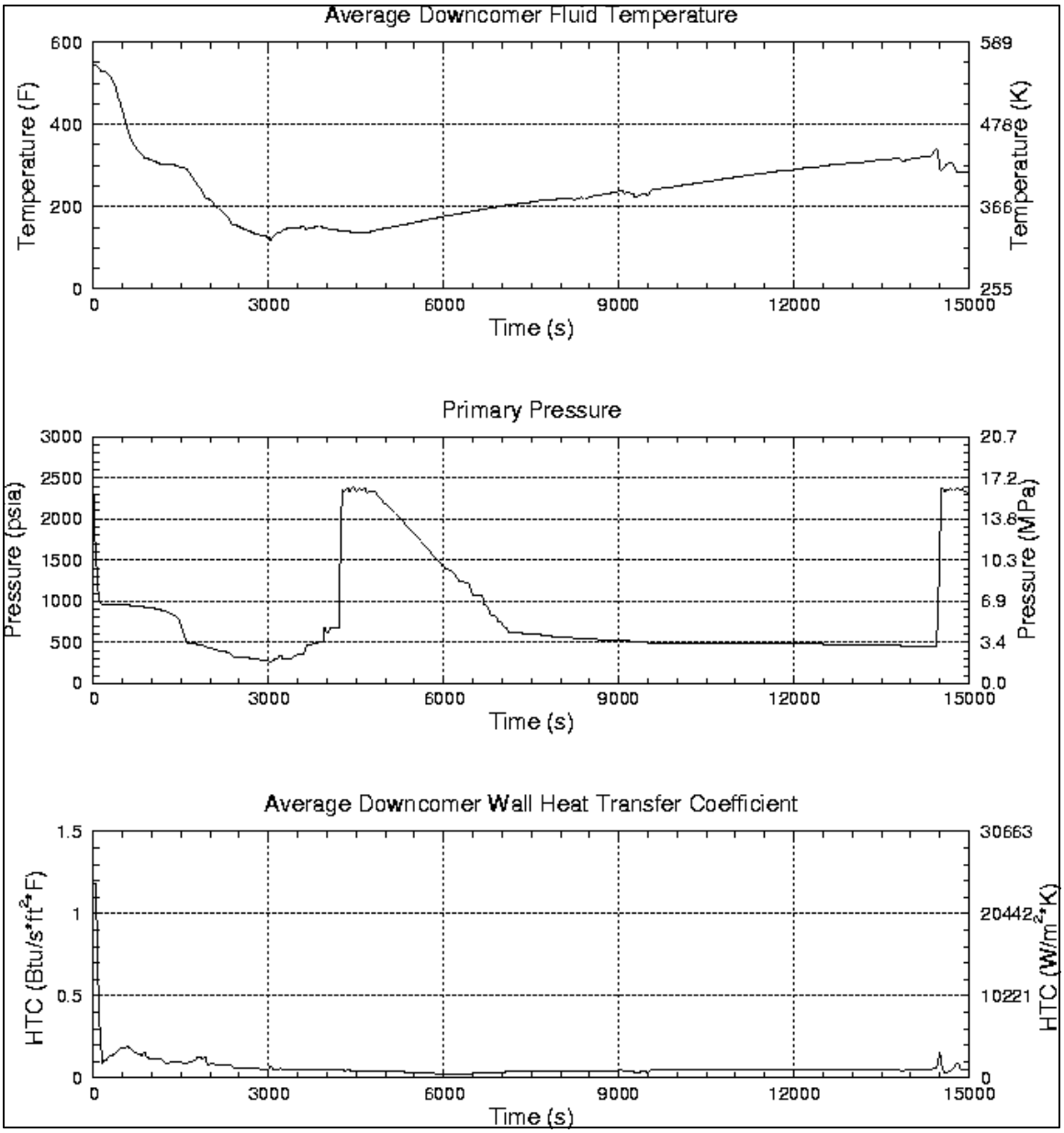


Figure B.2-102: Beaver Valley PTS Results for Case 101

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	373.3 K (212.2°F) at 3990 s
Comments	AFW continues to feed SG A for 30 minutes.

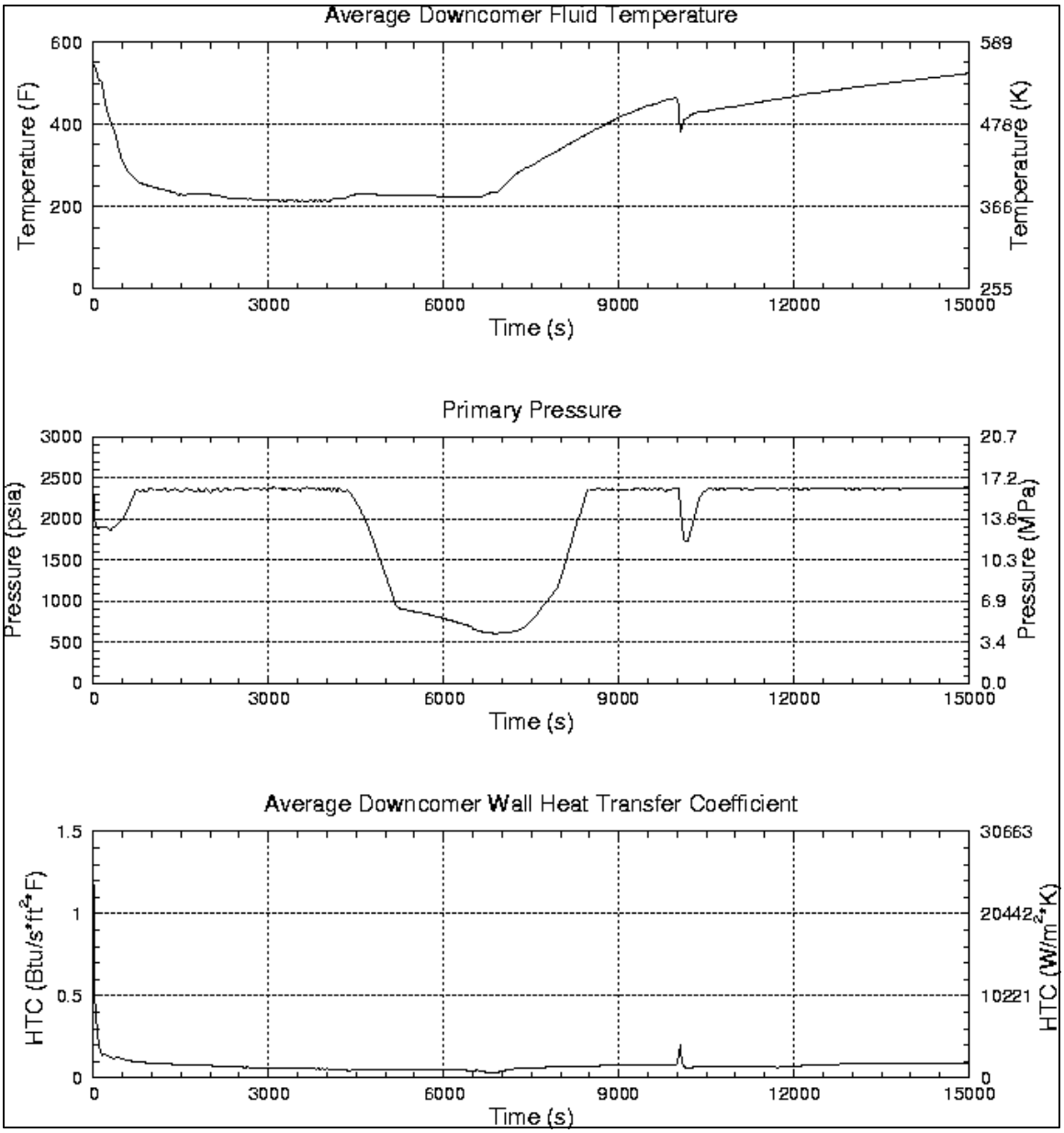


Figure B.2-103: Beaver Valley PTS Results for Case 102

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	361.7 K (191.5°F) at 3420 s
Comments	AFW continues to feed SG A for 30 minutes. Case 102 @ HZP.

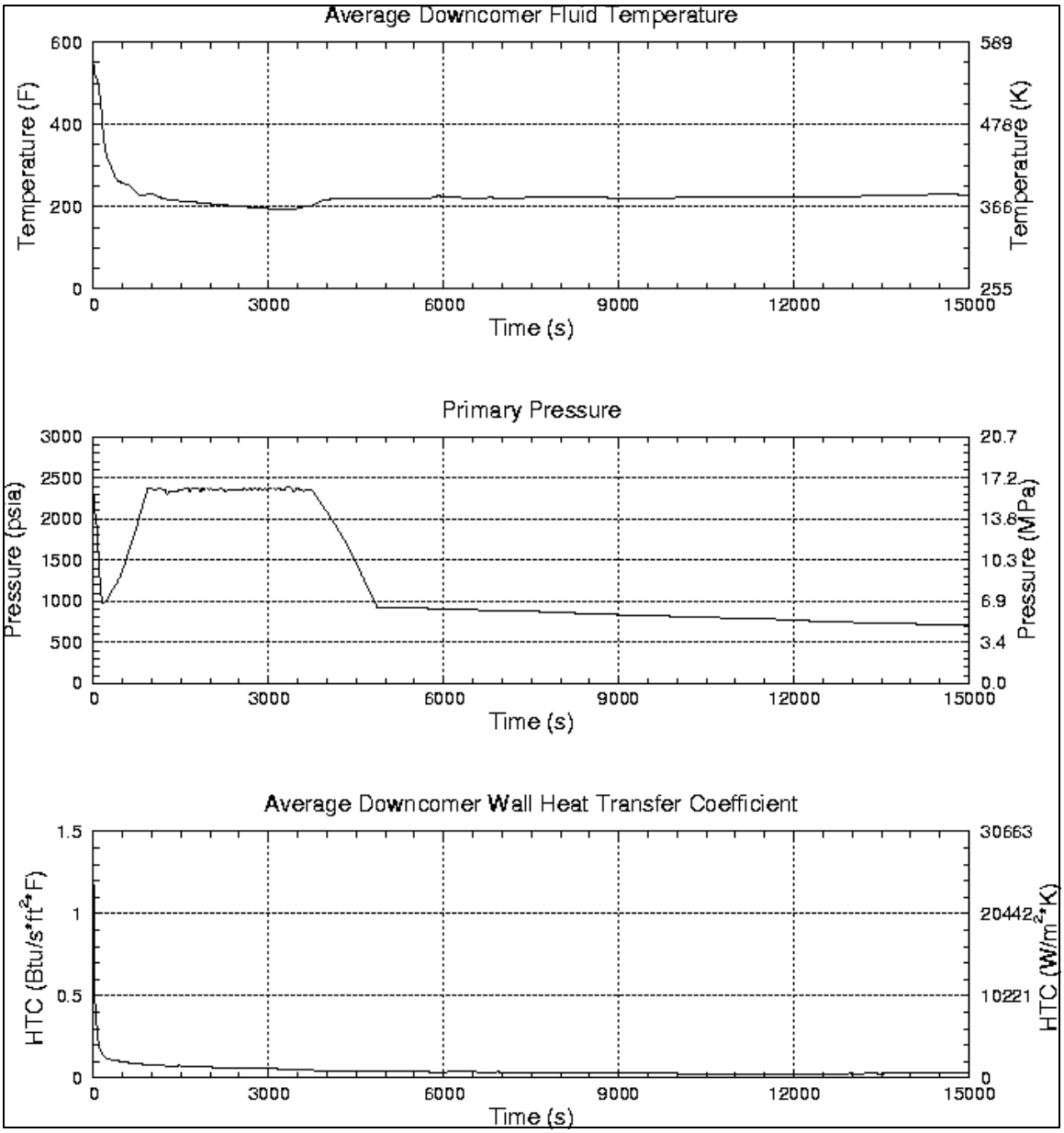


Figure B.2-104: Beaver Valley PTS Results for Case 103

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped. Controls HPI 60 minutes after allowed
Min DC Temp	369.6 K (205.6°F) at 5820 s
Comments	AFW continues to feed SG A for 30 minutes.

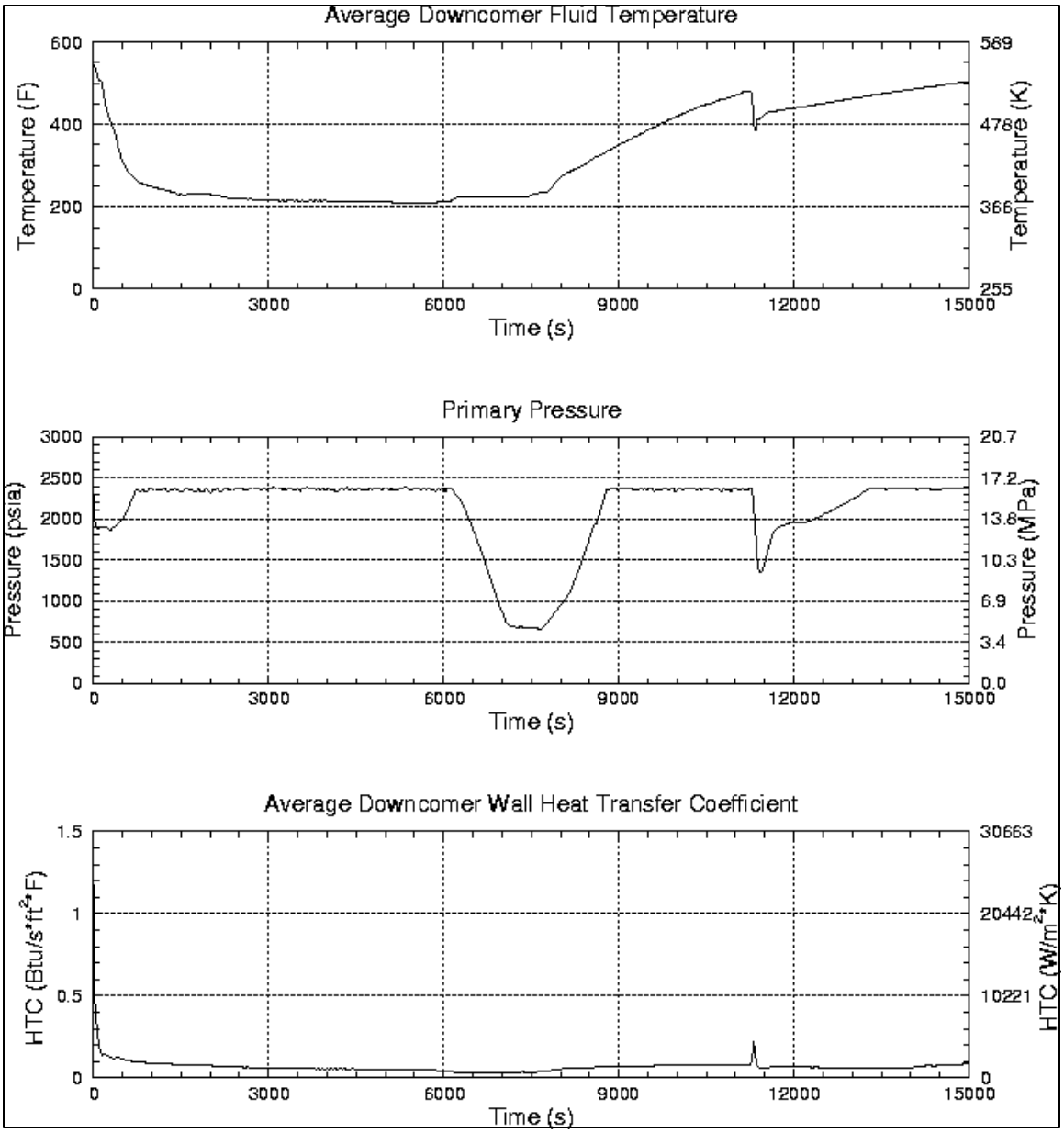


Figure B.2-105: Beaver Valley PTS Results for Case 104

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped. Controls HPI 60 minutes after allowed
Min DC Temp	355.0 K (179.4°F) at 5220 s
Comments	AFW continues to feed SG A for 30 minutes. Case 104 @ HZP.

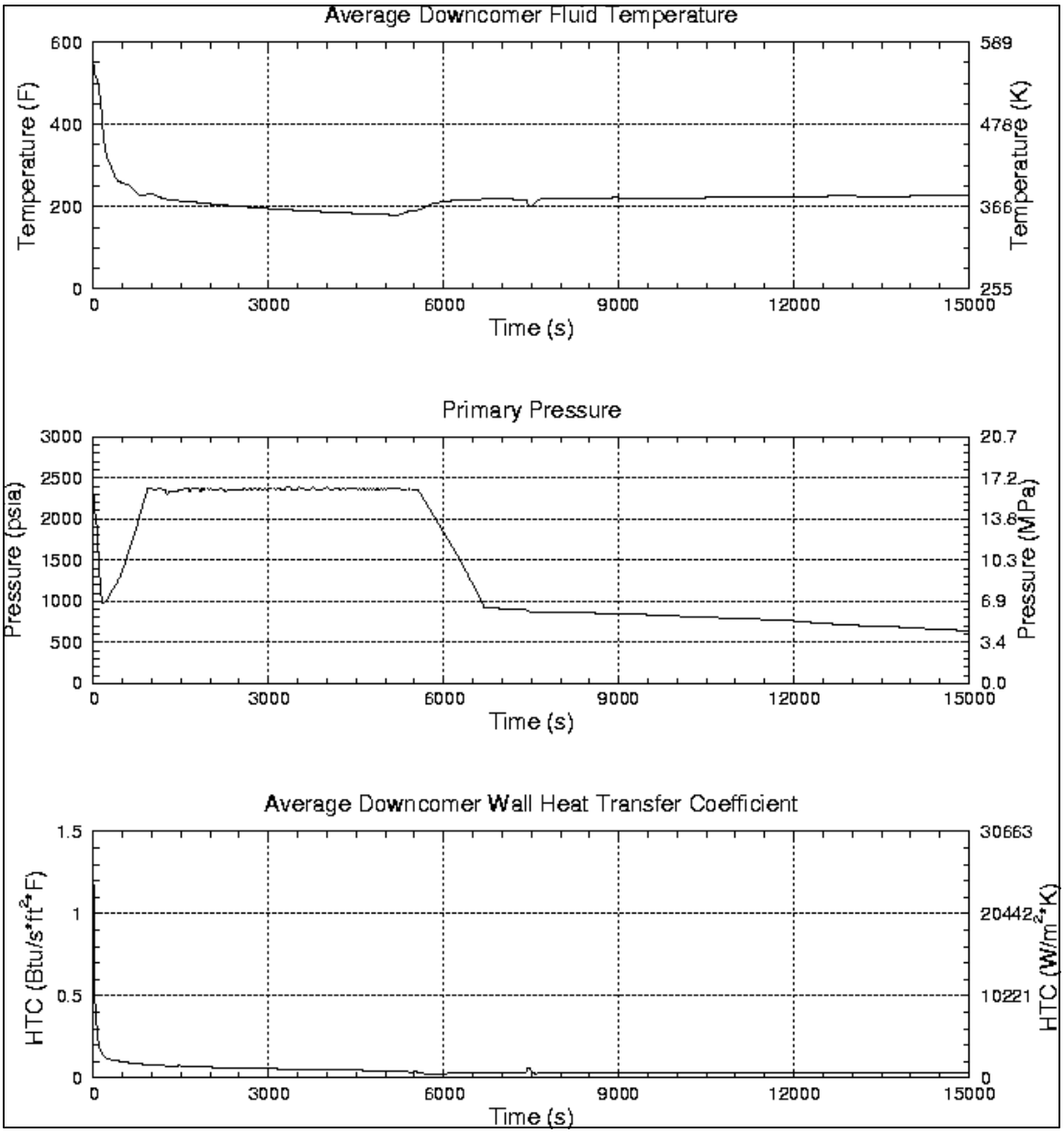


Figure B.2-106: Beaver Valley PTS Results for Case 105

Case Category	MSLB
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	370.4 K (207.1°F) at 3300 s
Comments	AFW continues to feed SG A.

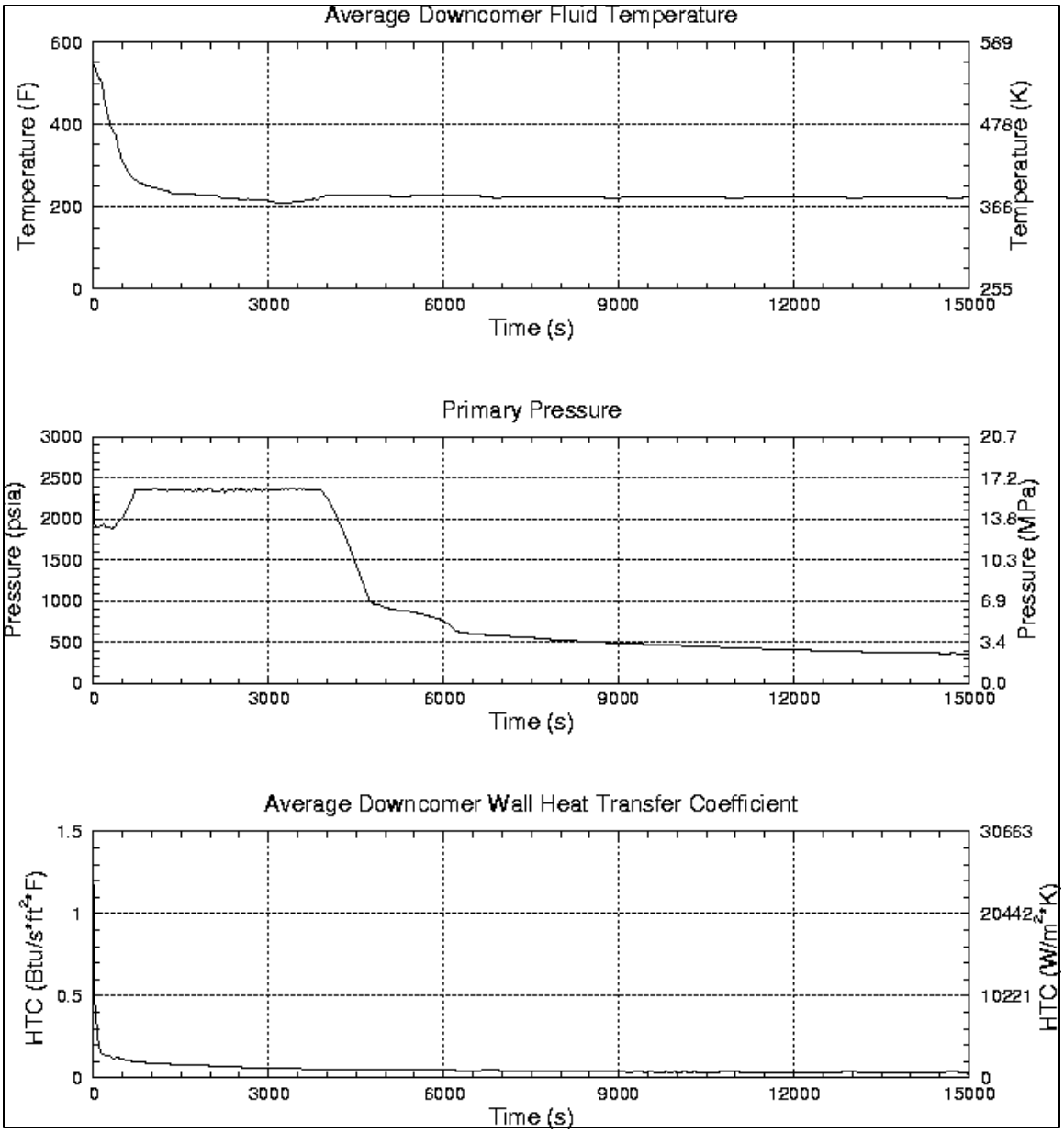


Figure B.2-107: Beaver Valley PTS Results for Case 106

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	Double ended guillotine break of steam line A
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	361.6 K (191.3°F) at 3420 s
Comments	AFW continues to feed SG A.

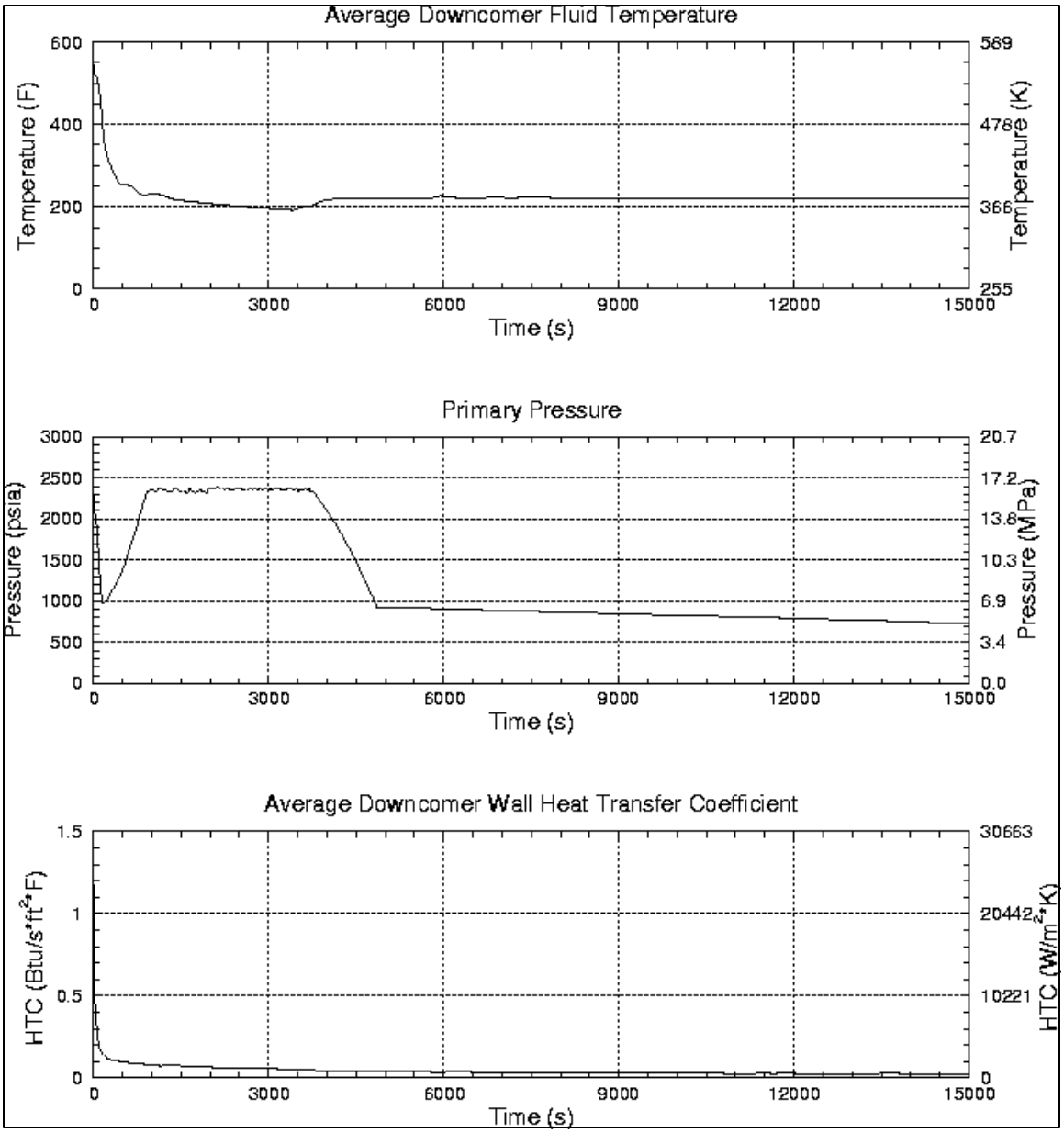


Figure B.2-108: Beaver Valley PTS Results for Case 107

Case Category	MSLB
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	Controls HPI 30 minutes after allowed
Min DC Temp	395.3 K (251.8°F) at 3600 s
Comments	AFW continues to feed SG A for 30 minutes.

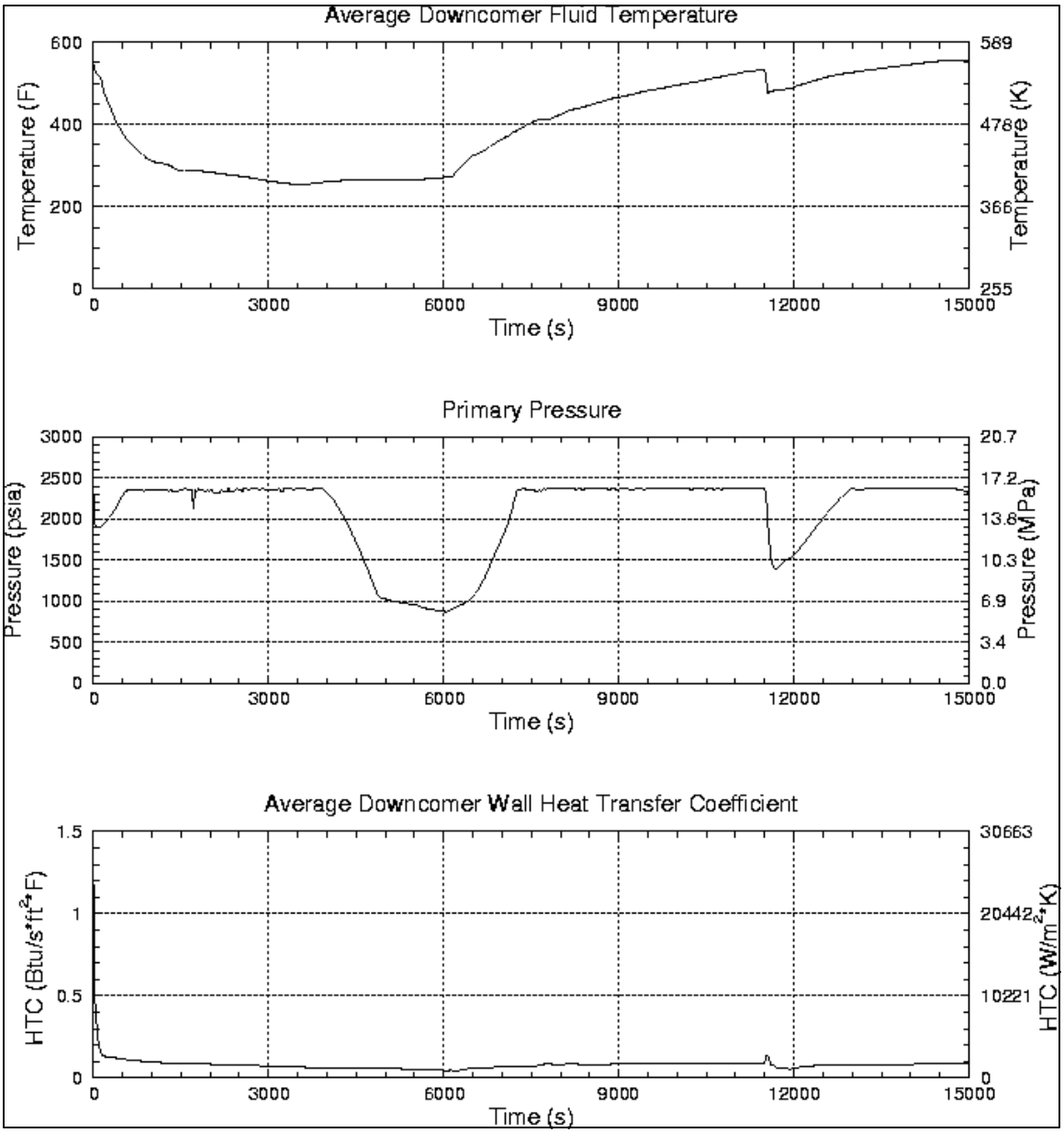


Figure B.2-109: Beaver Valley PTS Results for Case 108

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	373.7 K (213.0°F) at 2580 s
Comments	AFW continues to feed SG A for 30 minutes.

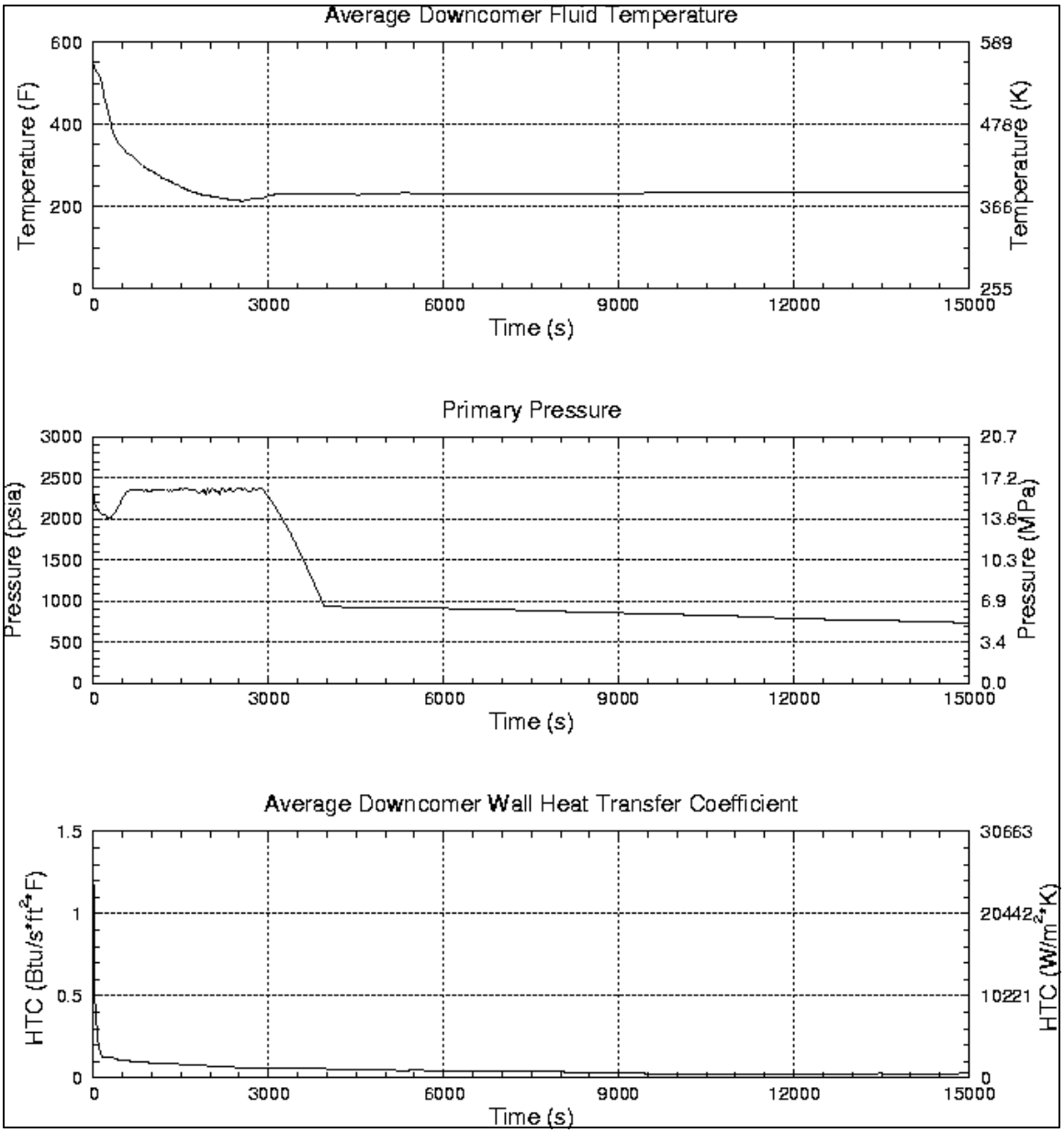


Figure B.2-110: Beaver Valley PTS Results for Case 109

Case Category	MSLB
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	Controls HPI 60 minutes after allowed
Min DC Temp	383.9 K (231.3°F) at 5400 s
Comments	AFW continues to feed SG A for 30 minutes.

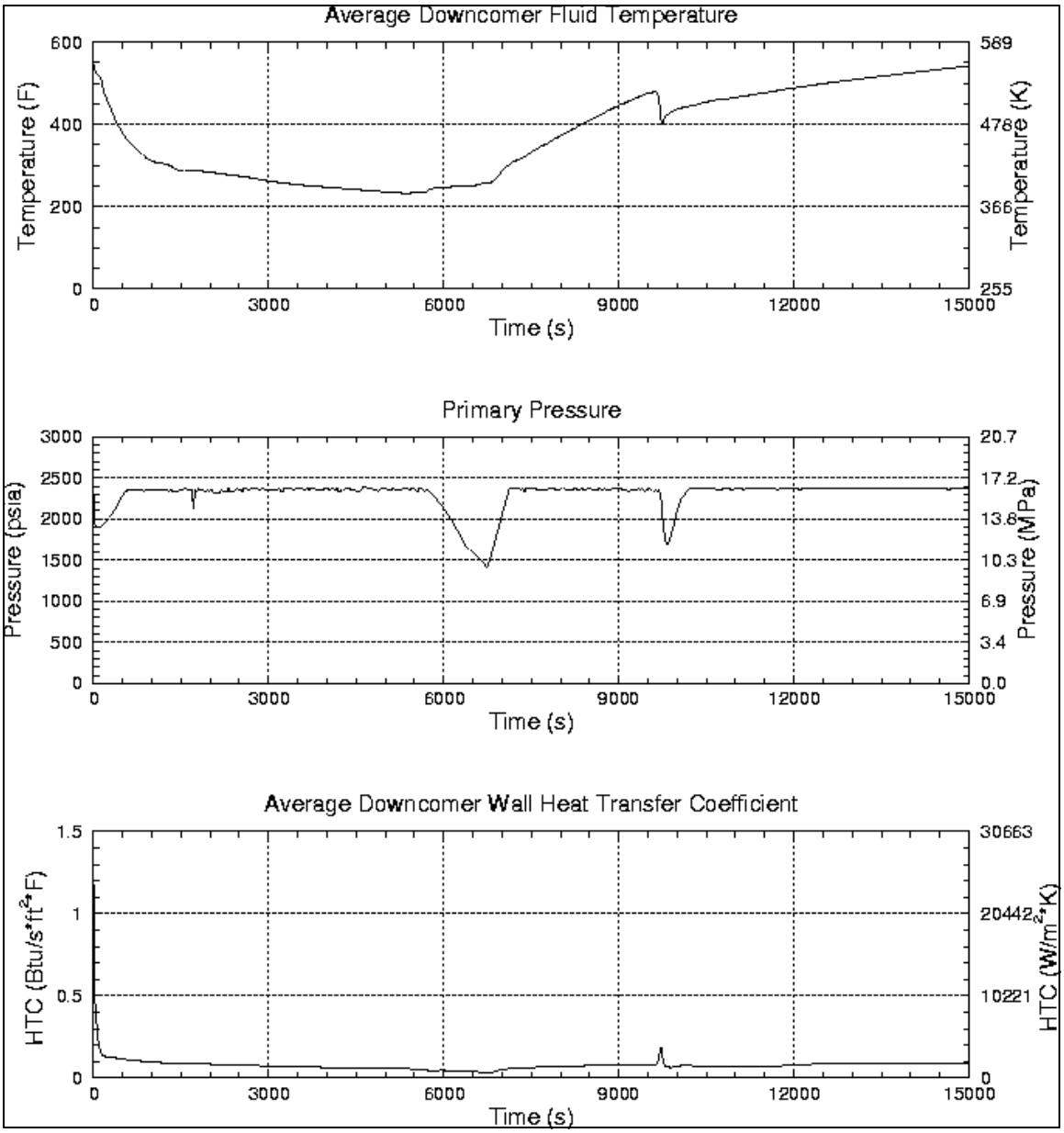


Figure B.2-111: Beaver Valley PTS Results for Case 110

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	RCP's are tripped. Controls HPI 60 minutes after allowed
Min DC Temp	360.6 K (189.4°F) at 4380 s
Comments	AFW continues to feed SG A for 30 minutes.

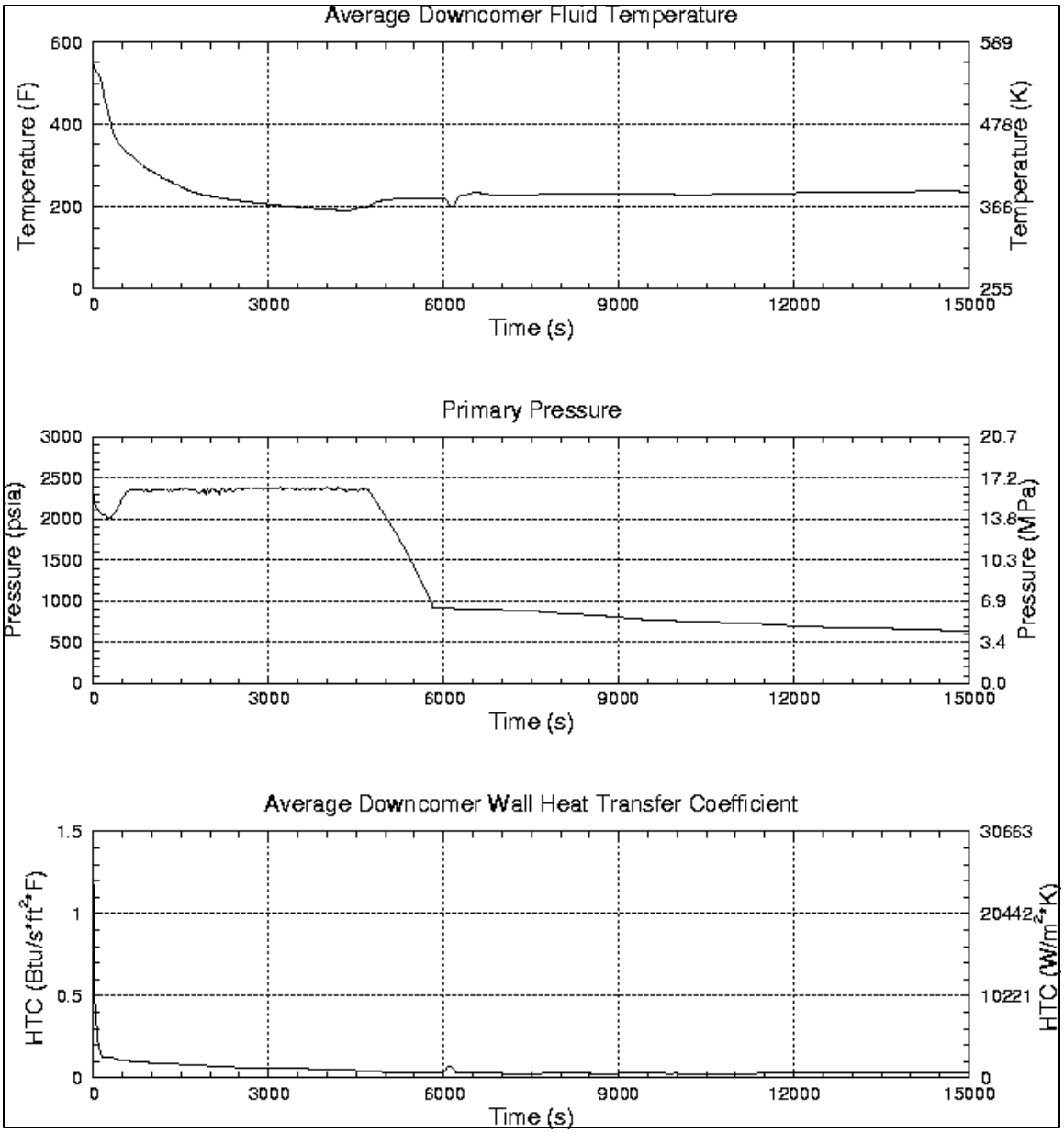


Figure B.2-112: Beaver Valley PTS Results for Case 111

Case Category	MSLB
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	391.7 K (245.4°F) at 10980 s
Comments	AFW continues to feed SG A.

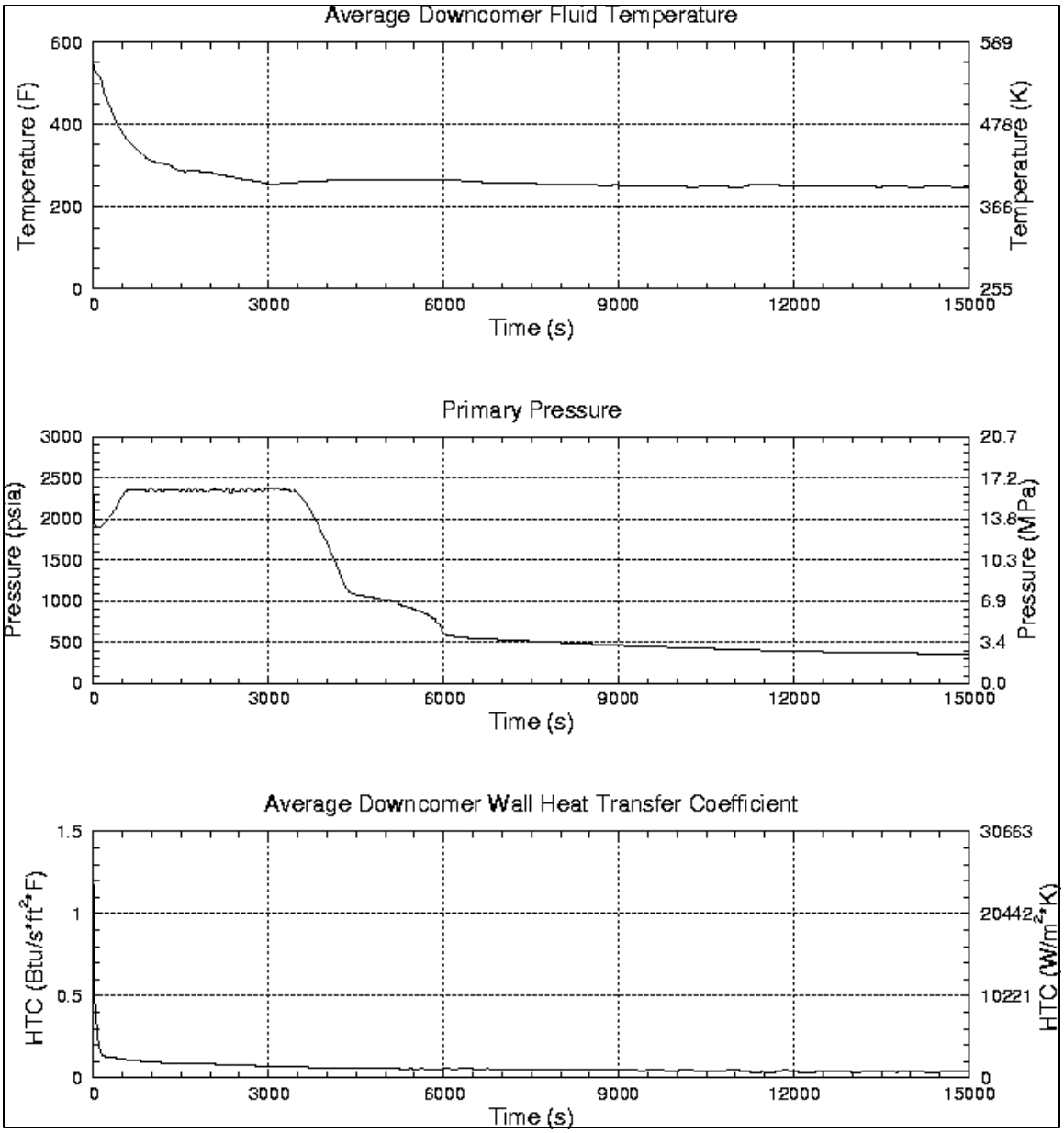


Figure B.2-113: Beaver Valley PTS Results for Case 112

Case Category	MSLB, HZP
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	RCP's are tripped. Controls HPI 30 minutes after allowed
Min DC Temp	372.2 K (210.4°F) at 4860 s
Comments	AFW continues to feed SG A.

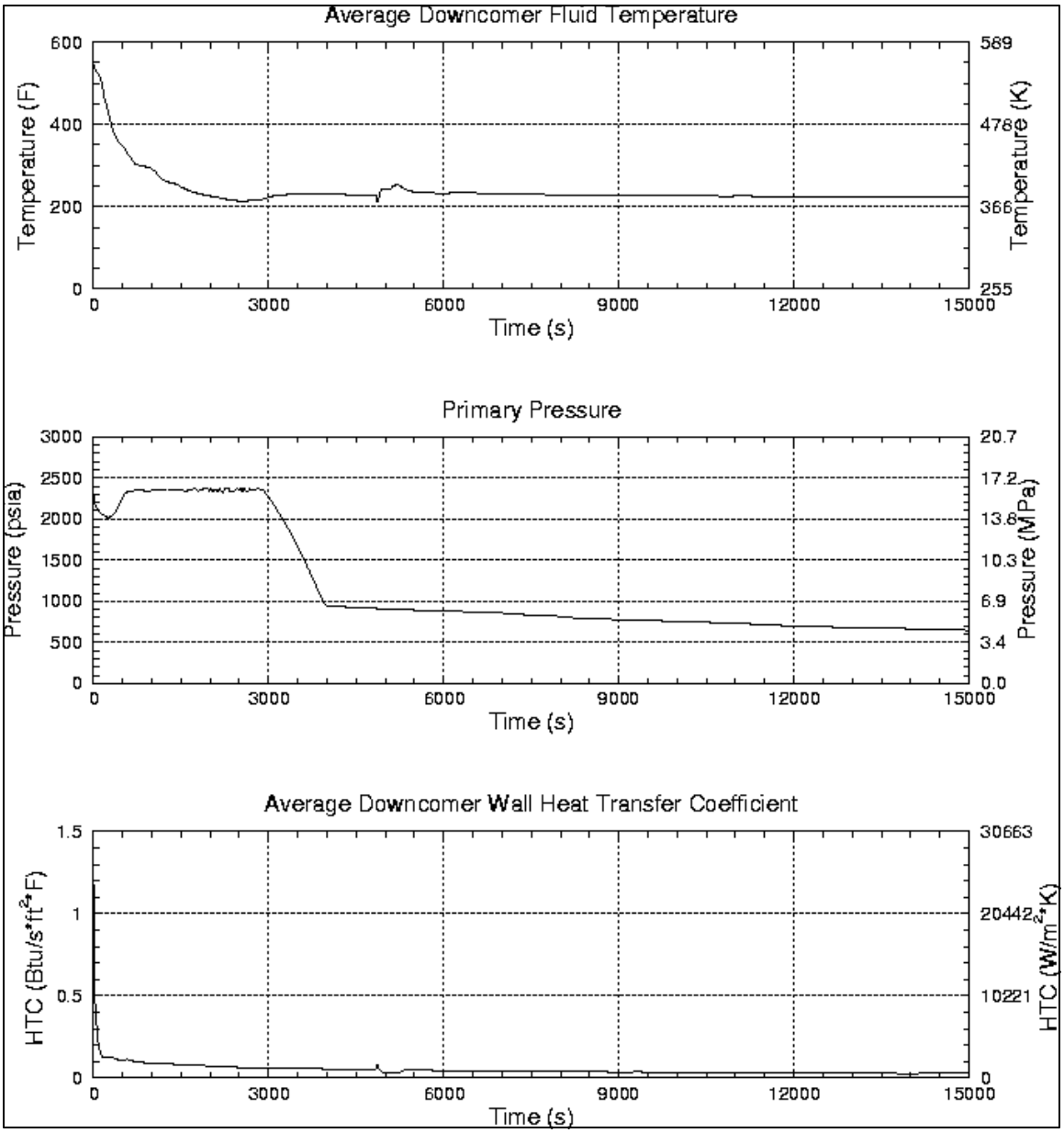


Figure B.2-114: Beaver Valley PTS Results for Case 113

Case Category	LOCA
Primary Failures	7.18 cm (2.828 in) surge line break
Secondary Failures	None
Operator Actions	None
Min DC Temp	304.0 K (87.5°F) at 4890 s
Comments	Sensitivity case; summer conditions and heat transfer coefficient increased 30%.

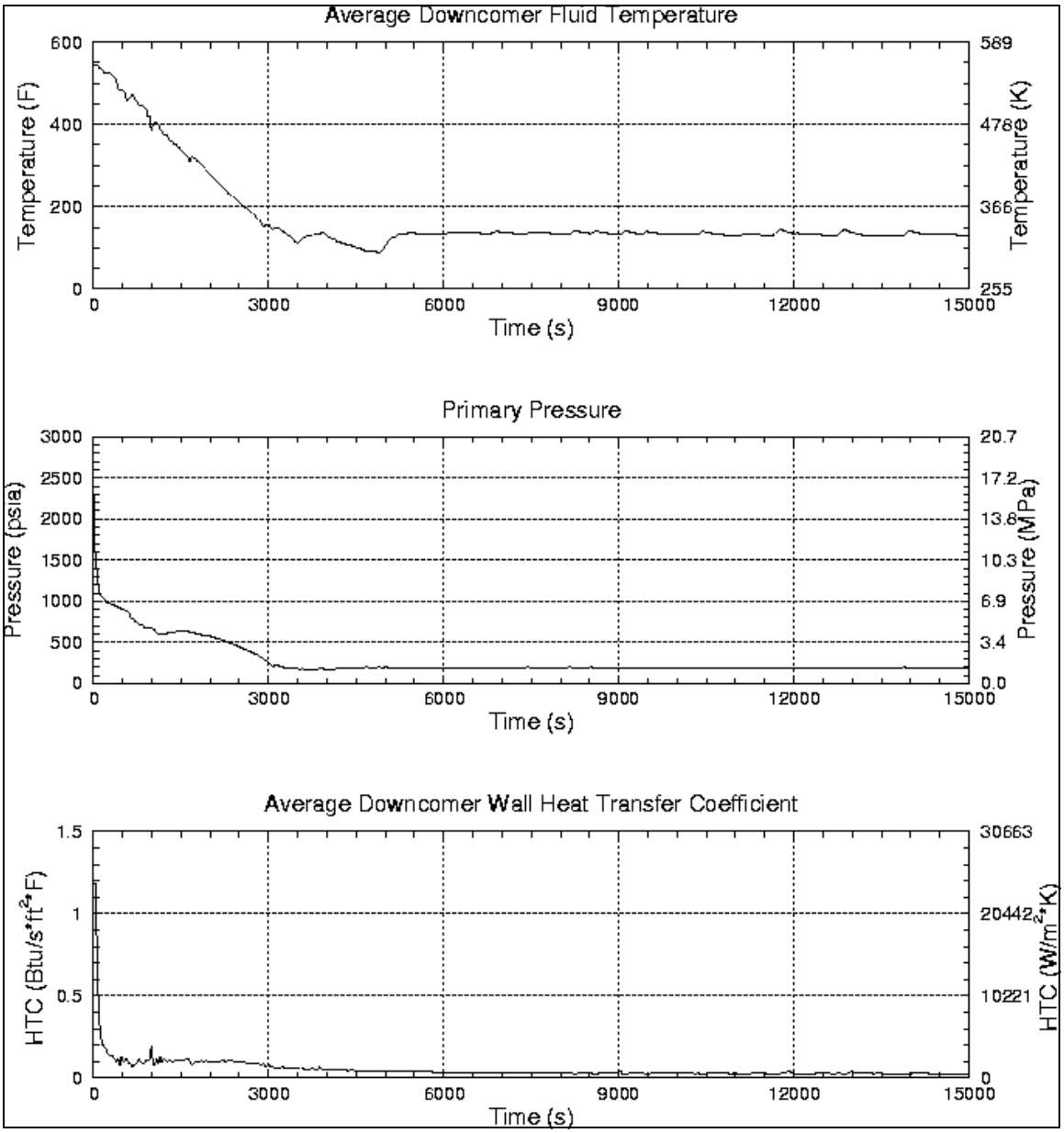


Figure B.2-115: Beaver Valley PTS Results for Case 114

Case Category	LOCA
Primary Failures	7.18 cm (2.828 in) cold leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	369.9 K (206.2°F) at 14760 s
Comments	None

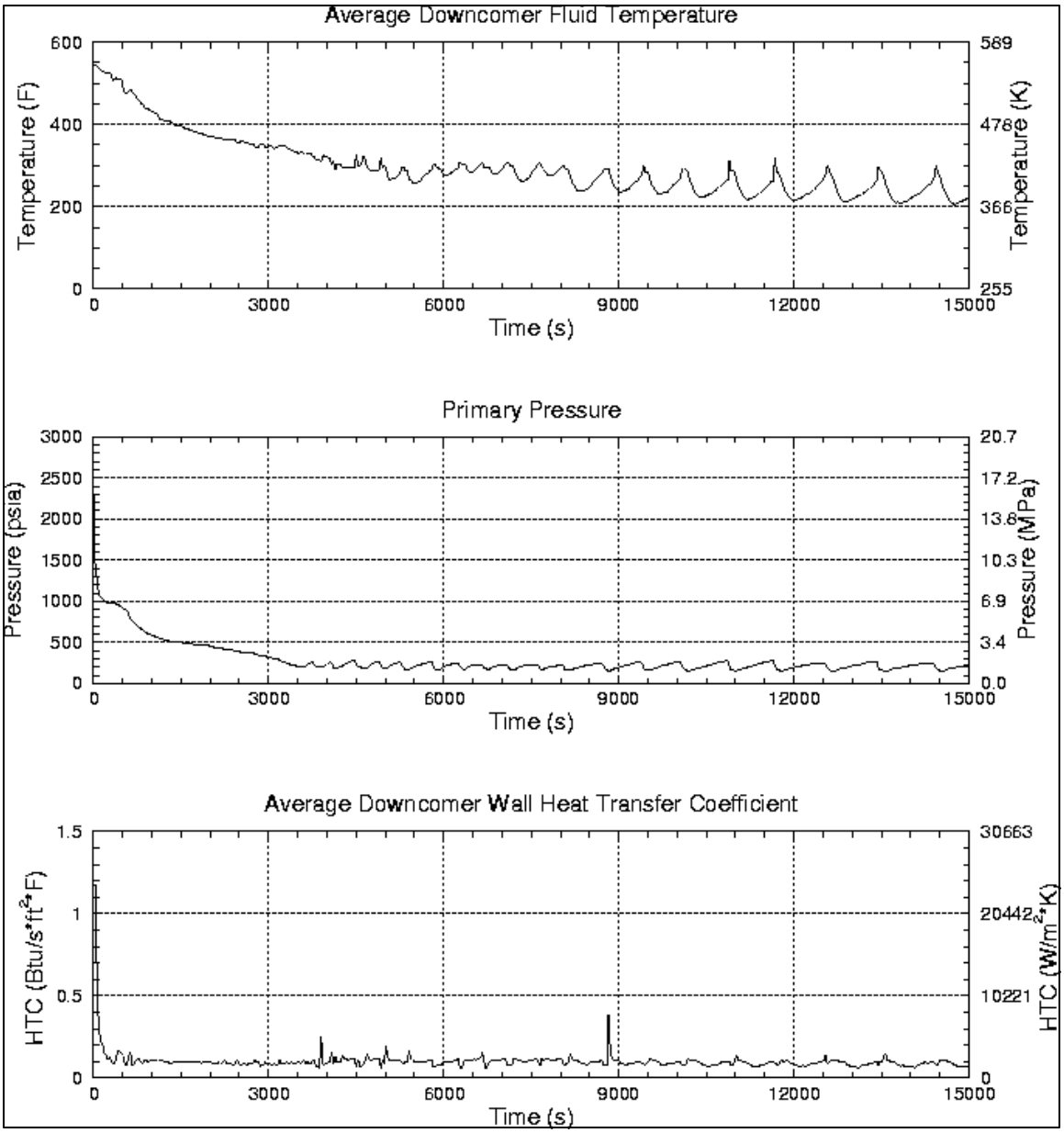


Figure B.2-116: Beaver Valley PTS Results for Case 115

Case Category	LOCA
Primary Failures	16.38 cm (6.45 in) cold leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	331.4 K (136.9°F) at 2550 s
Comments	Break area increased 30% over 14.37 cm (5.657 in) case.

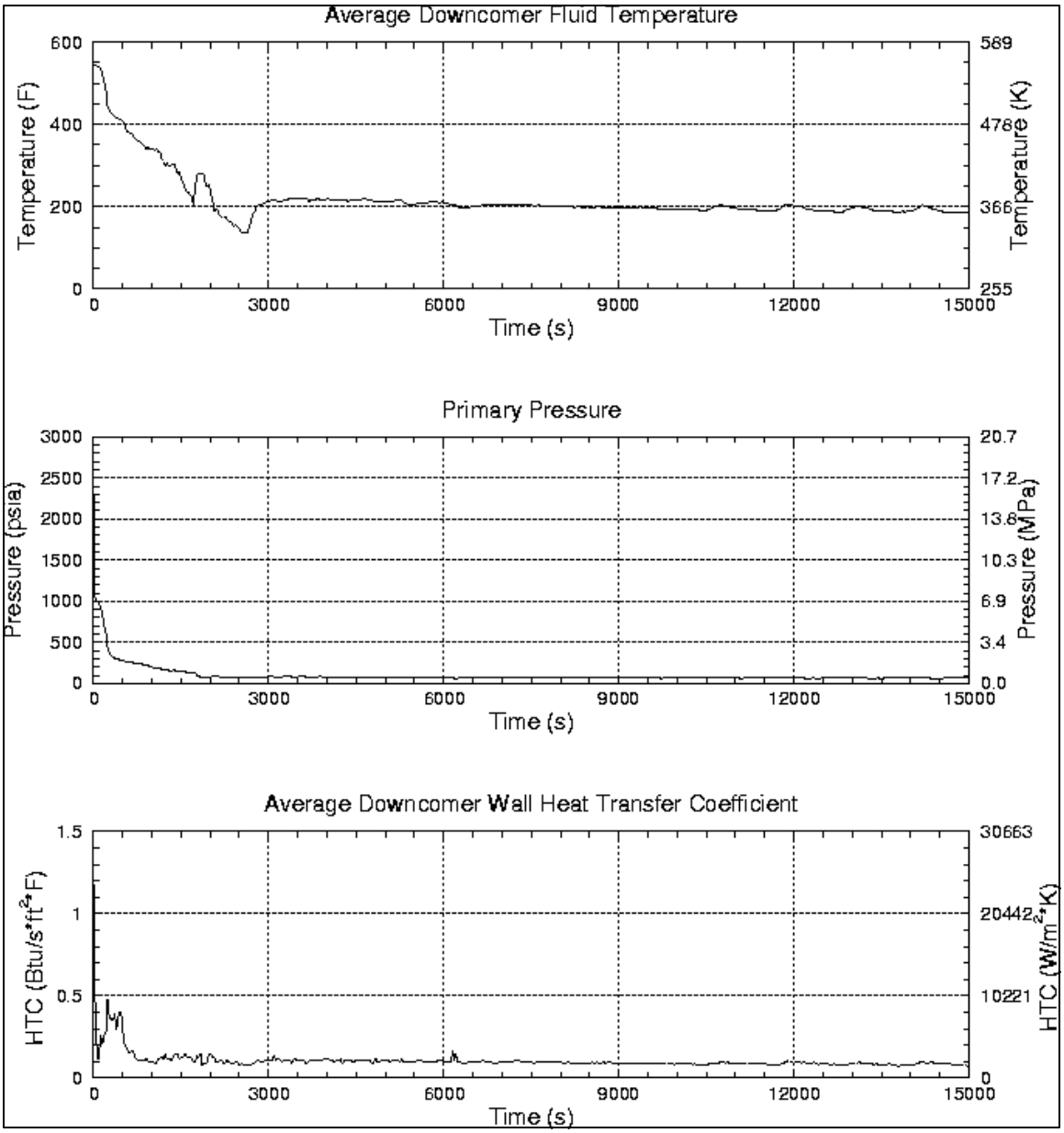


Figure B.2-117: Beaver Valley PTS Results for Case 116

Case Category	LOCA
Primary Failures	14.37 cm (5.657 in) cold leg break
Secondary Failures	None
Operator Actions	None
Min DC Temp	336.3 K (145.6°F) at 2820 s
Comments	Sensitivity case; summer conditions.

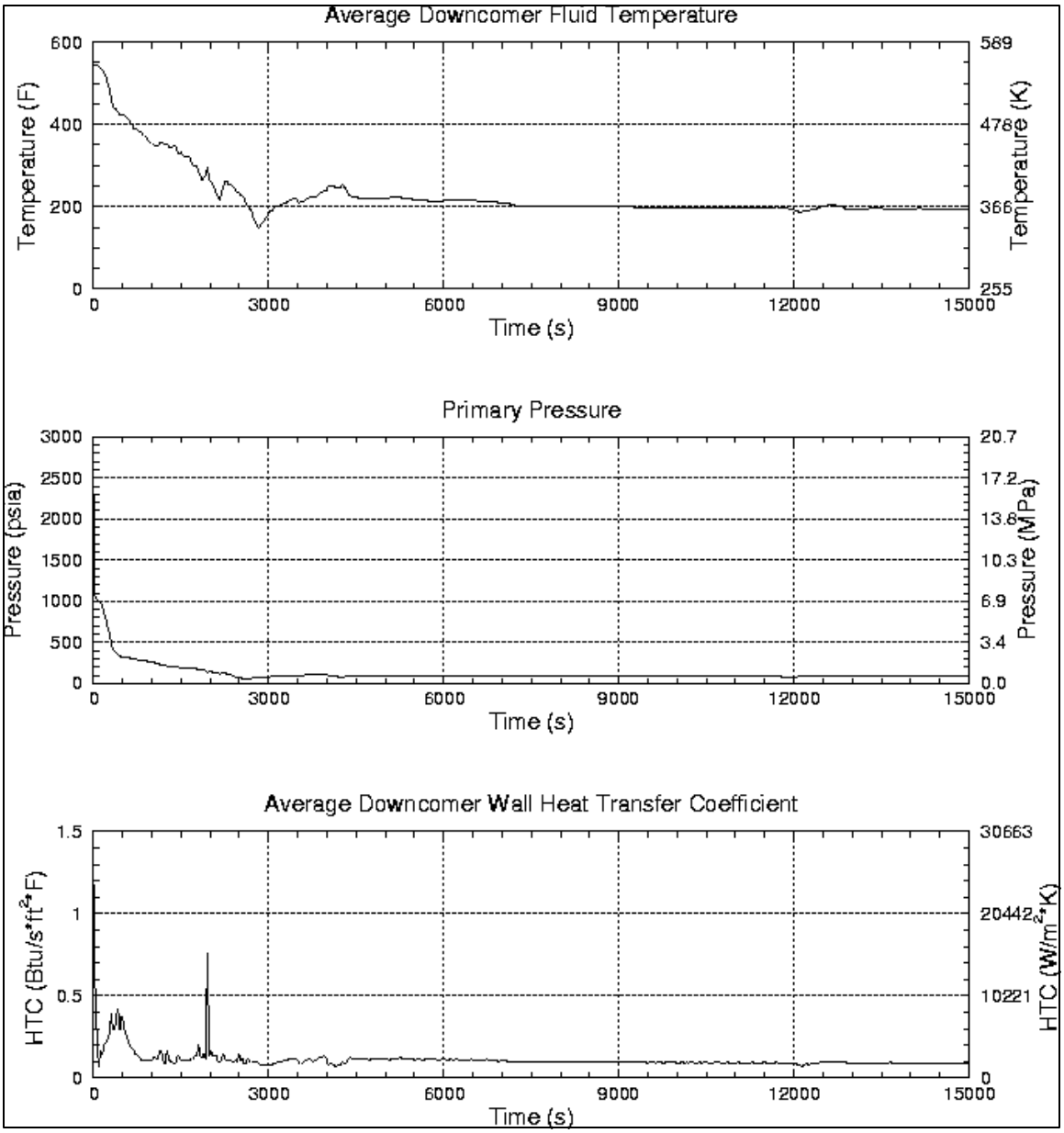


Figure B.2-118: Beaver Valley PTS Results for Case 117

Case Category	MSLB
Primary Failures	None
Secondary Failures	All MS-SRVs on SG A stuck open
Operator Actions	None
Min DC Temp	373.9 K (213.4°F) at 15000 s
Comments	AFW continues to feed SG A.

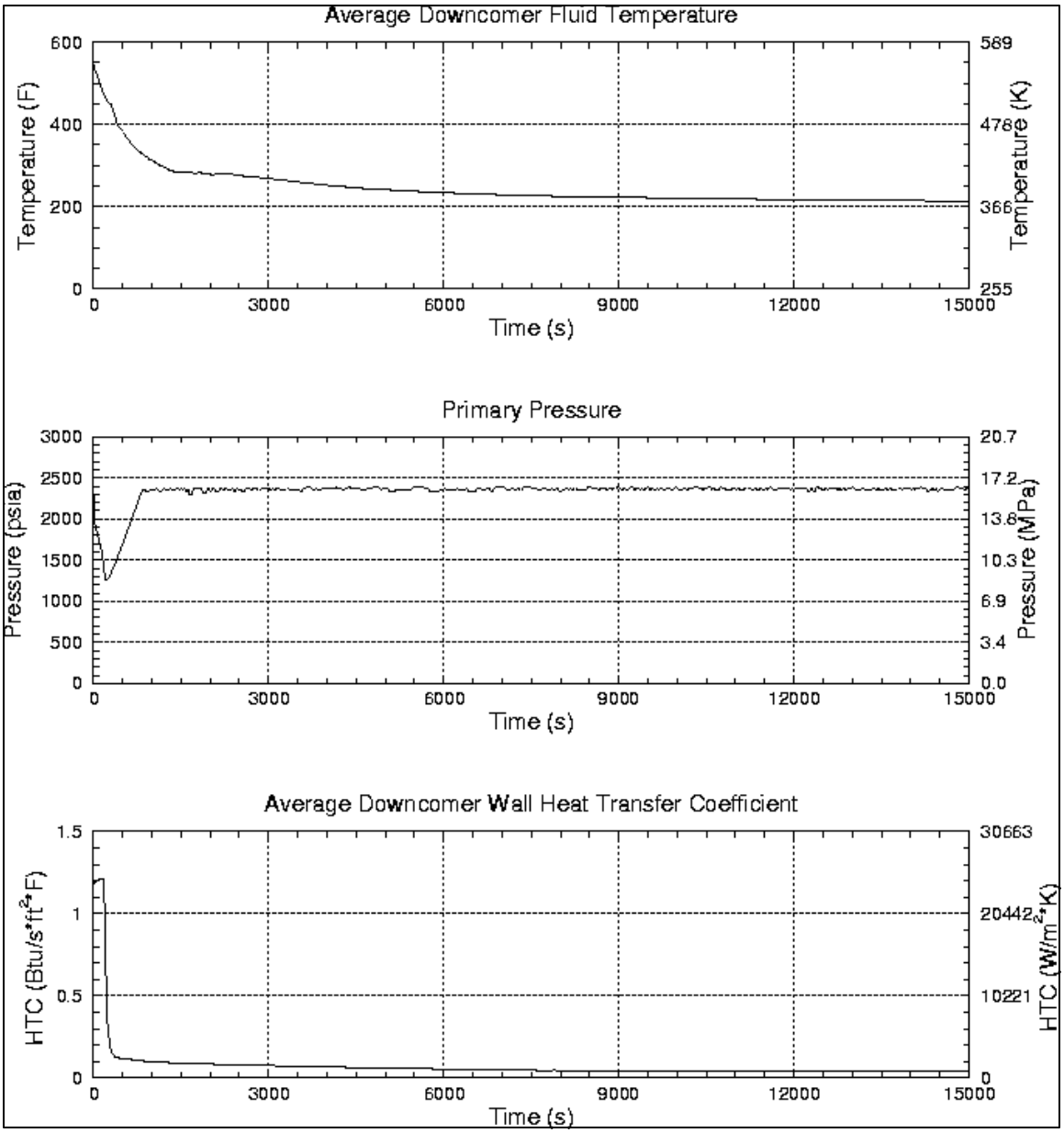


Figure B.2-119: Beaver Valley PTS Results for Case 118