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SECTION IV

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TEST INSTRUMENTATION REQUIREMENTS

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A. PURPOSE AND SCOPE

We have compiled test instrumentation in this section in order to present a composite picture of our requirements from the OSTF test instrumentation contractor, The Martin Company. Consequently, all test instrumentation covered in this section will be furnished by The Martin Company.

The ADL test instrumentation requirements cover all OSTF test instrumentation needed for the execution of Group I, Test Plan 5. The term "test instrumentation" does not cover system controls and instrumentation required for the sequenced operation of the propellant loading system.

System controls and instrumentation requirements are covered in Section V, and include:

(1) Sensors, gauges, and transducers or electrical pickups which are provided for or available within the basic propellant loading system; and

(2) Indicating gauges, electrical pickups, push buttons, and lights mounted on the ADL-provided PLS Test Control Panel, Test Selector Panel and Fuel Checkout, Fuel Test, and Fuel Control Panels.

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The instrumentation equipment covered in Section IV falls into two general categories, defined as follows:

(1) "Quick Look" instrumentation

Instrumentation which generates data available within eight hours after test completion.

(2) Miscellaneous instrumentation

This includes temperature indicators for the fuel storage tank and LO_2 storage tank plus pressure indicators and transducers needed for safety tests. (See Section II.)

"Quick Look" test instrumentation requirements are listed in Table IV-d. Miscellaneous instrumentation requirements are given in Table IV-e. Table IV-f shows the source and display points of the "Quick Look" instrumentation data.

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In Tables IV-d and IV-e, an attempt has been made to show reasons for the inclusion of each instrument. Basically, the instruments are required for the achievement of test objectives covered in specific test plans. (See Section II.)

Sensing and recording instrumentation with a time reference is required for the measurements of temperatures, pressures, and liquid levels. Such instrumentation is typical of that required to meet over-all objectives.

Typical instruments needed to meet specific, primary objectives are:

1. On/off and closed/open information for a time-referenced status record of valves (MR), liquid sensors (LSR), and drain pumps (MR).

2. Information as to pressure (PR), temperature (TR), and (in specific cases) level (LLR) in a section of the system which becomes isolated at any time during the sequence.

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3. Flow information (FR), as an aid to an analysis of flow distribution between missile stages and the rate of change of flow in specific flow paths.

4. A time-based record of the position of throttling flow control and pressure control valves (MRT) in order to analyze their response and performance in the system.

Instrumentation needed to meet specific secondary objectives are divided into two categories: special problems and contingencies.

Typical special problems are:

1. Balance between flow stages; and

2. Need for subcooling of liquid oxygen topping flow.

Instrumentation needed to evaluate the special problems has been included in the requirements listed.

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"Contingencies" refer to problems resulting from unfavorable test results. Instrumentation has not been provided to aid in the solution of contingencies. Sufficient taps and connections have, however, been provided in the OSTF piping to take care of any foreseeable contingencies. A small (unspecified) stock of versatile transducers will thus be needed to take care of the contingencies.

B. DESIGNATION OF TEST NUMBER

Test categories are designated as follows:

Test No.	Category
1.2	Fuel transfer tests
2.1	LO_2 cooldown tests
2.2	LO_2 transfer tests
6.1	Helium transfer (warm)
6.2	Helium transfer (cold)
PLS	Combined PLS tests
S	Safety tests
SC	Storage capability tests

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The test numbers correspond to "Detailed Test Plans," covered in Section II.

C. ACCURACY

Test instrument accuracies have been individually analyzed and generally reflect a relaxation of initial requirements.

Nearly all accuracies refer to the range "to be measured," which has been specified. When two ranges are indicated, sufficient time will be available to effect a recalibration. In any case, the accuracy should be interpreted as a percentage of reading within a given range. For example, (TR 202) is for temperatures of -320 to -100°F, a range of 220°F. A $\pm$ 5% of range accuracy implies $\pm$ 5% of 220 or $\pm$ 11°F at the high point of the range. At -250°F, the difference is -250 -(-320) = 70°F and $\pm$ 5% of 70° = $\pm$ 3.5°F. Since $\pm$ 5°F is sufficiently accurate at this temperature, this has been so stated.

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D. TEST TRANSDUCERS AND CHANNELS OF TRANSMISSION

Summaries of the total number of test transducers and channels of landline transmission have been made for each test series in Tables IV-a through IV-c. Note that the summary is based on the following assumptions:

1. Only channels connecting the whole launcher complex with the Control Center have been included.

2. Transducers (such as level sensors) provided for in the basic PLS have not been included.

3. No allowance has been made for contingencies. Allowance has been made for the vent systems. Simulated missile tank instrumentation has been included. A 10% contingency on instruments and channels should suffice (but has not been included).

4. A channel of transmission is assumed to include one or more wires needed to transmit a signal. In the case of valve position (MR), this would include the positive indication of two switches.

5. All test instrument recorders have been assumed to be located in the Control Center.

6. Missile tank test instrumentation has been included; however, instrumentation such as the LO_2 tank level measurement (Bogue System) has not, since it is part of the basic control system.

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E. SAFETY TESTS TRANSDUCERS AND PRESSURE INDICATORS

In order to monitor the safety tests, certain pressure indicators and transducers are needed. The transducers (PR-001 through PR-005 supplied by Martin) listed in Table IV-e are to be connected to the spare pressure taps (SPT's) upstream and downstream of the safety valve under test. A channel is needed from the appropriate SPT to the C.E.C. oscillograph for a chart record of the test. In addition, connections from the transducers to the portable pressure indicators (PR-001 through PR-006, also by Martin) are needed. In some cases, an existing transducer located either upstream or downstream of the

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safety valve may be used for the safety test. In general, the safety tests are performed by remotely (or manually, for the PRV's) controlling the flow control valve until the safety valve releases. The object is to test the ability of the safety valves and vent systems to carry away safely the maximum volume of gas available from the high-pressure system in case of malfunction in the control system.

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TABLE IV-a

NUMBER OF CHANNELS OF TRANSMISSION*
(Launcher Complex to Control Center)

System	LO_2			He			Fuel	Concurrent	Combined	Other	
Test Number	2.1	2.2	PLS	6.1	6.2	PLS	1.2	2.2 & 6.2	PLS	S	SC
Parameter:											
Temp. (TR)	23	29	14	7	8	6	3	37	23	9	2
Press. (PR)	26	35	13	9	10	8	2	45	23	7	4
Liquid Sense (LSR)	10	12	--	--	--	--	--	12	0	-	-
Liquid Sense (LSI)	2	2	2	--	--	--	4	2	6	-	-
Liquid Level (LLR)	--	2	2	--	--	--	--	2	2	--	-
Position (MR) & (MRT)	33	36	14	5	7	2	1	43	17	4	-
Flow (FR) or (PR)	2	4	2	1	1	1	--	5	3	-	-
Total Number of Channels in use during particular test	96	120	--	22	26	--	10	146	74	20	6

*See Table IV-c for summarized channel requirements.

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TABLE IV-b

SUMMARY OF TEST TRANSDUCER REQUIREMENTS*

System	LO_2			He			Fuel	Concurrent	Combined	Other	
Test Number	2.1	2.2	PLS	6.1	6.2	PLS	1.2	2.2 & 6.2	PLS	S	SC
Parameter:											
Temp. (TR)	23	29	14	7	8	6	3	37	23	-	2
Pres. (PR)	26	37	13	9	10	8	2	47	23	12	10
Liquid Sense (LSR)	2	4	--	--	--	--	--	4	--	--	--
Liquid Sense (LSI)	2	2	2	--	--	--	4	2	6	--	--
Liquid Level (LLR)	--	--	--	--	--	--	--	--	--	--	--
Position (MRT)	4	4	2	2	2	2	--	6	4	--	--
Other	--	--	--	--	--	--	--	--	--	--	--
Flow	2	2	2	2	2	2	--	4	4	--	--
	59	78	--	20	22	--	9	100	60	12	12

*See Table IV-c for total transducer requirements.

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TABLE IV-c

SUMMARY OF TOTAL TEST INSTRUMENTATION INSTALLATION REQUIREMENTS

System	No. Transducers	No. Channels
LO_2	78	120
He	22	26
Fuels and Nitrogen Services	9	10
Total	109	156

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TABLE IV-d

"QUICK LOOK" TEST INSTRUMENTATION REQUIREMENTS

PARAMETER: TEMPERATURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range: To Be Measured	Range: Extremes	Accuracy	Frequency of Readout
TR 101	St. I fill & drain line close to fuel SMT. Aboard missile	Well Type T.C.	Fuel	1.2	Temperature of fuel delivered to St. I SMT	45°F to 75°F	0 to 120°F 0 to 100 psig	±5% of given range	60 sec
TR 102	St. II fill & drain line close to fuel SMT. Aboard missile	"	"	1.2	Temperature of fuel delivered to St. II SMT	"	"	"	"
TR 201	In contact with top of inner tank of T-201. Vacuum	T.C. plus spare STC 20% by contractor	LO_2	2.1 2.2 SC-1	(1) Temp. of inner tank during pressurization. (2) Boiloff information	-100 to -300°F	Amb. to -320°F	±10°F or (± 5% range)	20 sec
TR 202	Near intersection of L-202 and L-204 Top of L-202. Propellant terminal	Wall T.C.	LO_2	2.1 2.2 PLS	(1) Progress of Cooldown, GO_2 followed by LO_2 temp. (2) After unload indicates absence of liquid in pipe section T-201 to FCV-211 & FCV-212	-100 to -320°F and -250 to -300°F	+100 -320°F "	±10°F or (±5% range) ±5°F or (-10% low range)	20 sec
TR 203	Top of L-204 between F-203 and FCV-204. Missile silo	Wall T.C.	LO_2	2.1 2.2	(1) Cooldown progress. (2) Indication of line fill completion (3) Status during hold (stagnant pipe zone)	-100 to -320°F and -250 -300°F	" "	±10°F or (±5% range) ±3°F (±5% "low" range)	1 sec
TR 204	Locate as near to missile as possible on top of horizontal portion of L-204 beyond junction with L-211. Missile silo.	Wall T.C.	LO_2	2.1 2.2	(1) Cooldown progress (2) Indication of line fill completion (3) Boiloff gas reheat (4) Status during hold-mixing temperature (5) Degree of subcooling	-100 to -320°F -270 to -320°F	+100 -320°F "	±10°F or (±5% range) ±3°F (±5% "low" range)	1 sec

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TABLE IV-d (Continued)

PARAMETER: TEMPERATURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range: To Be Measured	Range: Extremes	Accuracy	Frequency of Readout
TR 205	Top of L-211 between FCV-203 and F-205. Missile silo	Wall T.C.	LO_2	2.1 2.2	Topping Stream temperature St. II	-270° to -320°F	+100° -320°F	±3°F (or ± 5% range)	1 sec
TR 206	Top of L-210 between FCV-205 and F-204. Missile silo.	"	LO_2	2.1 2.2	Topping Stream temperature St. I	"	"	"	"
TR 207	Locate as near to missile as possible on top of horizontal portion of L-209 beyond junction with L-210. Missile silo.	"	LO_2	2.1 2.2	(1) Cooldown progress (2) Indication of line fill completion (3) Boiloff gas reheat (4) Status during hold-mixing temperature (5) Degree of subcooling	-100° to -320°F -270° to -320°F	"	±10°F or (±5% range) ±3°F (±5% "low" range)	1 sec
TR 208	Top of L-209 between F-202 and FCV-207. Missile silo.	"	LO_2	2.1 2.2	(1) Cooldown progress (2) Indication of line fill completion (3) Status during hold (stagnant pipe zone) St. I low point in system	-100° to -320°F -250° to -300°F	"	±10°F (or ±5% range) ±3% or (±5% range)	1 sec
TR 209	In center of flow stream L-208 between F-203 and FCV-208. LO_2 and GO_2 flow max. LO_2 velocity 20 F.P.S.	Thermowell with exposed T.C.	LO_2	2.1 2.2 PLS	(1) When temp. matches with TR-203 line is full (2) Status during hold (3) Status after unload	-250° to -300°F -270° to -320°F	+100° -320°F	±3°F or (± 5% of range)	1 sec
TR 210	On THC St. II connector near missile. L-208. LO_2 and GO_2 flow max. LO_2 velocity 20 F.P.S.	"	LO_2	2.2 PLS	(1) When temp. matches with TR-208 line is full (2) Indicates cooldown rapid, fine and hold delivery temp. to SMT	-250° to -300°F -270° to -320°F	+100° -320°F	±3°F or (± 5% of range)	1 sec
TR 211	In center of flow stream of L-211 between FCV-203 & F-205. LO_2 and GO_2 flow max. LO_2 velocity 20 F.P.S.	"	LO_2	2.1 2.2 PLS	(1) When temp. matches with TR 205 line is full. (2) Topping delivery (3) Determine necessity for LO_2 subcooler	-270° to -320°F	"	±3°F (or ± 5% of range)	1 sec

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TABLE IV-d (Continued)

PARAMETER: TEMPERATURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
TR 212	In center of flow stream of L-210 between FCV-205 & F-208. LO_2 and GO_2 flow max. LO_2 velocity 20 F.P.S.	Thermo-well with exposed T.C.	LO_2	2.1 2.2 PLS	(1) When temp. matches with TR 206 line is full. (2) Topping delivery (3) Determine necessity for LO_2 subcooler	-270° to -320°F	+100 -320°F	± 3°F (or ± 5% of range)	1 sec
TR 213	On THC St. 1 connector near missile. L-209. LO_2 and GO_2 flow max. LO_2 velocity 20 F.P.S.	"	LO_2	2.2 PLS	(1) When temp. matches with TR 207 line is full (2) Indicates cooldown rapid, fine and hold delivery temp. to SMT (3) Determine necessity for LO_2 subcooler	-250° to -300°F -270° to -300°F	+100 -320°F	±1°F (or ± 2% of range) ±3°F (or ± 5% of range)	1 sec
TR 214	In center of flow stream L-203 between F-202 and FCV-207. LO_2 and GO_2 flow max. LO_2 velocity 20 F.P.S.	"	LO_2	2.1 2.2 PLS	(1) When temp. matches with TR 208, line is full. (2) Status during hold (stagnant pipe zone) St. 1 low point in system	-250° to -300°F -270° to -320°F	+100 -320°F	±3°F or (± 5% range)	1 sec.
TR 215	LO_2 subcooler discharge on L-209, downstream of L-217. Propellant terminal.	Wall T.C.	LO_2	2.2 PLS	Subcooling measurement	-270° to -320°F	+100 -320°F	±3°F or (± 5% range)	60 sec
TR 216	LO_2 subcooler inlet, on line L-208. Propellant terminal	Wall T.C.	LO_2	2.2	Subcooling measurement	-250° to -300°F	+100 -320°F	±3°F or (± 5% range)	60 sec
TR 217	Bottom of L-208, in propellant terminal	Wall T.C.	LO_2	2.1 2.2	Temp. of LO_2 in propellant terminal during hold, cool-down and prior to reload.	-250° to -300°F -270° to -300°F	+100 -320°F	±3°F or (± 5% range)	20 sec
TR 218	Bottom of L-209, in propellant terminal	Wall T.C.	LO_2	2.1 2.2	Temp. of LO_2 in propellant terminal during hold, cool-down and prior to reload.	-250° to -300°F -270° to -320°F	+100 -320°F	±3°F or (± 5% range)	20 sec

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TABLE IV-d (Continued)

PARAMETER: TEMPERATURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
TR 219	Fill & drain line #1 close to missile tank. St. I. Aboard missile	Thermowell with exposed T.C.	LO_2	2.1 2.2 PLS	Temp. of LO_2 delivered to Stage I SMT	-100 to -320°F	+100 -320°F	±10°F or (± 5% range)	1 sec
						or -250 to -300°F		±9°F or (± 5% range)	
TR 220	Fill & drain line #2 close to missile tank. Stage I. Aboard missile	Thermowell with exposed T.C.	LO_2	2.1 2.2 PLS	Temp. of LO_2 delivered to Stage I SMT[2]	-100 to -320°F	+100 -320°F	±10°F or (± 5% range)	1 sec
						or -250 to -300°F		±9°F or (± 5% range)	
TR 301	Near T-301A neck L-302 Propellant terminal	Wall Type T.C. (exposed element)	LO_2	2.1 2.2 PLS 3	To evaluate GO_2 consumption	+250 to - 50°F	+250 -150°F	±10°F or (±5% of range)	60 sec
						or +100 to -150°F		±10°F or (±5% of range)	
TR 302	Near T-301B neck L-302 Propellant terminal	Wall Type T.C. (exposed element)		2.1 2.2 PLS	To evaluate GO_2 consumption	+250 to - 50°F	+250 -150°F	±10°F or (±5% of range)	60 sec
						or +100 to -150°F		±10°F or (±5% of range)	
TR 303	Near T-301C neck L-302 Propellant terminal	Wall Type T.C. (exposed element)	LO_2	2.1 2.2 PLS	To evaluate GO_2 consumption	+250 to - 50°F	+250 -150°F	±10°F or (±5% of range)	60 sec
						or +100 to -150°F		±10°F or (±5% of range)	
TR 304	On AMF St. I vent line near missile L-318. Missile silo	Wall Type T.C. (exposed element)	LO_2	2.1 2.2	Vent gas temp. from St. I SMT	+100°F -320°F	+100°F -320°F	±10°F or (±5% of range)	1 sec
								±10°F or (±5% of range)	
TR 305	Close to T-201 vent outlet L-303/320. Propellant terminal	Wall Type T.C. (exposed element)	LO_2	2.1 2.2	Vent gas temp. from T-201	+100°F -320°F	+100°F -320°F	±10°F or (±5% of range)	1 sec
								±10°F or (±5% of range)	

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TABLE IV-d (Continued)

PARAMETER: TEMPERATURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range: To Be Measured	Range: Extremes	Accuracy	Frequency of Readout
TR 306	On AMF St. II, No. 1 vent line near missile L 326. Missile also.	Well type T.C. (exposed element)	LO_2	2.1 2.2	Vent gas temp. from St. II SMT	+100 to -320°F	+100 to -320°F	±10°F or (±1% of range)	1 sec
TR 307	Portable sensing and recording system. Located at vent exit L 319. Surface	"	LO_2	SC-1	To record temp. of gas passing through FR 301	0°F to 70°F	+100 to - 50°F	±5°F	1 hour
TR 503	Near T 503 neck L-566. Surface	Well Type T.C.	LO_2	2.1 2.2 S	To evaluate GN_2 consumption-blanket and purge	-150 to +60°F	-150°F +150°F 0 to 2800 psig	±10°F	1 sec
TR 504	Near T-503 neck L-509 Propellant terminal	Well Type T.C.	GN_2 service	2.2 S SC-2	GN_2 consumption -1600 psi gas services	-150 to + 60°F	-150 to 120°F 0 to 2800 psig	±5% of given range	20 sec
TR 505	Near T-502 neck L-505 Propellant terminal	Well Type T.C.	Fuel	1.2 S	GN_2 consumption fuel blanket & purge T-502	0 to 120°F	-150 to +120°F 0 to 2800 psig	±5% of given range	20 sec
TR 506	Near T-504 neck L-580 Propellant terminal	Well Type T.C.	GN_2 service	2.2 S SC-2	GN_2 consumption - 750 psi gas services	-150 to +60°F	-150 to +120°F 0 to 2800 psig	±5% of given range	20 sec
TR 601	Near T-601A neck L 601. Propellant terminal	Thermo-couple exposed to fluid	Helium	6.1 6.2 PLS S	Helium consumption from storage bottle	+100 to -65°F	+100 to -65°F 0 to 6500 psig	±5% of given range	20 sec

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TABLE IV-d (Continued)

PARAMETER: TEMPERATURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
TR 602	Near T-601B neck L 601. Propellant terminal	Thermocouple exposed to fluid	Helium	6.1 6.2 PLS S	Helium consumption from storage bottle	+100 to -65°F	+100° to - 65°F 0 to 6500 psig	±5% of range	20 sec
TR 603	L-604, upstream of cooler, T-602. Propellant terminal	•	Helium	6.2 6.1	To evaluate cooler performance	•	+100° to - 65°F 0 to 3500 psig	•	1 sec
TR 604	L-605, downstream of cooler T-602. Pro llant terminal	•	Helium	6.1 6.2	•	-200° to -300°F	+100° to -320°F 0 to 3500 psig	•	1 sec
TR 605	On AMF piping upstream of cold connector L-606. Missile silo	•	Helium	6.1 6.2 PLS	Temperature upstream of connectors in cold helium line	-150° to -300°F	•	•	•
TR 606	St. I missile He bottle #1. On board missile	•	Helium	6.1 6.2 PLS	Helium temperature at delivery point	-150° to -300°F	•	•	•
TR 607	St. II missile He bottle. On board missile	•	Helium	6.1 6.2 PLS	•	•	•	•	•
TR 608	St. I missile He bottle #2. On board missile.	•	Helium	6.1 6.2 PLS	•	•	•	•	•

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TABLE IV-d (Continued)

PARAMETER: PRESSURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
PR 112	St. I fuel SMT ullage pressure. Missile silo	Pressure transducer	Fuel	1.2	Record of ullage pressure	0 to 65 psig	0 to 65 psig	±10%	60 sec
PR 119	St. II fuel SMT ullage pressure. Missile silo	•	Fuel	1.2	•	•	•	•	•
PR 202	L-202 at L-310 St. I & II. Propellant terminal	•	LO_2	2.1 2.2	Pressure in L-202 between T-201 and FCV-206, 211, etc.	0 to 100 psig	0 to 150 psig +100° to -320°F	±5% of reading	0.1 sec
PR 203	L-204 at PS 203 St. II. Propellant terminal	•	LO_2	2.1 2.2	Pressure in line L-204 in propellant terminal downstream of FCV 212	•	•	•	•
PR 205	L-204 between FCV-204 and F-203 St. II. Missile silo.	•	LO_2	2.1 2.2 PLS	Pressure in line L-204 in missile silo	•	•	•	•
PR 206	L-204 at L-215 Stage II. Missile silo	•	LO_2	2.2 PLS	Pressure in L-204 missile silo	•	•	•	•
PR 207	On THC St. II connector near missile L-204. Missile silo	•	LO_2	2.2	(1) Pressure at missile inlet (2) Approx. ΔP across disconnect with PR 206	•	•	•	•
PR 209	L-211 between FCV-203 and F-205 St. II. Missile silo	•	LO_2	2.1 2.2	(1) Pressure in line L-211 in missile silo (2) ΔP across FCV-203 (with PR 206) for flow info.	•	•	•	•
PR 211	L-211 at L-571 St. II topping. Propellant terminal	•	LO_2	2.1 2.2	Pressure in L-211 in prop. terminal	•	•	•	•

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TABLE IV-d (Continued)

PARAMETER: PRESSURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
PR 213	L-210 at L-568 St. 1 topping. Propellant terminal	Pressure transducer	LO_2	2.1 2.2 PLS	Pressure in L-210 in propellant terminal	0 to 100 psig	0 to 150 psig +100° to -320°F	±5% of reading	0.1 sec
PR 214	Across FCV-207 L-203. Missile silo	ΔP transducer	LO_2	2.1 2.2	ΔP across FCV-207	0 to 5 psid	0 to 100 psig +100° to -320°F	"	"
PR 215	Across FCV-204 L-204. Missile silo	"	LO_2	2.1 2.2	ΔP across FCV-204	0 to 5 psid	"	"	"
PR 216	L-210 between FCV-208 and F-204 St. 1 topping. Missile silo.	Pressure transducer	LO_2	2.1 2.2 PLS	Pressure in L-210 in missile silo	0 to 100 psig	0 to 170 psig +100° to -320°F	"	"
PR 217	On TMC St. 1 connector near missile L-203. Missile silo	"	LO_2	2.2	(1) Pressure at missile inlet (2) Approx. ΔP across disconnect with PR 218.	"	"	"	"
PR 218	L-203 at L-216 Stage 1. Missile silo	"	LO_2	2.1 2.2 PLS	Pressure in L-203 in Missile silo	"	"	"	"
PR 219	Between FCV-207 and F-202 (St. 1) L-203. Missile silo	"	LO_2	2.1 2.2 PLS	Pressure in L-203 in missile silo	"	"	"	"
PR 220	LLI 401 outlet on T-401. Propellant terminal	"	LO_2	2.2	To record LB_2 level in LO_2 subcooler	3 to 15 psig	0 to 20 psig	±5% of reading	20 sec
PR 221	L-216 elbow upstream from FCV-217 St. 1 drain. Missile silo	"	LO_2	2.1 2.2	Stagnation pressure at base of drop	0 to 150 psig	0 to 170 psig +100° to -320°F	"	0.1 sec

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TABLE IV-d (Continued)

PARAMETER: PRESSURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range: To Be Measured	Range: Extremes	Accuracy	Frequency of Readout
PR 222	L-203 at L-569 near CV-893 St. I. Propellant terminal	Pressure transducer	LO_2	2.1 2.2	L-203 pressure in propellant terminal downstream of FCV 211	0 to 100 psig	0 to 150 psig +100° to -320°F	±5% of reading	0.1 sec
PR 223	L-218 near PS 205. Missile silo	"	LO_2	2.1 2.2	Drain line pressure during unload	"	0 to 170 psig +100° to -320°F	"	"
PR 224	LLI 201 outlet on T-201. Propellant terminal	"	LO_2	2.1 2.2 PLS	To record LO_2 level in LO_2 tank	3 to 15 psig	0 to 20 psig	"	20 sec
PR 225	St. I LO_2 SMT ullage. Aboard missile	"	LO_2	2.1 2.2 PLS	To record LO_2 tank ullage pressure	0 to 30 psig	0 to 50 psig +100° to -320°F	"	0.1 sec
PR 226	St. II LO_2 SMT ullage. Aboard missile.	"	LO_2	2.1 2.2 PLS	"	0 to 40 psig	"	"	"
PR 901	Near T-901 (A, B, & C) at L-326 L-902. Propellant terminal	"	LO_2	2.1 2.2 PLS 8	(1) Tank T-901, (A, B, & C) pressure (2) GO_2 consumption	(1) 2800 to 1000 psig (2) 2000 to 200 psig	0 to 2800 psig +150-150°F	±5% of range (1) or (2) (ie ±90 psi at each peak)	60 sec
PR 902	L-902 upstream of FCV-901 and FCV-907. Propellant terminal.	"	LO_2	2.1 2.2	Pressure and flow correlation for LO_2 pressure valves	"	"	"	"
PR 905	Ullage T-201 low press. side of LLI 201 (T-201). Propellant terminal	"	LO_2	2.1 2.2 PLS	LO_2 tank ullage pressure	0 to 100 psig	10 to 150 psig	±5% reading	0.2 sec

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TABLE IV-d (Continued)

PARAMETER: PRESSURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extreme	Accuracy	Frequency of Readout
PR 501	LLI-502 outlet on T-502. Propellant terminal.	Pressure transducer	Helium	6.2	To record LH_2 level in helium cooler	9 to 15 psig	0 to 20 psig	±5% of reading	20 sec
PR 504	L-522 downstream of FCV-506 in propellant terminal	"	Fuel	1.2	Fuel purge pressure	0 to 30 psig	0 to 50 psig	"	60 sec
PR 505	Near T-502 neck L-505 Propellant terminal	"	Fuel	1.2 8	(1) T-502 bottle pressure (2) GH_2 consumption, fuel blanket & purge	0 to 2800 psig	0 to 2800 psig -150 to +150°F	"	"
PR 506	Near T-503 neck L-509 Propellant terminal	"	GH_2 service	2.2 SC-2 8	(1) T-503 bottle pressure (2) GH_2 consumption -1600 psi gas service	"	0 to 2800 psig -150 to +120°F	"	"
PR 507	L-882 downstream of FCV-512. Propellant terminal	"	GH_2 service	2.2 1.2.1	LO_2 and fuel unloading pressure from 750 psi gas service	0 to 40 psig 0 to 1000 psig	0 to 3000 psig -150 to +100°F	± 5% of reading	"
PR 508	L-511 downstream of FCV-507. Propellant terminal	"	GH_2 service	2.2 SC-2	Shock mount, engine start and AMF intermittent pressure. 1600 psi gas service	0 to 1800 psig	0 to 1800 psig -150 to +100°F	"	"
PR 510	Near T-505 neck L-566 Propellant terminal	"	LO_2	2.2 8	(1) Tank T-505 pressure (2) GH_2 consumption	0 to 2800 psig	0 to 2800 psig	±5% of range (1) or (2)	"
PR 511	L-567 downstream of FCV-510 Propellant terminal	"	LO_2	2.1 2.2	Blanket pressure	0 to 30 psig	0 to 60 psig	±5% of reading	"

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TABLE IV-d (Continued)

PARAMETER: PRESSURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
PR 512	Near T-604 neck L-580 Propellant terminal	Pressure transducer	GH_2 service	2.2 SC-2 S	(1) T-604 bottle pressure (2) GH_2 consumption 750 psi gas service	0 to 2800 psig	0 to 2800 psig -150°to +120°F	±5% of reading	60 sec
PR 513	Downstream of FCV-506 and FCV-513 L-581. Propellant terminal	"	"	2.2 SC-2	Missile pneumatic, degrease and purge box pressure 750 psi service	0 to 800 psig	0 to 800 psig -150°to +100°F	"	"
PR 601	Near T 601 A neck L-601. Propellant terminal	"	Helium	6.1 6.2 PLS S	Helium consumption and bottle pressure. To be used with bottle T-601A only	3500 to 6500 psig	0 to 6500 psig +100°to - 65°F	±5% of given reading within range i.e., at 6500: ±150 psig 3500: ±25 psig	0.2 sec
PR 602	Near T-601 B neck L-601. Propellant terminal	"	Helium	6.1 6.2 PLS S	Bottle pressure and helium consumption—to be used with bottle T-601B only	"	"	"	"
PR 605	L-604 upstream of helium cooler. Propellant terminal	"	Helium	6.1 6.2	Pressure of expanded warm helium upstream of cooler	500 to 3500 psig	0 to 3500 psig +100°to - 65°F	±5% of reading within given range i.e., at 3500: ±150 psig 500: ±25 psig	0.1 sec
PR 606	Facility side of warm helium connector L-610. Missile silo	"	Helium	6.1 6.2 PLS	Pressure of warm helium as close to connector as possible.	"	"	±5% of given reading within range	"
PR 607	On AMF piping upstream of cold connector L-605. Missile silo	"	Helium	6.1 6.2 PLS	Pressure of cooled helium as near to disconnect as possible	500 to 3200 psig	0 to 3500 psig +100°to -320°F	"	"

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TABLE IV-d (Continued)

PARAMETER: PRESSURE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
PR 608	St. I missile helium bottle. Aboard missile	Pressure transducer	Helium	6.1 6.2 PLS	Pressure at delivery point in missile	500 to 3200 psig	0 to 3200 psig +100 to -320°F	±3% of given reading within range	0.1 sec
PR 609	St. II missile helium bottles. Aboard missile	"	Helium	6.1 6.2 PLS	"	"	"	"	0.1 sec
PR 610	OF 601 flange taps L-602. Propellant terminal	Diff. Pressure transducer	Helium	6.1 6.2 PLS S	Differential pressure across OF 601 (for flow rate determination)	0 to 15 psid	0 to 20 psid	±3% of reading	0.2 sec
PR 611	OF 602 flange taps L-603. Propellant terminal	"	Helium	6.1 6.2 PLS S	Differential pressure across OF 602 (for flow rate determination)	"	"	"	0.2 sec
PR 612	Upstream tap of OF 601 L-602. Propellant terminal	Pressure transducer	Helium	6.1 6.2 PLS S	(1) Pressure record (2) For flow rate determination	3500 psig to 6500 psig	0 to 6500 psig -65 to 100°F	±150 psig at 6500 psi ±25 psig at 3500 psig	0.2 sec
PR 613	Upstream tap of OF 602 L-603. Propellant terminal	"	Helium	"	"	"	"	"	0.2 sec

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TABLE IV-d (Continued)

PARAMETER: POSITION

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extreme	Accuracy	Frequency of Readout
MR (T) 213	Mounted on FCV 202 - LO_2 St. I topping control. Propellant terminal	Position transducer	LO_2	2.1 2.2 PLS	Continuous record of valve seat position	Fully open through fully closed		±5% of valve stem movement	0.1 sec
MR (T) 214	Mounted on FCV 201 - LO_2 Stage II topping control. Propellant terminal	"	LO_2	2.1 2.2 PLS	"	"		"	"
MR (T) 304	Mounted on FCV 207 GO_2 pressure control. Propellant terminal	"	LO_2	2.1 2.2	"	"		"	"
MR (T) 305	Mounted on FCV 301 GO_2 pressure control. Propellant terminal	"	LO_2	2.1 2.2	"	"		"	"
MR (T) 603	Mounted on FCV 601 He flow control from T-601A. Propellant terminal	"	Helium	6.1 6.2 PLS	"	"		"	"
MR (T) 604	Mounted on FCV 602 He flow control from T-601B. Propellant terminal	"	Helium	6.1 6.2 PLS	"	"		"	"

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TABLE IV-d (Continued)

PARAMETER: POSITION

Item	Sensor Location	System	Test No.	Purpose of Measurement	Instrument Type	Accuracy	Frequency of Readout
MR 201	FCV 209 Stage II	LO_2	2.1 2.2	To record open and closed positions of valve	Existing limit switch pickup to multi-pen recorder	1 sec lag	0.1 sec
MR 202	FCV 212 Stage II	LO_2	2.1 2.2 PLS	•	•	•	•
MR 203	FCV 206 Stage I	LO_2	2.1 2.2	•	•	•	•
MR 204	FCV 211 Stage I	LO_2	2.1 2.2 PLS	•	•	•	•
MR 205	FCV 204 Stage II Line End	LO_2	2.1 2.2 PLS	•	•	•	•
MR 206	FCV 203 Stage II Topping Line End	LO_2	2.1 2.2	•	•	•	•
MR 207	FCV 215 Stage II Drain	LO_2	2.1 2.2	•	•	•	•
MR 208	FCV 205 Stage I Topping Line End	LO_2	2.1 2.2	•	•	•	•
MR 209	FCV 207 Stage I Line End	LO_2	2.1 2.2 PLS	•	•	•	•
MR 210	FCV 217 Stage I Drain	LO_2	2.1 2.2	•	•	•	•
MR 211	FCV 208 Pump Discharge	LO_2	2.1 2.2	•	•	•	•
MR 212	P-201 Pump Starter	LO_2	2.1 2.2	On and Off of LO_2 Unloading Pump	Starter circuit to pen recorder	•	•
MR 213	Stage I Fill & Drain Valve #1	LO_2	2.1 2.2 PLS	To record open and closed positions of valve	Limit switch to pen recorder	•	•
MR 214	Stage I Fill & Drain Valve #2	LO_2	2.1 2.2 PLS	•	•	•	•

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TABLE IV-d (Continued)

PARAMETER: POSITION

Item	Sensor Location	System	Test No.	Purpose of Measurement	Instrument Type	Accuracy	Frequency of Readout
MR 215	Stage II Fill & Drain Valve	LO_2	2.1 2.2 PLS	To record open and closed positions of valve	Limit switch to pen recorder	1 sec lag	0.1 sec
MR 301	FCV 304 Line Vent for L 204	LO_2	2.1 2.2	•	Existing limit switch pickup to multi-pen recorder	•	•
MR 302	FCV 303 Line Vent for L-203	LO_2	2.1 2.2	•	•	•	•
MR 303	FCV 302 Storage Tank Vent T-201	LO_2	2.1 2.2 PLS	•	•	•	•
MR 308	FCV 305 Drain Line Vent	LO_2	2.1 2.2	•	•	•	•
MR 309	FCV 306 Return Line Vent	LO_2	2.1 2.2	•	•	•	•
MR 310	Missile Vent Valve Stage II #1	LO_2	2.1 2.2 PLS	•	•	•	•
MR 311	Missile Vent Valve Stage II #2	LO_2	2.1 2.2 PLS	•	•	•	•
MR 312	Missile Vent Valve Stage I	LO_2	2.1 2.2 PLS	•	•	•	•
MR 313	Vent Blower Fan P-303	LO_2	2.1 2.2 PLS	On and Off of vent fan	Starter circuit to recorder	•	•
MR 314	FCV 301 Press. Control	LO_2	2.1 2.2	To give valve fully open position (only)	Limit switch to pen recorder	•	•
MR 505	Stage II LO_2 SMT Purge, FCV 516	LO_2	2.1 2.2	To record open and closed positions of valve	Limit switch to pen recorder	•	•
MR 506	FCV 507 1600 psi gas service	GN_2 Service	2.2 SC-2	•	Existing limit switches to multi-channel recorder	•	•

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TABLE IV-d (Continued)

PARAMETER: POSITION

Item	Sensor Location	System	Test No.	Purpose of Measurement	Instrument Type	Accuracy	Frequency of Readout
MR 507	FCV 508 750 psi gas service	GN_2 service	2.2 SC-2	To record open and closed positions of valve	Existing limit switches to multi-channel recorder	1 sec lag	0.1 sec
MR 511	FCV 505 Blanket Reg. Valve	Fuel LO_2	2.1 2.2 1.2	"	Limit switch to pen recorder	"	"
MR 516	SOV 564 Drain Blanket Stage I	LO_2	2.1 2.2	To record energized or de-energized status of solenoid coil	Solenoid coil to pen recorder	"	"
MR 518	St. I LO_2 SMT Purge, FCV 517	LO_2	2.1 2.2	To record open and closed positions of valve	Limit switch to pen recorder	"	"
MR 519	SOV 565 Line Blanket Stage I & II	LO_2	2.1 2.2	To record energized or de-energized status of solenoid coil	Solenoid coil to pen recorder	"	"
MR 521	FCV-513 750 psi gas service	GN_2 service	2.2 SC-2	To record open and closed positions of valve	Limit switch to pen recorder	"	"
MR 522	FCV-512 LO_2 and fuel unloading gas	GN_2 service	2.1 2.2	"	"	"	"
MR 601	FCV-601 warm helium L-610 in propellant terminal	Helium	6.2	"	Existing limit switch pickup to multi-pen recorder	"	"
MR 602	FCV-603 cold helium L-605 in propellant terminal	Helium	6.1 6.2	"	"	"	"
MR 605	FCV-605 helium recovery L-606 in propellant terminal	Helium	6.1 6.2	"	"	"	"
MR 606	Anti-geysering, helium injection valve #1 (solenoid operated)	Helium	6.2	"	"	"	"
MR 607	Warm helium line end valve (solenoid operated)	Helium	6.1 6.2	"	"	"	"
MR 608	Anti-geysering, helium injection valve #2 (solenoid operated)		6.2	"	"	"	"

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TABLE IV-d (Continued)

PARAMETER: LIQUID SENSE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
LSR 151	Top of St. I fuel SMT	LSR 151	Fuel	1.2	Flood signal	On/Off	-	1 sec lag	0.1 sec
LSR 152	Top of St. II fuel SMT	LSR 152	Fuel	1.2	Flood signal	"	-	"	"
LSR 201	L-203 Stage I fill line. Existing signal pickup in equipment terminal. Propellant terminal	LS 201	LO_2	2.1 2.2	Positive indication of presence of liquid at sensor with time to check sequence	"	-	"	"
LSR 202	L-208 Stage II fill line. Propellant terminal	LS 202	LO_2	2.1 2.2	"	"	-	"	"
LSR 209	L-209 Stage I Facility side of umbilical. Missile silo	LS 209	LO_2	2.1 2.2	"	"	-	"	"
LSR 204	Stage II (L-204) Facility side of umbilical. Missile silo	LS 204	LO_2	2.1 2.2	"	"	-	"	"
LSR 205	Stage I (L-216) Drain line. Missile silo	LS 205	LO_2	2.1 2.2	"	"	-	"	"
LSR 206	Stage II (L-215) Drain line. Missile silo	LS 206	LO_2	2.1 2.2	"	"	-	"	"
LSR 207	L-212. Pump discharge. Missile silo	LS 207	LO_2	2.1 2.2	"	"	-	Response time 1 sec	"
LSR 212	L-338 above Stage II drain catch pot. Missile silo	LS 212	LO_2	2.1 2.2	Positive record of presence of liquid at sensor.	"	-	"	"
LSR 251	Top of St. I LO_2 SMT Missile silo	Liquid sensor LSR 251	LO_2	2.2 PLS	Flood signal	"	-	"	"
LSR 252	Top of St. II LO_2 SMT. Missile silo	Liquid sensor LSR 252	LO_2	2.2 PLS	Flood signal	"	-	"	"

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TABLE IV-d (Continued)

PARAMETER: LIQUID SENSE

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range: To Be Measured	Range: Extremes	Accuracy	Frequency of Readout
LSR 253	At bottom of Stage I SMT. Aboard missile	Liquid sensor LSR 253	LO_2	2.1 2.2	Positive record of presence of liquid at sensor	On/Off	-	Response time 1 sec	0.1 sec
LSR 254	At bottom of Stage II SMT. Aboard missile	Liquid sensor LSR 254	LO_2	2.1 2.2	Positive record of pressure of liquid at sensor	"	-	"	"

PARAMETER: LIQUID LEVEL

LLR 251	Stage I LO_2 SMT. Aboard missile	Bogue liquid level sensor	LO_2	2.2 PLS	To record LO_2 level in SMT	0% to 110% full	-	As per Martin operational requirement	
LLR 252	Stage II LO_2 SMT. Aboard missile	"	LO_2	2.2 PLS	"	"	-	"	"

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TABLE IV-d (Continued)

PARAMETER: FLOW

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
FCV 208 flow	Line 208	No new instrument requirement. Information to be obtained from PR 205 and PR 206 and/or PR 215	LO_2	2.1 2.2 PLS	Stage II LO_2 flow. Valve to be calibrated as flow meter by manufacturer.	-	-	Accuracy of corresponding pressure systems	
FCV 207 flow	Line 209	No new instrument requirement. Information to be obtained from PR 219 and PR 218 and/or PR 214	LO_2	2.1 2.2 PLS	Stage I LO_2 flow. Valve to be calibrated as flow meter by manufacturer.	-	-	"	
FR 201	L-211 downstream from FCV 201. Missile silo.	Turbine type flow meter	LO_2	2.1 2.2 PLS	Continuous record of topping flow to Stage II missile tank.	2 to 7.5 gpm	10 gpm +100° to -320°F Reverse flow High velocity gas flow short duration	± 3% of reading	0.1 sec
FR 202	L-210 downstream from FCV 202. Missile silo.	"	LO_2	2.1 2.2 PLS	Continuous record of topping flow to Stage I missile tank.	2 to 15 gpm	20 gpm +100° to -320°F Reverse flow High velocity gas flow short duration	"	"
FR 301	(1) LO_2 storage tank vent L-309 (2) LO_2 subcooler vent (3) Helium cooler vent Surface. GO_2 or GN_2 passing through meter.	Temporary totalizing flow meter located at discharge of L-319 at surface	LO_2	SC.1	(1) Volume of GO_2 boiloff from storage tank* (2) Volume of GN_2 boiloff from LO_2 subcooler* (3) Volume of GN_2 boiloff from helium cooler* *with TR 307 information				

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TABLE IV-d (Continued)

PARAMETER: FLOW

Item	Sensor Location	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
Orifice plates for OF 201	Line 209	No data required from item	LO_2		A range of plates is to be provided in order to balance flow between St. I and II. Plates to have following orifice to pipe diameter ratios: 2 at 0.5, 2 at 0.7, 1 at 0.87, 1 at 0.99.			Standard manufacturing tolerances	
OF 601	Between CV-607 and CV-610. L-602. Propellant terminal	PR-610 PR-612 TR-601	Helium	6.1.1 6.2.2 6.2.4 6.2.6 2.2.3	Helium flow rate computed from PR-610, PR-612, TR-601 data	10 to 25 lbs/min helium	0 to 30 lbs/min - 0 to 6500 psig +100 to -65°F	•	
OF 602	L-603 between CV-608 and CV-611. Propellant terminal.	PR-611 PR-613 TR-602	Helium	6.2.1 6.2.3 6.2.5 6.2.6 2.2.1 2.2.6	Helium flow rate computed from PR-611, PR-613, TR-602 data.	•	•	•	

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TABLE IV-e

TEST INSTRUMENTATION REQUIREMENTS

(Miscellaneous)

Meter	Meter Location & Environment	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
TI 101	TI 101 (Fuel Storage Tank)	Existing in Basic Instrumentation System	Fuel	-	Fuel Temperature in Storage Tank	No Martin Requirements			
TI 201	Indicating instruments connected via switch to T.C.'s 201 through 207 & STC's 201, 202, 203, 205, 206, 207 & 208 on surface of T 201. T.C.'s buried with tank in ground	Wall T.C.'s by contractor	LO_2	SC-1.1	(1) Boiloff information (2) Temperature of Outer Tank Shell	+100 to -100°F	+100 to -100°F	± 10°F (± 5% range or simple gauge accuracy)	Manual Reading
PI 001	Safety test instrument rack - portable - located in equipment or propellant terminal	Transducer PR 001 to C.E.C. oscillograph	For connection to S.P.T's	SS.5 SS.8 SS.6 SS.7	Safety valve tests	0 to 50 psig	0 to 50 psig	1% of scale range	0.1 on C.E.C.
PI 002	"	Transducer PR 002 to C.E.C. oscillograph	"	SS.5 SS.6	"	0 to 50 psig	0 to 50 psig	"	"

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TABLE IV-e (Continued)

Meter	Meter Location & Environment	Sensor	System	Test No.	Purpose of Measurement	Range To Be Measured	Range Extremes	Accuracy	Frequency of Readout
PI 003	Safety test instrument rack - portable - located in equipment or propellant terminal	Transducer PR 003 to C.E.C. oscillograph	For connection to SPT's	35.4 35.6 35.7 89.1	Safety valve tests	0 to 100 psig	0 to 100 psig	1% of scale range	0.1 on C.E.C.
PI 004	"	Transducer PR 004 to C.E.C. oscillograph	"	35.1 35.2 35.6 86.1	"	0 to 300 psig	0 to 300 psig	"	"
PI 005	"	Transducer PR 005 to C.E.C oscillograph	"	35.2	"	0 to 1500 psig	0 to 1500 psig	"	"
PI 006	"	Transducer PR 006 to C.E.C. oscillograph	"	35.1 86.1	"	500 to 4000 psig	500 to 4000 psig	"	"

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TABLE IV-e (Continued)

Transducer	Test No. - Location	Purpose of Measurement	Transducer Range	Accuracy	Frequency of Readout
PR 001	35.4 - at SPT 530 downstream of SV 517 35.6 - at SPT 510 downstream of SV 532 35.7 - at SPT 521 downstream of SV 502	Safety Valve Tests	0 to 50 psig	1% of scale range	0.1 sec
PR 002	35.3 - at SPT 511 downstream of SV 514 35.6 - at SPT 534 downstream of SV 531	"	0 to 50 psig	"	"
PR 003	35.4 - at SPT 530 upstream of SV 517 35.7 - at SPT 529 upstream of SV 502 39.1 - at SPT 303 downstream of SV's 306, 318, & 319	"	0 to 100 psig	"	"
PR 004	35.1 - at SPT 514 downstream of SV 511 35.2 - at SPT 538 downstream of SV 535 35.6 - at SPT 532 upstream of SV 532 39.1 - at SPT 318 upstream of SV's 306, 318, & 319 36.1 - at SPT 602 downstream of SV 605	"	0 to 300 psig	"	"
PR 005	35.2 - at PR 513 tap upstream of SV 535 (Existing transducer PR 513 inadequate for this duty)	"	0 to 1500 psig	"	"

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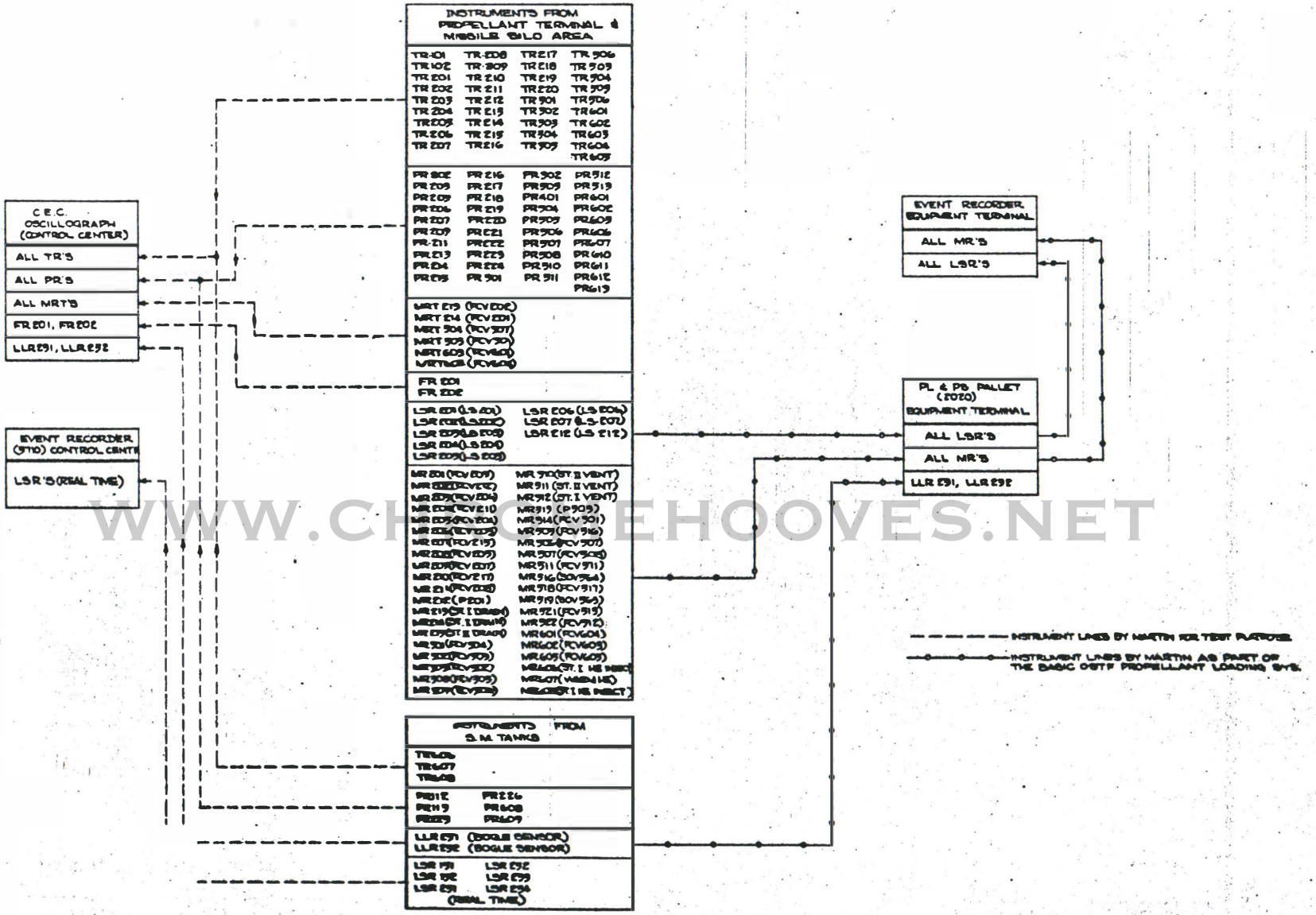

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Table IV-f

"QUICK LOOK" INSTRUMENTATION LAYOUT