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DRAIN MAST ICE PROTECTION - DESCRIPTION AND OPERATION

1. General
Waste water from the galley and toilet wash basins is drained overboard through drain masts. To prevent ice formation in or around the drain masts, electrical heating is provided both on the ground and in the air.

2. Component Location
(Ref. Fig. 001)

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(Ref. Fig. 002)

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FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
FED 801-815,817-899					
2DU	RELAY-FWD DRAIN MAST PWR SPLY SELECT ON	800VU	221	831	(Ref. 30-71-00)
3DU	AUTOTRANSFORMER-FWD DRAIN MAST	800VU	221	831	(Ref. 30-71-00)
5DU	RECTIFIER-FWD DRAIN MAST	800VU	221	831	(Ref. 30-71-00)
12DU	RELAY-AFT DRAIN MAST PWR SPLY SELECT ON	811VU	261	833	(Ref. 30-71-00)
13DU	AUTOTRANSFORMER-AFT DRAIN MAST	811VU	261	833	(Ref. 30-71-00)
14DU	DRAIN MAST-AFT		172		(Ref. 30-71-11)
15DU	RECTIFIER-AFT DRAIN MAST	811VU	261	833	(Ref. 30-71-00)
24DU	DRAIN MAST-FWD		136		(Ref. 30-71-11)
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2DU	RELAY-FWD DRAIN MAST PWR SPLY SELECT ON	800VU	221	831	(Ref. 30-71-00)
3DU	AUTOTRANSFORMER-FWD DRAIN MAST	800VU	221	831	(Ref. 30-71-00)
12DU	RELAY-AFT DRAIN MAST PWR SPLY SELECT ON	811VU	261	833	(Ref. 30-71-00)
13DU	AUTOTRANSFORMER-AFT DRAIN MAST	811VU	261	833	(Ref. 30-71-00)
14DU	DRAIN MAST-AFT		172		(Ref. 30-71-11)
24DU	DRAIN MAST-FWD		136		(Ref. 30-71-11)
26DU	CURRENT FLOW SENSOR-FWD DRAIN MAST	800VU	221	831	(Ref. 30-71-00)
27DU	RELAY-FWD DRAIN MAST MIN OR MAX PWR SPLY	800VU	221		(Ref. 30-71-00)

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FIN	FUNCTIONAL DESIGNATION	PANEL	ZONE	ACCESS DOOR	ATA REF.
28DU	THERMOSTAT-FWD DRAIN MAST		136		(Ref. 30-71-00)
29DU	RELAY-FAULT LIGHT	800VU	221	831	(Ref. 30-71-00)
126DU	CURRENT FLOW SENSOR-AFT DRAIN MAST	811VU	261	833	(Ref. 30-71-00)
127DU	RELAY-AFT DRAIN MAST MIN OR MAX PWR SPLY	811VU	261	833	(Ref. AMM 30-71-10)
128DU	THERMOSTAT-AFT DRAIN MAST		172		(Ref. AMM 30-71-10)
129DU	RELAY-FAULT LIGHT	811VU	261	833	(Ref. AMM 30-71-10)
FED 806,808-811,813-814 POST SB 30-2024 for A/C 806,808-811,813-814					
35DU	CONTROL UNIT		162		(Ref. 30-71-00)
45DU	CONTROL UNIT		132		(Ref. 30-71-00)
14DU	DRAIN MAST - AFT		172		(Ref. 30-71-00)
24DU	DRAIN MAST - FWD		136		(Ref. 30-71-00)

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3. System Description

A piping system (Ref. 38-00-00) carries waste water from the galley and lavatory compartment wash basins to two drain masts located on the outer skin of the aircraft.

The drain masts are heated to prevent ice forming when waste water is being dumped overboard.

When circuit breakers 1DU and 11DU are closed, the heating system is operational.

The system operates in flight or on the ground.

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4. Component Description

A. Drain Mast Assembly Heater 14DU, 24DU

This is an electrically heated tube, shrouded by an aerodynamically shaped, cast aluminum fairing.

The heating element is rated at 285 W. It is supplied with 28 V AC on the ground and 115 V AC in flight.

B. Autotransformers 3DU, 13DU

When the aircraft is on the ground, autotransformers 3DU and 13DU supply 28 V AC to the drain mast heaters.

To minimize magnetostrictive noise, and to facilitate maximum heat dissipation, the transformer is embedded in silicone rubber and encased in a black anodized aluminum case.

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A fuse mounted on top of the case protects the transformer against overload. Connecting sockets are provided on the side of the case.

C. Rectifier 5DU, 15DU
A full-wave, hermetically sealed plug-in-type rectifier converts the 115 V AC single phase supply to 100 ±3 V DC which is used to control flight/ground switching relay operation.

4.
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Component Description

A. Drain Mast Assembly Heater 14DU, 24DU
This is an electrically heated tube, shrouded by an aerodynamically shaped, cast aluminum fairing. The heating element is rated at 285 W.
On the ground at normal ambient conditions the heating element is supplied with 28 V AC and at extremely low ambient temperatures with 50 V AC.
In flight it is supplied with 115 V AC.

B. Autotransformers 3DU, 13DU
When the aircraft is on the ground, autotransformers 3DU and 13DU supply 28 V AC or 50 V AC to the drain mast assembly heaters according to the ambient temperaturee.

C. Thermostats 28DU, 128DU
The thermostats 28DU and 128DU are installed in the lower shell near the drains masts. On the ground the thermostats control the electrical power supply of the drain mast heating.

D. Current Flow Sensors 26DU, 126DU
If the current, which in flight is necessary for the drain mast heating, drops below a minimum, the current flow sensor will be activated.
Thus the sensor activates an electrical circuit with the FAULT light 130DU, which illuminates to indicate a malfunction.

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4. Component Description

A. Drain Mast Assembly Heater 14DU, 24DU
Each drain mast assembly has a drain tube with an integrated electrical heating element and an integrated temperature sensor.
The heating element is supplied with 115 V AC through a control unit.
The drain mast heating element operates from -55 °C (-65 °F) to

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+75 °C (+160 °F). The heating element is protected by an overtemperaturee switch, which stops the power supply if the temperature reaches +120 °C (+250 °F).

B. Control Unit 35DU, 45DU
Each drain mast heating element is controlled by a control unit.
The control unit uses the temperature sensor in the drain mast to regulate the temperature in the drain tube to between +10 °C (+50 °F) and +15 ° (+60 °F). Each control unit has built-in test equipment to test the control unit and the heating element.

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5. System Operation

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(Ref. Fig. 003)

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(Ref. Fig. 004)

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(Ref. Fig. 005)

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A. Operation of the Drain Mast Heating on Ground
On the ground with the aircraft electrical network energized and circuit breakers 1DU and 11DU closed, the landing gear relay 85GB is energized and the drain mast heating relays 2DU and 12DU are de-energized. 115 V AC from the normal AC busbars is thus directed via heating relay contacts to the two autotransformers 3DU and 13DU.
The autotransformers supply 28 V AC to the drain mast heating elements.

NOTE : On the ground the heating elements can be operated using 115 V AC for a maximum of 5 minutes.

B. Operation of the Drain Mast Heating in Flight
In flight, the landing gear relay 85GB is de-energized. With circuit breakers 1DU and 11DU closed, 115 V AC from the normal AC busbar is routed via relay contacts to the rectifiers.
The output from the rectifiers (100 ±3 V DC) is fed to the coils of heating relays 2DU and 12DU.
Operation of the heating relays allows 115 V AC from the normal ACsupply to the drain mast heating elements.

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A. Operation of the Drain Mast Heating on Ground
On the ground with the aircraft electrical network energized and circuit breakers 1DU and 11DU closed the landing gear relay 85GB is energized.
The drain mast heating relays 2DU and 12DU are not activated. Thus 115 V AC from the normal AC busbars is directed via circuit breakers 1DU and 11DU and relay contacts to the autotransformers 3DU and 13DU.
While the ambient temperature decreases to -10 ±4 °C (14 ±7.2 ° F), the contacts of the thermostats 28DU and 128DU are open. The relays 27DU and 127DU are de-energized and the autotransformers supply 28 V AC to the drain mast heating elements. If the ambient temperature drops further, the thermostats close at -10 ±4 °C (14 ±7.2 °F). The relays 27DU and 127DU will be activated and 50 V AC is directed from the autotransformers 3DU and 13DU to the drain mast heating elements. If the ambient temperature rises, the thermostats open at 0 ±4 °C (32 ±7.2 °F) again.

B. Operation of the Drain Mast Heater in Flight
In flight the landing gear relay 85GB is de-energized and the drain mast heating relays 2DU and 12DU are energized. 115 V AC is routed via the circuit breakers 1DU and 11DU, relay contacts and the current flow sensors 26DU and 126DU to the drain mast heating elements.
If in case of a malfunction a drain mast will not be heated, the corresponding current flow sensor activates the relay 29DU or 129DU by the missing or reduced current. Thus an electrical circuit will be closed and 28 V DC flows via circuit breaker 25DU and relay contacts to illuminate the FAULT light 130DU.

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A. Operation of the Drain Mast Heating
The drain mast heating is available when the aircraft electrical circuits are energized and the circuit breakers 1DU and 11DU are closed.
115 V AC is supplied from the normal busbar 210XP-B via circuit breaker 1DU to the control unit 45DU and the FWD drain mast 24DU.
115 V AC is supplied from the normal busbar 211XP-B via circuit breaker 11DU to the control unit 35DU and the AFT drain mast 14DU.
The control units regulate the heating of the drain masts to keep the temperature between +10 ° (+50 °F) and +15 ° (+60 °F). The heating system is protected by an overtemperature switch in the drain mast.

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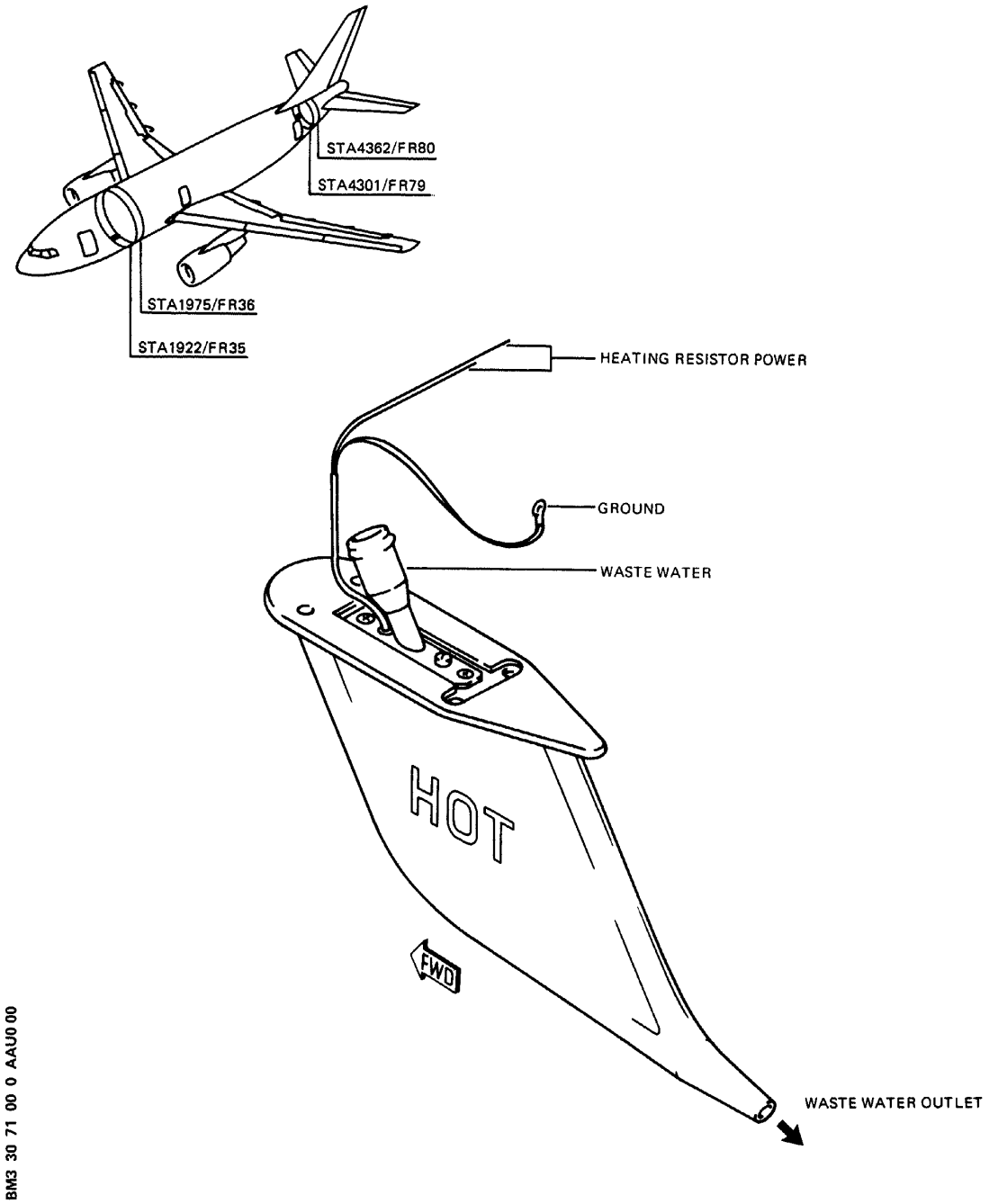


Figure 001

Figure 001. Drain Mast Ice Protection Component Location (Sheet 1)

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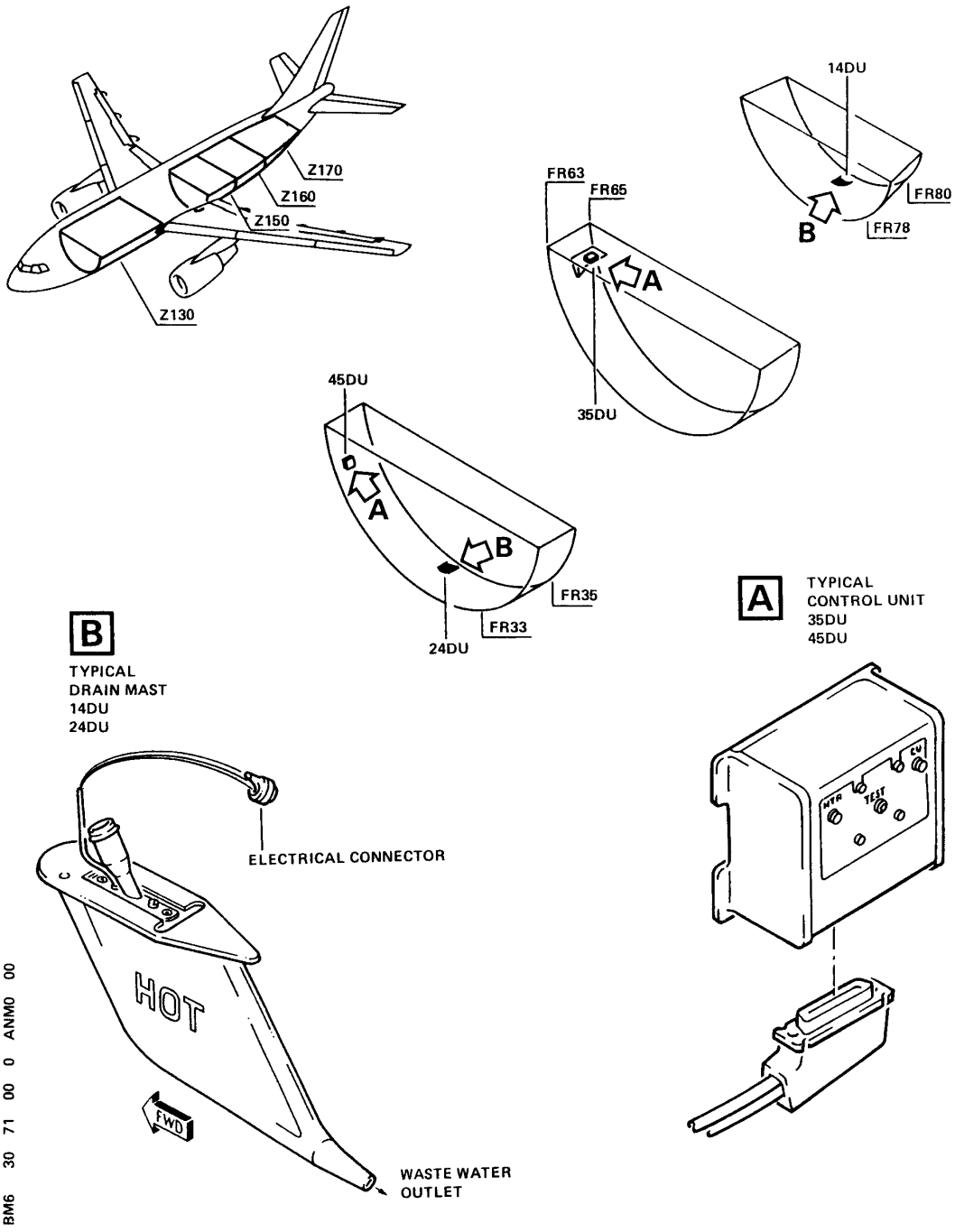


Figure 002

Figure 002. Drain Mast Ice Protection Component Location (Sheet 1)

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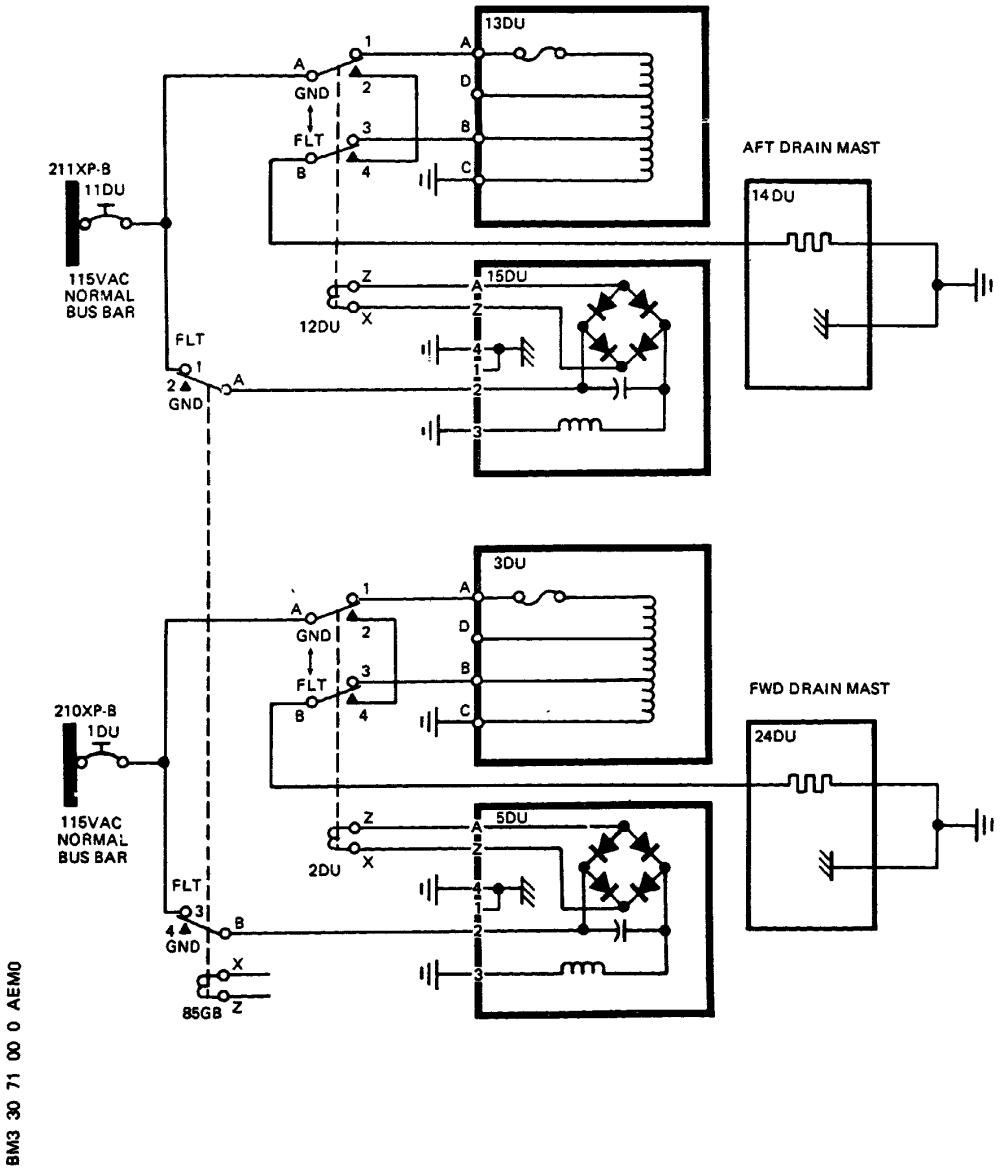


Figure 003

Figure 003. Drain Mast Ice Protection - Schematic (Sheet 1)

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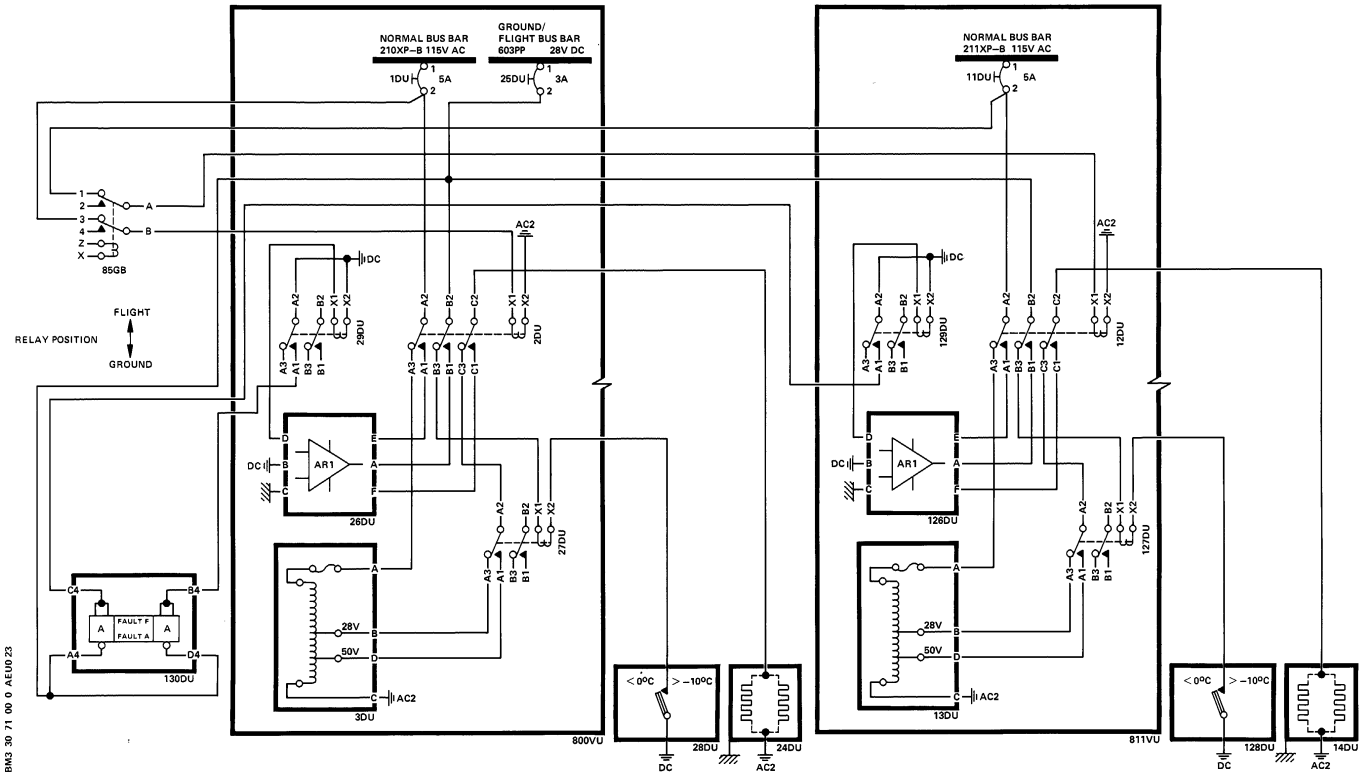


Figure 004

Figure 004. Drain Mast Ice Protection - Schematic (Sheet 1)

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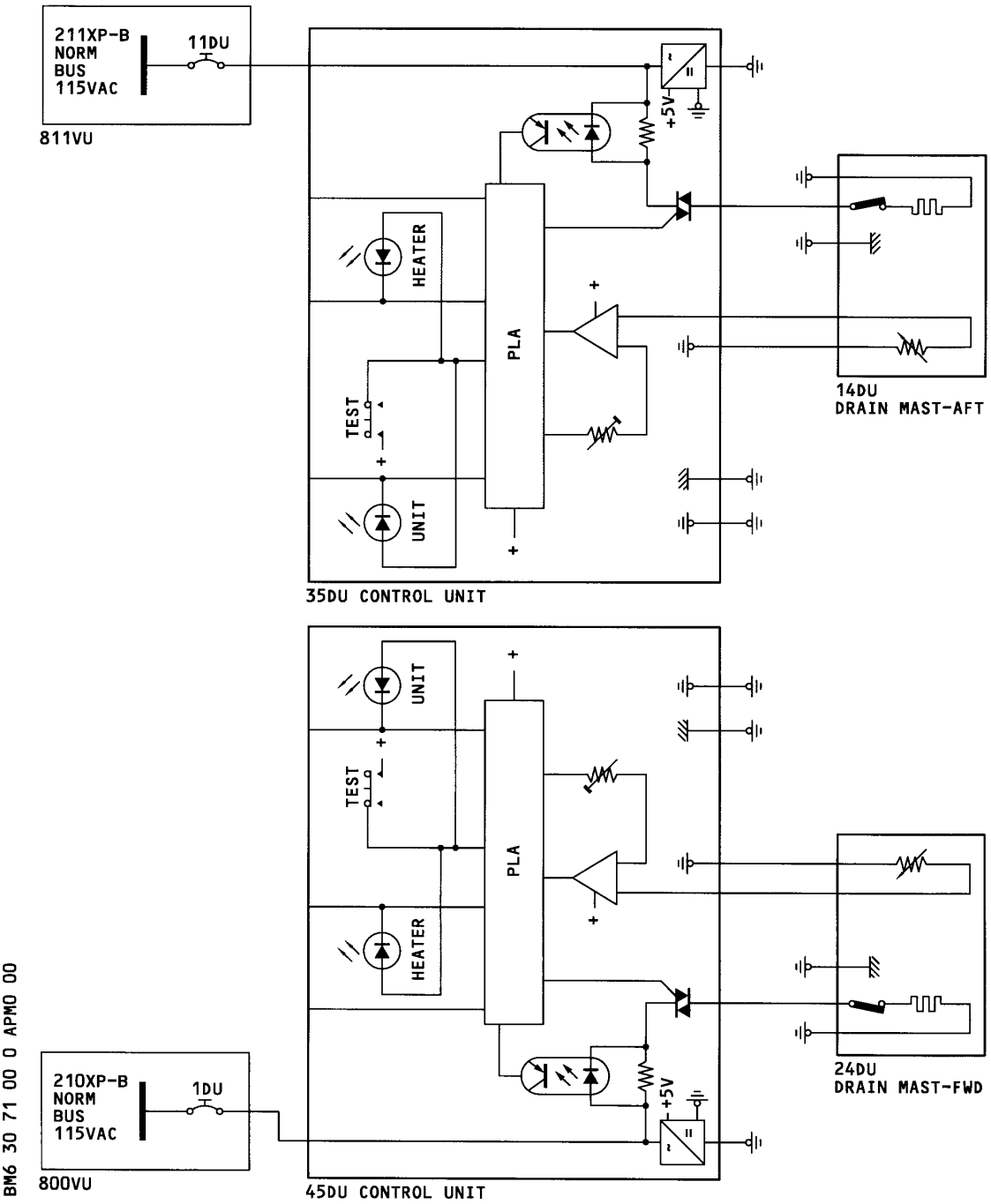


Figure 005

Figure 005. Drain Mast Ice Protection - Schematic (Sheet 1)

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