P, T, h ESTIMATION - CURRENT STATUS

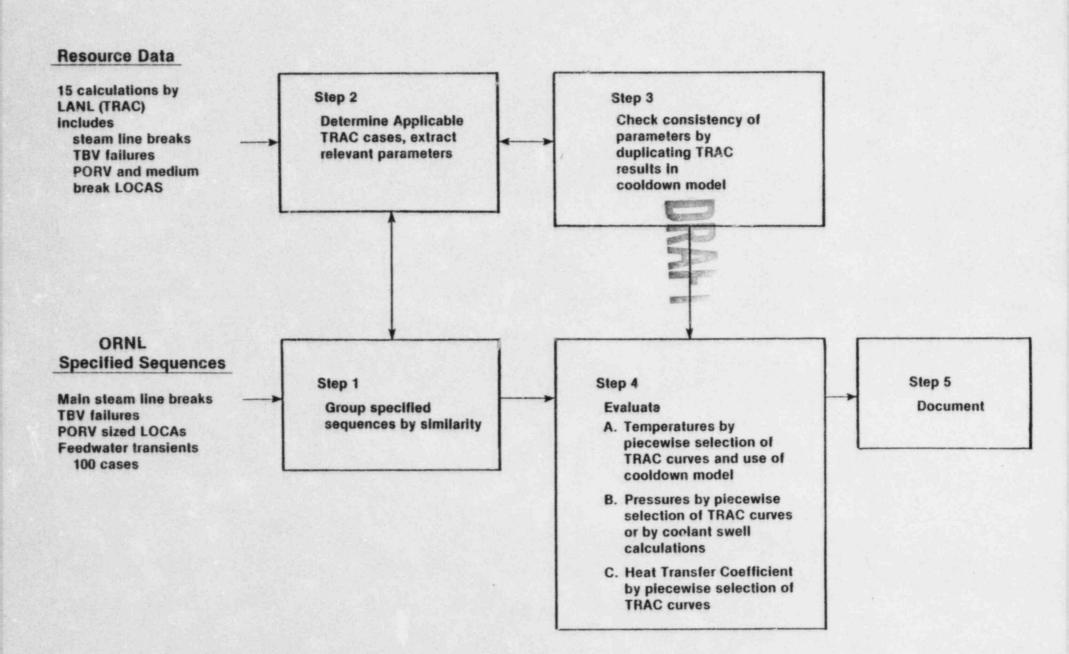
DRAFT

PTS Study Group Baltimore, Maryland February 16, 1984

Presented by:

Science Applications, Incorporated

Figure 1. P, T, h Estimation Approach



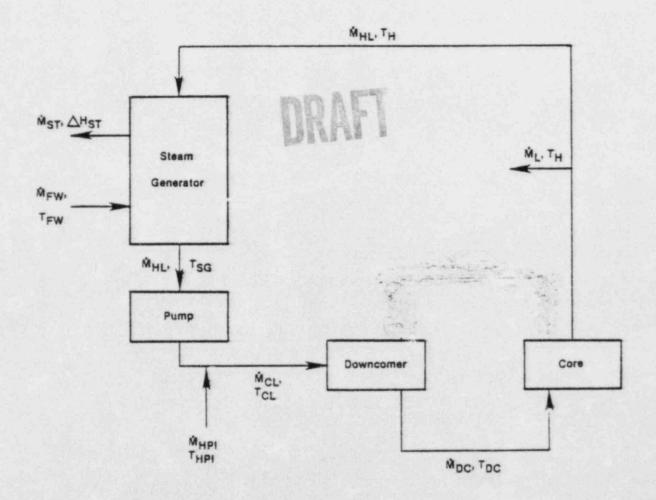


Figure 3. Simple Loop Model for Downcomer Temperature Evaluation

Heat Transfer Coefficient Estimation

Three main regimes are observed in the LANL calculations.

- 1. RCP's operating
- 2. RCP rundown following trip (100 sec)
- 3. Natural Circulation

Estimated h for each regime is given by:

- 1. h of 4000-5000 Btu/hr ft20F calculated by TRAC with RCP's running.
- 2. Rundown from 5000 to 400 Btu/hr ft20F following RCP trip.
- 3. Use floor of 400 Btu/hr ft20F for natural circulation regime.

Table 1. MAIN STEAMLINE BREAK AT HOT 0% POWER Initiator: Large Break Upstream of MSIV

Sequence	MSIVs condition	MFIVs condition	AFW condition	AFW isolation to low press. S/G	AFW flow condition	IPI condition	Operator action: turn off charging pumps	Operator action: throttle AFW	Early est. frequency probability/yr
1.0	all close on demand ~18.4 s	all close on demand start closing ~18.4 s	sctuates on demand ~90.9 s	actuates on demand ~90.9 a	suto control led	occurs on demand ~70 s	performed during fecovery phase when pressure rises to shutoff head of HPI system	throttles AFV at + 22* in S/G	total of 1.A and 1.B is 1.2 x 10
1.9	s'l close on demand -18.4 s	all close on demand start closing ~18.4 s	actuates on demand ~2.0 s	actuates on demand -18.7 s	auto controlled	domand ~70 s	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at + 22* in S/G	see 1.A
1	all close on demand ~16.4 s	all close on demand start closing -18.4 s	actuates on demand -90.9 s	ectuates on demand ~90.9 s	auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failure	5.0 x 10 ⁻⁶
•	on demand	all close on demand start closing -18.4 a	sctustes on demand ~90.9 s	sotuates on demand ~90.9 s	suto control led	occurs on domand ~70 s	failure	throttles AFV at + 22" is S/G	3.0 x 10 ⁻⁶
rı •	all close on demand ~18.4 s	all close on demand start closing ~18.4 s	actuates on demand ~90.9 s	actuates on domand ~90.9 s	euto control led	occurs on demand ~70 s	fatlure	failure	1.0 x 10 ⁻⁶
5.	sil close on demand ~18.4 s	ail close on demand start closing ~18.4 s	sotuates on demand ~90.9 s	octuates on domand ~90.9 s	auto controlled	fails	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV at + 22 " is S/G	2.0 x 10 ⁻⁷

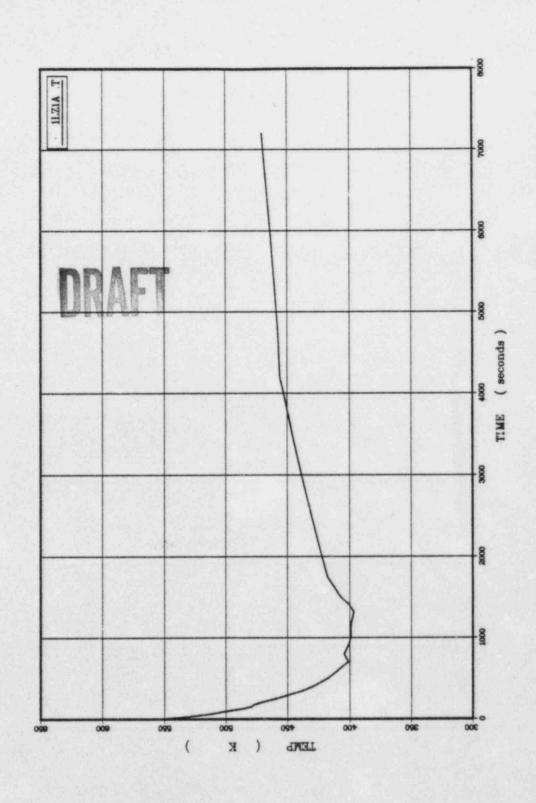
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Table.1. Continued

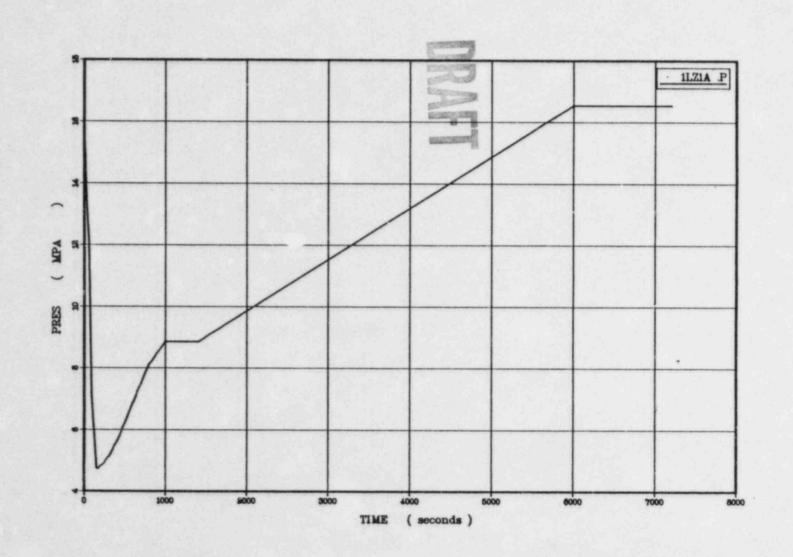
	Sequence number	MSIVs condition	MFIVs condition	AFW condition	AFF isolation to low press. S/G	flow condition	RPI condition	Operator action: turn off charging pumps	Operator action: throttle AFV	Early est. frequency probability/yr
= LANL T2	4.	sll close on demand ~18.4 s	all close on demand start closing ~18.4 s	on demand ~90.9 s	fails to	auto controlled	occurs on demand ~70 s	performed during recovery phase when pressure rises to shutoff head of HPI	throttles AFW at + 22" in 8/G	3.0 x 10 ⁻⁸
	1.4	both fail to close ~18.4 s	all slose on demand start closing ~18.4 s	actuates on demand (time?)	does not	ento controlled	occurs on demand (time?)	performed during recovery phase when pressure rises to shutoff head of HPI system	flow does not exceed 160 gal/min on any line	total of 7.A and 7.B i4 1.0 x 10
= 1.7.A	7.8	both fail to alose ~18.4 s	all close on demand start closing ~18.4 c	sctuates on demand (time?)	does not	initially in auto. operator tills flow to both S/Gs .300 s after MSIVs fail to close	occurs on demand (time?)	performed during recovery phase when pressure rises to shutoff head of HPI system	N/A	see 7.A

PLOT 1 23.50.50 TUES 7 PEB, 1984 JOB-KTNINT , 15500 DISSPLA VER 8.2

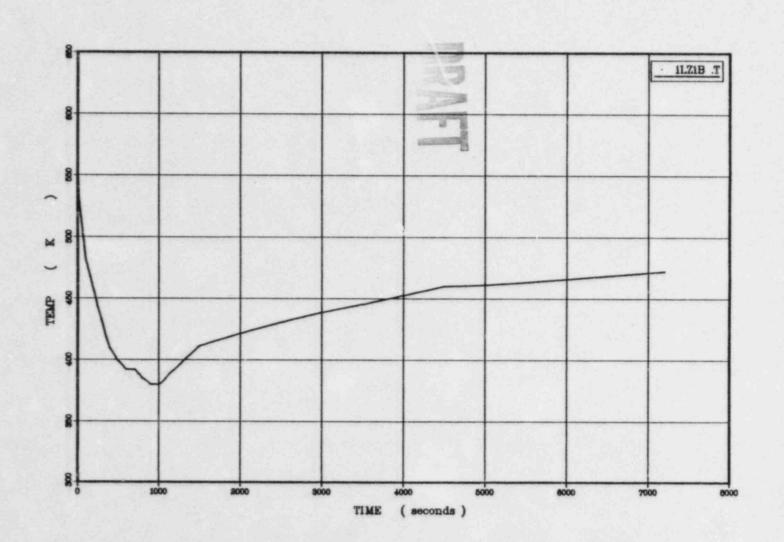
DC TEMP FOR LARGE SLB AT HOT ZERO POWER CASE 1.1A



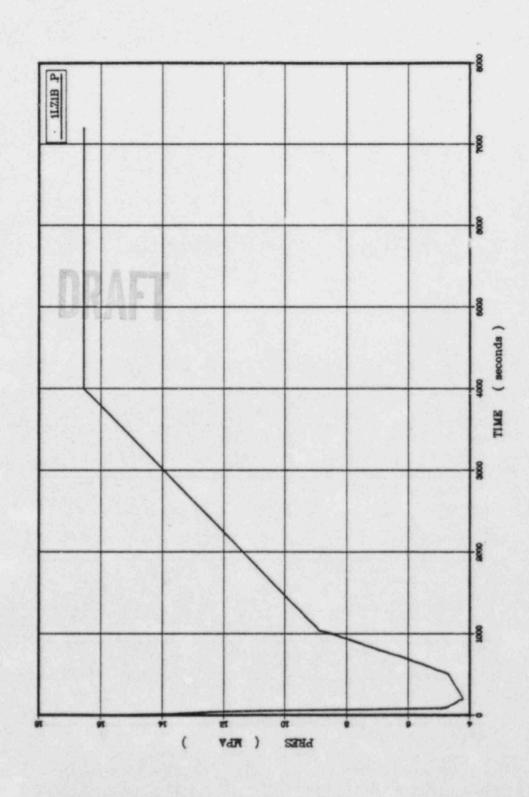
DC PRES FOR LARGE SLB AT HOT ZERO POWER CASE 1.1A



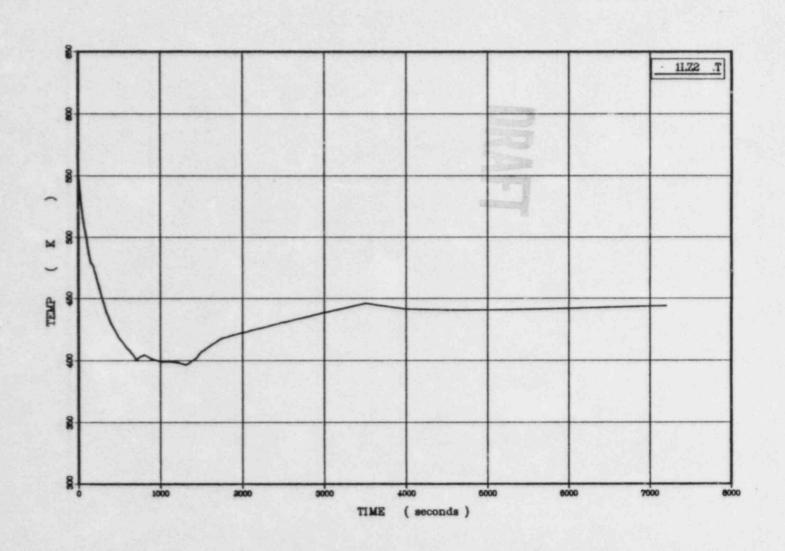
DC TEMP FOR LARGE SLE AT HOT ZERO POWER CASE 1.1B



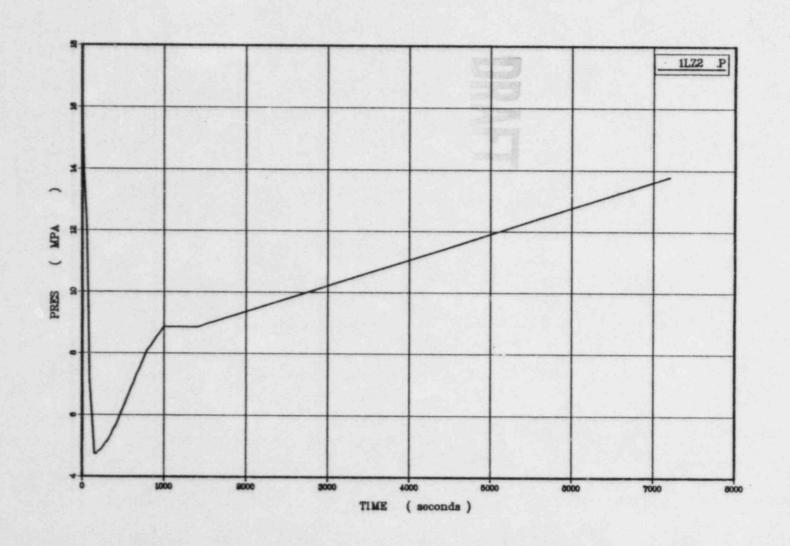
DC PRES FOR LARGE SLB AT HOT ZERO POWER CASE 1.1B



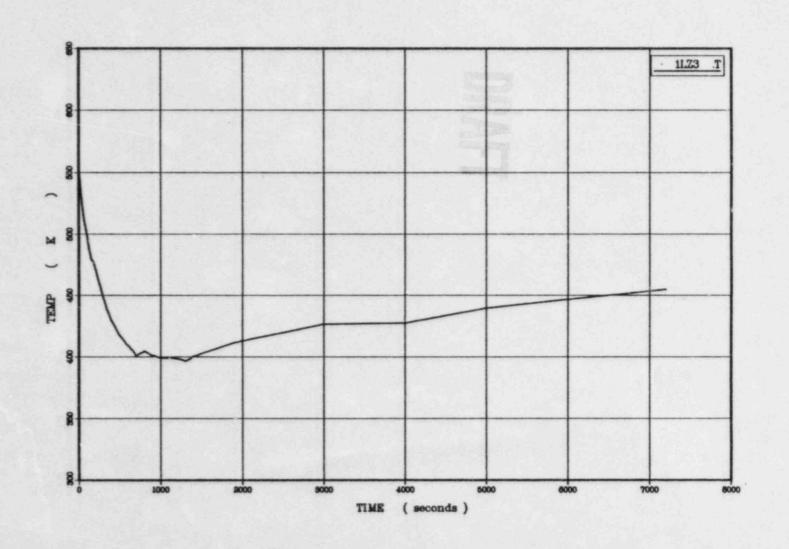
DC TEMP FOR LARGE SLB AT HOT ZERO POWER CASE 1.2



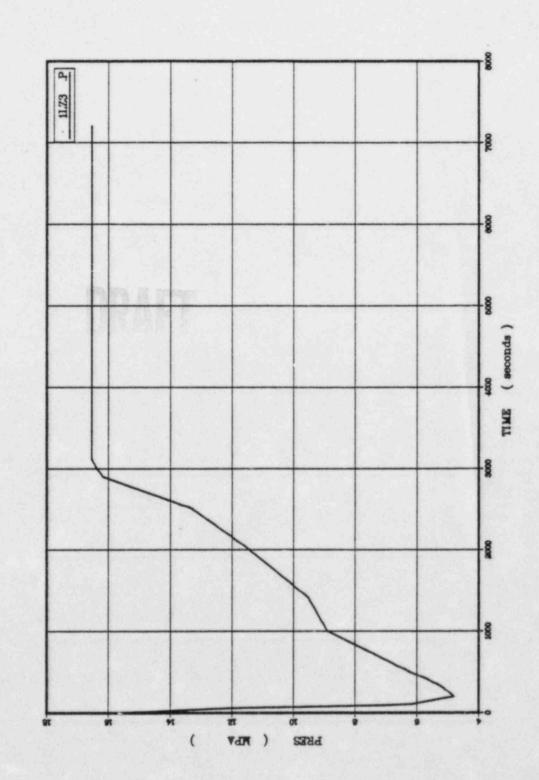
DC PRES FOR LARGE SLB AT HOT ZERO POWER CASE 1.2



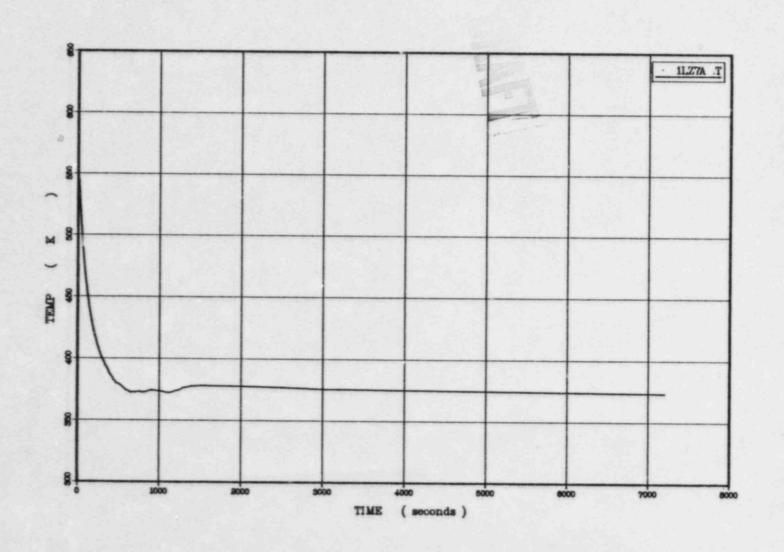
DC TEMP FOR LARGE SLB AT HOT ZERO POWER CASE 1.3



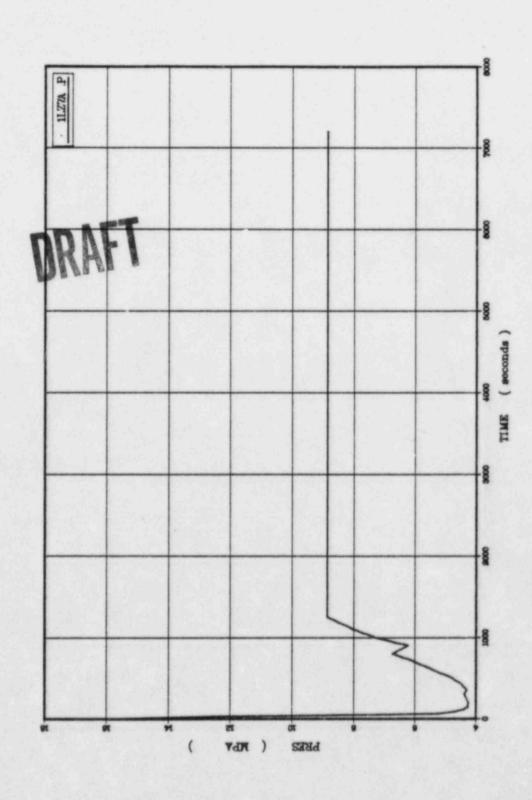
DC PRES FOR LARGE SLB AT HOT ZERO POWER CASE 1.3



DC TEMP FOR LARGE SLB AT HOT ZERO POWER CASE 1.7A



FOR LARGE SLB AT HOT ZERO POWER CASE 1.7A DC PRES



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Table 3. Mein Steamline Break at Full Power Initiator: Large Break Upstream of MSIV

		_							
	Sequence no.	Turbise condition	ADV:	TBVs condition	Main food runback	MSIVs condition	MFIVs condition	AFW condition	AFW isolation to low press S/G
= LANE T3	1.	trips on densed -2.8 s	all close on domand 28.7 s	all close on demand	runback	on demand	all close on demand ~41.2 s	on demand ~197.0 s	on demand ~197.0 s
= LANL T3	1.	trips on demand ~2.8 s	all close on demand 28.7 s	all close on demand ~4.0 s	runback	on demand	on demand	on demand	on demand ~197.9 s
= LANLT3	1.	trips on demand -2.8 s	on demand 28.7 s	on demand	reaback	on demand	on demand	en demand	on demand -197.9 s
= LANL T3	4.	trips on demand ~2.8 s	ell close on demend 28.7 s	on demand	runback	on densus	all close on demand	ectuates on demand ~197.9 s	on demand 197.9 s
= LANL T3	5.	trips on demand ~2.8 s	sil close on demand 28.7 s	ell close on demand	runback occurs	on dewend:	all close on demand	on demand	on demand
	0	trips on demand -2.8 s	sll close · on demand 28.7 s	ell close on demend ~4.0 s	runback occurs	both fail to close ~41.2 s	all close on demand ~41.2 s	on demand ~197.9 s	does not actuate since no ΔP signal generated
≈ 3.7.C	-7.4	trips on on demand	ADV on line opposite broken line fails to close but is manually isolated at 30 minutes	sli close on demand ~4.0 s	runback pecurs	sil close on demand ⊸11.2 s	all close on demand ~11.2 s	on demand -197.9 s	ectuates on demand -197.9 s
= 3.7.¢	7.8	trips or on demand	ADV on line opposits broken line fails to close but is manually isolated at 15 minutes	ell close on demand -4.0 s	runback occurs	all close on demand ~41.2 s	all close on demand ~41.2 s	actuates on demand ~197.9 s	actuates on demand ~197.9 s
	©	trips on on demand	ADV on line opposite broken line fails to close	all close on demand -4.0 a	runback occurs	all close on demand ⊸41.2 s	ell close on demand ~1.3 s	on demand ~197.9 a	on demand
	0	trips on domand 2.8 s	or demand 28.7 s	on demand	fails to occur on line with steam break	all close on demand (time?)	all close on demand (time?)	on demand	actuates on demand
= 3.8	,	trips on demand 2.8 s	nil close on demand 28.7 s	all close on demand ~4.0 a	fails to occur on both lines	all close on demand	all close on demand	actuates on demand	actuates on demand

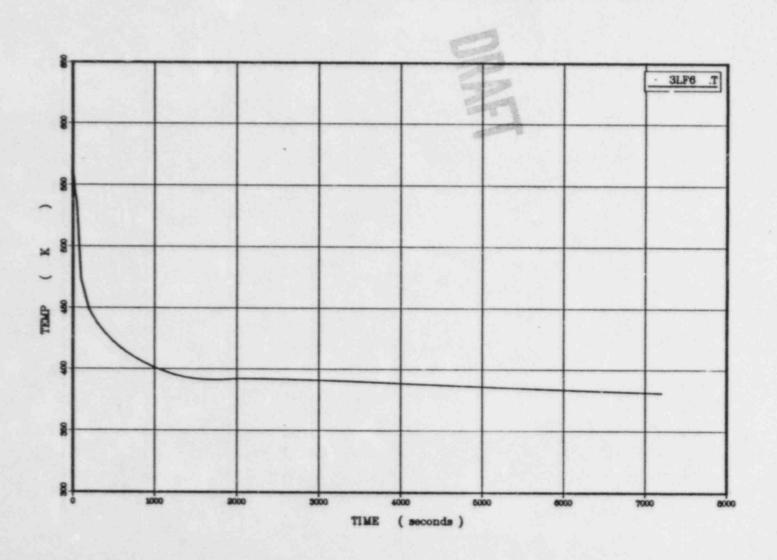
Table 3. Continued

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AFW flow condition	HPI condition	Operator action: turn off charging pumps	Operator action: throttle AFW	Early est. frequency	Sequence
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at + 22" im S/G	1.0 . 10-3	1.
auto sontrolled	demand	failure	throttles AFW at + 22" in S/G	3.0 x 10 ⁻⁵	2.
suto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI wates	failure	3.0 x 10 ⁻⁵	3.
suto controlled	deants on	failure .	failure	6.0 x 10 ⁻⁶	4.
auto controlled	fails to	performed during recovery phase when pressure rises to shutoff head of HPI system	throttlee AFV at + 22" in S/G	1.6 x 10 ⁻⁶	5.
ento controlled	on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gal/min on any line	1.0 x 10 ⁻⁷	•
auto controlled	on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV at + 22" in S/G	total of 7.A, 7.B. and 7.C ig 2.0 x 10	7.4.
auto controlled	on demand	performed during recovery phase when pressure rises to shatoff head of RPI system	throttles AFW at + 22" in S/G	100 T.A	7.8.
sato controlled	on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	AFV at + 22" is S/G	ses 7.A	7.C.
auto controlled	on demand	performed during recovery phase when pressure rises to shatoff head of HPI system	throtties AFV at + 22° ia S/G	5.0 g 10 ⁻⁶	•
suto controlled	on demand	performed during recovery phase when pressure rises to shatoff head of HPI system	thr. tiles AFW at + 22" in S/G	5.0 x 10 ⁻⁷	•

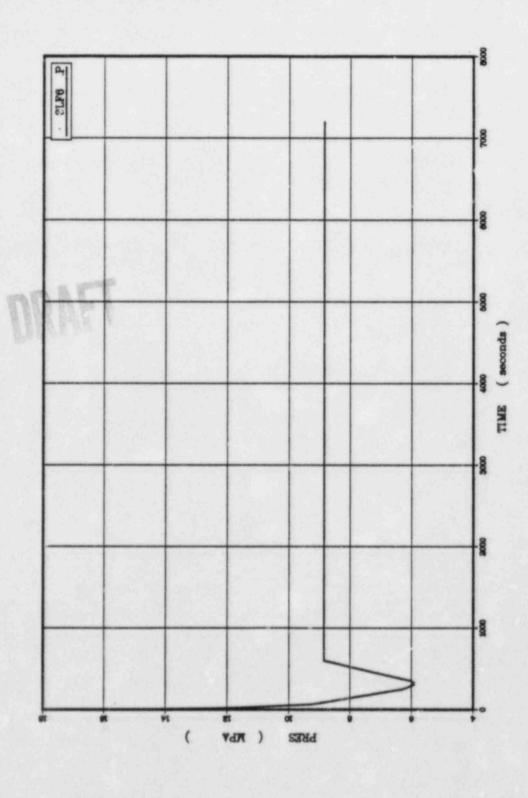
DC TEMP FOR LARGE SLB AT FULL POWER

CASE 3.6



PLOT 1 23.28.50 TACS 14 FTZ, 1884 JOS-KTHOSP , 15500 DISSTLA WER 8.2

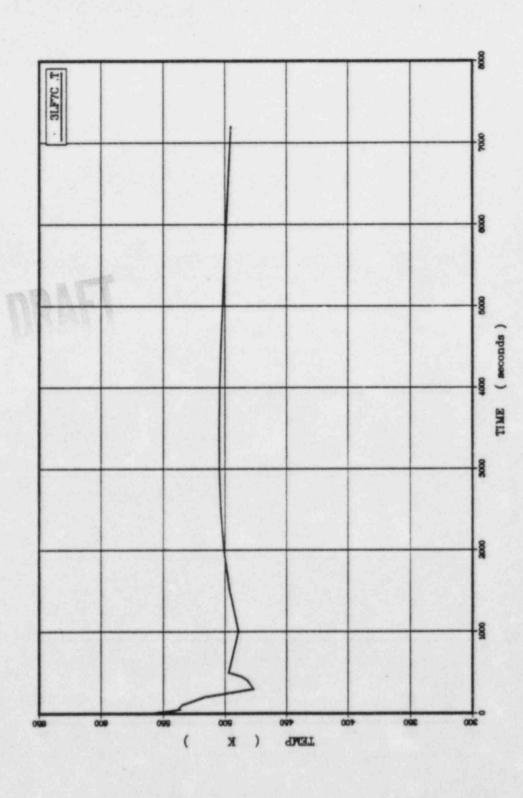
DC PRES FOR LARGE SLB AT FULL POWER CASE 3.6



PLOT 1 23.24.32 TUES 14 FIZB, 1884 JOB-KTM370T , 18500 0158FLA VER 8.2

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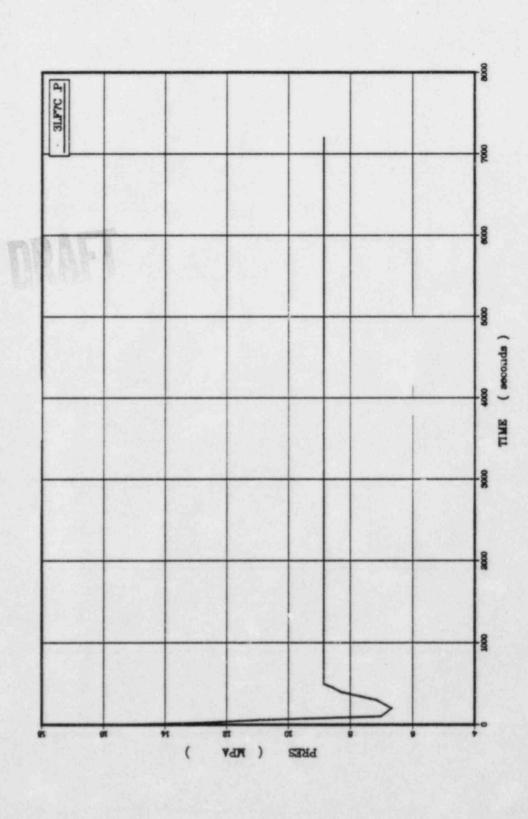
CASE 3.7C DC TEMP FOR LARGE SLB AT FULL POWER



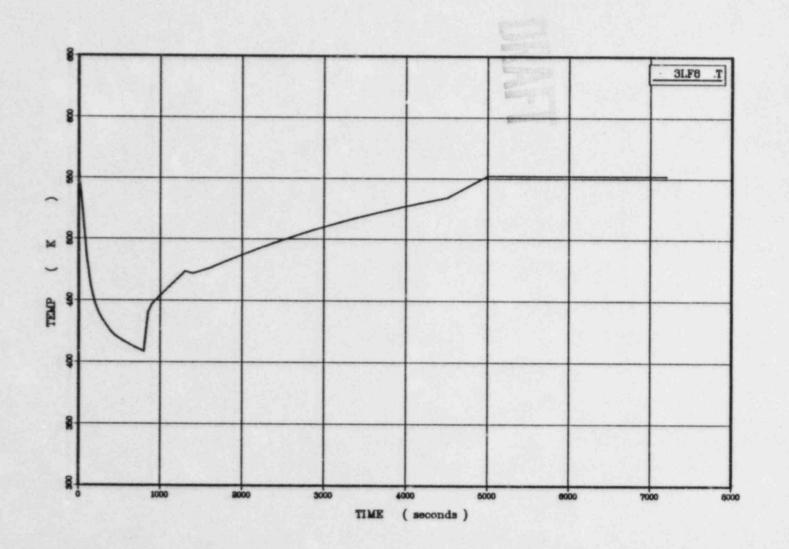
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DC PRES FOR LARGE SLB AT FULL POWER CASE 3.7C



DC TEMP FOR LARGE SLB AT FULL POWER CASE 3.8



PLOT 1 23.28.30 TOES 14 FZB, 1864 . JOB-KTN36F , ISSOO DISSPLA VER 6.2

DC PRES FOR LARGE SLB AT FULL POWER CASE 3.8

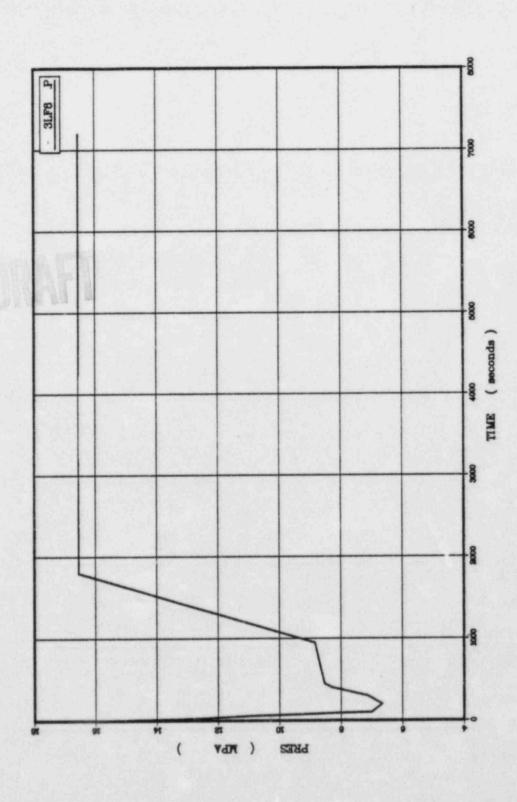


TABLE 5
REACTOR TRIP AT FULL POWER

Initiator: Unspecified

	Sequence no.	Turbine condition	ADV:	TBV _a condition	Naisfeed runback	MSIV. condition	MFIVs condition	AFV condition	AFW isolation to low pressure S/G
= Loss of Load	1.	trips on denand	etick open then close as required	quick open then close as required	runback occurs	open	censia open	actuated	not actuated
= LANL T9		demand	quick open then close as required	quick open then close as required	fails to occur on one line	remain open	remain open	on demand	actuated
= LANL T9		trips on demend	quick open then close as required	quick open then close as required	fails to occur on one line	remain	remain open	on demand	not actuated
= LANLT9	•	trips on demand	quick open then close se asquired	quick open then close as required	fails to occur on one line	open	remain	on demand	actuated
= LANLT9	3.	trips on demand	quick open then close as required	quick open then closs as required	fails to occur on one line	open	remain open	on demand	actuated
= LANLT8	6.	trips on demand	quick open then close as required	quick open then close as required	fails to occur on both lines	remain open	remain	on demand	not accusted
= LANLT8	7.	trips on demand	quick open then close as sequired	quick open then close as required	fails to occur on both lines	remain	open	on demand	actuated
= LANLT8		tripe on	quick open then close as required	quick open then elose as required	fails to occur on both lines	remain open	remain	on demand	actuated
= LANL T4	34.	trips on demand	quick open then close as required	one TBV fails to close -50 s	runback	on demand	on depend	on demand	actvated
= 5.12.B	7 h.	trips on demand	quick open then slose as required	fail to close -50 a	runback	on demand	oll close on domand ~510 p	on demand	not actuated
= 5.12.0	90.	. trips be deemd	quick open then closs as required	three TBVs fail to close ~50 s	runback occurs	on demand	on demend ~510 s	on demand	setueted
= LANLT4	20A.	trips on demand	quick open then close as required	one TBV fails to close ~50 s	reabsck	on demand	on demand	on demand	not actuates
= 5.12.B	108.	trips on demand	quick open then close as required	two :BVs fail to close ~50 s	runback	all close on demand ~510 ;	on demand ~510 s	or demand	actuated

TABLE 5 (CONTINUED)

AFV flow condition	HPI condition	Operator action: turn off cherging pumps	Operator action: throttle AFW	Early estimated frequency probability per year	Sequence no.
not sctusted	not actuated	NA	NA	5.5 10	1.
suto socifolied	demand occurs on	performed during recevery phase when pressure rises to shutoff head of MPI system	throttles AFW at +22" in S/G	5.0 x 10 ⁻³	2.
auto controlled	qemenq occurs on	failure	throttles AFV at +22" in S/G	1.3 x 10 ⁻⁴	3.
suto sontrolled	occurs on demend	performed during recovery phase when pressure rises to shutoff bead of HPI system	failure	1.3 = 10-4	••
esto controlled	domand	failure	fellere	3.0 x 10 ⁻⁵	5.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV t	2.5 x 10 ⁻⁴	6.
suto	occurs on demand .	feilure	throttles AFW at	7.6 x 10 ⁻⁶	7.
auto controlled	occurs on demand	performed during recovery phase when presence rises to shutoff head of HPI system	failure	7.0 x 10 ⁻⁶	•
auto . controlled	demand	performed during recovery phase when pre sure rises to shutoff head of HPI system	throttles AFV at +22" in S/G	1.0 : 10-2	94.
suto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles APV at +22" in S/G	8.0 x 10 ⁻⁴	98.
auto controlled	occurs on domand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at +22" in S/G	1.7 x 10 ⁻⁴	9C.
auto controlled	occurs on demand	failure	throttles AFW at +22" in S/G	3.0 x 10 ⁻⁴	10A.
suto controlled	occurs on demand	failure	throtties AFW at	2.0 x 10 ⁻⁵	109.

TABLE 5 (CONTINUED)

	Sequence no.	Turbine condition	ADVs condition	7BVa condition	Nainfeed runback	MSIVs condition	EFIVs condition	AFV	AFW isolation to low pressure S/G
= 5.12.C	10C.	trips on depand	quick open then close as required	chree TSVs fail to	runback	all close on demand ~310 s	ell close on demand ~510 a	actuates on demand	not actuated
= LANLT4	114.	trips on demand	quick open then close as required	one TBV fails to close ~50 s	runback	ell close on demand ~510 s	on demand	on demand	not actuated
= 5.12.8	118.	trips on demand	quick open then close as required	two TBVs fail to close ~50 s	cceurs	on demand	on demand	actuates on demand	not actuated
= 5.12.0	110.	trips on demand	quick open then close as required	three TBVs feel to close ~50 s	runback	on demand	on demend	actuates on demand	not actuated
= L ANL TH	124.	trips on demand	quick spon then close as required	one TBV fails to	runback	on demand	on demand	on demand	not actuated
	(123.)	trips on demand	then close as required	two TBVs fail to	runback	on demand	on demand	on demand	not actuated
	(:30.)	trips on demand	quick open then close as required	three TBVe fell to close -50 a	occurs	on demand	on demand	on demand	not actuated
	•	trips on slomend	quick open-	Initially one TBV fails to close at ~50 s. ~600 s after MSIV fails to close the TBV is isolated.	runback	one NSIV fails to close	on demand	actuates on demand	actuates on demand
	(11)	trips on demand	quick open then slose as required	Initially two TBVs [sil to close at -50 s900 s after MSIV fails to close the TBVs are isolated.	runback	one MSIV fails to close	all close on demand ~510 s	actuates on demand	actuates on demand
5.13.B	130.	trips on demand	cutck open then close as required	Initially three TBVs fail to close at -50 s1200 s after MSIVs fail to close all three TBVs are isolated.	sunback	one NSIV fails to close	on demand	ectuates on demand	accuates on demand
=LANLT4A	- 13D.	trips on demand	quick open then close as required	one TBV fails to close ~50 s	runback	fails to	on demend	on demand	demand
	(M)	trips on domand	quick open then close es required	Initially one TBV fails to close et -50 s600 s sfter NSIV fails to close the TBV is isolated.	runbsot occurs	both fail to clos. -510 s	all close on demand ~510 s	sctuates on demand	fails to actuate since no AP signal generated

TABLE 5 (CONTINUED)

AFW flow	HPI condition	Operator action: turn off charging pumps	Operator action: throttle	Early estimated frequency probability per year	Sequence no.
auto controlled	occurs on demand	fellure	throttles AFW at	5.0 x 10	10C.
auto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	feilure	3.0 x 10 ⁻⁴	11A.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failure	2.0 s 10 ⁻⁵	118.
suto sontrolled	demand	performed during recovery phase when pressure rises to shuto.f head of HPI system	failure	5.0 x 10-6	110.
auto controlled	demand	failure	failure	6.0 x 10 ⁻⁵	12A.
auto controlled	occurs on	failure	failure	5.0 x 10-6	128.
auto controlled	occurs on	failure	feilure	9.0 x 10 ⁻⁷	12C.
auto controlled	domend	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at +22" in S/G	4.0 ± 10 ⁻⁵	13A.
auto controlled	occurs ca demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV at +22" in S/G	3.0 x 10 ⁻⁶	138.
soto controlled	domand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at +22" in S/G	6.0 x 10 ⁻⁷	13C.
auto controlled	occurs ca demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW es +22" in S/G	4.0 z 10 ⁻⁶	13D.
suto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on any line	1.0 : 10-5	144.

TABLE 5 (CONTINUED)

	Sequence	Turbine condition	ADVs condition	TBVs condition	Mainfeed runback	MSIV.	MFIVs condition	AFV	AFW #solstion to low pressure S/G
	(148)	trips on demand	quick open then close as required	Initially two TBVs fail to close at -50 s900 s efter MSIV fails to close the TBVs are isolated.	runback	both fail to close ~510 s	sil elose on demand ~510 s	octuates on demand	fails to actuate since no AP signal generated
	(14C.)	trips on demand	quick open then close as required	Initially three TBVs fail to close at ~50 s. ~1200 s after MSIVs fail to close all three TBVs are isolated.	runback	both fail to close ~110 s	ell close on demand ~510 s	actuates on demand	fails to actuate since no AP signal generated
	140.	trips on donesd	quick open then close as required	one TBV fails to close ~50 s	runback	both fail to close ~510 e	on demand ~510 s	on demand	fails to actuate since no AP signal generated
= LANL T4	15A.	trips on demand	quick open then close as required	one TBV fails to close ~50 s	fails to occur on one line	on demand	ell elose on demand	on demand	actuate oh, demand
= 5.1 2.8	. 158.	trips on domand	quick open then close as required	two TBVs Cail to close ~50 s	fails to occur on one line	on demand -510 s	all close on demand	on demand	actuate on demand
= 5.12.C	15C.	trips on demand	quick open then close as required	three TBVs fail to close ~50 s	fails to occur on one line	on demand	all close on demand	on demand	actuate on demand
= 5.12.C	- 16.	trips on;	quick open then close as required	all TBVs fail to close	sunback occurs	on demand	on demand	on demand	demand
= 5.12.0	17.	trips on demand	quick open then close as required	all TBVs fail to	rumback	all close on demand	on demand	on demand	actuate on demand
=5.12.6	18.	trips on demand	quick open then close as required	all TBVs fail to	runback	on demand	on demand ~510 s	on demand	actuate on demand
= LANL T3	.19,	trips on demand	quick open then close as required	Initially all TBVs fail to close at ~50 s. ~1500 s after MSIV fails to close the TBVs are isolated	runback occurs	one MSIV fatis to close	all close on demand ~510 s	on demand	actuate on demand
= 5.23	20.	trips on demand	one fails to close and is not isolated	sil close on demand	runback	sil close on demand	all close on demand	ectuates on demand	actuates on demand

TABLE \$ (CONTINUED)

AFW flow condition	HPI condition	Operator action: turn off charging pumps	Operator sction: throttle AFW	Early estimated frequency probability per year	Sequence no.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on any line	8.0 x 10 ⁻⁷	14B.
auto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on any line	2.0 x 10 ⁻⁷	140.
auto controlled	demand pecar: on	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 ant /min	1.0 : 10-6	14D.
suto controlled	domand	performed during recovery phase when pressure rises to shutouf head of HPI system	threatte APV at	1.0 x 10 ⁻⁵	154.
ento controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throative APV at	8.0 a 10 ⁻⁷	158.
sate controlled	demand .	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at +22" im S/G	2.0 x 10 ⁻⁷	150.
sute controlled	demend	performed during recovery phase when pressure rises to shutoff head of HP1 system	throttles APV at +22" in S/G	4.5 ± 10 ⁻⁵	16.
auto	occurs on demand	feilure	throttles AFV at	1.2 : 10-6	17.
auto control led	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failere	1.2 x 10 ⁻⁶	10.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throtiles AFW at +22" in S/G	1.5 2 10-7	19.
suto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW st +22" in S/G	1.8 x 10 ⁻²	20.

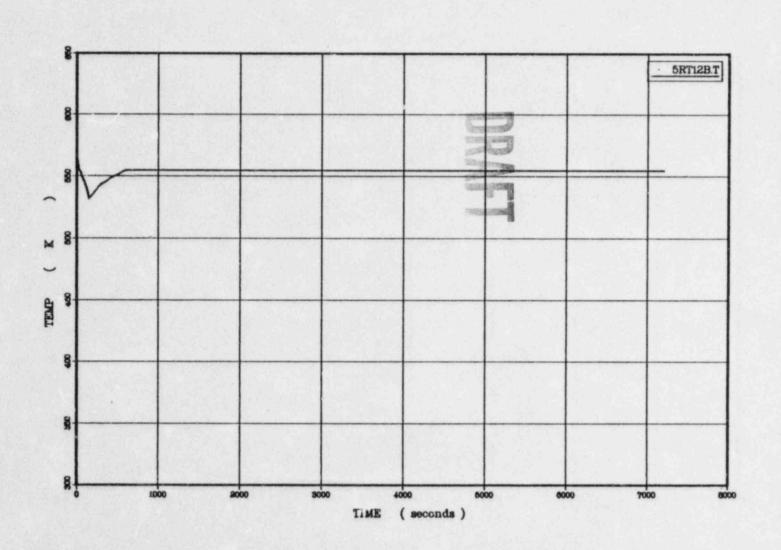
TABLE 5 (CONTINUED)

					CONTIN	ULD/			
	Sequence no.	Turbine condition	ADVs condition	TBVs condition	Mainfeed runback	MSIVs condition	MFIVs condition	AFV	AFW isolation to low pressure S/G
= 5.23	21.	trips on demand	one fails to close and is not isolated	all close on demand	runback	ell close on demand	all close on demand	actuates on demand	actuates on demand
= 5.23	12.	trips on demand	one fails to close and is not isolated	ell close on demand	occurs	all close on demand	on demand	actuates on densed	actuates on demand
	<u>a</u> .	trips on demand	one fails to close and is not isolated	ell close on demand	occurs.	both feil to close	ell close on demand	on demend	fails to actuate since so AP
= 5.23	24.	trips on demand	one fails to close and is not isolated	all close on demand	runback	all close on demand	ali close on demand	actuates on demand	actuates on demand
	(35.)	trips on demand	both feil to close and are not isolated	all close on demand	runback occurs	all close on demand		actuates on demand	fails to actuate since no AP
						THE THE PARTY OF			

TABLE 5 (CONTINUED)

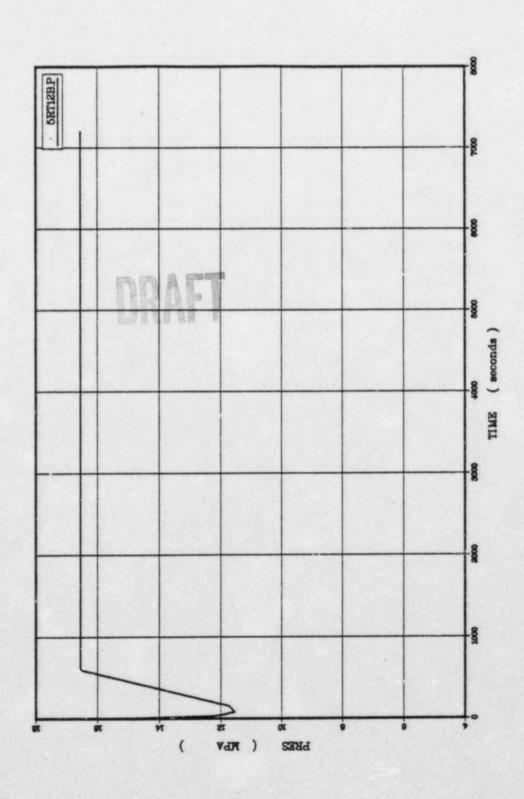
		(CONTINUE)	"		
AFF flow	UPI condition	Operator action: turn off charging pumps	Operator action: throttle AFW	Early estimated frequency probability per year	Sequence no.
auto controlled	occurs on demand	failure	throttles AFW at +22" in S/G	5.0 x 10	21.
auto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failure	5.0 x 10 ⁻⁴	22.
suto sontrolled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on any line	1.6 x 10 ⁻⁵	23.
auto controlled	occurs on	feilure	failure	1.0 x 10 ⁻⁷	24.
auto controlled	occurs on demand	performed during recovery phase whan pressure rises to shutoff head of HPI system	throttles AFW et +22" in S/G	9.0 x 10 ⁻⁴	25.

DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.12B

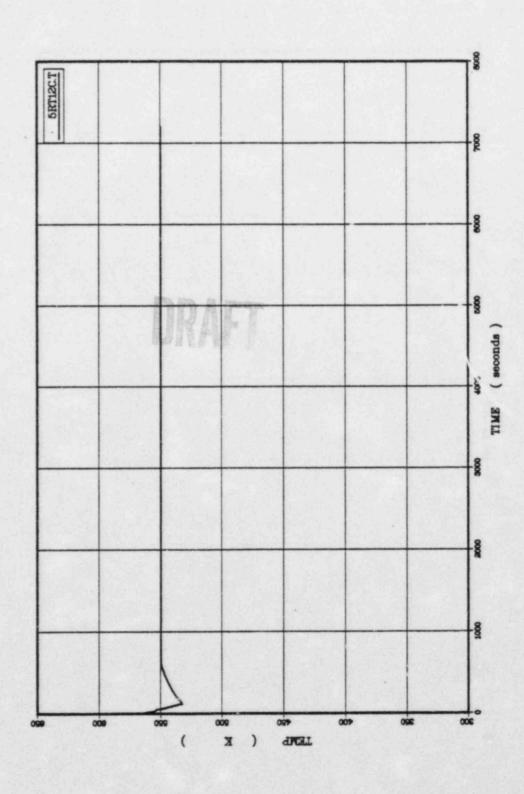


JOT 1 22.28.18 THAR 9 FEB, 1884 JOB-KTM5128F, 15500 DISSPLA PEN 8.2

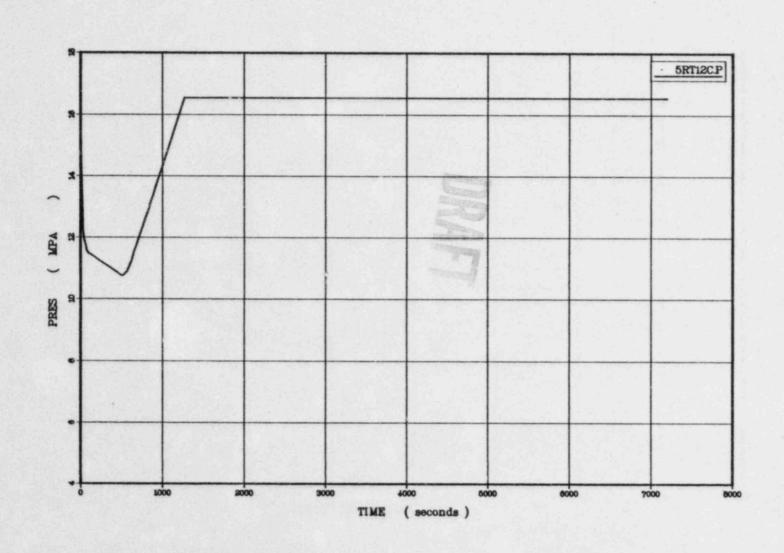
DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.12B



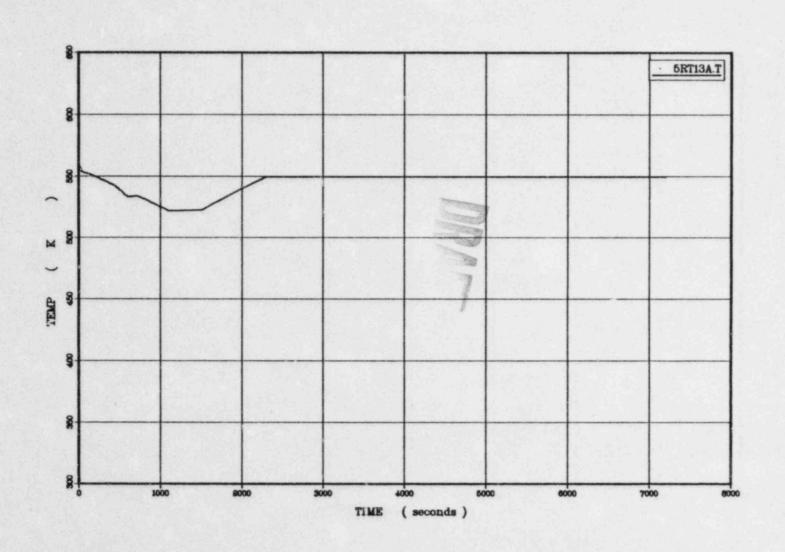
DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.12C



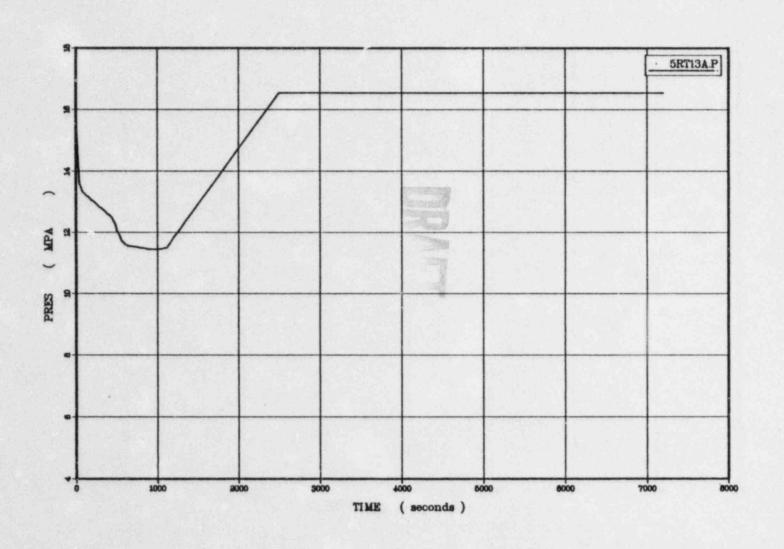
DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.12C



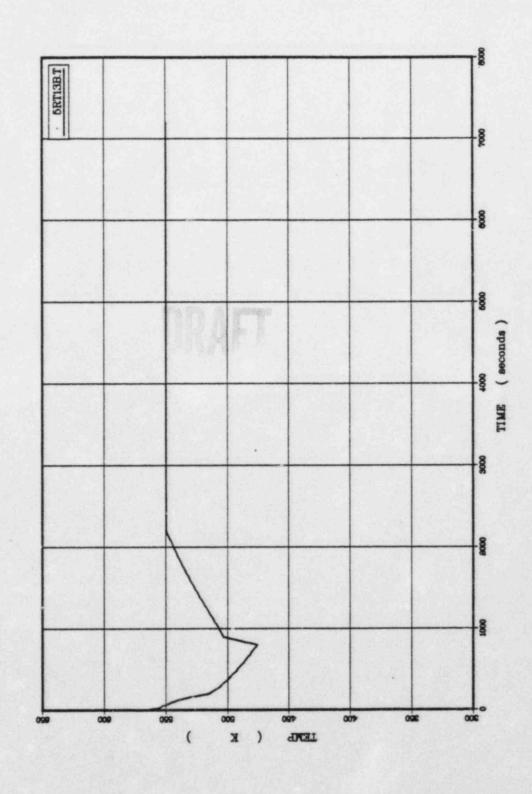
DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.13A



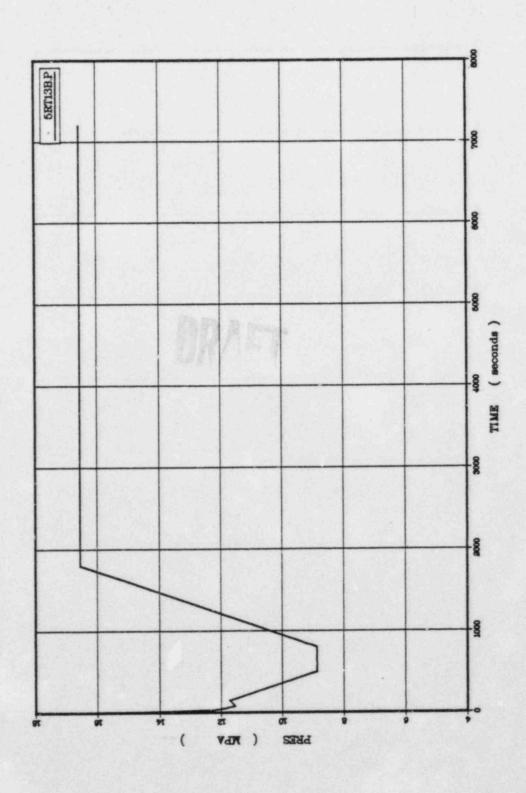
DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.13A



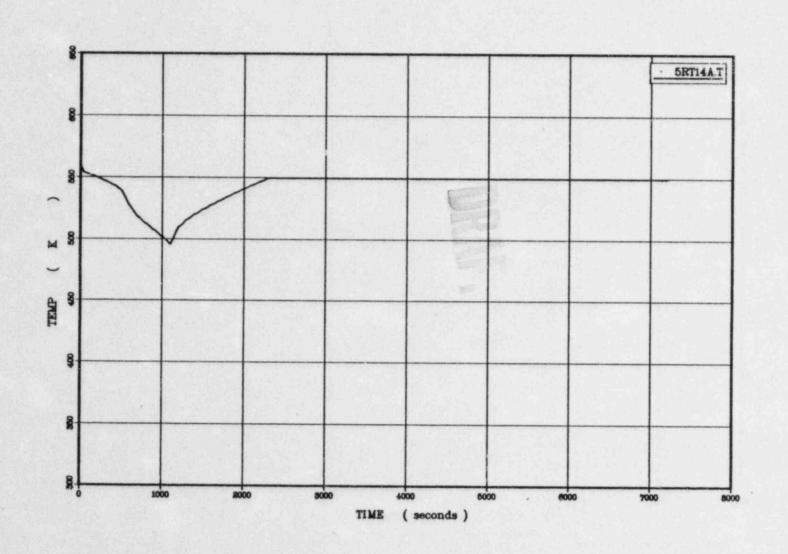
DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.13B



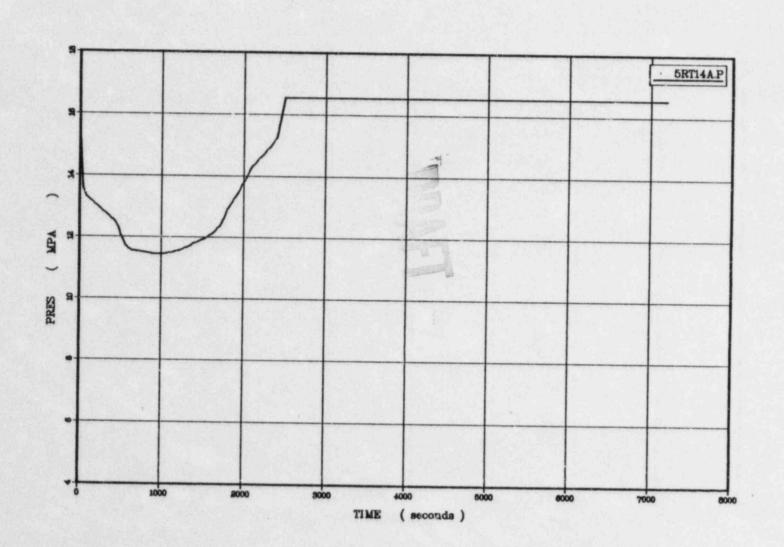
DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.13B



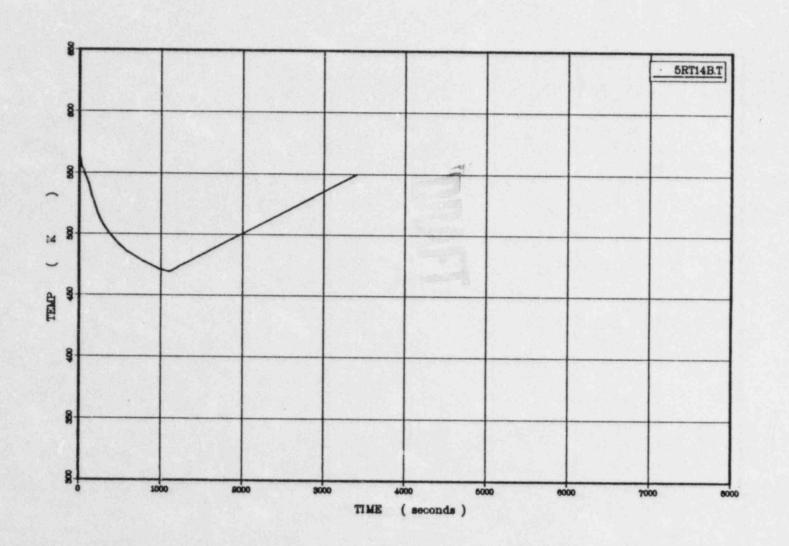
DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.14A



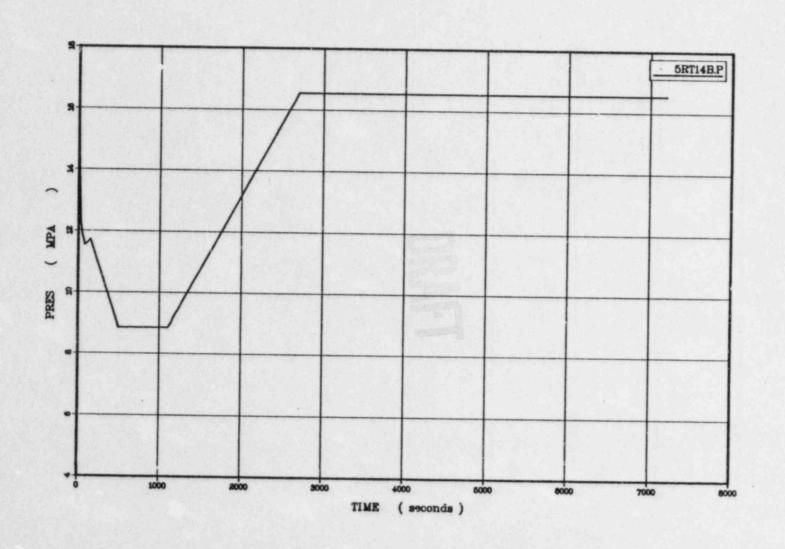
DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.14A



DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.14B

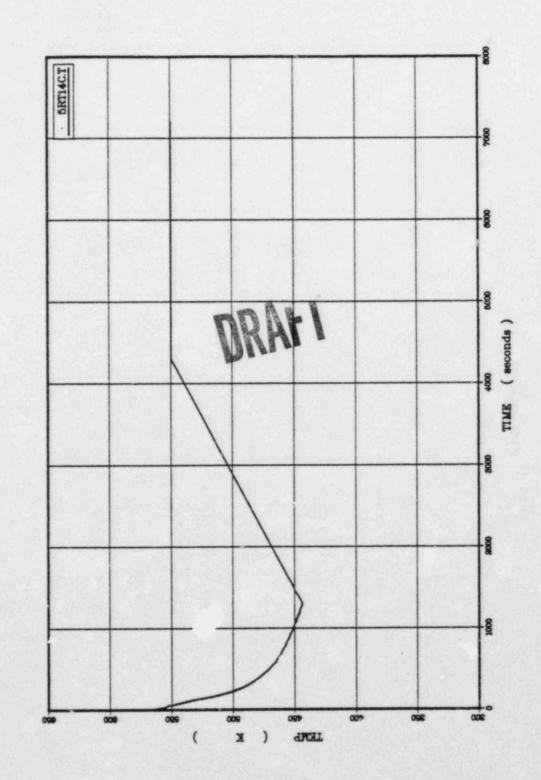


DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.14B



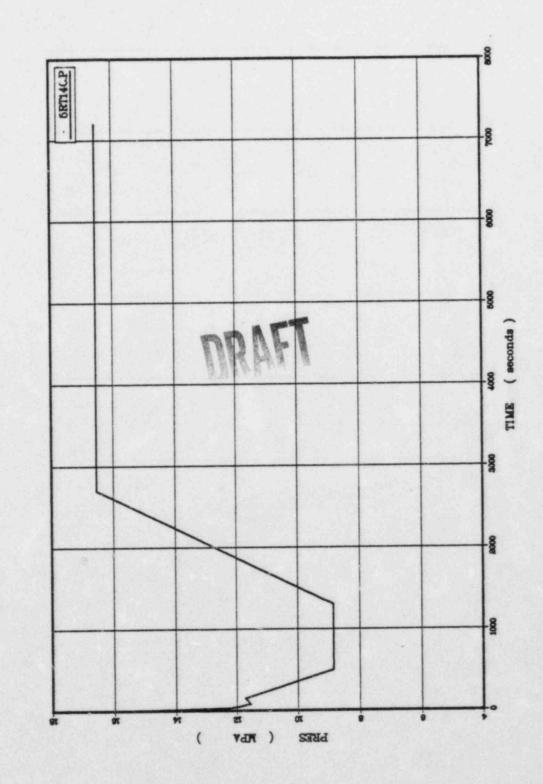
22.42.45 THUR 9 FEB, 1964 JOB-KINS140T, ISSCO DISSPLA VER 8.2 1 10

DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.14C

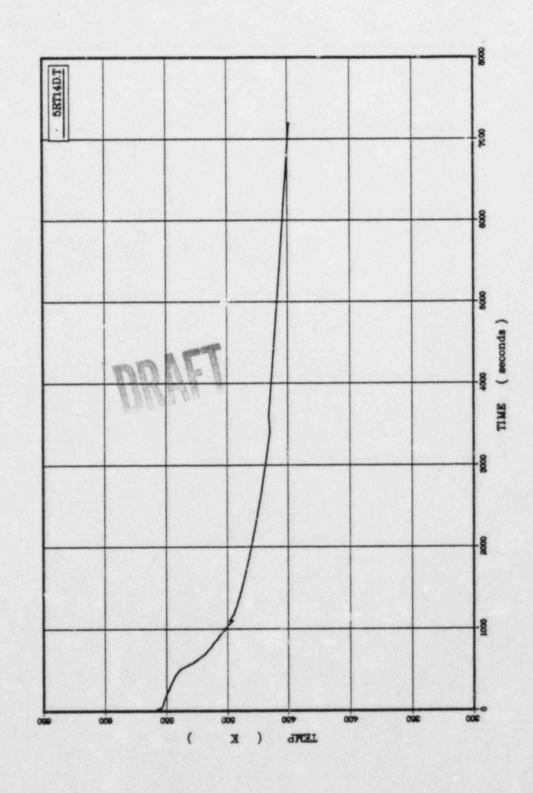


22.14.36 TIME 9 FEB, 1984 JOB-KINS14CP, 155CO DISSPLA VER 6.2

DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.14C

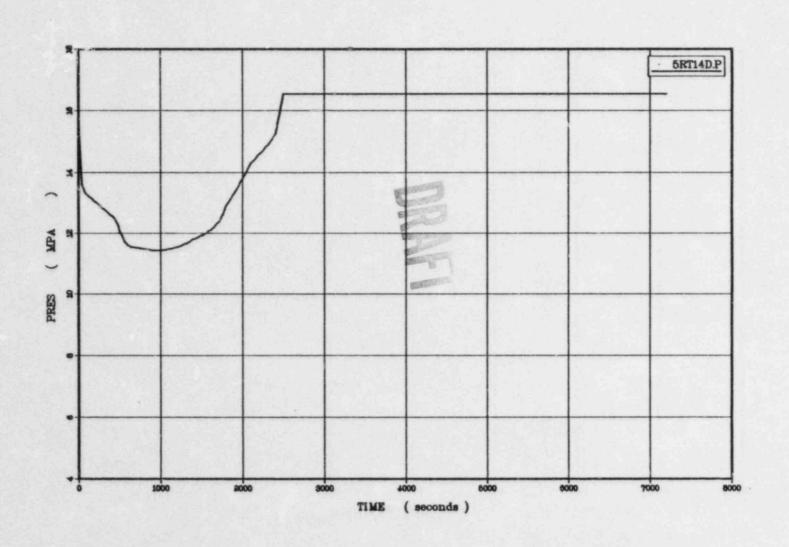


DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.14D

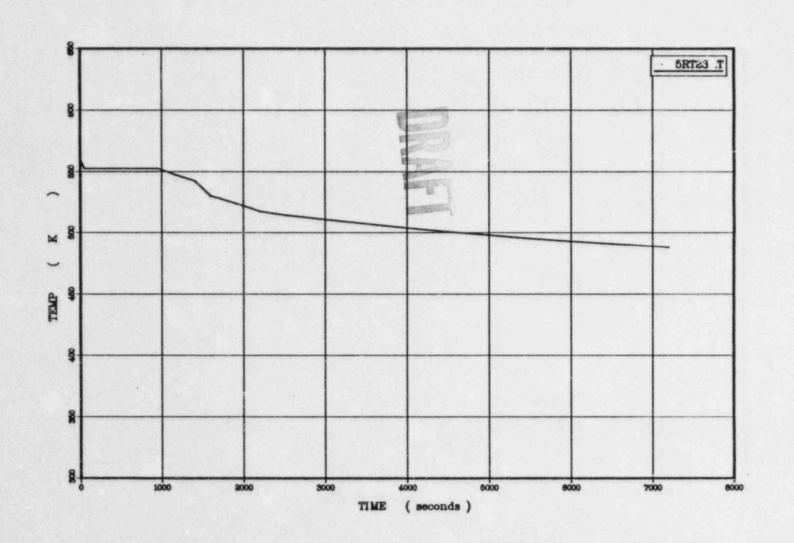


07.1

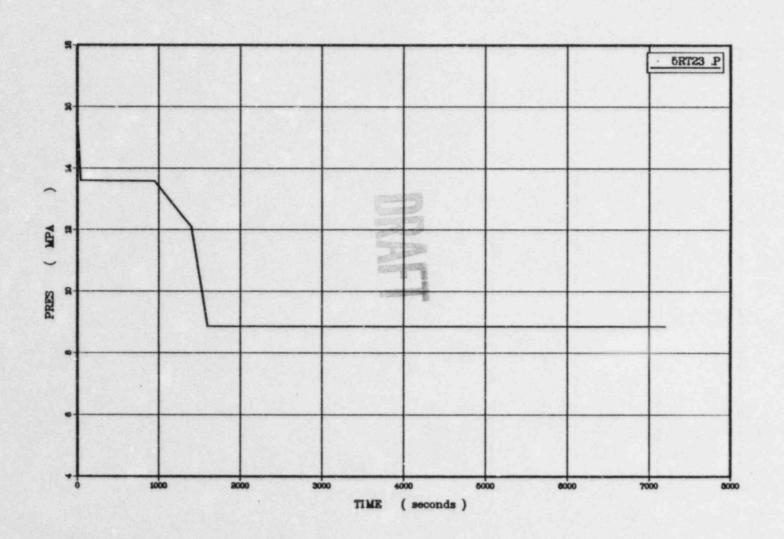
DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.14D



DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.23

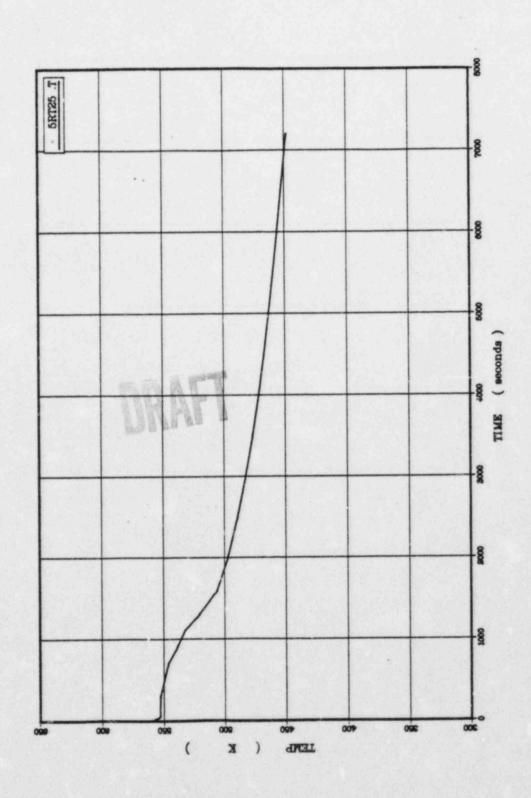


DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.23



. 22.48.32 THUR 9 FEB, 1884 JOS-CTMS25T, 15900 DISSPLA VER 8.2

DC TEMP FOR REACTOR TRIP FROM FULL POWER CASE 5.25



1 1

PLOT 1 22.51.17 THER 8 PEB, 1864 JOB-KINSZEP , 185CO DISSPLA VER 8.2

DC PRES FOR REACTOR TRIP FROM FULL POWER CASE 5.25

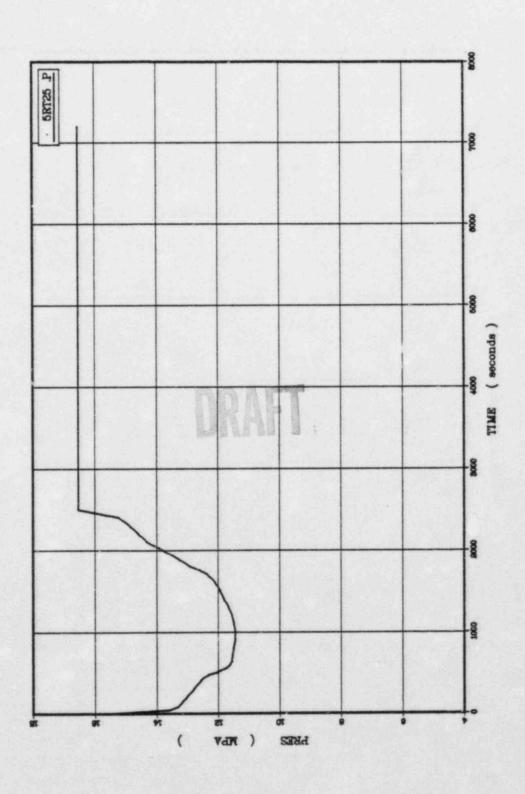


TABLE 6 SMALL EREAK LOCA

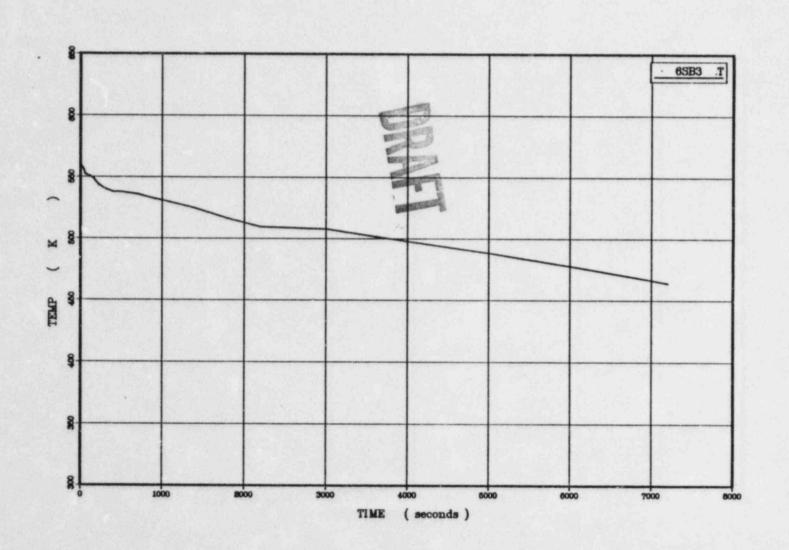
		Initiator: Unspecified											
	Sequence no.	Reactor	Turbine condition	ADVs condition	TBVs condition	Mainfeed runback	MSIVs condition	MFIVs condition	AFW				
= LANLT4	1.	trips at 14.6(s)	trips st 14.6(s)	ell close on demand ~227(a)	all close on demand	runback occurs	NA	NA	actuates on demand				
= LANL TY	2.	trips at 14.6(a)	trips at 14.6(a)	all close on demand ~227(s)	on demand	rumback occurs	NA	NA	actuates on demand				
	0	trips at 14.6(a)	trips at 14.6(s)	sil close on demand ~227(s)	all close on demand	runback occurs	NA	NA	actuates on demand				
	•	trips at 14.6(s)	trips at 14.6(s)	all close on demand ~227(a)	all slose on demand	runback occurs	NA	NA	actuates on demand				
	5.	trips at 14.6(s)	trips et 14.6(s)	on demand ~2,7(s)	fails to	runback occurs	on demand	all close on demand	actuates on demand				
	6.	trips at 14.6(s)	trips at 14.6(a)	on demand ~227(s)	fails to	runback occurs	ell close on demand	all close on demand	actuates on demand				
	1.	trips at 14.6(a)	trips at 14.6(s)	on demand ~227(a)	feil to	runback occurs	all close on demand	all close on demand	actuates on demand				
	•	trips at 14.6(s)	trips at 14.6(s)	on demand -227(s)	fail to close	runback occurs	ell close on demand	all close on demand	sctustes on demand				
	•	trips at 14.6(s)	trips at 14.6(s)	one fails to close ~227(s)	ell close on demand	runback occurs	ell close on demand	all close on demand	sctuates on demand				
LANL TS	10.	14.5(a)	trips at 14.6(s)	one feils to close ~227(s)	all close on demand	runback occurs	ell close on demand	all close on demand	dem. 1				
	11.	14.6(s)	14.6(a)	on demand ~227(s)	on demand	runback occurs	NA	NA	actuates on demand				

TABLE 6 (CONTINUED)

				(CONTINUED)			-
EPI	ANN taplation to low pressure S/G	Operator isolates break	AFW flow condition	Operator action: turn off charging pumps	Operator action: throttle AFW	Early estimated frequency probability per year	Sequence no.
scadition actuates on demand	actuates on demand	isolates at 300 s	euto flow controlles	performed during recovery phase when pressure rises to shutoff head of HPI	throttles AFW at +22" in S/G	1.0 x 10 ⁻²	1.
ectuates on demand	actuates on demand	isolates at	auto flor controlles	failure	throttles AFW at +22" in 3/G	2.7 s 10 ⁻⁴	3.
sotuates on	actuates on demand	break is not	auto flow	NA NA	throttles AFV at	1.9 x 10 ⁻³	3.
fails to	setuate: on	breek is not	auto ften	JN4	throttles AFV at +22" in S/G	1.1 x 10 ⁻⁵	4.
setuates on demand	actuates on demand	isolates et 300 s	entrolled	crformed during recovery hase when pressure rises a shutoff head of NPI	throttles AFW at +22" in 8/6	2.0 x 10 ⁻⁵	5.
actuates on	actuates on	Speck to not inclusable	sute flow		throt 'sa AFF at	1.4 = 10-5	6.
demand actuates on demand	actestes on densid	1001a29a 61	auto flow controlled	performed during recovery phase while pressure rises to shuself head of HPI	throttles AFF at -22" in S/G	1.5 ± 10-6	1.
actuates on	setuates on	break to not	suto flow	NA	throttles APF at	1.1 x 10 ⁻⁶	•
setuates on denand	actuates on demand	isolates et 363 s	auto /low controlled	performed during recovery phase when pressure rises to shutelf head of HPI system	throttles AFW et -22" in 8/6	3.0 2 10 5	,.
actuates on demand	actuates on demand	bresk is not	auto flow controlled	NA	throttles AFW st	2.3 x 10 ⁻⁵	10.
actuelos on	actuates on	isolates at	controlled	throttles at ~300 s after break is isolated	throttles AFW at	6.0 x 10 ⁻⁵	:1.

DC TEMP FOR SMALL BREAK LOCA

CASE 6.3



DC PRES FOR SMALL BREAK LOCA

CASE 6.3

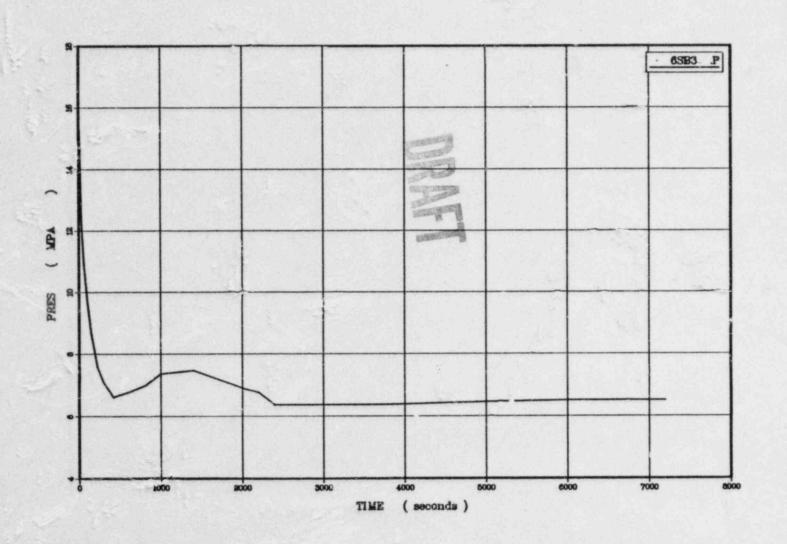


Table 2. Main Steamline Break at Hot O's Power Initiator: Small Break Upstream of MSIV

Sequence number	MSIVa condition	MFIVs condition	AFW condition	AFW isolation to low press. S/G	AFW flow condition	HPI condition	Operator action: turn off charging pumps	Operator action: throttles AFW	Early est. frequency probability/yr
1.	sll close on demand (time?)	all close on demand start closing (time?)	actuates on demand (time?)	actuates on domand (time?)	auto controlled	occurs on demand (time?)	performed during recovery phase when pressure rises to shutoff head of HFI system	throttles AFV at + 22" ia S/G	4.9 : 10-3
2.	ell close on demand	all close on demand	on demand	on demand	suto controlled	occurs on demand	failure	throttles AFW at + 22" in S/G	1.0 = 10-4
,	ell close on demand	ell close on demand	on demand	on domand	auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failure	1.0 x 10 ⁻⁵
4.	all close on demand	on demand	sotuates on demand	on demand	controlled	occurs on demand	failure	failure	2.0 x 10 ⁻⁵
•	all close on demand	all close on demand	actuates on demand	actuates on demand	auto controlled	fails to	performed during recovery phase when pressure rises to shutoff head of HPE system	throttles AFW at + 22" is S/G	6.0 x 10 ⁻⁶
٤.	all close on (emand	all close on demende	sctustes on demand	sctuates on demand	actuates on demand	feils to occur	failure	throttles AFW at + 22" in S/G	2.0 x 10 ⁻⁷
1.	sil close on demand	ell close on demand	actuates on demand	actuates on domand	auto controlled	fails to occur	performed during recovery phase when pressure rises to shutoff head of HPI system	throtties AFV at + 22" in S/G	2.0 x 10 ⁻⁷
1:	ell close on demand	ell close on demand	actuates on demand	fails to	auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV at + 22° in S/G	1.0 x 10 ⁻⁶

Table 2. Continued

Sequence number	MSIVs condition	MFIVs condition	APW condition	AFW isolation to low press. S/G	AFW flow condition	HPI condition	Operator action: turn off charging pumps	Operator action: throttles AFW	Early est. frequency probability/yr
9.A	both fail to close	all close on demand	actuates on demand	does not occur	auto control led	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on eny line	total of 9.A and 9.B is 3.5 z 10
2.8	both fail to elose	all close on demand	actuates on demand	does not	initially auto cont. At 300 s operator kills AFF to both S/Gs	on demand	performed during recovery phase when pressure rises to shutoff head of MPI system	AFV system not on	9.4
10.	both fail to close	sll close on demand	actuates on demand	doos not	auto controlled	occurs on demand	failure	flow does not exceed 160 gals/min on any line	1.0 x 10 ⁻⁷
<u></u>	both fail to close operator closes MFIVs at 300 s	both fail to close operator closes MFIVs at 300 s	on demand	on demand	control led	on demand	recovery phase whom pressure rises to shutoff head of HPU system	AFV , 22 **	1.2 s 10 ⁻⁷

TABLE 4
MAIN STREAMLINE BREAK AT FULL POWER

Initiator: Small Break Upstream of MSIV

mo.	Turbine condition	ADV s condition	TBVs condition	Nainfeed gunback	MSIV ₆ condition	MFIVs condition	AFW condition	AFW isolation to low pressure S/G
1.	trips on demand	all close on demand	all close on demand	runback occurs	all close on demand	all close on demand	actuates on dezand	actuates on demand
1.	trips on demand	all closs on demand	all close on demand	runback occurs	ell close on demand	all close on demand	actuates on demand	actuates on demand
3.	trips on demand	all slose on demand	all close on demand	runback occurs	all close on demand	all close on demand	actuates on demand	actuates on demand
•	trips on demand	all close on demand	all close on demand	runback occurs	all close on demand	all close on demand	actuates on demand	actuates on demand
5.	trips on demand	all close on demand	all close on demand	rumbeck occur-	on demand	on demand	netuates on demand	actuates on demand
6.	trips on demand	all close on demend	all close on demand	runback occurs	all close on demand	all close on demand	on demand	fails to occur
<u>7</u> .	trips on demand	all close on demand	on demand	runback occurs	both fail to close	on demand	on demand	fails to actuate since no AP signal generated
<u>.</u>	trips on domand	all close on demand	all close on demand	fails to occur	all close on demand	all close on demand	actuates on demand	actuates on demand
2	trips on demand	all close on demand	all close on demand	fails to occur on line with steam break	ell close on demand	all close on demand	actuates on demand	actuates on demand
10.	trips on demand	all close on demand	on domand	fails to occur on line with steam break	all close on demand	all close on demand	on demand	actuates on demand
11.	trips on demand	all blose on demand	all close on demand	fails to occur on both steam lines	on demand	all close on demand	on demand	actuates on demand
12A.	trips on domand	ADV on line opposite broken line initially fails to close but is isolated at 30 mins	all close on demand	runback occurs	ell close on demand	all close on demand	actuates on demand	actuates on deman
128.	trips on demand	ADV on line opposite broken line initially fails to close but is isolated at 15 mine	ell close on demend	runback occurs	ell close on demand	sll close on demand	on demand	actuates on demand
120.	trips on demand	ADV on line opposite broken line fails to	all close on demand	runback occurs	all close on demand	on demand	actuates on demand	actuates on demand
13A.	trips on deman4	ADV on line opposite broken line initially fails to close but is isolated at 30 mins	ell close on demand	runback occurs	all close on demand	ell close on demand	ectuates on demand	actuate on demand
138	trips on . demand	ADV on line opposite broken line initially fails to close but is isolated at 15 mins	all close on demand	runback occurs	all close on demand	ell close on demand	on demand	actuate on demand
13c	trips on domand	ADV on line opposite broken line fails to	all close on demand	runback occurs	all close on demand	ell close on demand	actuates on demand	actuate on demand

TABLE 4 (CONTINUED)

AFW flow condition	RPI condition	Operator action: turn off charging pumps	Operator action: throttle AFV	Early estimated frequency probability per year	Sequence no.
suto sontrolled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV at	1.2 x 10 ⁻²	1.
euto controlled	demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failure	3.0 x 10 ⁻⁴	2.
outo controlled	occurs on	failure	throttles AFW at	3.0 x 10 ⁻⁴	3.
auto controlled	occurs on demand	failure	failure	6.0 x 10 ⁻⁵	4.
auto controlled	fails to	performed during recover to shuto f head of HPI system	throttles AFW at	2.0 x 10 ⁻⁵	5.
auto controlled	occurs on demand	performed during recovery of phase when pressure rises to to shutoff head of HPI system	Ardties APV st	2.5 x 10 ⁻⁶	•.
auto controlled	densad	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on any line	1.0 x 10 ⁻⁵	7.
suto controlled	domend	performed during recovery phase when pressure rises to shutoff heed of HPI system	throttles AFW at +22" in S/G	5.0 x 10 ⁻⁵	•.
auto controlled	occurs on demand	failure	throttles AFW at	1.4 x 10-6	9.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	failure	i.4 s 10 ⁻⁶	10.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at +22" in S/G	5.0 x 10 ⁻⁶	11.
auto controlled	occurs on demand	performed during recovery phase when pressure rises to shutoff head of HPI system	insures that flow does not exceed 160 gals/min on any line	total of 12A, 12B, and 32C is 2.0 x 10	12A. 12B. 12C.
auto controlled	domand	feilure	insures that flow does not exceed 160 gals/min on any line	total of 13A. 13B. and 43C is 5.0 a 10	13A. 13B. 13C.

TABLE 7 MEDIUM BREAK LOCA

				Initiator:	Unspecified			
Sequence	Resctor	Turbine sondition	ADVs condition	TBVs condition	Nainfeed runback	MSIVs condition	MFIV:	AFV
1	trips on demand	trips on demand	all close on demend	all close on demand	runback occurs	NA	NA	actuates or demand
1	trips on demand	trips on demand	all close on demand	all close on demand	runback occurs	NA	NA	Actuates or demand
3	trips on demand	trips on demand	ell close on domand	ell close on demand	runback occurs	NA	NA	actuates or
•	trips on demand	demand	ell close on demand	all close on demand	runback occurs	NA	NA	sctustes or demand
5	trips on demand	demand	all close on demand	one fails to close	runback occurs	on demand	all close on demend	actuates on denand
6.	trips on demand	trips on demand	all close on demand	one fails te close	runback occurs	on demand	all close on demand	actuates on demand
1.	trips on demand	trips on demand	one fails	on demand	runback occurs	on demand	all closs on demand	actuates on demand
5.	trips on demand	trips on demand	one fails	on demand	rentack occurs	eli close on demand	all close on demand	actuates on demand

TABLE 7

				(CONTINUED)			
HP1 condition	AFW isolation to low pressure S/G	Operator isolates break	AFF flow condition	Operator action: turn off charging pumps	Operator action: throutle AFW	Early estimated frequency probability per year	Sequence no.
actuates on demand	actuates on domand	isolates at 300 s	auto flow controlled	performed during recovery phase when pressure rises to shutoff head of MP3 system	throttles AFW at +22" in S/G	6.0 g 10	1.
ectuates on demand	ictuates on	isolates at 1.5 hours	suto flow controlled	break is isolated	throttles AFV at	1.0 x 10 ⁻⁶	2.
settetas di demand	Sec and	break is not isolated	controlled	NA	throttles AFV at	2.0 x 10 ⁻³	3.
demand	demand	isolates at	auto flow controlled	failure	throttles AFV at	1.0 x 10 ⁻⁵	4.
sotuites an domead	derand	isolates at 300 s	auto flow controlled	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFV at +22" in S/G	1.9 : 10-6	5.
sctuates on demand	actuates on demand	break is not isolatable	auto flow controlled	NA NA	throttles AFV at	3.0 x 10-6	6.
sctuates on demand	actuates on domand	isoletee at 300 s	auto flow controlled	performed during recovery phase when pressure rises to shutoff head of HPI system	throttles AFW at +22 " in S/G	2.0 x 10 ⁻⁶	7.
demand	actuates on demand	break is not isoletable	auto flow controlled	NA	throttles AFV at	5.0 x 10-6	