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This document provides the general instructions for performing acceptance test number four as indicated in the Acceptance Test Index (TI-022-130-003). Also indicated are the plant conditions and special equipment required to conduct the test. The acceptance criteria for each portion of the test are specified.

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TEST NUMBER 4

PROCESS SENSOR AND DISPLAY TEST

1.0 PURPOSE

Test Number 4 provides verification of the overall adequacy of the process sensors and their associated control center displays to permit appropriate control of the test activities. Checks will be made of sensor accuracy, display calibration, and computed displays. Many of the process control signals are generated by transient test sensors directly and by transient sensors which simultaneously feed the transient data logging system and the mini-computer. The signals are combined by the mini-computer to produce the required control panel displays. The mini-computer output will be checked to confirm the adequacy of the software and the input signals. The measurements and observations made in this test will be compared to the requirements of this specification to determine acceptability.

2.0 TEST REQUIREMENTS

2.1 SENSOR DISPLAY CHECKS

2.1.1 GASEOUS NITROGEN FLOWMETERS

The gaseous flowmeters and their displays will be checked at two points within their respective flow ranges. These checks will be made at their respective calibration conditions.

With the NBM-2 nitrogen supply delivery pressure set at 35 ± 5 psig, V266A open to permit gas flow from NBM-2 into the 261

low pressure nitrogen header, and all other connecting lines isolated, adjust V262A to establish a flow indication of 20% on the control panel display, FI262. Monitor the pressure decay of the 20-bottle manifold and the flow through F262 for 10 minutes. The acceptable pressure decay rate is given in Section 5. Repeat the same test with a 60% indicated flow for a duration of 5 minutes.

With 262A closed and the same supply conditions as above open V265A to establish 20% flow through F265. Monitor the pressure decay in the bottle supply and the flow rate through F265 for 20 minutes. Repeat the test at the 80% flow indication with a test duration of 10 minutes. The acceptable flowmeter reading and supply pressure decay are given in Section 5.

With V266A closed, the NBM-2 delivery pressure set at 435 ± 10 psig, and the 1/8-inch orifice plate in the downstream position, open V201D and E. The vent line on Tank T1 and the V201A and B valves should be open for this test to prevent backpressure buildup. Monitor the NBM-2 pressure decay and the FI253 indicator readings for 20 minutes. Replace the 1/8-inch orifice with a 1/4-inch orifice and repeat the test with a duration of 10 minutes. The acceptable readings are indicated in Section 5. The 1/8-inch orifice shall be replaced upstream of F253 after this test.

Repeat the display test of F253 for F255. All requirements are the same except that V201D and E will be used to start the test and the vent line on Tank T2 and the V203A and B valves shall be open.

Repeat the display test of F253 for F256. All requirements are the same except that V204D and E will be used to start the test and valve V204F shall be open to vent the gas to atmosphere.

2.1.2 GAS ANALYZER

The control center oxygen and hydrogen display shall be checked against the local mounted displays on the analyzing system. The normal analyzer calibration shall be used for this check. The control center displays shall agree with the local indicators as specified in Section 5.

2.1.3 LEVEL SPARK PLUGS IN LINE 110

With the spark plug LSP110A removed from its installation port, short circuit the electrodes one to the other and monitor the control panel light SP110A for activation. Then short the positive electrode to ground and again monitor to control panel light.

Repeat the above test for LSP110B and monitor SP110B for activation.

2.1.4 SODIUM FILL FLOWMETER F222

Attach a millivolt DC supply at the field terminals of the flowmeter leads. Apply a plus $15 \pm .1$ millivolt potential to the field wires and monitor the high range control panel readout. Repeat the test with a negative $15 \pm .1$ millivolt potential. To check the low range readout apply a positive and negative 1 millivolt potential and monitor the low range readout. Repeat the above checks with 50% of the specified values. The acceptable control panel readings are indicated in Section 5. The correlation between millivolts and actual flow rate is obtained from the flowmeter characteristic curve.

2.1.5 PRESSURE SENSOR P252B

The control panel display of the output of P252B can be checked directly against P252A which is a local mounted pressure gage at the same sensing location. Pressurize the 252 header sequentially to 100, 300, and 500 psig as indicated by PI252A and the NBM-2 delivery pressure indicator. At each pressure level monitor the control panel display for comparison to the acceptable values of Section 5.

2.1.6 WATER/STEAM INJECTION SYSTEM FLOWMETERS

These flowmeters (F501, F502, and F503) are part of the transient data system and will be checked with regard to measuring system accuracy and appropriate setup as part of Acceptance Test Number 7. The control panel display shall be checked against the flowmeter flow rate monitors mounted in the transient data racks. The flow rate monitors have meter scales in percent of full flow which are the same as the control panel. The checks conducted in Test 7 will be performed at 20, 50, and 80% of each flowmeter range. The cross check of the display meters shall be made concurrent with these tests and at the indicated flow conditions. The acceptable deviations are indicated in Section 5.

2.1.7 WATER/STEAM INJECTION SYSTEM PRESSURES

These pressure sensors (P501, P502, P503, P504, and P506) are part of the transient data system and will be performance checked as part of Acceptance Test Number 7.

The output of these sensors and their associated signal conditioning is 0 to 5 VDC corresponding to the pressure range of 0 to 3000 psia.

Attach a DC voltage source to the output leads of the P501 amplifier and apply a potential of $1.00 \pm .01$, $3.00 \pm .01$, $5.00 \pm .01$ VDC sequentially. Monitor PI501 on the control panel and record the panel meter readings for comparison to the acceptable values in Section 5.

Repeat the above test for P502, P503, P504, and P506.

2.1.8 LLID PISTON POSITION Z503

The output of the LLID - LVDT will be ± 0.5 VDC representing a full range travel of ± 3 inches. Apply $\pm 0.200 \pm 0.002$, $\pm 0.300 \pm 0.002$, and $\pm 0.500 \pm 0.002$ VDC to the output leads from the Z503 signal conditioning unit and monitor the output on the 3-pen recorder on the control panel. The acceptable display readings are given in Section 5.

2.1.9 WATER TANK LEVEL SENSORS

The water tank level sensors (DP501 and DP502) are part of the transient data system and will be performance checked as part of Acceptance Test Number 7. The digital display of each tank level shall be checked concurrent with Test 7. The output of the signal conditioning network shall be 1 to 5 VDC at the leads to the DAS which corresponds to 70°F water levels of 0 to 200 inches. During Test 7, measuring system checks will be made at levels corresponding to 2 and 4 VDC output. The digital display should correspond to these outputs as indicated in Section 5.

2.2 COMPUTED DISPLAYS

2.2.1 QUALITY COMPUTATION

The quality computation is made by the DAS mini-computer based on inputs from F501, F502, F503, TE501, and P503. It also generates an output signal of 0 to 1 VDC corresponding to 0 to 100% quality to drive one pen of the control panel chart recorder. The check of this system including the computer program shall be performed as follows:

- a) Apply a $2.83 \pm .03$ VDC potential to the P503 leads to the DAS.
- b) Apply a $2.29 \pm .02$ VDC potential to the T501 leads to the DAS
- c) Apply a $1.80 \pm .01$ VDC potential to the F502 leads to the DAS
- d) Apply a $1.09 \pm .01$ VDC potential to the F503 leads to the DAS
- e) Apply a 4.0 ± 0.1 VDC potential to the F501 leads to the DAS
- f) Monitor the computer output as indicated on the control panel chart recorder. The acceptable reading is indicated in Section 5.
- g) Repeat the check at different qualities by applying $1.17 \pm .01$ and $1.26 \pm .01$ VDC to the F503 leads to the DAS while all other inputs remain unchanged.
- h) Repeat a) through g) with the following changes:
 - a) Same
 - b) Same
 - c) Apply a 1.44 ± 0.01 VDC potential to the F501 leads to the DAS

- d) Apply a 1.44 ± 0.01 VDC potential to the F503 leads to the DAS
- e) Apply a 4.0 ± 0.1 VDC potential to the F502 leads to the DAS
- f) Same
- g) Repeat the check at different quantities by applying 1.86 ± 0.01 VDC and 2.30 ± 0.01 VDC to the F503 leads to the DAS while all other inputs remain unchanged.

2.2.2 MASS TRANSFER COMPUTATION

The mass transfer calculation is a simple differencing operation in which the current level in Tank T1 during the mass transfer operation is subtracted from the initial level to obtain the total mass removed or transferred. The appropriate tank area and fluid density at sensor calibration conditions are internally programed. The mass transfer calculation and display shall be checked by applying a DC potential of $4.00 \pm .02$ VDC to the DP501 leads to the DAS. With the mini-computer activated, begin to decrease the applied voltage at a rate of 1.0 ± 0.2 VDC per minute. Stop the voltage decrease at the $3.50 \pm .02$ and $3.00 \pm .02$ VDC and record the displayed values. The acceptable values are given in Section 5.

2.2.3 MASS INJECTION COMPUTATION

The mass injection calculation by the DAS mini-computer feeds the same digital display as the mass transfer calculation. The feed to this meter will be switched by a signal from Z503 indicating tube rupture. The inputs to the injection calculation

are signals from Z503, TE501, F501, P506, F503, and D501. The performance of this calculation and display shall be checked as follows:

- a) Apply a 2.29 ± 0.02 VDC potential to the TE501 leads to the DAS
- b) Apply a 3.61 ± 0.02 VDC potential to the F501 leads to the DAS
- c) Apply a $4.40 \pm .04$ VDC potential to the F503 leads to the DAS
- d) Apply a 3.47 ± 0.04 VDC potential to the D501 leads to the DAS
- e) Apply a 2.83 ± 0.03 VDC potential to the P506 leads to the DAS

The system is now set to start integrating the injected flow. With the mini-computer activated apply a 0.5 ± 0.1 VDC potential to the Z503 leads to the DAS and simultaneously start a clock timer. After a simulated injection of 30 ± 5 seconds terminate the test by simultaneously dropping the applied potential on the F501 and F503 leads to ZERO. The acceptable display reading for this test is given in Section 5. Repeat this test 2 times to verify reproducibility of the results.

3.0 PLANT CONDITIONS

The system physical condition for this test is completely flexible. The NBM-2 nitrogen supply must be activated, the process control system must be fully operational, and the transient data system must be operational with respect to the DAS mini-computer. The mini-computer software programs for

the quality, mass transfer, and mass injection computations must be debugged and functional in the mini-computer.

For some of the tests indicated in this document which are to be done concurrent with Test 7, the plant conditions of Test 7 shall apply.

4.0 SPECIAL EQUIPMENT

The following special equipment is required for this test.

1. Millivolt DC source with a range of 0 to ± 20 mv and a resolution of 0.05 mv
2. DC voltage sources with a range of 0 to 5 VDC and a resolution of 0.002 VDC
3. Clock timer with 0.1 second resolution

5.0 ACCEPTANCE CRITERIA

The acceptance criteria for the gaseous nitrogen flowmeters are given in Table 5.1. The criteria is given in terms of pressure decay in the 20-bottle NBM-2 nitrogen supply.

The gas analyzer displays of Section 2.1.2 shall agree with the local mounted displays to $\pm 0.1\%$ gas concentration.

The acceptance criteria for Section 2.1.3 is that the lights indicating line 110 full should be on whenever the spark plug is shorted.

The acceptable control panel meter readings for F222 as tested in Section 2.1.4 are given in Table 5.2 in terms of percent full scale.

TABLE 5.1

ACCEPTABLE GN₂ FLOWMETER INDICATIONS

Flowmeter	Percent Indicated Flow @ Test Conditions	NBM-2 Pressure Decay psi/min
F262	20	65 $\pm$ 6
F262	60	195 $\pm$ 20
F265	20	20 $\pm$ 2
F265	80	80 $\pm$ 8
F253	10 (1/8" orifice)	28 $\pm$ 3
F253	40 (1/4" orifice)	112 $\pm$ 11
F255	10 (1/8" orifice)	28 $\pm$ 3
F255	40 (1/4" orifice)	112 $\pm$ 11
F256	10 (1/8" orifice)	28 $\pm$ 3
F256	40 (1/4" orifice)	112 $\pm$ 11

TABLE 5.2
ACCEPTABLE FLOW INDICATIONS FOR F222

Flowmeter Output Millivolts	Control Panel Readings	
	High Range %	Low Range %
+ 15 ± 0.1	+ 100 ± 10	--
- 15 ± 0.1	- 100 ± 10	--
+ 1 ± 0.1	--	+ 100 ± 10
- 1 ± 0.1	—	- 100 ± 10
+ 7.5 ± 0.05	+ 50 ± 5	--
- 7.5 ± 0.05	- 50 ± 5	--
+ 0.5 ± 0.05	--	+ 50 ± 5
- 0.05 ± 0.05	--	- 50 ± 5

The acceptable pressure indications from P252B as tested in Section 2.1.5 shall be in agreement with P252A to within $\pm 5\%$.

The acceptable water system flowmeter indications as tested in Section 2.1.6 shall be in agreement with the respective flow rate monitors to within $\pm 2\%$ of full scale.

The acceptable display readings for the water system pressure measurements of Section 2.1.7 are given in Table 5.3.

The acceptable display readings for Section ~~2.1.8~~ are $\pm 1.2 \pm 0.1$, $\pm 1.8 \pm 0.1$, and $\pm 3.0 \pm 0.1$ inches for input voltages of ± 0.200 , ± 0.300 , and ± 0.500 VDC, respectively.

The acceptance criteria for the water tank level gage displays as tested in Section 2.1.9 shall be indications of 305 ± 5 lbm and 915 ± 5 lbm for the input voltages of 2 and 4 VDC respectively.

The acceptance criteria for Section 2.2.1 shall be qualities of $20 \pm 2\%$, $50 \pm 2\%$, and $80 \pm 2\%$ for the applied voltages from F503 of 1.09, 1.17, and 1.26 VDC, respectively. The same qualities shall be computed for item h) for applied voltages from F503 of 1.44, 1.86, and 2.30 VDC, respectively.

The acceptance criteria for Section 2.2.2 shall be meter indications of 0, 152 ± 3 , and 305 ± 3 at the voltages of 4.00, 3.50, and 3.00 VDC, respectively.

The acceptance criteria for Section 2.2.3 shall be 10 ± 0.5 pounds per second; therefore, the meter shall read 300 ± 15 at the end of the 30-second interval.

TABLE 5.3

ACCEPTABLE PRESSURE INDICATIONS FOR THE
WATER/STEAM INJECTION SYSTEM

Sensors	Signal VDC	Acceptable Control Panel Reading psia
P501, P503, P504, P502, P506	1.00 $\pm$ 0.01	600 $\pm$ 25
	3.00 $\pm$ 0.01	1800 $\pm$ 25
	5.00 $\pm$ 0.01	3000 $\pm$ 25

6.0 DATA REQUIRED

The required data is listed in Table 6.1 for each test in this document. The recording intervals are also indicated where applicable.

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TABLE 6.1

DATA REQUIRED FOR TEST 4

Test	Data Required	Recording Interval
2.1.1 - F262 - 20%	F262, PI-NBM-2	1 min
" - 60%	" "	"
- F265 - 20%	F265, "	2 min
" - 80%	" "	1 min
- F253 - 1/8	F253, "	2 min
" - 1/4	" "	1 min
- F252 - 1/8	F255 "	2 min
" - 1/4	" "	1 min
- F256 - 1/8	F256 "	2 min
" - 1/4	" "	1 min
2.1.2 - O ₂	O ₂ - Local, O ₂ - Control Rm	--
- H ₂	H ₂ - Local, O ₂ - Control Rm	--
2.1.3 - LSP110A	SP110A Light Condition	--
- LSP110B	SP110B " "	--
2.1.4 - F222	Applied Voltage, Panel Meter	each voltage
2.1.5 - P252B	P252A, P252B	each press
2.1.6 - F501	Rate Meter, Panel Meter	each flow
- F502	" "	"
- F503	" "	"
2.1.7 - P501	Applied Voltage, Panel Meter	each voltage
- P502	" "	"
- P503	" "	"
- P504	" "	"
- P506	" "	"
2.1.8 - Z503	Applied Voltage, Chart Recorder	"
2.1.9 - DP501	Output Voltage, Meter	each voltage
- DP502	" "	"
2.2.1 - Quality	Applied Voltages, Chart Recorder	each voltage
2.2.2 - Mass Trans.	Applied Voltages, Digital Meter	each voltage
2.2.3 - Mass Inject.	Applied Voltages, Time, Digital Meter	each test