

PERFORMANCE REQUIREMENTS
FOR J86641 (523A) OR J86642 (524A) POWER PLANT
GENERAL PURPOSE INVERTER PLANT
WITH REGULAR AND RESERVE SUPPLY
GENERAL EQUIPMENT REQUIREMENTS
POWER SYSTEMS

1. GENERAL

1.01 This section covers the performance requirements which the J86641 (802-813-150) and J86642 (802-814-150) reserve power plants shall meet in supplementary tests before turnover to the telephone company.

1.02 This section is reissued to include the KS-21353 and KS-21354 rectifiers.

1.03 Reference shall be made to Section 800-630-180 covering general requirements and definitions for additional information necessary for the proper application of the requirements.

1.04 Before application of this section the equipment shall be in accordance with all job information including circuits and circuit descriptions.

2. SUPPLEMENTARY TEST REQUIREMENTS

2.01 The plant shall be operated for 15 minutes, with the OPERATION SELECTOR switch (OSS) in the INVR PWR position and with a test load of 1.5 kW and PF = 0.8 lagging connected for the 523A plant and 5.0 kW and PF = 0.8 lagging for the 524A plant. If such a load is not available, the plant shall be operated for 1 hour with all office loads energized but without message service.

2.02 Wherever a network or diode is used for contact protection, check polarity if applicable.

2.03 Check the battery supply voltage; float voltage shall be approximately -52V.

2.04 Check the following: fuses (rating and type), alarms, alarm lamps, indicators, and test lamps.

FUSES

A. AC Control Distribution Panel

- (1) AC OUTPUT Fuses (F1 NEUT & F2 LINE)
- (2) AC LOAD & ALARM Fuses (F6 through F23) for the 523A plant or F6 through F21 for the 524A plant.
- (3) MON INPUT Fuses (F3 COML & F4 INVR)
- (4) F5 FA REL INPUT Fuse (Option P)

B. Plant Input Fuses

- (1) Commercial Service Supply 117VAC (RPP1)
- (2) Inverter -48 DC Input [on Battery Discharge Fuse Panel (RPP2)]
- (3) Control Circuit -48V DC Input (on Battery Distribution Board A, B, C)

C. Inverter Fuses

- (1) F1, F2, F3 (Option Z), F4, F5, F6 through F15 (Option S) fuses in the KS-19951 and KS-19952 inverters.

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SECTION 802-813-180

- (2) F1 through F5 fuses in the KS-21353 (J87428B-90) inverter.
- (3) F1, F2, and F3 fuses in the KS-21353 (J87428A-90) inverter.
- (4) F1, F2, and F3 fuses in the KS-21354 (J87429A-90) inverter.
- (5) F1, F2, and F3 fuses in the KS-21354 (J87429B-90) inverter.

ALARMS AND ALARM LAMPS

A. AC Control Distribution Panel

PLANT ALARMS	LENS COLOR
(1) COML FAIL	RED
(2) INVR FAIL	RED
(3) FUSE ALARM	RED
(4) MINOR ACO	WHITE
(5) MAJOR ACO	WHITE
(6) INVR ALARM RESET	RED

INDICATORS

A. AC Control Distribution Panel

FUNCTION	LENS COLOR
(1) POWER ON	WHITE
(2) OPERATION SELECTOR Switch	WHITE
(COML PWR, INVR PWR)	

2.05 Check that operating the OPERATION SELECTOR switch (OSS) causes the load to be transferred from INVR PWR to COML PWR,

and that operating the OSS switch again causes the load to be transferred back to INVR PWR.

KS-19951 AND KS-19952 INVERTERS (2.06 through 2.08)

2.06 Check that the output of the inverter is adjusted for 117Vac $\pm 1/4$ percent at the inverter output test jacks, with a load of 1.5 kW and PF = 0.8 lagging for the 523A plant or 5.0 kW and PF = 0.8 lagging for the 524A plant, and the input battery at approximately -52Vdc for a 24-cell battery plant or 50Vdc for a 23-cell plant. Also check that with no load the inverter output voltage does not exceed 120Vac. For both sets of conditions check that the inverter frequency is 59.5 ± 0.1 Hz. If the test load noted above is not available, carefully measure and record the no-load inverter output voltage, at the inverter output test jacks, before making any adjustments. Use the voltage value so obtained to reset the inverter output voltage after the tests called for in 2.07 are completed. It should be noted that this test procedure does not insure the inverter will meet the output voltage regulation requirement given in 4.09 or 4.25.

2.07 Check that the INVR voltage monitor AI relay operates when the inverter line-to-neutral voltage rises above 111 $\pm 1V$ rms and releases when the line-to-neutral voltage drops between 106 $\pm 1V$ rms (INVR FAIL red lamp lights) and that the load is transferred to commercial power after a delay of approximately 6 seconds. Use the VOLTS ADJ potentiometer on the inverter for varying the voltage, and use a Weston Model 622 thermocouple voltmeter; a 500-type Greibach true rms voltmeter, or equivalent, to measure the output voltage. Check that with the INVR FAIL lamp lighted, depressing the MAJOR ACO/MINOR ACO switch retires the minor audible alarm and maintains a minor visual alarm.



It is extremely important to reset the inverter output voltage in accordance with 2.06 after completing the above checks.

2.08 After restoring the inverter output to normal limits, operate the INVR ALARM RESET switch to extinguish its red lamp and transfer the load back to the inverter.

KS-21353 AND KS-21354 INVERTERS (2.09 through 2.11)

2.09 Check that the output of the inverter is 120 (+4, -9) volts rms at the inverter output test jacks, with a load of 1.5 kW and PF = 0.8 lagging for the 523A plant or 5.0 kW and PF = 0.8 lagging for the 524A plant, and the input battery at approximately -52Vdc for a 24-cell battery plant or 50Vdc for a 23-cell plant. Also check that with no load the inverter output voltage does not exceed 124Vac. For both sets of conditions check that the inverter frequency is 59.5 ± 0.5 Hz.

2.10 Remove the inverter voltage monitor input fuse F4 and connect a variac (properly polarized) across the AC IN test jacks of the inverter monitor. Slowly vary the voltage applied to the inverter monitor. Check that the INVR voltage monitor AI relay operates when the line-to-neutral voltage rises above 109 ± 1 V rms and releases when the line-to-neutral voltage drops below 105 ± 1 V rms (INVR FAIL red lamp lights) and that the load is transferred to commercial power after a delay of approximately 6 seconds. Check that with the INVR FAIL lamp lighted, depressing the MAJOR ACO/MINOR ACO switch retires the minor audible alarm and maintains a minor visual alarm.

2.11 After restoring the inverter, operate the INVR ALARM RESET switch to extinguish its red lamp and transfer the load back to the inverter.

ALL PLANTS

2.12 With the OSS switch in the INVR PWR position, block the CI side of the KI contactor operated. Remove the F3 COML monitor input fuse and connect a variac (properly polarized) across the AC IN test jacks of the COML monitor. Check that the COML voltage monitor AC relay operates when the voltage applied to the monitor circuit rises above 111 ± 1 V rms and releases when the voltage drops below 106 ± 1 V rms (COML FAIL red lamp lights). Check that with the COML FAIL lamp lighted depressing the MAJOR ACO MINOR ACO switch retires the minor audible alarm and maintains a minor visual alarm. Disconnect variac, replace fuse F3, unblock C1 contactor, and restore load to COML PWR by operating the OSS switch.

2.13 With the OSS switch in the COML PWR position, remove the COML (F3) MON INPUT fuse and check that the load is transferred to inverter power after a delay of approximately 1 second. Replace the F3 fuse, check to see if the AC relay has operated and that after a delay of 153 through 207 seconds, the load has been transferred back to commercial power.

2.14 Remove the COML (F3) and INVR (F4) MON INPUT fuses. Check that both sides of the K1 contactor are unoperated (disconnecting the load from either power source). Also, check that depressing the MAJOR ACO/MINOR ACO switch retires the major audible alarm and maintains a major visual alarm. Replace the F3 fuse, the F4 fuse, and operate the INVR ALARM RESET switch after it is illuminated.

3. TEST REPORTS AND RECORDS

3.01 The required record of these tests shall be entered on the proper forms.

4. PLANT PERFORMANCE

4.01 This section is for information only and should not be used for test purposes.

COMMERCIAL POWER**A. Voltage Rating**

4.02 Line-to-neutral voltage between 105 and 127Vac.

KS-19951 INVERTER

4.03 The function of the KS-19951 inverter is to provide a continuous, regulated, sine wave, 117V rms, regulated 59.5-Hz frequency, single phase alternating current from a -48V battery plant.

A. Rating

4.04 1.5 kW, -0.8 through 1.0 PF, 59.5 ± 0.5 Hz, single phase, 117 ± 6 V rms.

B. DC Input Voltage

4.05 Operation conditions:

- (1) Normal Operation: -48.25 through -52.5V for a 23-cell or 24-cell battery plant.

SECTION 802-813-180

- (2) Emergency Operation: -42 through -52.5V
- (3) Extreme or Trouble Operation: -42 through -55V.

C. Ambient Temperature

4.06 The ambient temperature in the vicinity of the inverter shall not be less than 0°C nor more than 50°C for continuous and reliable operation.

D. Frequency Stability

4.07 The output frequency is 59.5 ± 0.5 Hz for operation within the temperature limits of 0° through 50°C. The output frequency is not load or line sensitive. See 4.18.

E. AC Output Current

4.08 The rated output current is 16.0 amperes at 117V at 0.8 power factor lagging.

F. Output Voltage Regulation

4.09 The output voltage of the inverter, measured at the inverter output test jacks, is 117 ± 6 V for all conditions of line, load, or temperature as specified in 4.05, 4.06, and 4.10. See 4.18.

G. Output Capacity

4.10 The rated output is 1.5 kW, 0.8 lagging to 1.0 PF at 117V.

H. Load Power Factor

4.11 The inverter is capable of operating at 117V, 1.5 kW for loads from 0.8 PF lagging to unity PF, but is not guaranteed to meet the limits specified in 4.09, 4.12, and 4.13 when connected to loads having a PF less than 0.8 lagging.

I. Output Harmonic Content

4.12 The total rms harmonic content of the output voltage wave does not exceed 5 percent of the fundamental under any condition of line, load, or temperature as specified in 4.05, 4.06, and 4.11.

J. Transient Response

4.13 The inverter output voltage will not exceed 200V peak for the following conditions: turn

on, turn off, addition or removal of rated load, and removal of a short circuit from the output. Following the application of a 1.875 kVA load at 0.8 lagging PF or a 1.5 kW load at unity PF, the terminal voltage shall return to the 111-123V rms steady-state band and remain there within 200 milliseconds; and the inverter output voltage shall not drop below 75V peak and shall recover to at least 130V peak within 3 cycles (approximately 50 milliseconds). The output frequency shall remain within the 59 to 60 Hz range for all of the above mentioned conditions.

K. Output Adjustment Range

4.14 The output voltage measured at the inverter output test jacks, can be adjusted between 100 and 120V rms at full rated load (with load impedance fixed at 117V, 1.5 kW, PF = 0.8 lag) and between 100 and 123V rms at no load with a -52Vdc input.

L. Short Circuit Capability

4.15 The inverter is capable of handling overloads up to and including short circuits on the output. In the overload region the output voltage is reduced as the current is increased. With a short circuit across the output terminals, the output current is limited to approximately 40 amperes.

M. Voltage Bobble

4.16 The maximum voltage bobble (amplitude modulation) on the output of the inverter is less than 350 mV peak-to-peak over a frequency range of zero through 20 Hz.

N. Efficiency

4.17 The inverter efficiency is 75 percent minimum at 1.5 kW, 0.8 PF lagging load with -48V input.

O. Nominal Setting of Voltage and Frequency Adjustment Potentiometers

4.18 The nominal setting of the inverter output frequency and voltage is made at the factory as follows: with the ambient air temperature between 25° and 30°C, the inverter delivering 1.875 kVA, 0.8 lagging PF load, and the battery voltage at the nominal float level, the FREQ ADJ potentiometer shall be adjusted so that the output

frequency is 59.5 ± 0.1 Hz, and the VOLTS ADJ potentiometer shall be adjusted so that the output terminal voltage is $117\text{Vac} \pm 1/4$ percent.

KS-19952 INVERTER

4.19 The function of the KS-19952 inverter is to provide a continuous, regulated, sine wave, 117V rms, regulated 59.5-Hz frequency, single phase alternating current from a -48V battery plant.

A. Rating

4.20 5.0 kW, -0.8 through 1.0 PF, 59.5 ± 0.5 Hz, single phase, $117 \pm 6\text{V}$ rms.

B. DC Input Voltage

4.21 Operation conditions:

- (1) Normal Operation: -48.25 through -52.5V for a 23-cell or 24-cell battery plant.
- (2) Emergency Operation: -42 through -52.5V
- (3) Extreme or Trouble Operation: -42 through -55V.

C. Ambient Temperature

4.22 The ambient temperature in the vicinity of the inverter shall not be less than 0°C nor more than 50°C for continuous and reliable operation.

D. Frequency Stability

4.23 The output frequency is 59.5 ± 0.5 Hz for operation within the temperature limits of 0° to 50°C . The output frequency is not load or line sensitive. See 4.34.

E. AC Output Current

4.24 The rated output current is 53.5 amperes at 117V at 0.8 power factor lagging.

F. Output Voltage Regulation

4.25 The output voltage of the inverter, measured at the inverter output test jacks, is $117 \pm 6\text{V}$ for all conditions of line, load, or temperature as specified in 4.21, 4.22, and 4.26, respectively. See 4.34.

G. Output Capacity

4.26 The rated output is 5.0 kW, 0.8 lagging to 1.0 PF at 117V.

H. Load Power Factor

4.27 The inverter is capable of operating at 117V, 5.0 kW for loads from 0.8 PF lagging to unity PF, but is not guaranteed to meet the limits specified in 4.25, 4.28, and 4.29 when connected to loads having a PF less than 0.8 lagging.

I. Output Harmonic Content

4.28 The total rms harmonic content of the output voltage wave does not exceed 5 percent of the fundamental under any condition of line, load, or temperature as specified in 4.21, 4.22, and 4.27, respectively.

J. Transient Response

4.29 The inverter output voltage will not exceed 200V peak for the following conditions: turn on, turn off, addition or removal of rated load, and removal of a short circuit from the output. Following the application of a 6.25 kVA load at 0.8 lagging PF or a 5.0 kW load at unity PF, the terminal voltage shall return to the 111-123V rms steady-state band and remain there within 200 milliseconds; and the inverter output voltage shall not drop below 75V peak and shall recover to at least 130V peak within 3 cycles (approximately 50 milliseconds). The output frequency shall remain within the 59 through 60 Hz range for all the above mentioned conditions.

K. Output Adjustment Range

4.30 The output voltage measured at the inverter output test jacks, can be adjusted between 100 and 120V rms at full rated load (with load impedance fixed at 117V, 5.0 kW, PF = 0.8 lag) and between 100 and 123V rms at no load with a -52V dc input.

L. Short Circuit Capability

4.31 The inverter is capable of handling overloads up to and including short circuits on the output. In the overload region the output voltage is reduced as the current is increased. With a

SECTION 802-813-180

short circuit across the output terminals, the output current is limited to approximately 130 amperes.

M. Voltage Bobble

4.32 The maximum voltage bobble (amplitude modulation) on the output of the inverter is less than 350 mV peak-to-peak over a frequency range of zero through 20 Hz.

N. Efficiency

4.33 The inverter efficiency is 80 percent minimum at 5.0 kW, 0.8 PF lagging load with -48V input.

O. Nominal Setting of Voltage and Frequency Adjustment Potentiometers

4.34 The nominal setting of the inverter output frequency and voltage is made at the factory as follows: with the ambient air temperature between 25° and 30°C, the inverter delivering 6.25 kVA, 0.8 lagging PF load, and the battery voltage at the nominal float level, the FREQ ADJ potentiometer shall be adjusted so that the output frequency is 59.5 ±0.1 Hz, and the VOLTS ADJ potentiometer shall be adjusted so that the output terminal voltage is 117V ac±1/4 percent.

KS-21353 INVERTER

4.35 The function of the KS-21353 inverter is to provide a continuous, regulated, sine wave, 120 rms, regulated 59.5-Hz frequency, single phase alternating current from a -48V battery plant.

A. Rating

4.36 1.5 kW, 0.8 through 1.0 PF lagging, 59.5 ±0.5 Hz, single phase, 120 (+4, -9) volts rms.

B. DC Input Voltage

4.37 Operation conditions:

- (1) Normal Operation: -48.25 through -52.5V
- (2) Emergency Operation: -42 through -52.5V
- (3) Extreme or Trouble Operation: -42 through -55V.

C. Ambient Temperature

4.38 The ambient temperature in the vicinity of the inverter shall not be less than 0°C nor more than 50°C for continuous and reliable operation.

D. Frequency Stability

4.39 The output frequency is 59.5±0.5 Hz for operation within the temperature limits of 0° through 50°C. The output frequency is not load or line sensitive. See 4.49.

E. AC Output Current

4.40 The rated output current is 16.0 amperes at 117V and at 0.8 power factor lagging.

F. Output Voltage Regulation

4.41 The output voltage of the inverter, measured at the inverter output test jacks, is 120 (+4, -9) volts rms for all conditions of line, load, or temperature as specified in 4.37, 4.42, and 4.38, respectively. See 4.49.

G. Output Capacity

4.42 The rated output is 1.5 kW, 0.8 lagging to 1.0 PF at 117V.

H. Load Power Factor

4.43 The inverter is capable of operating at 120 (+4, -9) volts rms, 1.5 kW for loads from 0.8 PF lagging to unity PF, but is not guaranteed to meet the limits of 4.41, 4.44, and 4.45 when connected to loads of different power factors.

I. Output Harmonic Content

4.44 The total rms harmonic content of the output voltage wave does not exceed 5 percent of the fundamental under any condition of line, load, or temperature as specified in 4.37, 4.43, and 4.38, respectively.

J. Transient Response

4.45 The inverter output voltage shall not exceed 200V peak for the following conditions: turn on, turn off, addition or removal of rated load, and removal of a short circuit from the output. Following the application of full rated load, the

terminal voltage shall return to the 111-124V rms steady-state band within 200 milliseconds and the inverter output voltage shall not drop below 70V peak and shall recover to at least 130V peak within 3 cycles (approximately 50 milliseconds). The output frequency shall remain within the 59 to 60 Hz range for all of the above mentioned conditions.

K. Short Circuit Capability

4.46 The inverter is capable of handling overloads up to and including short circuits on the output. In the overload region the output voltage is reduced as the current is increased. With a short circuit across the output terminals, the output current is limited to 42 amperes.

L. Voltage Bobble

4.47 The maximum voltage bobble (amplitude modulation) on the output of the inverter is less than 350 mV peak-to-peak over a frequency range of zero through 20 Hz.

M. Efficiency

4.48 The inverter efficiency is 75 percent minimum at 1.5 kW, 0.8 PF lagging load with -48V input.

N. Nominal Setting of Frequency Adjustment Potentiometer

4.49 The nominal setting of the inverter output frequency is made at the factory. If readjustment becomes necessary, connect a frequency counter across the inverter ac output test jacks and adjust the inverter FREQ ADJ potentiometer so that the output frequency is 59.5 ± 0.1 Hz.

KS-21354 INVERTER

4.50 The function of the KS-21354 inverter is to provide a continuous, regulated, sine wave 120 rms, regulated 59.5-Hz frequency, single phase ac from a -48V battery plant.

A. Rating

4.51 5.0 kW, 0.8 through 1.0 PF lagging, 59.5 ± 0.5 Hz, single phase, 120 (+4, -9) volts rms.

B. DC Input Voltage

4.52 Operation conditions:

- (1) Normal Operation: -48.25 through -52.5V
- (2) Emergency Operation: -42 through -52.5V
- (3) Extreme or Trouble Operation: -42 through -55V.

C. Ambient Temperature

4.53 The ambient temperature in the vicinity of the inverter shall not be less than 0°C nor more than 50°C for continuous and reliable operation.

D. Frequency Stability

4.54 The output frequency is 59.5 ± 0.5 Hz for operation within the temperature limits of 0° through 50°C. The output frequency is not load or line sensitive. See 4.64.

E. AC Output Current

4.55 The rated output current is 53.5 amperes at 117V at 0.8 power factor lagging.

F. Output Voltage Regulation

4.56 The output voltage of the inverter, measured at the inverter output test jacks, is 120 (+4, -9) volts rms for all conditions of line, load or temperature as specified in 4.52, 4.57, and 4.53, respectively. See 4.64.

G. Output Capacity

4.57 The rated output is 5 kW, 0.8 lagging to 1.0 PF at 117V.

H. Load Power Factor

4.58 The inverter is capable of operating at 120 (+4, -9) volts rms, 5 kW for loads from 0.8 PF lagging to unity PF, but is not guaranteed to meet the limits specified in 4.56, 4.60, and 4.59 when connected to loads of different power factors.

I. Output Harmonic Content

4.59 The total rms harmonic content of the output voltage wave does not exceed 5 percent of

SECTION 802-813-180

the fundamental under any condition of line, load, or temperature as specified in 4.52, 4.58, and 4.53, respectively.

J. Transient Response

4.60 The inverter output voltage shall not exceed 200V peak for the following conditions; turn on, turn off, addition or removal of rated load, and removal of a short circuit from the output. Following the application of full rated load, the terminal voltage shall return to the 111-124V rms steady-state band within 200 milliseconds; and the inverter output voltage shall not drop below 70V peak and shall recover to at least 130V peak within 3 cycles (approximately 50 milliseconds). The output frequency shall remain within the 59 to 60 Hz range for all of the above mentioned conditions.

K. Short Circuit Capability

4.61 The inverter is capable of handling overloads up to and including short circuits on the output. In the overload region the output voltage is reduced as the current is increased. With a short circuit across the output terminals, the output current is limited to approximately 145 amperes.

L. Voltage Bobble

4.62 The maximum voltage bobble (amplitude modulation) on the output of the inverter is less than 350 mV peak-to-peak over a frequency range of zero through 20 Hz.

M. Efficiency

4.63 The inverter efficiency is 80 percent minimum at 5 kW, 0.8 PF lagging load with -48V input.

N. Nominal Setting of Frequency Adjustment Potentiometer

4.64 The nominal setting of the inverter output frequency is made at the factory. If readjustment becomes necessary, connect a frequency counter across the inverter ac output test jacks and adjust the inverter FREQ ADJ potentiometer so that the output frequency is 59.5 ± 0.1 Hz.

5. REFERENCE INFORMATION

- CD- & SD-81840-01—523A and 524A Power Supply Circuit, J86651A
- CD- & SD-81852-01—1.5 kW, KS-19951 Inverter
- CD- & SD-81853-01—5.0 kW, KS-19952 Inverter
- CD- & SD-81860-01—Common Control Circuit, for KS-19951 and KS-19952 Inverters
- CD- & SD-82335-01—1.5 kW, KS-21353; J87428A-90 Inverter
- CD- & SD-82336-01—5.0 kW, KS-21354; J87429A-90 Inverter
- CD- & SD-82349-01—1.5 kW, KS-21353; J87428B-90 Inverter
- CD- & SD-82374-01—5.0 kW, KS-21354; J87429B-90 Inverter